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**Bid Documents**

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**St. Clair Catholic District School Board**

**Our Lady of Fatima Catholic School  
545 Baldoon Rd  
Chatham, Ontario**

**General Renovations and Addition for  
Mechanical Equipment**

**Project No. 619-CP1825**

Prepared by:

**Wilson Diaz Architects Inc.**  
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April 12th. 2018

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Submitted By: \_\_\_\_\_

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

**Project: No. 619-CP1825**

**General Renovations and Addition for Mechanical Equipment**

**Our Lady of Fatima Catholic School  
545 Baldoon Rd  
Chatham, 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 Forty-Five Thousand Dollar (\$45,000.00) to cover costs associated with the supply and installation of new hardware.
2. Include a Stipulated Sum of Three Thousand Dollar (\$3,000.00) to cover costs associated with rework of existing security system in areas affected by construction (Damar).
3. Include a Stipulated Sum of Five Thousand Dollar (\$5,000.00) to cover costs associated with removal of unforeseen Asbestos products discovered during construction.
4. Include a Stipulated Sum of Three Thousand Dollar (\$3,000.00) to cover costs associated with reinstallation of Fibre Optic communications cable (Cogeco).

The General Contractor is to coordinate and ensure that all cash allowances specified in section 15001-22 Mechanical General Provisions, described under section 3.27 are fully accounted for in the Base Bid price.

The General Contractor is to coordinate and ensure that all cash allowances specified in section 16001-22 Electrical General Provisions, described under section 3.24 are fully accounted for in the Base Bid price.

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 refer to the documents for the reconciliation terms and conditions.

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. Not Applicable

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 work includes demolition of exterior masonry face brick, interior load bearing & non-load bearing partitions, ceilings, portions of door and window assemblies, concrete floors for underfloor services, finishes and site works demolition. New work includes new exterior wall facing assemblies, new door & window systems, and parapet renovations. New work also includes the construction of a new mechanical room area and reworking of interior spaces to be included as part of the introduction of major mechanical equipment upgrades. New washroom areas and corridor improvements to be completed. Major mechanical work will include the phased installation of a building sprinkler system, new heat pumps, new ventilation systems and associated mechanical services. Lay in Acoustic (LAT) and some Gypsum Wall Board (GWB) ceilings will be replaced with new ceiling systems once above ceiling mechanical and electrical work has been completed in new areas. In certain areas where ongoing above ceiling work is required, ceiling systems will be completed with new suspended

track and finished with previously removed and stored existing ceiling tile as noted on drawings. Site work to provide new underground water service to a newly created water service room are also part of the general scope of work for this project.

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**

**Not Applicable**

13) **UNIT PRICES**

**Not Applicable**

14) **ALTERNATE PRICES**

It is accepted that the intent of alternate prices is to allow the Owner to select an alternate scope of work at a price which is declared below, and solely at the owner's discretion.

The following prices have not been included in the Base Bid amount. The following prices, if accepted by the owner, shall include all labour, material, tools, equipment, overhead and profit, but exclude H.S.T. No other cost consideration shall be added to the contract for the scope of this work if accepted by the owner.

**Alternate Price #1:**

In lieu of providing new replacement windows (55) only, provide the cost of carefully removing the existing windows & frames, store and reinstall coordinated with ongoing masonry restoration. Provide new wall flashing brackets, closures, waterproofing, and sealants. Provide costs related to the installation of a 190mm deep stone sill with support clip in lieu of standard 90mm stone sill without support clip. Entirely clean all units, ensure all glazing is in good condition without seal breaks, ensure all insect screens are in as new condition and repair any defects with frames, windows and hardware. Assume all liability for damage. Refer to Drawing details on Drawing A625.

Extra \$ \_\_\_\_\_ Credit \$ \_\_\_\_\_  
(Complete only the appropriate Value Change)

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	_____
Steel	_____
Glazing	_____
Metal Siding	_____
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**

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**1.01 INVITATION**

- .1 **St. Clair Catholic District School Board** (the Owner) invites Bids from General Contractors for **General Renovations and Additions for Mechanical Equipment at Our Lady of Fatima Catholic School, 545 Baldoon Rd. Chatham, 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. Drawings/Sketches
    6. 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 Center,  
420 Creek Street  
Wallaceburg, ON.  
N8A 4C4**
- .4 Bids shall be received no later than **2:00 p.m. on Thursday, May 3rd, 2018** 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**

**General Renovations and Addition for Mechanical Equipment**

**Our Lady of Fatima Catholic School  
545 Baldoon Rd.  
Chatham, 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](mailto:Tony.prizio@st-clair.net)  
CC Email: [victoria.iaccino@st-clair.net](mailto:victoria.iaccino@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 **Tuesday April 17th. 2018 @ 4:00 p.m.**
  - .3 All interested parties will meet at the main entrance of **Our Lady of Fatima Catholic School, 545 Baldoon Rd. Chatham, 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

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- .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 \$2,000,000.00 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 **June 30<sup>th</sup>. 2018.**
  - .1 Install construction barriers as indicated on the drawings. Provide continuous and safe work areas defined by barriers throughout the entire schedule of work and only to be removed upon the direction of the Board upon completion of the work.
  - .2 Exterior fencing and barriers shall be relocated and made safe as work progresses in a phased fashion for the wall assembly renovation work. All exterior work shall be completed as soon as possible, and may continue into the fall. The contractor shall develop a schedule of exterior works which will detail areas of work, expected completion and move to new area of work with completion dates and site area returned to the Board. The overall phasing schedule to be reviewed and approved by the architect and the board prior to commencing all work.
  - .3 Start work on the interior renovations and addition portions of the project as indicated on the drawings as soon as possible, preferably on Saturday, **June 30<sup>th</sup>. 2018.** The Contractor shall include all costs for labour and material to ensure that the scope of work for the addition enclosure and Interior renovation projects in the corridors, classrooms and washrooms are complete and facilities that are accessible by students and staff are made safe by **Monday, August 27<sup>th</sup>. 2018.**
  - .4 After **Sunday, August 26<sup>th</sup>. 2018,** the ongoing wall assembly replacement work schedule and continuing Mechanical & Electrical scope of work identified in .2 above, the Contractor may continue with minor works in safe and contained areas of the site and interior after hours beginning no earlier than 5:00 p.m. until 12:00 midnight on weekdays and regular or extended hours on weekends and board professional development days. The contractor shall develop a schedule of proposed interior works which will detail areas of work, expected completion and move to new area of work with completion dates and interior area returned to the Board. The overall phasing schedule to be reviewed and approved by the architect and the board prior to commencing all work. The contractor is to obtain substantial completion for the entire scope of work by **Wednesday October 31<sup>st</sup>. 2018.**
- .2 Contractors shall completely review the site, drawings & specifications, have coordinated with all subtrades and material suppliers to confirm the entire scope of work and schedule for completion. In delivering a bid to the Board, the contractor agrees to the expectations for project completion prior to bid close and warrants that all schedules shall be met in accordance with the contract.

### 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.

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- .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**



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**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 architect shall apply for the building permit. The owner shall pay for the building permit. The contractor shall pay for any and all other 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.

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**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.

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- .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 OSHA, 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 ) minimum of  
Injury or death to more than one person ) \$2,000,000.00

.2 Automobile ) \$2,000,000.00  
) 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.

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.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 45<sup>th</sup> 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:

Refer to Supplementary to CCDC2 – 2008 GC 6.2 Change Order.

**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.

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- .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' 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](http://www.st-clair.net).

**END OF GENERAL CONDITIONS**



ST. CLAIR CATHOLIC  
DISTRICT SCHOOL BOARD

**CCDC 2- 2008**  
**Stipulated Price Contract**

~

**Supplementary Conditions**



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 interest 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 *Contractor* 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.

- 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 *Contract 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".

Re-number 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 *Contractor* 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 injured 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-owned 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 *Owner* 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**



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**DESIGNATED SUBSTANCES SURVEY**  
(per Section 30, OHSA)  
**ASBESTOS PRODUCTS RE-ASSESSMENT**  
(per Section 8, O.Reg. 278/05)

**Our Lady of Fatima Catholic School**  
**Chatham, Ontario**

Prepared for:

St. Clair Catholic District School Board  
245 Tecumseh Street  
Sarnia, Ontario  
N7T 2L1

October 31, 2017

Project No.: 17-1176

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## 1.0 INTRODUCTION

OH Solutions Inc. (OHS) was retained by the St. Clair Catholic District School Board to conduct a re-assessment of the condition of known friable asbestos-containing materials (ACM) and a visual inspection for mould at Our Lady of Fatima School located at 545 Baldoon Road North in Chatham, Ontario.

The school is a single storey structure, with a total area of 27,000 square feet. The original building was constructed in 1978. In addition to the investigation for asbestos and mould, the school was evaluated for the presence of any other designated substances.

Under the *Occupational Health & Safety Act* (OSHA), an owner must determine whether any Designated Substances are present at a site and is required to prepare a list of all Designated Substances that are present. These substances may require special handling procedures. The current OSHA regulation lists the following eleven (11) substances as Designated Substances in the workplace: acrylonitrile, arsenic, asbestos, benzene, coke oven emissions, ethylene oxide, isocyanates, lead, mercury, silica and vinyl chloride.

Based on the estimated construction date and the reported use of the building, the review undertaken by OHS targeted asbestos, lead, mercury, and silica which, in our experience, are most likely to be present on-site.

The following report explains our survey methodology and summarizes the hazardous building materials found at the Site.

## 2.0 SURVEY METHODOLOGY

During this investigation the surveyor inspected the building for construction material suspected of containing asbestos after reviewing previous reports and database information. In addition, the surveyor inspected the building for construction materials suspected of containing other Designated Substances.

Note:

- Repetitive testing was generally not performed. Items, which were visually similar to others tested, were considered to be of like material and were not sampled again. However, due to the variable nature of some products, several samples may have been collected of some materials.
- No destructive testing was performed. The inaccessible spaces within the building were not inspected. This includes areas above plaster or

drywall ceilings (in the absence of access panels) as well as shafts, chases and bulkheads. Similarly, doors, motors and other equipment were not disassembled to determine composition.

- Vinyl sheet flooring and vinyl asbestos tiles have been recorded where observed, but may not be identified where they are present beneath multiple layers of flooring.

There was no access to the roof at the time of the assessment.

## **2.1 Asbestos**

No additional asbestos bulk samples were collected as a part of this re-assessment.

## **2.2 Other Hazardous Building Materials and Designated Substances**

All other hazardous building materials or Designated Substances were identified based on visual assessment and historical usage.

## **3.0 REGULATORY REQUIREMENTS**

“Designated Substance” as defined by the Ontario *Occupational Health & Safety Act* (OHSa) means “a biological, chemical or physical agent or combination thereof prescribed as a Designated Substance to which the exposure of a worker is prohibited, regulated, restricted, limited or controlled.” Under Section 30 of the OHSa an owner is required to determine whether any Designated Substances are present at a project site before beginning construction. If any portion of the project is tendered, the person issuing the tenders is required to list the Designated Substances present at the project site. The constructor is then required to ensure that every contractor and sub-contractor receives a copy of the list.

Designated Substances are regulated under Ontario Regulation 490/09, which identifies the occupational exposure limits for these materials. Under Subsection 3(3) of the Regulation, construction projects are excluded from the OELs and most of the other requirements of the Regulation. For this reason, the Ministry of Labour (MOL) has issued regulations and guidelines to cover asbestos, lead and silica on construction.

Ontario Regulation 278/05 classifies all disturbance of asbestos as Type 1, Type 2 or Type 3, each of which is associated with defined work practices. All asbestos material waste is subject to special handling and disposal practices, and must be removed prior to partial or full demolition. Removal of any quantity of asbestos of more than 1m<sup>2</sup> requires notification of the MOL. Disposal of asbestos waste is

subject to waste management regulations under Ontario Regulation 347/90 as amended to Ontario Regulation 102/07.

The Guidelines: “Silica on Construction Projects” and “Lead on Construction Projects” identify precautions required for various activities that may disturb silica, or lead during construction, renovation or maintenance activities.

The MOL guideline for the control of lead exposures during the removal of lead on construction projects does not include criteria for categorizing lead paint. The Ontario Ministry of Labour (MOL) does not have a standard to state what percentage of lead a material must have to be considered lead-containing. The Environmental Abatement Council of Ontario (EACO) has issued a “Lead Guideline for Construction, Renovation, Maintenance or Repair”. This guideline recommends procedures to protect against lead exposure when concentrations of lead in paint exceed 0.1% by weight, but suggests that finishes with concentrations below 0.1% by weight do not require lead specific precautions provided the material is not disturbed in an aggressive manner (e.g. grinding or sandblasting) and that general dust control is adequate.

There are currently no regulations specifically covering exposure to mould or outlining mould remediation practices. In addition, there are no occupational exposure limits stating acceptable levels of exposure without adverse health effects.

However, Sections 25 and 27 of the Ontario *Occupational Health and Safety Act* states that an employer must take every reasonable precaution to ensure the health and safety of their workers. This includes exposure to moulds.

## **4.0 RESULTS**

### **4.1 Asbestos-Containing Materials**

Asbestos is a general name for several varieties of highly fibrous silicate minerals. Commercially significant types of asbestos include chrysotile, amosite and crocidolite. The fibres are valued for their heat and chemical resistance properties. The combination of fibrous structures, low heat conductivity, high electrical resistance, chemical inertness, strength and flexibility, as well as its effectiveness as a reinforcing or binding agent when combined with cement and/ or plastic, made asbestos popular for widespread industrial use.

One measure of the potential hazard of ACM is its friability. The Ontario Ministry of Labour asbestos regulation defines a friable material as one when dry can be crumbled, pulverized or powdered by hand pressure. The friability of ACM is considered a significant indicator of the ease with which fibres may be released

into the air. Non-friable products with bound asbestos pose no danger of releasing airborne fibres unless cut, broken up or otherwise physically abraded.

The following is a summary of the asbestos-containing or asbestos-suspect materials that were encountered at Our Lady of Fatima School. A detailed summary of asbestos materials identified in the building are included in Appendix II.

#### **4.1.1 Sprayed Fireproofing**

No sprayed fireproofing was encountered in the survey of this facility.

#### **4.1.2 Texture Finishes**

No texture finishes was encountered in the survey of this facility.

#### **4.1.3 Acoustic Ceiling Tiles**

Asbestos-containing ceiling tiles have been removed from the building.

#### **4.1.4 Mechanical Insulation**

Asbestos and non-asbestos mechanical insulation is present in this building. Parging cement has been removed from the majority of piping systems although it is still present in the gymnasium and may be present in inaccessible areas. Non-asbestos parging cement is present in some locations. Straight run pipe insulation is generally non-asbestos fiberglass.

#### **4.1.5 Plaster and Drywall**

Plaster finishes were not encountered in the survey of this school.

Drywall joint compound was not generally sampled as a part of this re-assessment. Drywall compound used in construction prior to 1988 should be considered to be asbestos-suspect. The compound in the Resource Room at the south end of the school (Location 80) was sampled in advance of a renovation project and found to be asbestos-free.

#### **4.1.6 Asbestos Cement Sheets**

No asbestos cement or "transite" products were encountered in the re-assessment of this facility.

#### **4.1.7 Vinyl Floor Tiles**

The vinyl floor tiles in the facility have been assumed to contain asbestos. These products are non-friable, and as such are not expected to release airborne



asbestos fibre under normal conditions of building use. If a large quantity of floor tile is to be removed, it may be practical to verify the presence of asbestos at that time.

#### **4.2 Lead**

Painted finishes in the building were not sampled. Lead may be present in some finishes within the building.

#### **4.3 Mercury**

Mercury is present in thermostats and within fluorescent light tubes located within the building.

#### **4.4 Silica**

Common construction sand contains free crystalline silica and is present in concrete products, mortar, brick, etc. These construction products are typically found throughout building structures.

#### **4.5 Acrylonitrile, Benzene, Isocyanates, Arsenic, Ethylene Oxide, Vinyl Chloride and Coke Oven Emissions**

Evidence suggesting the presence of acrylonitrile, benzene, isocyanates, arsenic, ethylene oxide, vinyl chloride monomer or coke oven emissions was not observed at Our Lady of Fatima School.

#### **4.6 Mould**

In recent years, contamination of buildings with mould has become a major concern. Mould growth will occur on any water damaged building material. Evidence does exist to support the relationship between exposure to mould in buildings and many health effects.

This re-assessment included the inspection of areas for visible mould growth. In the absence of occupants experiencing symptoms, the inspection for and remediation of visible mould present in the building will be an appropriate response to the issue. Where occupants are experiencing symptoms, in the absence of visible mould growth, some invasive inspection may be necessary to find potential sources of mould. In general this was beyond the scope of this assessment.

Although some evidence of water damage was present, visible mould was not evident in the course of this inspection. Locations where water stained/damaged tiles were identified are outlined in the following table:

Location	Quantity of Water Damaged Material
<b>LOC 29 – Meeting Room 109A</b>	2 stained ceiling tiles
<b>LOC 40 - Classroom</b>	3 stained ceiling tiles
<b>LOC 55 – Storage 142</b>	1 stained ceiling tile
<b>Classroom 164 – Addition</b>	1 stained ceiling tile
<b>Classroom 174 – Addition</b>	1 stained ceiling tile
<b>Classroom 125B – Addition</b>	1 stained ceiling tile
<b>Classroom 166B – Addition</b>	1 stained ceiling tile
<b>Classroom 166 – Addition</b>	1 stained ceiling tile

## 5.0 RECOMMENDATIONS

The following recommendations are made with respect to the hazardous building materials and Designated Substances noted at Our Lady of Fatima School:

### 5.1 Asbestos

#### 5.1.1 Asbestos Management Program

Since asbestos-containing materials were identified at this facility, the building is subject to the requirement for an Asbestos Management Program, as specified under Ontario Regulation 278/05.

#### 5.1.2 Specific Recommendations

##### 5.1.2.1 Mechanical Insulation

Any activity, which will disturb asbestos-containing mechanical insulation, is governed by the procedures outlined in Reg. 278/05. The disturbance of less than nine linear feet (or nine parged fittings or nine square feet of parging cement) of asbestos-containing mechanical insulation may be performed as a Type 2 operation, while any greater disturbance requires Type 3 precautions.

### **5.1.2.2 Drywall Joint Compound**

The sampling of drywall compound was not performed throughout the school. If any disturbance of these materials is planned, sampling should be performed in advance.

Removal of more than 9 square feet, of drywall compound containing asbestos requires Type 2 procedures under Reg. 278/05.

### **5.1.2.3 Vinyl Floor Tiles**

Vinyl floor tiles may be removed, with manually powered tools, following the Type 1 procedures outlined in Reg. 278/05. The use of powered equipment on non-friable asbestos materials, an activity which could result in the release of airborne fibre, must be performed under Type 3 precautions.

## **5.2 Lead**

Although samples were not collected, it should be assumed that lead is present within paint finishes at the site. As a result, the handling or disturbance of painted finishes should be evaluated to help ensure that workers are not adversely affected.

The lead-containing materials in the building will not generate airborne lead dust in the absence of disturbance. However, significant lead dust levels can result when uncontrolled work procedures are used on lead-based materials. The control of dust levels during the demolition of the buildings can be accomplished through proper work practises such as wetting the surface of the materials to reduce overall dust levels and providing workers with washing facilities and proper respiratory protection.

The procedures outlined in the MOL document 'Guideline – Lead on Construction Projects' (2004) should provide an adequate standard for the handling or disturbance of the material.

The disposal of construction waste containing lead is controlled under Ontario Regulation 347, as amended by O. Reg. 102/07, and may be subject to Leachate Criteria (Schedule 4) of this regulation.

## **5.3 Mercury**

The presence of mercury in fluorescent light tubes and thermostats poses minimal risk to occupants or workers provided the equipment is handled properly and the mercury is not allowed to escape. In the event of future renovations, light tubes and thermostat tubes should be removed intact to prevent the mercury vapour

from escaping.

It is good management practice to take precautions to prevent mercury vapours from becoming airborne during building demolition. Exposure to airborne mercury is regulated under Ontario Regulation 490/09 made under the *Occupational Health and Safety Act*. The current TWAEV for mercury vapour is 0.025 mg/m<sup>3</sup> (except alkyl compounds).

Mercury waste must be handled and disposed of according to Ontario Regulation 347, as amended by O. Reg. 102/07, and may be subject to Leachate Criteria (Schedule 4) of this regulation.

#### **5.4 Silica**

Disturbance of materials containing silica will occur during demolition of walls and ceilings, saw cutting floor slabs and removal of lay-in acoustic ceiling tiles containing silica and is regulated under Ontario Regulation 490/09. The current TWAEV for amorphous fused silica is 0.1 mg/m<sup>3</sup> and is 0.05 mg/m<sup>3</sup> for crystalline silica (quartz). This can be accomplished through proper work practises such as wetting the surface of the materials to reduce overall dust levels and providing workers with washing facilities and proper respiratory protection.

#### **5.5 Mould**

Mould growth on building materials was not observed during this investigation. At this time, no further action is required regarding conditions observed. However water damaged acoustic tiles and drywall were observed throughout the school. OHS recommends that this material be removed to reduce the potential for mould growth on the water impacted surface.

Moisture issues are the only factor in the growth of mould that may be controlled by the building operator. Any existing moisture problems in the building must be addressed to prevent or control mould growth. The following general recommendations are made to reduce the potential for future mould growth within the building:

- Promptly respond to any water infiltration, including minor leaks.
- Where HVAC units permit, maintain relative humidity below 60%.
- Maintain caulking at sinks, bathrooms and at exterior locations.

In the event of a flood, remove water by pumping or vacuuming as soon as possible. Drying of construction and finishing materials must begin promptly (in

less than 24 hours). It may be practical to remove and dispose of some wetted materials, (e.g. drywall and carpet) in some cases.

## **6.0 LIMITATIONS AND WARRANTY**

OHS has prepared this report for the exclusive use of the Client in evaluating the Site at the time of OHS's assessment. OHS will not be responsible for the use of this report by any third party, or reliance on or any decision to be made based on it without the prior written consent of OHS. OHS accepts no responsibility for damages, if any, by any third party because of decisions or actions based on this report.

The findings and conclusions documented in this report have been prepared for specific application to this project and have been developed in a manner consistent with that level of care and skill normally exercised by qualified professionals currently practising in this area of environmental assessment. No other warranty, expressed or implied, is made.

The findings contained in this report are based upon conditions as they were observed at the time of investigation. No assurance is made regarding changes in conditions subsequent to the time of investigation.

If new information is developed in future work, OHS should be contacted to re-evaluate the conclusions of this report and to provide amendments as required.

Respectfully submitted,

**OH Solutions Inc.**

A handwritten signature in black ink, appearing to read 'K. Olson', with a long horizontal line extending to the right.

Kris Olson, P.Eng.  
Senior Project Manager

**APPENDIX I**  
**BULK SAMPLING RESULTS**  
**(From Previous Assessments)**

## Pinchin Environmental Asbestos Samples Report

**Project #:** 13256

**Client Name:** St. Clair Catholic District School Board

**Building #:** 31

**Building Name:** Our Lady of Fatima School Chatham

**Survey Date:** 08/28/2007

Sample Number	System	Material	Location Number	Has Asbestos	Phase One		Phase Two		Description
					Asb. Type	Result	Asb. Type	Result	
0001	Piping	Parging Cement	1	<input checked="" type="checkbox"/>	Chrysotile	50-75%	No Result	NR	Parging cement pipe fittings
0002	Ceiling	Lay-in tiles	3	<input type="checkbox"/>	None Detected	ND	No Result	NR	Lay-in ceiling tiles
0003	Ceiling	Lay-in tiles	5	<input type="checkbox"/>	None Detected	ND	No Result	NR	Lay-in ceiling tiles
0004	Walls	Glued-on tiles	7	<input type="checkbox"/>	None Detected	ND	No Result	NR	Stuck-on ceiling tiles
0005	Ceiling	Lay-in tiles	15	<input checked="" type="checkbox"/>	Amosite	0.5-5%	No Result	NR	Lay-in ceiling tiles
0006	Ceiling	Lay-in tiles	80	<input type="checkbox"/>	None Detected	ND	No Result	NR	Lay-in tiles
0007	Ceiling	Lay-in tiles	80	<input type="checkbox"/>	None Detected	ND	No Result	NR	Lay-in Tiles
0008	Ceiling	Lay-in tiles	80	<input type="checkbox"/>	None Detected	ND	No Result	NR	Lay-in Tile
0009	Walls	Drywall Compound	80	<input type="checkbox"/>	None Detected	ND	No Result	NR	Drywall Joint Compound
0010	Walls	Drywall Compound	80	<input type="checkbox"/>	None Detected	ND	No Result	NR	Drywall Joint Compound
0011	Walls	Drywall Compound	80	<input type="checkbox"/>	None Detected	ND	No Result	NR	Drywall Joint Compound

**APPENDIX II**

**UPDATED ROOM-BY-ROOM ASBESTOS MATERIALS SUMMARY**



# Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'SC 31'

OH SOLUTIONS

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
<b>Building Number : SC 31</b>		<b>Building Name : Our Lady of Fatima School Chat</b>				<b>Survey Date : 08/28/2017</b>			
<b>Level : LOC 01 - First Floor</b>		<b>Room : Boiler Room</b>			<b>Asbestos Present : Potentially</b>				
Ceiling	Suspect Drywall Compound	400.0 SF	Good		C	8	Yes	No	
Duct	Uninsulated								
Floor	Concrete								
Mechanical	Boiler								
Piping	Fibreglass Straight Run								
Piping	Uninsulated								
Structure	Inaccessible								
Wall	Masonry								
<b>Comments:</b> No access above ceiling.									
<b>Level : LOC 02 - First Floor</b>		<b>Room : Electrical Room</b>			<b>Asbestos Present : Potentially</b>				
Ceiling	Suspect Drywall Compound	120.0 SF	Good		C	8	Yes	No	
Duct	Inaccessible								
Floor	Concrete								
Mechanical	Inaccessible								
Piping	Inaccessible								
Structure	Inaccessible								
Wall	Masonry								
<b>Comments:</b> No access above ceiling.									
<b>Level : LOC 03 - First Floor</b>		<b>Room : Corridor</b>			<b>Asbestos Present : Potentially</b>				

# Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'SC 31'

OH SOLUTIONS

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Ceiling	Non-Asbestos Lay-in Tile								S0002
Duct	Uninsulated								
Floor	Terrazzo								
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Structure	Steel Beam, Deck & Joist								
Wall	Masonry								
Wall	Suspect Drywall Compound	10.0	SF	Good		C 8	Yes	No	

**Comments:**

Level :	Room :	Asbestos Present :
LOC 04 - First Floor	Corridor	Potentially
Ceiling	Non-Asbestos Lay-in Tile	S0002
Ceiling	Suspect Drywall Compound	15.0 SF Good C 8 Yes No
Duct	Uninsulated	
Floor	Terrazzo	
Mechanical	Not Found	
Piping	Fibreglass Fitting	
Piping	Fibreglass Straight Run	
Structure	Steel Beam, Deck & Joist	
Wall	Masonry	
Wall	Suspect Drywall Compound	25.0 SF Good C 8 Yes No

**Comments:**

# Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'SC 31'

OH SOLUTIONS

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
<b>Level :</b> LOC 05 - First Floor		<b>Room :</b> Side Entrance			<b>Asbestos Present :</b> Potentially				
Ceiling	Non-Asbestos Lay-in Tile								S0003
Duct	Uninsulated								
Floor	Terrazzo								
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Rain Water Leader								
Piping	Fibreglass Straight Run								
Structure	Steel Beam, Deck & Joist								
Wall	Suspect Drywall Compound	150.0 SF	Good		A	8	Yes	No	
<b>Comments:</b>									
<b>Level :</b> LOC 06 - First Floor		<b>Room :</b> Office			<b>Asbestos Present :</b> No				
Ceiling	Not Found								
Duct	Not Found								
Floor	Concrete								
Mechanical	Not Found								
Piping	Not Found								
Structure	Steel Beam, Deck & Joist								
Wall	Masonry								
<b>Comments:</b>									
<b>Level :</b> LOC 07 - First Floor		<b>Room :</b> Gymnasium			<b>Asbestos Present :</b> Yes				

# Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'SC 31'

OH SOLUTIONS

Design	Description	Quantity		Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Ceiling	Non-Asbestos Lay-in Tile									
Duct	Uninsulated									
Floor	Suspect Vinyl Floor Tile	2,520.0	SF	Good		A	8	Yes	No	
Piping	Asbestos Parging Cement Fittings	2.0	EA	Good		C	7	Yes	Yes	V0001
Piping	Fibreglass Straight Run									
Piping	Fibreglass with PVC									
Structure	Steel Beam, Deck & Joist									
Wall	Masonry									
Wall	Non-Asbestos 1 x 1 Tile									S0004

**Comments:**

Includes corridor to left side of stage

Level : LOC 08 - First Floor		Room : Equipment Storage Room				Asbestos Present : Potentially				
Ceiling	Not Found									
Duct	Not Found									
Floor	Suspect Vinyl Floor Tile	100.0	SF	Good		A	8	Yes	No	
Mechanical	Not Found									
Piping	Fibreglass Fitting									
Piping	Fibreglass Straight Run									
Piping	Non-Asbestos Parging Cement									
Structure	Concrete									
Wall	Masonry									

**Comments:** Vinyl Floor Tile Assumed to Contain Asbestos

Fittings in this location sampled by THEM. Non-asbestos

# Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'SC 31'

OH SOLUTIONS

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
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**Level :** LOC 09 - First Floor                      **Room :** Stage                      **Asbestos Present :** Potentially

Ceiling	Non-Asbestos 1 x 1 Tile								
Ceiling	Not Found								
Duct	Not Found								
Floor	Suspect Vinyl Floor Tile	480.0	SF	Good	A	8	Yes	No	
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Structure	Steel Beam, Deck & Joist								
Wall	Masonry								
Wall	Suspect Drywall Compound	100.0	%	Good	C	8	Yes	No	

**Comments:** Vinyl Floor Tile Assumed to Contain Asbestos

**Level :** LOC 10 - First Floor                      **Room :** Equipment Storage Room                      **Asbestos Present :** Potentially

Ceiling	Not Found								
Duct	Uninsulated								
Floor	Suspect Vinyl Floor Tile	200.0	SF	Good	A	8	Yes	No	
Mechanical	Not Found								
Piping	Not Found								
Structure	Steel Beam, Deck & Joist								
Wall	Masonry								

**Comments:** Vinyl Floor Tile Assumed to Contain Asbestos

# Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'SC 31'

OH SOLUTIONS

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
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**Level :** LOC 11 - First Floor

**Room :** Boy's Change Room

**Asbestos Present :** Potentially

Ceiling	Suspect Drywall Compound	300.0 SF	Good		C	8	Yes	No	
Duct	Inaccessible								
Floor	Terrazzo								
Mechanical	Inaccessible								
Piping	Uninsulated								
Structure	Inaccessible								
Wall	Masonry								

**Comments:** No access above ceiling.

**Level :** LOC 12 - First Floor

**Room :** Girl's Change Room

**Asbestos Present :** Potentially

Ceiling	Suspect Drywall Compound	300.0 SF	Good		C	8	Yes	No	
Duct	Inaccessible								
Floor	Terrazzo								
Mechanical	Inaccessible								
Piping	Uninsulated								
Structure	Inaccessible								
Wall	Masonry								

**Comments:** No access above ceiling.

**Level :** LOC 13 - First Floor

**Room :** Custodial Storage Room

**Asbestos Present :** Potentially

Ceiling	Non-Asbestos Lay-in Tile								V0002
Ceiling	Suspect Drywall Compound	15.0 SF	Good		C	8	Yes	No	

# Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'SC 31'

OH SOLUTIONS

Design	Description	Quantity		Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Duct	Inaccessible									
Floor	Suspect Vinyl Floor Tile	126.0	SF	Good		A	8	Yes	No	
Mechanical	Inaccessible									
Piping	Fibreglass Fitting									
Piping	Fibreglass Straight Run									
Wall	Masonry									
Wall	Suspect Drywall Compound	5.0	SF	Good		C	8	Yes	No	

**Comments:** No access above ceiling.

Vinyl Floor Tile Assumed to Contain Asbestos

**Level :** LOC 14 - First Floor

**Room :** 2 - Washroom

**Asbestos Present :** Potentially

Ceiling	Suspect Drywall Compound	25.0	SF	Good		C	8	Yes	No	
Duct	Inaccessible									
Floor	Suspect Vinyl Floor Tile	25.0	SF	Good		A	8	Yes	No	
Mechanical	Inaccessible									
Piping	Uninsulated									
Structure	Inaccessible									
Wall	Masonry									
Wall	Suspect Drywall Compound	5.0	SF	Good		C	8	Yes	No	

**Comments:** No access above ceiling.

Vinyl Floor Tile Assumed to Contain Asbestos

**Level :** LOC 15 - First Floor

**Room :** Secretary's Office

**Asbestos Present :** Potentially

Ceiling	Non-Asbestos Lay-in Tile									
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# Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'SC 31'

OH SOLUTIONS

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Ceiling	Suspect Drywall Compound	15.0 SF	Good		C	8	Yes	No	
Duct	Uninsulated								
Floor	Non-Asbestos Vinyl Tile - New								
Mechanical	Not Found								
Piping	Not Found								
Structure	Steel Beam, Deck								
Wall	Masonry								
Wall	Suspect Drywall Compound	5.0 SF	Good		C	8	Yes	No	

**Comments:**

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**Level :** LOC 16 - First Floor      **Room :** Vestibule      **Asbestos Present :** Potentially

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Ceiling	Non-Asbestos Lay-in Tile								
Duct	Not Found								
Floor	Terrazzo								
Mechanical	Not Found								
Piping	Not Found								
Structure	Steel Beam, Deck & Joist								
Wall	Masonry								
Wall	Suspect Drywall Compound	25.0 SF	Good		C	8	Yes	No	

**Comments:**

---

**Level :** LOC 17 - First Floor      **Room :** Principal's Office      **Asbestos Present :** Potentially

---

Ceiling	Non-Asbestos Lay-in Tile
Duct	Uninsulated



# Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'SC 31'

OH SOLUTIONS

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Floor	Carpet								
Mechanical	Not Found								
Piping	Not Found								
Structure	Steel Beam, Deck								
Wall	Masonry								
Wall	Suspect Drywall Compound	15.0 SF	Good		C	8	Yes	No	

**Comments:**

**Level :** LOC 18 - First Floor

**Room :** 2 - Office

**Asbestos Present :** Potentially

Ceiling	Non-Asbestos Lay-in Tile								
Duct	Inaccessible								
Floor	Suspect Vinyl Floor Tile	180.0 SF	Good		A	8	Yes	No	
Mechanical	Inaccessible								
Piping	Fibreglass Straight Run								
Structure	Inaccessible								
Wall	Masonry								
Wall	Suspect Drywall Compound	15.0 SF	Good		C	8	Yes	No	

**Comments:** No access above ceiling.

Vinyl Floor Tile Assumed to Contain Asbestos

**Level :** LOC 19 - First Floor

**Room :** Corridor

**Asbestos Present :** Potentially

Ceiling	Non-Asbestos Lay-in Tile								
Duct	Not Found								
Floor	Suspect Vinyl Floor Tile	80.0 SF	Good		A	8	Yes	No	

# Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'SC 31'

OH SOLUTIONS

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Mechanical	Not Found								
Piping	Not Found								
Structure	Steel Deck & Joist								
Wall	Masonry								
Wall	Suspect Drywall Compound	30.0 SF	Good		C	8	Yes	No	

**Comments:** Vinyl Floor Tile Assumed to Contain Asbestos

**Level :** LOC 20 - First Floor

**Room :** Supply Room

**Asbestos Present :** Potentially

Ceiling	Non-Asbestos Lay-in Tile								
Duct	Not Found								
Floor	Suspect Vinyl Floor Tile	70.0 SF	Good		A	8	Yes	No	
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Structure	Steel Deck & Joist								
Wall	Masonry								
Wall	Suspect Drywall Compound	15.0 SF	Good		C	8	Yes	No	

**Comments:** Vinyl Floor Tile Assumed to Contain Asbestos

**Level :** LOC 21 - First Floor

**Room :** Washroom

**Asbestos Present :** Potentially

Ceiling	Suspect Drywall Compound	30.0 SF	Good		C	8	Yes	No	
Duct	Inaccessible								
Floor	Suspect Vinyl Floor Tile	30.0 SF	Good		A	8	Yes	No	

# Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'SC 31'

OH SOLUTIONS

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Mechanical	Inaccessible								
Piping	Uninsulated								
Structure	Inaccessible								
Wall	Masonry								
<b>Comments:</b> No access above ceiling.									
Vinyl Floor Tile Assumed to Contain Asbestos									
<b>Level :</b> LOC 22 - First Floor		<b>Room :</b> Teacher's Work Room			<b>Asbestos Present :</b> Potentially				
Ceiling	Non-Asbestos Lay-in Tile								V0002
Duct	Uninsulated								
Floor	Suspect Vinyl Floor Tile	170.0 SF	Good		A	8	Yes	No	
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Structure	Steel Beam, Deck & Joist								
Wall	Masonry								
Wall	Suspect Drywall Compound	15.0 SF	Good		C	8	Yes	No	
<b>Comments:</b> Vinyl Floor Tile Assumed to Contain Asbestos									
<b>Level :</b> LOC 23 - First Floor		<b>Room :</b> Staff Room			<b>Asbestos Present :</b> Potentially				
Ceiling	Non-Asbestos Lay-in Tile								V0002
Duct	Uninsulated								
Floor	Suspect Vinyl Floor Tile	440.0 SF	Good		A	8	Yes	No	
Mechanical	Not Found								
Piping	Fibreglass Fitting								

# Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'SC 31'

OH SOLUTIONS

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Piping	Fibreglass Straight Run								
Structure	Steel Beam, Deck								
Wall	Masonry								
Wall	Suspect Drywall Compound	15.0 SF	Good		C	8	Yes	No	

**Comments:** Vinyl Floor Tile Assumed to Contain Asbestos

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<b>Level :</b> LOC 24 - First Floor	<b>Room :</b> Staff Washroom	<b>Asbestos Present :</b> Potentially
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Ceiling	Suspect Drywall Compound	30.0 SF	Good		C	8	Yes	No	
Duct	Inaccessible								
Floor	Suspect Vinyl Floor Tile	30.0 SF	Good		A	8	Yes	No	
Mechanical	Inaccessible								
Piping	Uninsulated								
Structure	Inaccessible								
Wall	Masonry								
Wall	Suspect Drywall Compound	3.0 SF	Good		C	8	Yes	No	

**Comments:** No access above ceiling.

Vinyl Floor Tile Assumed to Contain Asbestos

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<b>Level :</b> LOC 25 - First Floor	<b>Room :</b> Corridor	<b>Asbestos Present :</b> Potentially
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Ceiling	Non-Asbestos Lay-in Tile								V0002
Duct	Uninsulated								
Floor	Terrazzo								
Mechanical	Not Found								
Piping	Fibreglass Fitting								

# Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'SC 31'

OH SOLUTIONS

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Piping	Fibreglass Straight Run								
Structure	Steel Beam, Deck & Joist								
Wall	Masonry								
Wall	Suspect Drywall Compound	15.0 SF	Good		C	8	Yes	No	

**Comments:**

**Level :** LOC 26 - First Floor

**Room :** Corridor

**Asbestos Present :** Potentially

Ceiling	Non-Asbestos Lay-in Tile								V0002
Duct	Uninsulated								
Floor	Terrazzo								
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Structure	Steel Beam, Deck & Joist								
Wall	Masonry								
Wall	Suspect Drywall Compound	30.0 SF	Good		C	8	Yes	No	

**Comments:**

**Level :** LOC 27 - First Floor

**Room :** Corridor

**Asbestos Present :** Potentially

Ceiling	Non-Asbestos Lay-in Tile								V0002
Duct	Uninsulated								
Floor	Terrazzo								
Mechanical	Not Found								
Piping	Fibreglass Fitting								

# Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'SC 31'

OH SOLUTIONS

Design	Description	Quantity		Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Piping	Fibreglass Straight Run									
Structure	Steel Beam, Deck & Joist									
Wall	Masonry									
Wall	Suspect Drywall Compound	20.0	SF	Good		C	8	Yes	No	

**Comments:**

Includes vestibule

**Level :** LOC 28 - First Floor

**Room :** Library

**Asbestos Present :** Potentially

Ceiling	Non-Asbestos Lay-in Tile									V0002
Floor	Carpet									
Floor	Suspect Vinyl Floor Tile	200.0	SF	Good		A	8	Yes	No	
Mechanical	Not Found									
Piping	Fibreglass Fitting									
Piping	Fibreglass Straight Run									
Structure	Steel Beam, Deck & Joist									
Wall	Masonry									
Wall	Suspect Drywall Compound	150.0	SF	Good		C	8	Yes	No	

**Comments:**

**Level :** LOC 29 - First Floor

**Room :** Resource Centre

**Asbestos Present :** Potentially

Ceiling	Non-Asbestos Lay-in Tile									V0002
Duct	Uninsulated									
Floor	Suspect Vinyl Floor Tile	308.0	SF	Good		A	8	Yes	No	
Mechanical	Not Found									

# Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'SC 31'

OH SOLUTIONS

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Structure	Steel Beam, Deck & Joist								
Wall	Masonry								
Wall	Suspect Drywall Compound	15.0	SF	Good		C 8	Yes	No	
<b>Comments:</b> Vinyl Floor Tile Assumed to Contain Asbestos									
<b>Level :</b> LOC 30 - First Floor			<b>Room :</b> Librarian's Office			<b>Asbestos Present :</b> Potentially			
Ceiling	Non-Asbestos Lay-in Tile								V0002
Duct	Uninsulated								
Floor	Suspect Vinyl Floor Tile	144.0	SF	Good		A 8	Yes	No	
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Structure	Steel Beam, Deck & Joist								
Wall	Masonry								
Wall	Suspect Drywall Compound	15.0	SF	Good		C 8	Yes	No	
<b>Comments:</b> Vinyl Floor Tile Assumed to Contain Asbestos									
<b>Level :</b> LOC 31 - First Floor			<b>Room :</b> Storage Room			<b>Asbestos Present :</b> Potentially			
Ceiling	Non-Asbestos Lay-in Tile								V0002
Duct	Uninsulated								
Floor	Suspect Vinyl Floor Tile	168.0	SF	Good		A 8	Yes	No	

# Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'SC 31'

OH SOLUTIONS

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Mechanical	Inaccessible								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Structure	Inaccessible								
Wall	Masonry								
Wall	Suspect Drywall Compound	15.0 SF	Good		C	8	Yes	No	
<b>Comments:</b> No access above ceiling.									
Vinyl Floor Tile Assumed to Contain Asbestos									
<b>Level :</b> LOC 32 - First Floor			<b>Room :</b> 3 - Storage Room			<b>Asbestos Present :</b> Potentially			
Ceiling	Non-Asbestos Lay-in Tile								V0002
Duct	Uninsulated								
Floor	Suspect Vinyl Floor Tile	80.0 SF	Good		A	8	Yes	No	
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Structure	Steel Beam, Deck & Joist								
Wall	Masonry								
Wall	Suspect Drywall Compound	15.0 SF	Good		C	8	Yes	No	
<b>Comments:</b> Vinyl Floor Tile Assumed to Contain Asbestos									
<b>Level :</b> LOC 33 - First Floor			<b>Room :</b> Publishing Room			<b>Asbestos Present :</b> Potentially			
Ceiling	Non-Asbestos Lay-in Tile								V0002
Duct	Uninsulated								



# Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'SC 31'

OH SOLUTIONS

Design	Description	Quantity		Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Floor	Non-Asbestos Vinyl Tile - New									
Mechanical	Not Found									
Piping	Fibreglass Fitting									
Piping	Fibreglass Straight Run									
Structure	Steel Beam, Deck & Joist									
Wall	Masonry									
Wall	Suspect Drywall Compound	15.0	SF	Good		C	8	Yes	No	

**Comments:**

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Level : LOC 34 - First Floor		Room : Girl's Washroom		Asbestos Present : Potentially						
Ceiling	Suspect Drywall Compound	120.0	SF	Good		C	8	Yes	No	
Duct	Inaccessible									
Floor	Terrazzo									
Mechanical	Inaccessible									
Piping	Uninsulated									
Structure	Inaccessible									
Wall	Masonry									
Wall	Suspect Drywall Compound	15.0	SF	Good		C	8	Yes	No	

**Comments:** No access above ceiling.

Vinyl Floor Tile Assumed to Contain Asbestos

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Level : LOC 35 - First Floor		Room : Boy's Washroom		Asbestos Present : Potentially						
Ceiling	Suspect Drywall Compound	120.0	SF	Good		C	8	Yes	No	
Duct	Uninsulated									

# Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'SC 31'

OH SOLUTIONS

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Floor	Terrazzo								
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Piping	Uninsulated								
Structure	Steel Deck & Joist								
Wall	Masonry								
Wall	Suspect Drywall Compound	15.0 SF	Good		C	8	Yes	No	

**Comments:**

**Level :** LOC 36 - First Floor

**Room :** 5 - Classroom

**Asbestos Present :** Potentially

Ceiling	Non-Asbestos Lay-in Tile								V0002
Duct	Uninsulated								
Floor	Suspect Vinyl Floor Tile	784.0 SF	Good		A	8	Yes	No	
Floor	Terrazzo								
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Structure	Steel Beam, Deck & Joist								
Wall	Masonry								
Wall	Suspect Drywall Compound	30.0 SF	Good		C	8	Yes	No	

**Comments:** Limited access above ceiling.

Vinyl Floor Tile Assumed to Contain Asbestos

# Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'SC 31'

OH SOLUTIONS

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
<b>Level :</b> LOC 37 - First Floor		<b>Room :</b> 4 - Classroom			<b>Asbestos Present :</b> Potentially				
Ceiling	Non-Asbestos Lay-in Tile								V0002
Duct	Uninsulated								
Floor	Suspect Vinyl Floor Tile	840.0 SF	Good		A	8	Yes	No	
Floor	Terrazzo								
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Structure	Steel Beam, Deck & Joist								
Wall	Masonry								
Wall	Suspect Drywall Compound	15.0 SF	Good		C	8	No	Yes	
<b>Comments:</b> Vinyl Floor Tile Assumed to Contain Asbestos									
<b>Level :</b> LOC 38 - First Floor		<b>Room :</b> 3 - Classroom			<b>Asbestos Present :</b> Potentially				
Ceiling	Non-Asbestos Lay-in Tile								V0002
Duct	Uninsulated								
Floor	Suspect Vinyl Floor Tile	840.0 SF	Good		A	8	Yes	No	
Floor	Terrazzo								
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Structure	Steel Beam, Deck & Joist								
Wall	Masonry								

# Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'SC 31'

OH SOLUTIONS

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Wall	Suspect Drywall Compound	15.0 SF	Good		C	8	No	Yes	
<b>Comments:</b> Vinyl Floor Tile Assumed to Contain Asbestos									
<b>Level :</b> LOC 39 - First Floor			<b>Room :</b> 2 - Classroom			<b>Asbestos Present :</b> Potentially			
Ceiling	Non-Asbestos Lay-in Tile								V0002
Duct	Uninsulated								
Floor	Suspect Vinyl Floor Tile	840.0 SF	Good		A	8	Yes	No	
Floor	Terrazzo								
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Structure	Steel Beam, Deck & Joist								
Wall	Masonry								
Wall	Suspect Drywall Compound	15.0 SF	Good		C	8	No	Yes	
<b>Comments:</b> Vinyl Floor Tile Assumed to Contain Asbestos									
<b>Level :</b> LOC 40 - First Floor			<b>Room :</b> 1 - Classroom			<b>Asbestos Present :</b> Potentially			
Ceiling	Non-Asbestos Lay-in Tile								V0002
Duct	Uninsulated								
Floor	Suspect Vinyl Floor Tile	840.0 SF	Good		A	8	Yes	No	
Floor	Terrazzo								
Mechanical	Not Found								
Piping	Fibreglass Fitting								

# Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'SC 31'

OH SOLUTIONS

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Piping	Fibreglass Straight Run								
Structure	Steel Beam, Deck & Joist								
Wall	Masonry								
Wall	Suspect Drywall Compound	15.0 SF	Good		C	8	No	Yes	

**Comments:** Vinyl Floor Tile Assumed to Contain Asbestos

**Level :** LOC 41 - First Floor

**Room :** Corridor

**Asbestos Present :** Yes

Ceiling	Non-Asbestos Lay-in Tile								V0002
Duct	Uninsulated								
Floor	Terrazzo								
Piping	Asbestos Parging Cement Roof Hopper	1.0 EA	Good		C	7	No	Yes	V0001
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Piping	Transite Straight Run	5.0 LF	Good		D	7	No	No	
Structure	Steel Beam, Deck & Joist								
Wall	Masonry								
Wall	Suspect Drywall Compound	50.0 SF	Good		C	8	Yes	No	

**Comments:**

**Level :** LOC 42 - First Floor

**Room :** Corridor

**Asbestos Present :** Potentially

Ceiling	Non-Asbestos Lay-in Tile								V0002
Duct	Uninsulated								
Floor	Terrazzo								

# Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'SC 31'

OH SOLUTIONS

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Structure	Steel Beam, Deck & Joist								
Wall	Masonry								
Wall	Suspect Drywall Compound	30.0 SF	Good		C	8	Yes	No	

**Comments:**

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<b>Level :</b> LOC 43 - First Floor	<b>Room :</b> Corridor	<b>Asbestos Present :</b> No
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Ceiling	Non-Asbestos Lay-in Tile								V0002
Duct	Not Found								
Floor	Terrazzo								
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Structure	Steel Beam, Deck & Joist								
Wall	Masonry								

**Comments:**

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<b>Level :</b> LOC 44 - First Floor	<b>Room :</b> 6 - Classroom	<b>Asbestos Present :</b> Potentially
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Ceiling	Non-Asbestos Lay-in Tile								V0002
Duct	Uninsulated								
Floor	Suspect Vinyl Floor Tile	784.0 SF	Good		A	8	Yes	No	
Floor	Terrazzo								

# Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'SC 31'

OH SOLUTIONS

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Structure	Steel Beam, Deck & Joist								
Wall	Masonry								
Wall	Suspect Drywall Compound	15.0 SF	Good		C	8	No	Yes	
<b>Comments:</b> Vinyl Floor Tile Assumed to Contain Asbestos									
<b>Level :</b> LOC 45 - First Floor			<b>Room :</b> 7 - Classroom			<b>Asbestos Present :</b> Potentially			
Ceiling	Non-Asbestos Lay-in Tile								V0002
Duct	Uninsulated								
Floor	Suspect Vinyl Floor Tile	784.0 SF	Good		A	8	Yes	No	
Floor	Terrazzo								
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Structure	Steel Beam, Deck & Joist								
Wall	Masonry								
Wall	Suspect Drywall Compound	15.0 SF	Good		C	8	No	Yes	
<b>Comments:</b> Vinyl Floor Tile Assumed to Contain Asbestos									
<b>Level :</b> LOC 46 - First Floor			<b>Room :</b> 8 - Classroom			<b>Asbestos Present :</b> Potentially			
Ceiling	Non-Asbestos Lay-in Tile								V0002
Duct	Uninsulated								

# Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'SC 31'

OH SOLUTIONS

Design	Description	Quantity		Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Floor	Suspect Vinyl Floor Tile	784.0	SF	Good		A	8	Yes	No	
Floor	Terrazzo									
Mechanical	Not Found									
Piping	Fibreglass Fitting									
Piping	Fibreglass Straight Run									
Structure	Steel Beam, Deck & Joist									
Wall	Masonry									
Wall	Suspect Drywall Compound	15.0	SF	Good		C	8	No	Yes	

**Comments:** Vinyl Floor Tile Assumed to Contain Asbestos

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**Level :** LOC 47 - First Floor                      **Room :** 9 - Kindergarten                      **Asbestos Present :** Potentially

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Ceiling	Non-Asbestos Lay-in Tile									V0002
Duct	Uninsulated									
Floor	Suspect Vinyl Floor Tile	784.0	SF	Good		A	8	Yes	No	
Floor	Terrazzo									
Mechanical	Not Found									
Piping	Fibreglass Fitting									
Piping	Fibreglass Straight Run									
Piping	Uninsulated									
Structure	Steel Beam, Deck & Joist									
Wall	Masonry									
Wall	Suspect Drywall Compound	30.0	SF	Good		C	8	No	Yes	

**Comments:** Vinyl Floor Tile Assumed to Contain Asbestos



# Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'SC 31'

OH SOLUTIONS

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
<b>Level :</b> LOC 48 - First Floor		<b>Room :</b> 9 - Kindergarten Coat Room			<b>Asbestos Present :</b> Potentially				
Ceiling	Non-Asbestos Lay-in Tile								V0002
Duct	Uninsulated								
Floor	Suspect Vinyl Floor Tile	216.0 SF	Good		A	8	Yes	No	
Floor	Terrazzo								
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Piping	Uninsulated								
Structure	Steel Beam, Deck & Joist								
Wall	Masonry								
Wall	Suspect Drywall Compound	15.0 SF	Good		C	8	No	Yes	
<b>Comments:</b> Vinyl Floor Tile Assumed to Contain Asbestos									
<b>Level :</b> LOC 49 - First Floor		<b>Room :</b> Storage Room			<b>Asbestos Present :</b> Potentially				
Ceiling	Non-Asbestos Lay-in Tile								V0002
Duct	Uninsulated								
Floor	Suspect Vinyl Floor Tile	96.0 SF	Good		A	8	Yes	No	
Floor	Terrazzo								
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Structure	Steel Beam, Deck & Joist								

# Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'SC 31'

OH SOLUTIONS

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Wall	Masonry								
Wall	Suspect Drywall Compound	15.0 SF	Good		C	8	No	Yes	
<b>Comments:</b> Vinyl Floor Tile Assumed to Contain Asbestos									
<b>Level :</b> LOC 50 - First Floor			<b>Room :</b> Side Entrance			<b>Asbestos Present :</b> No			
Ceiling	Non-Asbestos Lay-in Tile								
Duct	Not Found								
Floor	Terrazzo								
Mechanical	Not Found								
Piping	Not Found								
Structure	Steel Beam, Deck & Joist								
Wall	Masonry								
<b>Comments:</b>									
<b>Level :</b> LOC 51 - First Floor			<b>Room :</b> 10 - Classroom			<b>Asbestos Present :</b> Potentially			
Ceiling	Non-Asbestos Lay-in Tile								V0002
Duct	Uninsulated								
Floor	Suspect Vinyl Floor Tile	784.0 SF	Good		A	8	Yes	No	
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Structure	Steel Beam, Deck & Joist								
Wall	Masonry								
Wall	Suspect Drywall Compound	15.0 SF	Good		C	8	No	Yes	

# Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'SC 31'

OH SOLUTIONS

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
<b>Comments:</b> Vinyl Floor Tile Assumed to Contain Asbestos									
<b>Level :</b> LOC 52 - First Floor		<b>Room :</b> 11 - Classroom			<b>Asbestos Present :</b> Potentially				
Ceiling	Non-Asbestos Lay-in Tile								V0002
Duct	Uninsulated								
Floor	Suspect Vinyl Floor Tile	784.0 SF	Good		A	8	Yes	No	
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Structure	Steel Beam, Deck & Joist								
Wall	Masonry								
Wall	Suspect Drywall Compound	15.0 SF	Good		C	8	No	Yes	
<b>Comments:</b> Vinyl Floor Tile Assumed to Contain Asbestos									
<b>Level :</b> LOC 53 - First Floor		<b>Room :</b> 12 - Classroom			<b>Asbestos Present :</b> Potentially				
Ceiling	Non-Asbestos Lay-in Tile								V0002
Duct	Uninsulated								
Floor	Suspect Vinyl Floor Tile	784.0 SF	Good		A	8	Yes	No	
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Structure	Steel Beam, Deck & Joist								
Wall	Masonry								

# Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'SC 31'

OH SOLUTIONS

Design	Description	Quantity		Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Wall	Suspect Drywall Compound	15.0	SF	Good		C	8	No	Yes	
<b>Comments:</b> Vinyl Floor Tile Assumed to Contain Asbestos										
<b>Level :</b> LOC 54 - First Floor			<b>Room :</b> Prep Room			<b>Asbestos Present :</b> Potentially				
Ceiling	Non-Asbestos Lay-in Tile									V0002
Duct	Uninsulated									
Floor	Suspect Vinyl Floor Tile	215.0	SF	Good		A	8	Yes	No	
Mechanical	Not Found									
Piping	Fibreglass Fitting									
Piping	Fibreglass Straight Run									
Structure	Steel Beam, Deck & Joist									
Wall	Masonry									
Wall	Suspect Drywall Compound	15.0	SF	Good		C	8	No	Yes	
<b>Comments:</b> Vinyl Floor Tile Assumed to Contain Asbestos										
<b>Level :</b> LOC 55 - First Floor			<b>Room :</b> Storage Room			<b>Asbestos Present :</b> Potentially				
Ceiling	Non-Asbestos Lay-in Tile									V0002
Duct	Uninsulated									
Floor	Suspect Vinyl Floor Tile	80.0	SF	Good		A	8	Yes	No	
Mechanical	Not Found									
Piping	Fibreglass Fitting									
Piping	Fibreglass Straight Run									
Structure	Steel Beam, Deck & Joist									

# Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'SC 31'

OH SOLUTIONS

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
--------	-------------	----------	-------	---------------	---------	--------	---------	---------	--------

Wall	Masonry								
Wall	Suspect Drywall Compound	15.0 SF	Good		C	8	No	Yes	

**Comments:** Vinyl Floor Tile Assumed to Contain Asbestos

---

<b>Level :</b> LOC 56 - First Floor	<b>Room :</b> Boy's Washroom	<b>Asbestos Present :</b> Potentially
-------------------------------------	------------------------------	---------------------------------------

---

Ceiling	Suspect Drywall Compound	230.0 SF	Good		C	8	Yes	No	
Duct	Uninsulated								
Floor	Terrazzo								
Mechanical	Inaccessible								
Piping	Uninsulated								
Structure	Inaccessible								
Wall	Masonry								
Wall	Suspect Drywall Compound	5.0 SF	Good		C	8	Yes	No	

**Comments:** No access above ceiling.

---

<b>Level :</b> LOC 57 - First Floor	<b>Room :</b> Girls Washroom	<b>Asbestos Present :</b> Potentially
-------------------------------------	------------------------------	---------------------------------------

---

Ceiling	Suspect Drywall Compound	230.0 SF	Good		C	8	Yes	No	
Duct	Inaccessible								
Floor	Terrazzo								
Mechanical	Inaccessible								
Piping	Uninsulated								
Structure	Inaccessible								
Wall	Masonry								

# Asbestos Status Report

(sorted by Building Number)

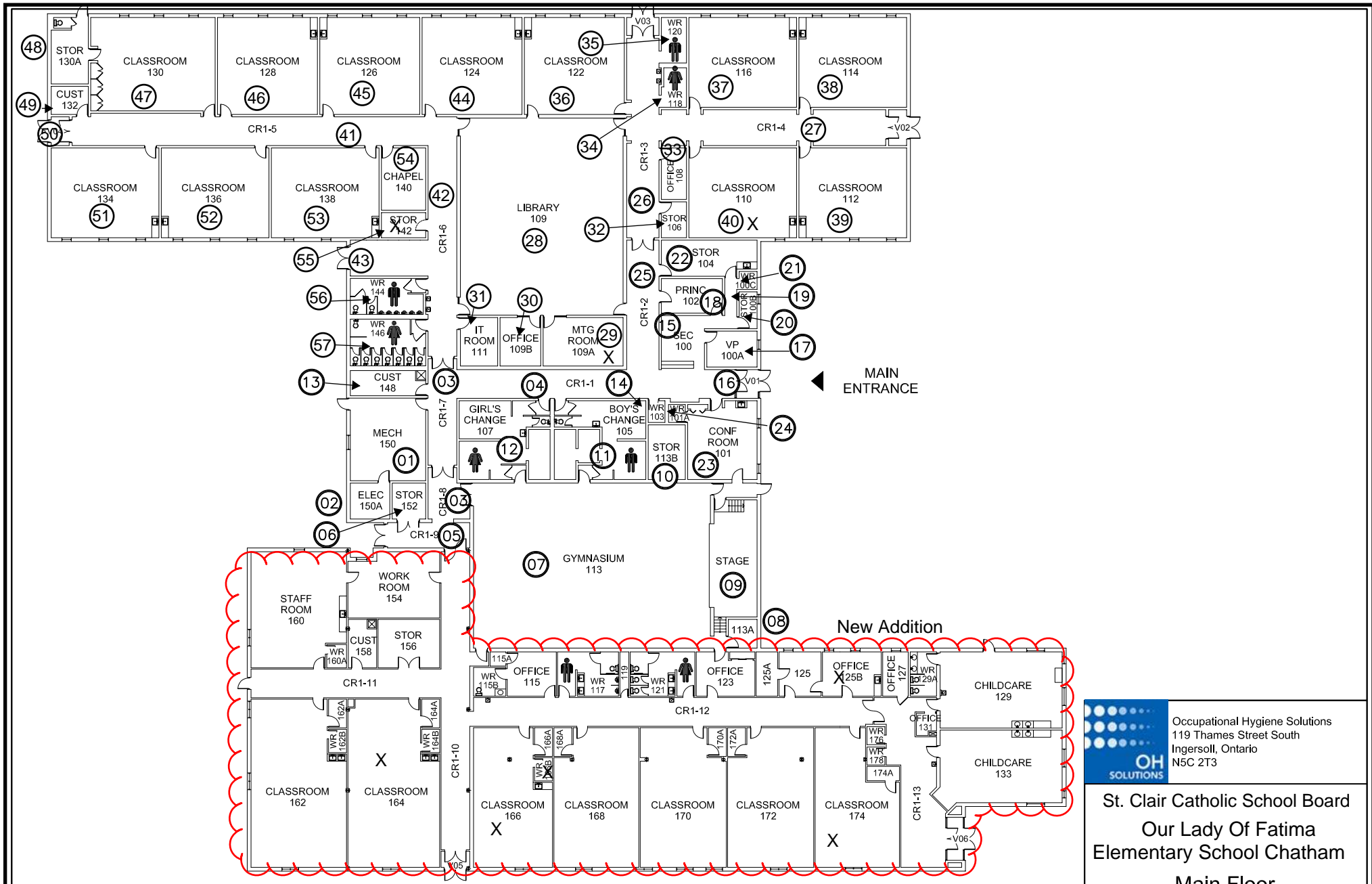
UPPER(BUILD:BuildingNumber) = 'SC 31'

OH SOLUTIONS

Design	Description	Quantity		Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Wall	Suspect Drywall Compound	5.0	SF	Good		C	8	Yes	No	

**Comments:** No access above ceiling.

**APPENDIX III**  
**DRAWINGS OUTLINING INSPECTION LOCATIONS**



New Addition

New Addition

Occupational Hygiene Solutions  
 119 Thames Street South  
 Ingersoll, Ontario  
 N5C 2T3

**OH SOLUTIONS**

**St. Clair Catholic School Board**  
**Our Lady Of Fatima**  
**Elementary School Chatham**  
**Main Floor**  
**Survey Locations**

Project: <b>17-1176</b>	Prepared by: <b>JE</b>
Scale: <b>N.T.S.</b>	Date: <b>Aug 2017</b>





**GEOTECHNICAL INVESTIGATION REPORT  
PROPOSED PARKING LOT, BUS ROUTE AND PLAYGROUND  
AREA CONSTRUCTION  
OUR LADY OF FATIMA SCHOOL  
CHATHAM, ONTARIO**

Submitted to:

**St. Clair Catholic District School Board**

c/o ROA Studio Inc.  
67 King Street West  
Chatham, Ontario  
N7M 1C7

Attn: Mr. Joseph Ouellette

Submitted by:

Amec Foster Wheeler Environment and Infrastructure  
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16 June 2017

SWW177161

Distribution:

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- ] ROA Studio Inc. – 1 Digital Copy
- ] Amec Foster Wheeler Environment & Infrastructure - 1 Copy

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## 1.0 INTRODUCTION

Amec Foster Wheeler Environment & Infrastructure, a Division of Amec Foster Wheeler Americas Limited (“Amec Foster Wheeler”) was retained by the St. Clair Catholic District School Board (“SSCDSB”) c/o ROA Studio Inc. (the “Client”) to conduct a geotechnical investigation for the proposed playground addition, parking lot and bus route reconstruction for Our Lady of Fatima School located at 545 Baldoon Road, in Chatham, Ontario (the “Site”).

The project areas are shown on the Key Plan, Figure 1. The purpose of this investigation was to provide subsurface soil information, and based on this information, to provide geotechnical recommendations pertaining to the construction of the pavement structure for the parking lot, bus route and playground area, as well as provide preliminary bearing capacities and depths of foundations for a potential building addition, should one be proposed.

The scope of the fieldwork for this geotechnical investigation included the advancement of one (1) borehole within the existing parking lot, one (1) borehole within the existing bus route, one (1) borehole for the proposed new parking lot and one (1) borehole within the existing playground area. The boreholes were advanced to a depth of 5.0 metres (m) below the existing ground surface.

This report contains the findings of Amec Foster Wheeler’s geotechnical investigation, together with recommendations and comments. The recommendations and comments are based on factual information and intended only for use by design engineers. The number of boreholes may not be sufficient to determine all of the factors that may affect construction methods and costs. Subsurface and groundwater conditions between and beyond the boreholes may differ from those encountered at the borehole locations, and conditions may become apparent during construction that could not be detected or anticipated at the time of the site investigation.

The anticipated construction conditions are also discussed, but only to the extent that they may influence the design decisions. The feasible construction methods; however, express our opinion and are not intended to direct contractors on how they carry out construction. Contractors should also be aware that the data and their interpretation presented in this report may not be sufficient to assess all factors that may have effect upon construction.

This report has been prepared with the assumption that the design will be in accordance with good engineering practices, applicable regulations of jurisdictional authorities, and applicable standards and regulations. Further, the recommendations and opinions in this report are applicable only to the proposed project. Environmental considerations were not included in the scope of work. The limitations of this report, as discussed in detail in Appendix “A”, constitute an integral part of this report.

There should be an ongoing liaison with Amec Foster Wheeler during both the design and construction phases of this project to ensure that the recommendations in this report have been interpreted and implemented. Also, should any further clarification and/or elaboration be needed concerning the geotechnical aspects of this project, Amec Foster Wheeler should be contacted immediately.

## **2.0 SITE DESCRIPTION AND GEOLOGICAL BACKGROUND**

### **2.1 Site Description**

The Site is located at 545 Baldoon Road in Chatham, Ontario, as shown on Figure 1. The Site is located in a residential and agricultural area of Chatham. The general topography of the site was flat.

The boreholes were advanced at the approximate locations, as indicated in our proposal PSWW177109 dated February 16, 2017, within the existing parking lot, the existing bus route, the proposed new parking lot and the new playground area, where underground utilities allowed.

### **2.2 Geologic Background**

The Site is located within a mapped area of coarse glaciolacustrine deposits, underlain by shale bedrock at a depth of approximately 30 m to 40 m (Ontario Geological Survey, Preliminary Map P. 3255, 1994).

### **3.0 INVESTIGATIVE PROGRAM**

#### **3.1 Field Work**

The scope of the geotechnical fieldwork included four (4) sampled boreholes designated as BH1 to BH4, inclusive, in the parking lot, bus route and playground area. The boreholes were advanced to depths of 5.0 m below the existing ground surface. The locations and depths of the boreholes were determined by Amec Foster Wheeler based on the requirements from the Client.

The locations of the boreholes from the current geotechnical investigation are shown on Figure 2. The coordinates of the boreholes are shown on the Record of Borehole sheets attached in Appendix B. The coordinates at the borehole locations were recorded in the field using a hand-held GPS device with a horizontal accuracy of 3.0 m.

The borehole drilling program for the investigation was carried out on May 1, 2017. The boreholes were advanced using a self-propelled drill equipped with hollow stem augers and conventional soil sampling tools. Soil samples were taken at frequent intervals of depth following the Standard Penetration Test (ASTM D-1586) procedure.

The drilling was conducted under the full-time supervision of Amec Foster Wheeler's engineering staff who directed the drilling and sampling operation, and logged the boreholes.

After completion of the borehole, the augers were extracted, the borehole was inspected for groundwater and caving, then backfilled using bentonite hole plug and temporary asphalt patching, if necessary.

All samples were field logged, placed in airtight containers, and transported to Amec Foster Wheeler's Tecumseh laboratory for further examination and testing.

Ground surface elevations at the borehole locations were referenced to a local datum, with a given elevation of 100.000 m, described as:

*The top nut of the fire hydrant adjacent to the west corner of the Site building.*

The elevations used in this report were obtained strictly for use by this office in the geotechnical design of the project. They should not be used by any other party for any other purpose.

#### **3.2 Laboratory Testing**

Natural moisture content tests were carried out in accordance with ASTM D2216 on all recovered soil samples. One grain size distribution was completed on a sample from BH4 in accordance with ASTM D7928. The test results are included in Appendix C.

## 4.0 SUBSURFACE CONDITIONS

### 4.1 Subsurface Soil Conditions

The results of laboratory testing carried out on select samples are also shown on the Record of Borehole sheets in Appendix B. The results of the grain size analysis can be found in Appendix C. The following is a brief description of the soil conditions encountered, presented as a summary only.

#### Topsoil

Topsoil was encountered in BH1 from ground surface to a depth of approximately 200 millimetres (mm).

#### Pavement Structure - Asphalt and Granular Materials

Three boreholes, BH2, BH3 and BH4, were drilled within the existing asphalt located on the north, west and south sides of the existing building and encountered a surface layer of asphalt overlying a layer of granular fill. The existing thicknesses of asphalt, granular fill and sand fill materials encountered at the borehole locations are tabulated below:

**Table 1: – Existing Pavement and Fill**

Borehole No.	Pavement Structure	
	Asphalt Thickness (mm)	Granular Fill Thickness (mm)
BH2	50	175
BH3	75	430
BH4	100	200

#### Fill Materials

Fine sand fill was encountered in boreholes BH2 and BH4 below the granular fill to depths of 460 mm and 965 mm, respectively.

Silty clay fill was encountered below the topsoil in BH1 and below the granular fill in BH3. The silty clay fill was encountered to a depth of 1.4 m at both locations. The measured “N” values from the Standard Penetration Tests obtained in the silty clay fill were 11 blows per 0.3 m. The moisture content ranged from 20% to 22%.

#### Native Soils

Underlying the fill materials was a deposit of a wide range of soils, ranging from silty sand to silty clay. Silty clay was encountered directly below the sand fill in BH2 to a depth of 1.4 m. The

measured “N” values from the Standard Penetration Tests obtained were 13 blows per 0.3 m, indicating a stiff consistency. The moisture content of this sample was 2%.

Silty sand was encountered below the fill in BH1 and the silty clay in BH2 to depths of 2.1 m. The measured “N” values from the Standard Penetration Tests obtained ranged from 9 to 13 blows per 0.3 m, indicating a compact consistency. The moisture contents ranged from 21% to 25%.

Sandy silt was encountered below the silty sand in BH2, and below the fill in boreholes BH3 and BH4. The measured “N” values from the Standard Penetration Tests obtained ranged from 13 to 28 blows per 0.3 m, indicating a compact consistency. The moisture contents ranged from 18% to 25%.

Brown silty clay was encountered in BH1 at a depth ranging from 2.1 m to 3.3 m and a measured “N” values from the Standard Penetration Tests obtained of 9 blows per 0.3 m, indicating a firm consistency. The moisture contents ranged from 26% to 32%.

Grey silty clay till was encountered to the termination of each borehole. The measured “N” values from the Standard Penetration Tests obtained ranged from weight of hammer to 5 blows per 0.3 m, indicating a very soft to soft consistency. The moisture contents ranged from 24% to 30%. Vane shear testing was conducted in the grey silty clay till in BH4 at a depth of 5.3 m and indicated the silty clay had an undrained shear strength of 21 kPa, and a remoulded shear strength of 7 kPa.

#### Geotechnical Laboratory Testing

One grain size distribution analysis was carried out on Sample 2 from BH4. The results of the test are included on the borehole log sheet and attached in Appendix C.

**Table 2: Results of Grain Size Analysis**

Borehole No. / Sample No.	Sample Depth (metres)	Grain Size Distribution			
		Gravel (%)	Sand (%)	Silt (%)	Clay (%)
B4/Sa 2	1.5 – 2.0	0.0	1.2	84.3	14.5

#### **4.2 Groundwater**

Groundwater level observations and measurements in the boreholes, and in-situ moisture contents of recovered soil samples are presented on the Record of Borehole sheets.

Groundwater was encountered in boreholes BH2, BH3 and BH4. Groundwater was measured at depths of 4.0 m and 4.6 m in BH3 and BH4, respectively. Borehole BH2 was found to cave in at 1.7 m below ground surface, consistent with the depth of the silty sand encountered at that location.



Typically, the 'grey zone' is indicative of a permanent saturated condition, and therefore, fluctuation of the long-term groundwater should be anticipated near this depth. The anticipated long-term groundwater should be expected to be between El. 96.0 m and El. 97.2 m. However, during and after local precipitation events, groundwater that is 'perched' above the long-term levels may accumulate in the fills and weathered mottled/brown silty clays, as well as the silty sand and sandy silt stratigraphic layers above the relatively more impervious grey silty clay. In addition, significant amounts of groundwater may be present within the layers/pockets of granular soils known to occur randomly within the overburden soils and within any fill materials around the existing utilities that may be present.

Perched groundwater may rise to the ground surface following precipitation and snowmelt. In the absence of an active, engineered drainage system, the design should assume possible temporary groundwater levels rising to the ground surface.

## **5.0 DISCUSSION AND RECOMMENDATIONS**

### **5.1 General**

Amec Foster Wheeler understands the Client is planning a full reconstruction of the parking lot, bus route and playground area. After the completion of the field investigation and during the preparation of the report, Amec Foster Wheeler was notified that a building addition without basement may be constructed at the Site. The Client has requested preliminary Serviceability Limit State (SLS) and Ultimate Limit State (ULS) bearing capacities to be included in the report. The boreholes were all advanced to a depth of 5.0 m below ground surface.

### **5.2 Soil Types**

The soils encountered in this investigation below the existing pavement material and fill was native undisturbed sandy silt and silty clay to the full extent of drilling.

### **5.3 Shallow Foundations**

At the time of the writing of this report, no indication was given to Amec Foster Wheeler that a building addition was to be constructed. The SLS and ULS bearing capacities given are intended as preliminary calculations and can be further refined if an additional field investigation is carried out and design parameters for a new building addition are provided to Amec Foster Wheeler.

The foundations of the potential building addition should not be placed on the existing fill material surrounding the building. Strip or square footings should be placed at 1.4 m below ground surface, or about El. 97.8 m and may be designed using a geotechnical reaction at SLS of 40 kPa for 25 mm of settlement and a factored geotechnical resistance at ULS of 60 kPa for footings founded on the compact native silty sand and sandy silt.

Typical footing dimensions for these applications include should have a maximum dimension of less than 1.5 m. The serviceability limit state is based on maximum total and minimum differential settlement tolerances of 25 mm and 20 mm, respectively. Differential settlement should be expected between the new addition and existing building sections and adequate settlement control/mitigation measures should be included in the building design.

The geotechnical pressure values listed above are for vertical loads (no inclination) and no eccentricity. The ULS values could be significantly less than stated if inclined or eccentric loading conditions exist. The foundation design must also consider load inclinations and eccentricity as per the applicable principles presented in the 2006 Canadian Foundation Engineering Manual (CFEM). Amec Foster Wheeler would be pleased to provide detailed assistance in the required geotechnical calculations to satisfy these requirements.

Exterior footings and foundations in unheated areas should be provided with a minimum of 1.2 m of soil cover or equivalent thermal insulation for adequate frost protection. Should new foundations be constructed next to the existing building foundations, they should be founded at the same elevation as the existing foundations. Footings founded at different elevations should be stepped in accordance with the 2012 Ontario Building Code (2012 OBC) and at a slope not steeper than 2 horizontal to 1 vertical.

The footing excavation should be reviewed by a qualified geotechnical consultant to confirm that the bearing soil has adequate bearing capacity.

Loose or disturbed material should be removed from the footing excavation prior to the placement of concrete. Hand cleaning may be required to prepare an acceptable bearing surface. The footing subgrade should be protected at all times from rain, snow, freezing temperatures and the ingress of free water. Concrete should not be placed on frozen soil, nor should the soil beneath the footing be allowed to freeze after construction of the footing.

#### **5.4 Shallow Mat Foundation on Native Soils**

If the shallow foundations are not practical for design purposes, a raft foundation may be used and will bear on the native materials. The raft foundation may be designed using a geotechnical reaction at ULS of 75 kPa and a factored geotechnical resistance at SLS of 50 kPa. The total long-term settlement for the structure would be about 50 mm while differential settlement would be about 20 mm.

The raft foundation should be founded at 1.4 m below ground surface, or at El. 97.8 m. The depth of the raft foundation should not be below 1.7 m in order to be above the groundwater table.

The silty sand or sandy silt subgrade soil should be proof rolled without the use of vibration and inspected by a geotechnical consultant prior to the placement of concrete.

#### **5.5 Comments on Foundation Options**

If higher bearing capacities are required, consideration should be given to deepen the boreholes to provide refined recommendations for shallow and deep foundation options. Considering the limited field investigation, the Site appears to be suitable for ground improvement techniques such as geo - concrete columns with the tip placed below the very soft soils encountered. Also, helical piles are used on Sites similar to this one, where very soft soil conditions are encountered and where light to moderate loads are required. As noted, additional field work is required to expand on any of the foundation options noted above.

#### **5.6 Seismic Conditions**

The 2012 OBC contains updated seismic analysis and design methodology. The 2012 OBC uses a site classification system defined by the average soil/bedrock properties in the top 30 metres (100 feet) of the subsurface profile beneath the structure. Based on the limited site investigation and our experience in the area, a "Site Class E – Soft Soil" designation could be used for design in accordance with the 2012 OBC methodology (Table 4.1.8.4.A). Seismic field testing (geophysical testing) is recommended to confirm the seismic site classification. The four values of the Spectral response acceleration  $S_a(T)$  for different periods and the Peak Ground Acceleration (PGA) can be obtained from 2012 OBC. The design values of  $F_A$  and  $F_V$  for the project site should be calculated in accordance to 2012 OBC.

## **5.7 Frost Design Considerations**

In accordance with the Ontario Provisional Standard Drawing (OPSD 3090.101) the design frost depth below the ground surface for the general area is estimated to be 1.2 m. Therefore, a permanent soil cover of 1.2 m or equivalent thermal insulation is required for frost protection of shallow foundations.

Where provision of the minimum depths of soil cover outlined above is not practical, rigid high density extruded polystyrene insulation could be used to reduce the required thickness of soil cover. Amec Foster Wheeler can provide recommended insulation details for specific development conditions upon request.

## **5.8 Backfill Requirements**

The footings may be backfilled with select free-draining granular material meeting the gradation requirements of OPSS Granular 'A' or Granular 'B', Type I. The granular fill should be placed in loose lifts not exceeding 200 mm in thickness and should be uniformly compacted to 95% of Standard Proctor Maximum Dry Density (SPMDD).

The use of the existing silty clay fill as backfill is not recommended for the footings due to the fine grained nature of the material and the low permeability nature of it. The existing fill had elevated moisture contents which may also impede compaction. The silty clay fill material excavated may be used in landscaping areas where compaction specifications are not necessary.

## **5.9 General Recommendations for Excavations**

Excavations with conventional equipment and open cut methods are feasible in these soils. Excavations must be carried out in accordance with Ontario Regulation 213 / 91 of the Occupational Health and Safety Act (OHSA). These regulations designate four broad classifications of soils to stipulate appropriate measures for excavation safety. The silty clay fill and silty sand above the recommended footing design elevation can be classified as Type 3 soils. However, unprotected slopes exposed to elements will degrade with time. If the groundwater table is found to be at an elevation higher than the design elevation, or if the excavation is advanced deeper than the groundwater table, the sandy silt may be saturated, and would be classified as Type 4 soils. Excavations within and Type 3 soils may be carried out with unsupported side-slopes not steeper than 1V:1H. Type 4 soils requires slopes at 3H:1V, or flatter, or engineered temporary shoring.

## **5.10 Groundwater Control**

Groundwater inflow into the excavations should be minimal as the recommended footing design elevation is above the anticipated groundwater levels; however, significant 'perched' groundwater may be present within the fill materials, utility trenches and abandoned utilities. This would especially be true during and after local precipitation events. In this case, the inflow into excavations may become significant.

The soils identified are sensitive to disturbance by water. Groundwater and surface water run-off should be removed from excavations by means of pumping from strategically placed open sumps located within the excavation bottom but outside the zone of influence of any foundations.

### 5.11 Pavement Design

Based on the subsurface conditions encountered at the borehole locations and the laboratory testing, the following pavement design is recommended as a minimum for use at this Site:

**Table 4: Minimum Recommended Pavement Thickness**

Layer	Material	Recommended Minimum Thickness Parking Areas (mm)	Recommended Minimum Thickness Playground Areas (mm)	Recommended Minimum Thickness Bus Drop Off Route Access Routes and Entrances (mm)
Asphaltic Concrete	HL 3 Surface Course (OPSS 1150)	40	40	40
	HL 4 Binder Course (OPSS 1150)	50	50	75
Granular Base	Granular 'A' (OPSS 1010)	300	300	450
Granular Subbase	Granular 'B' Type I (OPSS 1010)	300	300	300

The subgrade material should be sloped so as to promote drainage and prevent the build-up and stagnation of pore water within the granular base. The Contractor should conduct non-vibratory proof-rolling of the subgrade soils, which should be inspected by a geotechnical consultant prior to the placement of the granular base. Any soft spots noted during the proof-roll should be sub-excavated and replaced with approved granular backfill such as Granular 'B' Type I or Type II (OPSS 1010).

The base layer should be hydraulically connected to catch basins, using filtered subdrains.

All granular materials should be compacted to 100% of the SPMDD. The asphalt base course and surface course should be compacted to 92% to 96.5% of their respective Maximum Relative Densities (MRD) obtained from the mix design.

If the construction is not carried out during dry weather conditions, it may be necessary to increase the recommended thicknesses of the pavement structure. Further, the granular thickness may not be sufficient to support construction traffic prior to the asphaltic concrete placement, and additional granular material may be required to support this traffic.

## 5.12 Drainage

To meet the design requirements for the pavement life, the pavement structure should be well drained at all times. This can be accomplished by installing 150 mm diameter full-length perforated subdrain pipes and connected to the existing catch basins, below the granular base level, to ensure effective drainage in accordance with OPSD 216.021. The subdrain pipes should be surrounded by a minimum drainage zone of 20 mm size clear stone of minimum 150 mm thickness and wrapped in suitable non-woven geotextile to provide separation from the surrounding soil.

A minimum slope of 2% should be maintained across the surface of paved sections to ensure proper surface drainage.

## 5.13 Pavement Construction Considerations

Fill and organic materials should be removed to expose the native sandy silt and sandy silt subgrade material, which should be immediately inspected by the Geotechnical Consultant. Any soft spots noted should be sub-excavated and replaced with approved granular backfill such as Granular 'B' Type I or Type II (OPSS 1010). Alternatively to subexcavation of soft/loose areas, a biaxial geogrid similar to Terrafix 2500 placed over a non-woven geotextile similar to Terrafix 270R can be used to reinforce the subgrade.

The Contractor should conduct non-vibratory proof-rolling of the subgrade soils. Any soft or loose spots revealed by the proof-rolling should be sub-excavated and replaced with approved granular backfill Granular 'B' Type I or Type II (OPSS 1010). Where new fill is needed to raise the grade, or replace disturbed portions of the subgrade, imported granular fill conforming to the gradation requirements of OPSS Granular 'B' Type I (OPSS 1010) should be placed in maximum 300 mm thick lifts and compacted to at least 98% of SPMDD. The long term performance of the pavement structure is dependent upon the sub-grade support conditions. Stringent construction control procedures must be maintained to ensure that uniform subgrade moisture and density conditions are achieved as much as practically possible where fill is placed and that the subgrade is not disturbed or weakened after it is exposed.

Following the stripping of the existing asphalt, the existing granular material may be suitable for reuse at the Site. A representative sample should be collected and tested during construction to determine if the material meets OPSS 1010.

Control of surface water is a significant factor in achieving good pavement life. Grading adjacent to pavement area must be designed so that water is not allowed to pond adjacent to the outside edges of the pavement or curb.

The subgrade soils identified in this report are sensitive to disturbance from exposure to weathering and/or construction traffic (vehicular and pedestrian). Once the excavations have been completed to design elevations, the Geotechnical Consultant should immediately inspect the subgrade soils. Upon approval, the subgrade soil should be protected from further exposure. Disturbance by weathering or construction traffic may compromise the soils and necessitate further excavation.

If construction is to be completed during the winter months additional care should be given to protecting any subgrade from freezing. No backfill materials shall be placed on frozen subgrade and all backfill shall be free of frozen materials.

## 6.0 CLOSURE

The limitations of this report, as discussed in detail in Appendix "A", constitute an integral part of this report. We recommend the Geotechnical Consultant be retained to review drawings and the intended methods of construction prior to implementation in order to assure conformance with the geotechnical restrictions and assumptions.

We trust this report is complete within the terms of our reference. However, should questions arise concerning this report, do not hesitate to contact us.

Sincerely,  
**Amec Foster Wheeler Environment & Infrastructure**  
**a Division of Amec Foster Wheeler Americas Limited**

Prepared By:



Anthony Pusic, EIT,  
Geotechnical EIT

Reviewed By:



Mauro Cortes, P. Eng.  
Senior Geotechnical Engineer





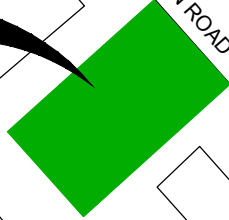
## FIGURES



GREGORY DRIVE WEST

Chatham

SITE



BALDOON ROAD

OXLEY DRIVE

PARRY DRIVE

VALENCIA DRIVE

MORNING GLORY LANE

BALMORAL ROAD

GARDEN PATH

McNAUGHTON AVENUE WEST

KEIL TRAIL NORTH

LARK STREET

BEAR LINE ROAD

**NOTES:**

THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE AMEC FOSTER WHEELER ENVIRONMENT & INFRASTRUCTURE REPORT No. SWW177161. ALL LOCATIONS ARE APPROXIMATE.

**REFERENCES:**

CANMAP STREETFILES V2008.4.

**ORIGINAL PAPER SIZE: 8½ x 11.**

CLIENT:  
**ST. CLAIR CATHOLIC DISTRICT SCHOOL BOARD**  
 c/o ROA STUDIO INC.  
 67 KING STREET WEST  
 CHATHAM, ONTARIO, N7M 1C7

TITLE:  
**KEY PLAN**

PROJECT:  
 GEOTECHNICAL INVESTIGATION  
 PROPOSED PARKING LOT, BUS ROUTE AND  
 PLAYGROUND AREA CONSTRUCTION  
 OUR LADY OF FATIMA SCHOOL  
 CHATHAM, ONTARIO

**Amec Foster Wheeler**  
 Environment & Infrastructure  
 11865 COUNTY ROAD 42  
 TECUMSEH, ONTARIO  
 N8N 2M1  
 519-735-2499



DATUM:  
 NAD83  
 DWN BY:  
 BM  
 CHK'D BY:  
 AP

PROJECTION:  
 UTM Zone 17  
 REV. No:  
 0  
 SCALE:  
 1:10000

DATE:  
 MAY 8, 2017  
 PROJECT No:  
 SWW177161  
 FIGURE No:  
 1

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- LEGEND:**
- APPROX. SITE BOUNDARY
  - BOREHOLE LOCATION

**NOTES:**  
 THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE AMEC FOSTER WHEELER ENVIRONMENT & INFRASTRUCTURE REPORT No. SWW177161.

ALL LOCATIONS ARE APPROXIMATE.

**ORIGINAL PAPER SIZE: 8½ x 11.**

**REFERENCES:**  
 2010 AERIAL PHOTOGRAPHS BY CHATHAM-KENT;  
 CANMAP STREETFILES V2008.4.

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<b>CLIENT:</b> ST. CLAIR CATHOLIC DISTRICT SCHOOL BOARD c/o ROA STUDIO INC. 67 KING STREET WEST CHATHAM, ONTARIO, N7M 1C7		<b>DWN BY:</b> BM	<b>PROJECT:</b> GEOTECHNICAL INVESTIGATION PROPOSED PARKING LOT, BUS ROUTE AND PLAYGROUND AREA CONSTRUCTION OUR LADY OF FATIMA SCHOOL CHATHAM, ONTARIO	<b>DATE:</b> MAY 8, 2017
<b>Amec Foster Wheeler          Environment &amp; Infrastructure</b> 11865 COUNTY ROAD 42 TECUMSEH, ONTARIO N8N 2M1 519-735-2499		<b>CHK'D BY:</b> AP		<b>PROJECT No.:</b> SWW177161
		<b>DATUM:</b> NAD83	<b>TITLE:</b> BOREHOLE LOCATION PLAN	<b>REV. No.:</b> 0
		<b>PROJECTION:</b> UTM Zone 17		<b>FIGURE No.:</b> 2
		<b>SCALE:</b> 1:2500		

**APPENDIX A**  
**REPORT LIMITATIONS**

## REPORT LIMITATIONS

The conclusions and recommendations given in this report are based on information determined at the testhole locations. The information contained herein in no way reflects on the environmental aspects of the Project, unless otherwise stated. Subsurface and groundwater conditions between and beyond the testholes may differ from those encountered at the testhole locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. It is recommended practice that the Geotechnical Engineer be retained during the construction to confirm that the subsurface conditions across the site do not deviate materially from those encountered in the testholes.

The design recommendations given in this report are applicable only to the project described in the text, and then only if constructed substantially in accordance with the details stated in this report. Since all details of the design may not be known, we recommend that we be retained during the final design stage to verify that the design is consistent with our recommendations, and that assumptions made in our analysis are valid.

The comments made in this report relating to potential construction problems and possible methods of construction are intended only for the guidance of the designer. The number of testholes may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work. This work has been undertaken in accordance with normally accepted geotechnical engineering practices. No other warranty is expressed or implied.

The benchmark and elevations mentioned in this report were obtained strictly for use by this office in the geotechnical design of the project, and should not be used by any other party for any other purpose.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Amec Foster Wheeler Environment & Infrastructure accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

**APPENDIX B**

**EXPLANATION OF RECORD OF BOREHOLE SHEETS AND  
RECORD OF BOREHOLE SHEETS BH1 to BH4**

## GENERAL REPORT NOTES

### DEFINITIONS OF PENETRATION RESISTANCE

Standard penetration resistance 'N' – The number of blows required to advance a standard split spoon sampler 30 cm into the subsoil, driven by means of a 63.5 kg hammer falling freely a distance of 76 cm.

Dynamic penetration resistance – The number of blows required to advance a 50 mm, 60 degree cone, fitted to the end of drill rods, 30 cm into the subsoil, the driving energy being 474.5 Joules per blow.

### SAMPLE TYPE ABBREVIATIONS USED IN BOREHOLE LOGS

S.S.	Split spoon	T.W.	Thinwall open	R.C.	Rock core
A.U.	Auger sample	T.P.	Thinwall piston	W.S.	Washed sample
P.H.	Sample pushed hydraulically			P.M.	Sample pushed manually

### SOIL TEST SYMBOLS USED IN BOREHOLE LOGS

○	Standard penetration resistance	▼	Laboratory Vane	□	Unconfined compression
●	Dynamic penetration resistance	▲	Field Vane	■	Undrained shear strength
		X	Penetrometer	S	Sensitivity

### NOTE

The soil conditions, profiles, comments, conclusions and recommendations found in this report are based upon the samples recovered during the fieldwork. Soils are heterogeneous materials and, consequently, variations (possibly extreme) may be encountered at site locations away from boreholes. During construction, competent, qualified inspection personnel should verify that no significant variations exist from the conditions described in this report.

## EXPLANATION OF BOREHOLE LOG

This form describes some of the information provided on the borehole logs, which is based primarily on examination of the recovered samples, and the results of the field and laboratory tests. Additional description of the soil/rock encountered is given in the accompanying geotechnical report.

### GENERAL INFORMATION

Project details, borehole number, location coordinates and type of drilling equipment used are given at the top of the borehole log.

### SOIL LITHOLOGY

#### ***Elevation and Depth***

This column gives the elevation and depth of inferred geologic layers. The elevation is referred to the datum shown in the Description column.

#### ***Lithology Plot***

This column presents a graphic depiction of the soil and rock stratigraphy encountered within the borehole.

#### ***Description***

This column gives a description of the soil strata, based on visual and tactile examination of the samples augmented with field and laboratory test results. Each stratum is described according to the *Modified Unified Soil Classification System*.

The compactness condition of cohesionless soils (SPT) and the consistency of cohesive soils (undrained shear strength) are defined as follows (*Ref. Canadian Foundation Engineering Manual*):

<b>Compactness of</b>	
<b>Cohesionless Soils</b>	<b>SPT N-Value</b>
Very loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	> 50

<b>Consistency of Cohesive Soils</b>	<b>Undrained Shear Strength</b>	
	<b>kPa</b>	<b>psf</b>
Very soft	0 to 12	0 to 250
Soft	12 to 25	250 to 500
Firm	25 to 50	500 to 1000
Stiff	50 to 100	1000 to 2000
Very stiff	100 to 200	2000 to 4000
Hard	Over 200	Over 4000

### Soil Sampling

Sample types are abbreviated as follows:

SS	Split Spoon	TW	Thin Wall Open (Pushed)	RC	Rock Core	GS	Grab Sample
AU	Auger Sample	TP	Thin Wall Piston (Pushed)	WS	Washed Sample	AR	Air Return Sample

Additional information provided in this section includes sample numbering, sample recovery and numerical testing results.

### Field and Laboratory Testing

Results of field testing (e.g., SPT, pocket penetrometer, and vane testing) and laboratory testing (e.g., natural moisture content, and limits) executed on the recovered samples are plotted in this section.

### Instrumentation Installation

Instrumentation installations (monitoring wells, piezometers, inclinometers, etc.) are plotted in this section. Water levels, if measured during fieldwork, are also plotted. These water levels may or may not be representative of the static groundwater level depending on the nature of soil stratum where the piezometer tips are located, the time elapsed from installation to reading and other applicable factors.

### Comments

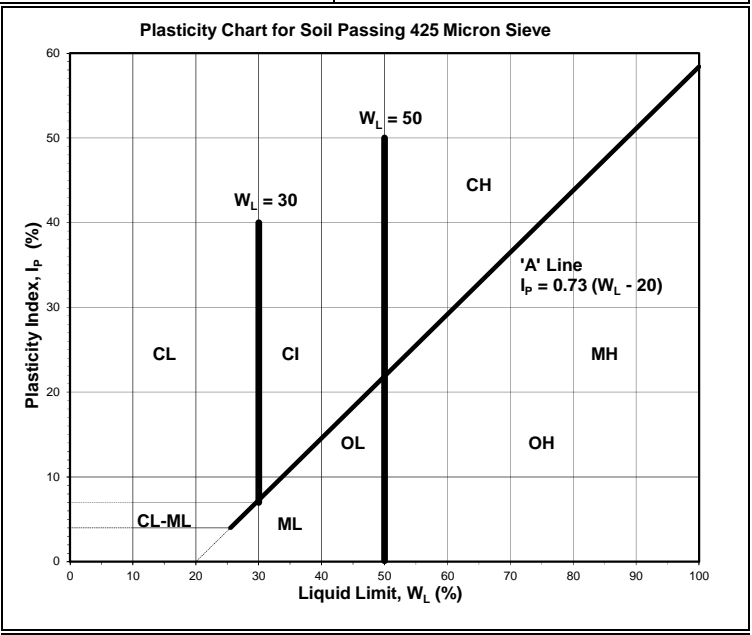
This column is used to describe non-standard situations or notes of interest.



MODIFIED \* UNIFIED CLASSIFICATION SYSTEM FOR SOILS  
 \*The soil of each stratum is described using the Unified Soil Classification System (Technical Memorandum 36-357 prepared by Waterways Experiment Station, Vicksburg, Mississippi, Corps of Engineers, U.S Army, Vol. 1 March 1953.) modified slightly so that an inorganic clay of "medium plasticity" is recognized.

MAJOR DIVISION		GROUP SYMBOL	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA	
COARSE GRAINED SOILS (MORE THAN HALF BY WEIGHT LARGER THAN 75µm)	GRAVELS MORE THAN HALF THE COARSE FRACTION LARGER THAN 4.75mm	CLEAN GRAVELS (TRACE OR NO FINES)	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	$C_u = \frac{D_{60}}{D_{10}} > 4; C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1 \text{ to } 3$
			GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS
		DIRTY GRAVELS (WITH SOME OR MORE FINES)	GM	SILTY GRAVELS, GRAVEL-SAND- SILT MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I MORE THAN 4
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I MORE THAN 7
	SANDS MORE THAN HALF THE COARSE FRACTION SMALLER THAN 4.75mm	CLEAN SANDS (TRACE OR NO FINES)	SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	$C_u = \frac{D_{60}}{D_{10}} > 6; C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1 \text{ to } 3$
			SP	POORLY GRADED GRAVELS, GRAVEL- SAND MIXTURES, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS
		DIRTY SANDS (WITH SOME OR MORE FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I MORE THAN 4
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I MORE THAN 7
FINE-GRAINED SOILS (MORE THAN HALF BY WEIGHT SMALLER THAN 75µm)	SILTS BELOW "A" LINE NEGLIGIBLE ORGANIC CONTENT	$W_L < 50\%$	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY SANDS OF SLIGHT PLASTICITY	CLASSIFICATION IS BASED UPON PLASTICITY CHART (SEE BELOW)
		$W_L < 50\%$	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOILS	
	CLAYS ABOVE "A" LINE NEGLIGIBLE ORGANIC CONTENT	$W_L < 30\%$	CL	INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY OR SILTY CLAYS, LEAN CLAYS	
		$30\% < W_L < 50\%$	CI	INORGANIC CLAYS OF MEDIUM PLASTICITY, SILTY CLAYS	
		$W_L < 50\%$	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
	ORGANIC SILTS & CLAYS BELOW "A" LINE	$W_L < 50\%$	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	WHENEVER THE NATURE OF THE FINES CONTENT HAS NOT BEEN DETERMINED, IT IS DESIGNATED BY THE LETTER "F", E.G SF IS A MIXTURE OF SAND WITH SILT OR CLAY
		$W_L < 50\%$	OH	ORGANIC CLAYS OF HIGH PLASTICITY	
	HIGH ORGANIC SOILS		Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS	STRONG COLOUR OR ODOUR, AND OFTEN FIBROUS TEXTURE

SOIL COMPONENTS					
FRACTION	U.S STANDARD SIEVE SIZE	DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS			
		PASSING	RETAINED	PERCENT	DESCRIPTOR
GRAVEL	COARSE	76 mm	19 mm	35-50	AND
				20-35	Y/EY
	FINE	19 mm	4.75 mm	10-20	SOME
SAND	COARSE	4.75 mm	2.00 mm	1-10	TRACE
	MEDIUM	2.00 mm	425 µm		
	FINE	425 µm	75 µm		
FINES (SILT OR CLAY BASED ON PLASTICITY)		75 µm			
OVERSIZED MATERIAL					
ROUNDED OR SUBROUNDED: COBBLES 76 mm TO 200 mm BOULDERS > 200 mm				NOT ROUNDED: ROCK FRAGMENTS > 76 mm ROCKS > 0.76 CUBIC METRE IN VOLUME	



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Note 1: Soils are classified and described according to their engineering properties and behaviour.  
 Note 2: The modifying adjectives used to define the actual or estimated percentage range by weight of minor components are consistent with the Canadian Foundation Engineering Manual (4th Edition, Canadian Geotechnical Society, 2006.)

# RECORD OF BOREHOLE No. BH1

Project Number: SWW177161 Drilling Method: 180 mm O.D. Hollow Stem Augers  
 Project Client: St. Clair Catholic District School Board Drilling Machine: CME 55  
 Project Name: Our Lady of Fatima School Date Started: 01 May 2017 Date Completed: 01 May 2017  
 Project Location: Chatham, Ontario Logged by: SS Compiled by: SS  
 Drilling Location: N4696051, E399498 Reviewed by: SM Revision No.: 0



LITHOLOGY PROFILE		SOIL SAMPLING				FIELD TESTING		LAB TESTING		INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%)
Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing ○ SPT ● DCPT MTO Vane* Intact ◊ Intact ▲ Remould ◆ Remould ■ Undrained Shear Strength (kPa) (from P. Penetrometer tests) 20 40 60 80	Atterberg Limits W <sub>p</sub> — W — W <sub>L</sub> Plastic — Liquid * Passing 75 um (%) ○ Moisture Content (%) ★ Unit Weight (KN/m <sup>3</sup> ) 20 40 60 80		
	Local Ground Surface Elevation: 99.3 m										
	TOPSOIL (200 mm thick)										
	FILL Silty clay, some sand, trace gravel Grey					99					
		SS	1	54	11	1	98		○21		
	SILTY SAND Some clay, trace gravel Brown					97.9					
		SS	2	83	9	2	97		○21		
	SILTY CLAY Some sand, trace gravel Brown Stiff					97.1					
		SS	3	89	9	3	96		○26		
		SS	4a	100	5	4	96		○33		
			b						○24		
	Grey Firm										
		SS	5	100	2	4	95		○30		
	Soft										
		SS	6	100	2	5	95		○26		
	END OF BOREHOLE (no refusal)					94.2					
						5.0					

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∇ No freestanding groundwater observed in open borehole upon completion of drilling.

Borehole details, as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretive assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Borehole Log'.

Page: 1 of 1

# RECORD OF BOREHOLE No. BH2

Project Number: SWW177161 Drilling Method: 180 mm O.D. Hollow Stem Augers  
 Project Client: St. Clair Catholic District School Board Drilling Machine: CME 55  
 Project Name: Our Lady of Fatima School Date Started: 01 May 2017 Date Completed: 01 May 2017  
 Project Location: Chatham, Ontario Logged by: SS Compiled by: SS  
 Drilling Location: N4696097, E399346 Reviewed by: SM Revision No.: 0



LITHOLOGY PROFILE		SOIL SAMPLING				FIELD TESTING		LAB TESTING		INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%)
Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing ○ SPT ● DCPT MTO Vane* Nilcon Vane* △ Intact ◇ Intact ▲ Remould ◆ Remould ■ Undrained Shear Strength (kPa) (from P. Penetrometer tests)	Atterberg Limits W <sub>p</sub> W L <sub>p</sub> W <sub>u</sub> Plastic Liquid * Passing 75 µm (%) ○ Moisture Content (%) ★ Unit Weight (kN/m <sup>3</sup> )		
	Local Ground Surface Elevation: 99.3 m										
▨	ASPHALT (50 mm thick)										
	FILL										
	Coarse sand, some gravel						99				
	Grey						99.0				
	FILL										
	Fine sand										
	Brown						98.6				
▨	SILTY CLAY										
	Some sand, trace gravel	SS	1	50	7	1	98.7	○	23		
	Mottled brown and grey										
	Firm										
							97.9				
▨	SILTY SAND										
	Brown	SS	2	72	13	2	97.9	○	25		
	Compact										
							97.2				
▨	SANDY SILT										
	Grey	SS	3	100	28		97.2	○	19		
							96.4				
▨	SILTY CLAY										
	Some sand, trace gravel	SS	4	100	2	3	96.4	○	28		
	Grey										
	Very soft										
							95				
		SS	5	100	2	4	95	○	30		
							94.3				
	END OF BOREHOLE										
	(no refusal)						5.0				
							94				
							93				
							92				

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▽ Groundwater measured at a depth of 1.7 m upon completion of drilling.

Borehole details, as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretive assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Borehole Log'.

Page: 1 of 1

# RECORD OF BOREHOLE No. BH3

Project Number: SWW177161 Drilling Method: 180 mm O.D. Hollow Stem Augers  
 Project Client: St. Clair Catholic District School Board Drilling Machine: CME 55  
 Project Name: Our Lady of Fatima School Date Started: 01 May 2017 Date Completed: 01 May 2017  
 Project Location: Chatham, Ontario Logged by: SS Compiled by: SS  
 Drilling Location: N4696046, E399619 Reviewed by: SM Revision No.: 0



LITHOLOGY PROFILE		SOIL SAMPLING				FIELD TESTING		LAB TESTING		INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%)
Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing ○ SPT ● DCPT	Atterberg Limits W <sub>p</sub> W L <sub>p</sub> W <sub>u</sub>		
	Local Ground Surface Elevation: 99.1 m										
	ASPHALT (76 mm thick)						99				
	FILL Silty clay, some sand, some gravel Grey						98.6				
	FILL Silty clay, some sand, trace gravel Mottled brown and grey	SS	1	83	11	1	98	○	○22		
	SANDY SILT Some clay Mottled brown and grey Compact	SS	2	83	15	2	97.8	○	○24		
	Grey	SS	3	89	14		97	○	○25		
	SILTY CLAY Some sand, trace gravel Grey Soft	SS	4	100	3	3	96.2	○	○29		
	Very soft	SS	5	100	2	4	95	○	○26		
	SS	6	100	1		5	94.1	○	○30		
	END OF BOREHOLE (no refusal)						5.0				
							94				
							93				
							92				

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∇ No freestanding groundwater observed in open borehole upon completion of drilling. ■ Cave in measured at a depth of 4.0 m upon completion of drilling.

Borehole details, as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretive assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Borehole Log'.

# RECORD OF BOREHOLE No. BH4

Project Number: SWW177161 Drilling Method: 180 mm O.D. Hollow Stem Augers  
 Project Client: St. Clair Catholic District School Board Drilling Machine: CME 55  
 Project Name: Our Lady of Fatima School Date Started: 01 May 2017 Date Completed: 01 May 2017  
 Project Location: Chatham, Ontario Logged by: SS Compiled by: SS  
 Drilling Location: N4695993, E399574 Reviewed by: SM Revision No.: 0



Lithology Plot	LITHOLOGY PROFILE		SOIL SAMPLING				FIELD TESTING		LAB TESTING		INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%)
	DESCRIPTION	ELEVATION (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing	Atterberg Limits		
	Local Ground Surface Elevation: 99.1 m											
	ASPHALT (100 mm thick)	99.0					99					
	FILL Coarse sand, some gravel	0.1 98.8										
	FILL Fine sand Brown	0.3										
	SANDY SILT Some clay Mottled brown and grey Compact	98.1 1.1	SS	1	83	11	1	98	○	○24		
	Grey		SS	2	78	13	2	97	○	○23		
	SILT CLAY Some sand, trace gravel Grey Soft	96.2 2.9	SS	3	72	17	3	96	○	○18		
	Very soft		SS	4	100	3	4	95	○	○27		
			SS	5	50	WOH	5	94	○	○28		
			SS	6	50	WOH	6	93	○	○30		
	END OF BOREHOLE (no refusal)	93.6 5.5	VT				7	92	▲ ▲21			

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∇ No freestanding groundwater observed in open borehole upon completion of drilling. ■ Cave in measured at a depth of 4.6 m upon completion of drilling.

Borehole details, as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretive assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Borehole Log'.

**APPENDIX C**

**GEOTECHNICAL LABORATORY TEST RESULTS**

Amec Foster Wheeler Environment & Infrastructure  
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**GRAIN SIZE DISTRIBUTION**  
**MTO LS 702 / ASTM D7928 / ASTM D6913**

Tel +1 (519) 735-2499  
 Fax +1 (519) 735-9669  
[www.amecfw.com](http://www.amecfw.com)

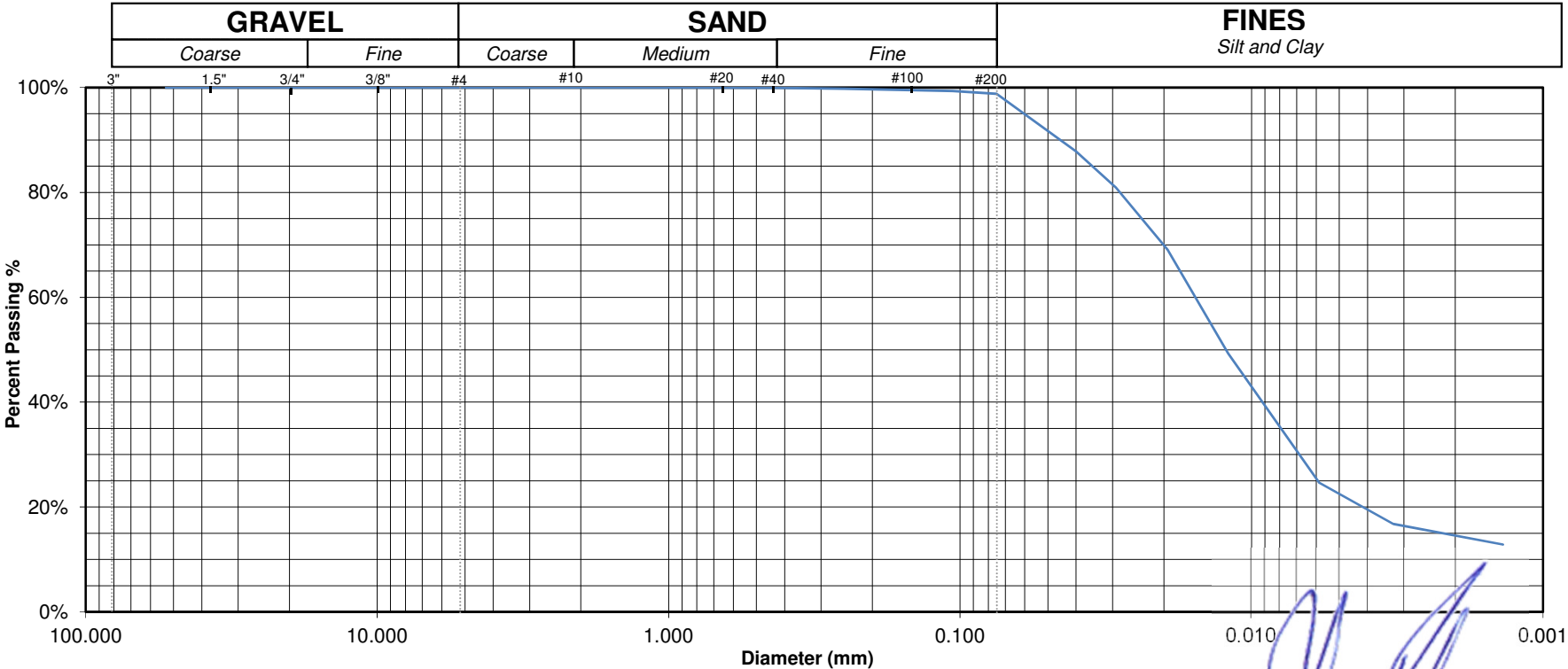
**Project Number:** SWW177161  
**Project Client:** Joseph Ouellette  
**Project Name:** Our Lady of Fatima School  
**Project Location:** 545 Baldoon Road Chatham On.

**Sampled on:** 1-May-2017  
**Received on:** 1-May-2017  
**Tested on:** 5-May-2017

**Sampled by:** SS  
**Received by:** JP  
**Tested by:** JP

**Test Results**

Sample Location: **BH4, Sa. 2**      **Gravel**      **Sand**      **Silt**      **Clay**      **Soil Classification**  
 Sample Identification: **202**      1.2%      84.3%      14.5%



Signed by: \_\_\_\_\_  
 Justin Palmer, Lab Supervisor, C. Tech.

## **PART 1 – GENERAL**

### **1.1. General Requirements**

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

### **1.2. Shop Drawings**

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

1.2.2. 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.

### **1.3. Permits and Fees**

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

### **1.4. By-laws**

1.4.1. 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

## **PART 2 – PRODUCTS**

### **2.1. Materials – For Internal Barriers**

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

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

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

2.1.4. Exterior alkyd paint to approved manufacturer.

2.1.5. Interior fire retardant paint to approved manufacturer.

2.1.6. 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.

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

### **2.2. Chain-Link Fencing: For Exterior Site Enclosures**

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



- 2.2.2. 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.
- 2.2.3. Tension Wire: No. 6 gauge single strand, finished to match fabric.
- 2.2.4. Fabric Bands: Galvanized steel to fit tubing.
- 2.2.5. Rail Fittings: Galvanized steel for caps, top tails guides.
- 2.2.6. Galvanizing: Galvanize fittings, accessories and steel tube by hot dip method after fabrication to meet specified requirements of CSA Standard G164.
- 2.2.7. 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.
- 2.2.8. Fence height: 1830mm high unless noted otherwise.
- 2.2.9. **Commercially available temporary construction fencing may be approved at the discretion of the architect.**

### **PART 3 – EXECUTION**

#### **3.1. Fabrication and Installation**

##### **3.1.1. Hoarding**

- 3.1.1.1. 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.
- 3.1.1.2. Provide posts, planking and plywood.
- 3.1.1.3. Provide pedestrian and vehicular entrances as required, complete with swing or sliding gates, screened openings and all necessary hardware including locks.
- 3.1.1.4. Paint complete hoarding in colour selected by Consultant.
- 3.1.1.5. Maintain hoarding in good condition at all times.
- 3.1.1.6. Repair any hoarding removed or damaged, to satisfaction of the Consultant and authorities.
- 3.1.1.7. Wash all hoarding at least every two months.
- 3.1.1.8. Remove hoarding and fencing from site only when authorized by the Consultant.

##### **3.1.2. Barrier**

- 3.1.2.1. Install barriers within the existing building to separate a work area from the remainder of the building.
- 3.1.2.2. Barriers shall be erected such that it is self-supporting and braced on work area side.
- 3.1.2.3. 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
- 3.1.2.4. Barriers shall not allow for the passage of airborne dust.
- 3.1.2.5. Maintain minimum clearance for exits and access to exits.
- 3.1.2.6. Relocate, temporarily any existing life safety devices which may

become hidden or obscure due to the erection of barrier.

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

3.1.3. **Chain Link Fencing**

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

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

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

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

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

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

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

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

3.2. **Exception**

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

3.2.2. 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. General**

- 1.1.1. The Contractor is fully responsible for continuous examination and inspection of the Work related to the exterior assemblies to ensure compliance with the Contract Documents.
- 1.1.2. Materials and workmanship shall be subject to inspection and testing at any time. Cooperate in permitting access for inspection and testing to places where work is being done or stock is being stored.
- 1.1.3. In addition to Consultant site review, the Owner may provide quality control inspection and testing as specified.
- 1.1.4. Allow sufficient time for testing, evaluation, alterations and retesting so as not to affect the Progress Schedule for the Work.
- 1.1.5. The Consultant or Owner's inspection and testing agency may require testing of connections and special prefabricated inserts, as part of the work of this Section.

**PART 2 – DESIGN AND PERFORMANCE**

**2.1. Design and Performance**

- 2.1.1. Building envelope includes, but is not limited to, slabs-on-grade, foundation walls, cladding systems, glazing systems, louvres, doors, frames, mechanical and electrical penetrations of assemblies, sealants, air and vapour barrier materials, roofing and waterproofing.
- 2.1.2. Design and engineer as required by applicable Section of the Specifications, fabricate, erect or install building envelope in compliance with the Ontario Building Code, other regulations and requirements of authorities having jurisdiction, with the stringent requirements to govern.
- 2.1.3. Take into account tolerance limitations of the structure, creep, deflection and other movements of the structure, both during the Work and in service.
- 2.1.4. Allow for expansion and contraction of components caused by ambient, temperature range and surface temperature variation of components, and structural movements, without causing distortion, failure of fastening, joints and/or air/vapour barrier seals, undue stress or other defects detrimental to appearance and/or performance.
- 2.1.5. Accommodate, by means of expansion and contraction provisions, any movements in the building assemblies themselves and between the assemblies and the building structure, caused by structural movements, both deflection and racking; and/or thermal expansion and contraction, without distortion, damage, misalignment of joints, breakage of air/vapour barriers, water and air penetration through the assembly, or glass breakage.
- 2.1.6. Method of attachment to the structure shall take into account site peculiarities such that there shall be no possibility of site and air vibrations or normal temperature

movements of the building to loosen, weaken and/or fracture the connection between building envelope assembly components and the structure or between the components themselves.

- 2.1.7. Reinforce building envelope assembly components, as required, so that the members can safely sustain design loads.
- 2.1.8. Assemble and secure assemblies in manner which will keep stresses on sealants within the sealant manufacturers' recommended maximum.
- 2.1.9. Construct building envelope wall and window assemblies based on "Rain Screen" principle as advocated by the National Research Council of Canada. All voids between the assembly components as well as those between components and structure shall have:
  - 2.1.9.1. Gaskets, baffles, overlaps, seals and compartmentalization as required to provide a barrier "Rain Screen" to effectively prevent excessive rain water entry into any of the building envelope cavities but allow pressure equalization of cavity air spaces.
  - 2.1.9.2. Air barriers and seals as required to prevent entry of interior building air into building envelope cavities, and exterior air into the building. Air barriers and seals shall be able to withstand design pressures.
  - 2.1.9.3. Such provisions in the form of openings between cavities and the building exterior of sufficient cross sections to provide adequate pressure equalization. Openings shall be effectively baffled against direct rain water entry.
  - 2.1.9.4. Thermal separators, isolators and seals placed to eliminate contact between interior humid air and a cold surface or structural component to prevent condensation and ice build-up on such surfaces during cold weather.
- 2.1.10. Comply with the design and performance requirements specified in the Ontario Building Code, with the most stringent requirements to govern, and as specified herein, including the following principles:
  - 2.1.10.1. Drain to exterior face of the wall or window assembly, any water entering at joints and any condensation occurring within the building envelope assembly.
  - 2.1.10.2. Design, fabricate and install the assembly to minimize specified materials' ability to transmit moisture through capillary action.
  - 2.1.10.3. Design, fabricate and install the assembly to be watertight to the interior under the interior and exterior design conditions in combination with the movements occurring due to loads imposed.
- 2.1.11. The requirements for an air barrier and a vapour barrier are intended to be provided at same plane in the building envelope design, unless otherwise indicated or specified. In such cases, the Drawings and Specifications refer to "air/vapour barrier". The definition of the air/vapour barrier for the purpose of these Specifications is "a continuous membrane including joints of membrane between components and to adjacent construction which prevents or retards passage of moisture laden air and the diffusion of water vapour through it".
- 2.1.12. Design sealant joints with strict regard for sizing of joint and parallel orientation of contact surfaces. Ensure support for both sealant and backer rod.

- 2.1.13. This project incorporates the design principles of positive air and vapour leakage control at the building enclosure line. Drawing details illustrate continuity of air/vapour barrier penetrating elements such as door, window and louver frames.
- 2.1.14. The barrier extends nominally from foundation line, vertically along exterior walls and to positive contact with roof air/vapour barrier.
- 2.1.15. In order to maintain the continuity of the envelope, the interfacing of various building elements requires close coordination by all trades involved with the exterior building elements. The positive mechanical connections and seal of transition medium extending from the primary wall air/vapour barrier to the insulation line of window or door frame, shall be made with proper construction sequencing established by Contractor to ensure such interfacing. All such transition installation shall be inspected by Consultant prior to concealing with subsequent construction.
- 2.1.16. Manufacturers of such window or door frames shall ensure that correctly designed and positioned metallic legs, extensions or recesses are provided at the thermal break line to facilitate connections of rigid or flexible transition medium as indicated prior to setting such elements in their allotted openings.
- 2.1.17. Provide completed installations free from vibrations, wind whistles, and noise due to thermal and structural movement and wind pressure.
- 2.1.18. Design building envelope assemblies to prevent damage due to earthquake forces as required by the Ontario Building Code.

**End of Section**

**PART 1 - GENERAL**

**1.1. Related Sections**

- 1.1.1. Comply with Division One as applicable.
- 1.1.2. Restrictions on noise, dust, interference, obstructions, access, and hours of work as described in the Instructions to Bidders and General Conditions.
- 1.1.3. Temporary facilities, public safety, weather and dust barriers or partitions: General Instructions, and Section 01530.
- 1.1.4. Work described in Division 15000 and 16000.
- 1.1.5. The requirements of this Section apply to all other Sections of the specifications.

**1.2. References**

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

**1.3. Existing Conditions**

- 1.3.1. 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.
- 1.3.2. 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.
- 1.3.3. 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.
- 1.3.4. 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.
- 1.3.5. 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**

- 1.4.1. 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**

- 1.5.1. Prevent movement, settlement or damage of existing structures, services, walks, paving, trees, landscaping, adjacent grades and parts of existing building to remain.
- 1.5.2. Provide bracing, shoring and underpinning as required. Make good damage caused by demolition.
- 1.5.3. Take precautions to support affected structures and, if safety of building being demolished appears to be endangered, cease operations and notify Consultant.
- 1.5.4. Prevent debris from blocking surface drainage system, elevators, mechanical and electrical systems which must remain in operation.
- 1.5.5. 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.
- 1.5.6. 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.
- 1.5.7. Maintain temporary supports in place until permanent structure is able to fully support all imposed loads.
- 1.5.8. Make good damage to existing elements to remain caused by demolition.
- 1.5.9. Prevent debris from blocking surface drainage system, and obstructing mechanical and electrical systems which must remain in operation.
- 1.5.10. Protect salvaged elements from damage. Provide protective coverings and storage.

**PART 2 – PRODUCTS**

**Not used.**

**PART 3 – EXECUTION**

**3.1. Work**

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

- 3.1.2. 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.
- 3.1.3. Items for Demolition: Refer to drawings for specific details.
  - 3.1.3.1. Portions of existing VCT.
  - 3.1.3.2. Door and window openings in walls, overhead lintels, portions of masonry walls.
  - 3.1.3.3. Miscellaneous plumbing, mechanical and electrical items.
  - 3.1.3.4. Windows as indicated.
  - 3.1.3.5. Ceiling systems as indicated.
  - 3.1.3.6. All other elements required to allow the Work to be completed, whether specifically indicated, or not.
- 3.1.4. Carefully dismantle items containing materials for salvage and stockpile salvaged materials on site at locations as indicated or as directed by Consultant.
- 3.1.5. Temporarily reroute 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.
- 3.1.6. Do not disrupt active or energized utilities designated to remain undisturbed without Consultant's consent.
- 3.1.7. Reference the demolition of specific Mechanical and Electrical as documented in drawings and Specifications.

**3.2. Safety Code**

- 3.2.1. Comply with all applicable legislation.

**3.3. Dismantling and Demolition**

- 3.3.1. Do all work in a manner to prevent endangering safety of building assemblies, systems or occupants.
- 3.3.2. 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.
- 3.3.3. Remove existing equipment, services, and obstacles where required for refinishing or making good of existing surfaces, and replace as work progresses.
- 3.3.4. Do not disturb adjacent items designated to remain in place.
- 3.3.5. 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.
- 3.3.6. Demolish to minimize dusting. Keep materials wetted as directed by Consultant.
- 3.3.7. Do not throw or allow debris to fall uncontrolled from heights. Use chutes and other controls.



3.4. **Restoration**

- 3.4.1. Upon completion of work, remove debris, trim surfaces and leave work site clean.
- 3.4.2. Reinstate areas and existing works outside areas of demolition to conditions that existed prior to commencement of work.

**End of Section**

**PART 1: GENERAL**

**1.1. General Requirements**

1.1.1. Conform to requirements specified under Division 1.

**1.2. Scope of the Work**

**1.2.1. Work Included**

1.2.1.1. Provide all plant, labour, equipment and materials to carry out the work of this section. The work includes, but is not limited to, the following:

- Grubbing, stripping and stockpiling of topsoil
- Excavation and disposal
- Backfill and compaction
- Rough grading to make ready for application of topsoil for seed or sod
- Removal and disposal of existing foundations
- Dewatering

**1.2.2. Related Work Specified Elsewhere**

Cast-in-Place Concrete - Division 3  
Excavations and Backfill for Mechanical & Electrical Services - Division 15 & 16.  
Asphalt, curbs - Division 2  
Site Services - Division 2  
Finish Grading and Landscaping - Division 2

**1.3. Applicable Standards**

1.3.1. Ontario Building Code

1.3.2. The Construction Safety Act, local by-laws and all other regulations of the Ontario Ministry of Labour relating to the work of this Section.

1.3.3. OPSS Forms 1010, and 1010, Material Specification for Aggregates-General and Granular A, B, M, and Select respectively.

**1.4. Sub-Surface Conditions**

1.4.1. Sub-surface investigations were carried out by Amec Foster Wheeler Ltd. (Chatham Office) dated June, 2017.

1.4.2. A copy of their report is appended within this specification.

1.4.3. The information given in these reports was obtained for the use of the Owner in the execution of the design. It is presented in good faith to assist the Contractor. No guarantee is made or implied as to its detailed accuracy for every site location. It is incumbent upon the Contractor to make any additional tests to obtain any additional information deemed necessary for the proper execution of the work, at no additional cost to the Owner.

**1.5. Drawings**

- 1.5.1. Examine the drawings forming a part of this Contract and conform to the requirements of all such drawings.

**1.6. Coordination and Cooperation**

- 1.6.1. Co-ordinate the work of this Section with the work of all other Sections in accordance with the General Conditions.
- 1.6.2. Co-ordination and co-operation is particularly important with Landscaping, Asphalt Paving, Cast-in-Place Concrete, and excavation for Mechanical Electrical trades.

**1.7. Examination**

- 1.7.1. Examine the site for the purpose of determining the conditions prevailing there, which may affect the work of this Section, including available access to the site, existing contours, existing services, etc.
- 1.7.2. Determine the nature and locations of all existing services below and above ground, which may affect the work of this Section.

**1.8. Special Conditions**

- 1.8.1. The Contractors attention is drawn to existing grade elevations in the vicinity of the new building. After removal of topsoil, soft spots, and otherwise unsuitable material the Contractor must manage existing site excavated materials, and imported materials, to bring grades up to finished elevations shown Architectural and/or Site Service drawings.

**1.9. Prices**

**1.9.1. Unit Prices**

- 1.9.1.1. Provide unit prices for items listed in tender form
- 1.9.1.2. Include all costs as outlined in Division 1
- 1.9.1.3. Additional payment will not be made for accidental over-excavation by the Contractor.

**PART 2: PRODUCTS**

**2.1. Materials**

**2.1.1. Granular Fills - Class 'A' and Class 'B':**

- 2.1.1.1. Imported in accordance with current OPSS Form 1010, with the added requirement that material to be deposited within the building must be clean with no asphalt or other contaminates on or mixed with the soil.

**2.1.2. Granular Fill - Class PR:**

- 2.1.2.1. Imported, well-graded, compactable stony pit-run granular material with a maximum 8% silt fraction as approved by the soils consultant.

2.1.3. **Crushed Stone:**

2.1.3.1. Clean, screened crushed stone, well graded in size between 10mm and 25mm, with sufficient angular particles rather than round, to ensure proper compaction.

2.1.4. **Approved Site Excavated Materials:**

2.1.4.1. Site excavated lower level till material for use as general construction backfill on the exterior of the building. (Note that the moisture content and compactability of this material may have to be adjusted by drying out the material and /or mixing with other material prior to its use as backfill.)

2.1.4.2. Granular materials shall be free draining and not susceptible to frost action as determined by current M.T.C. Standards. All granular materials to be used within the building shall also be free of asphalt or other contaminants on or mixed with the soil

2.1.4.3. Submit representative samples of each class of proposed material to the Geotechnical Inspection Company for testing and approval for use on this project. Mark samples as to source of supply, including pit locations.

2.1.4.4. Supply only those materials approved for use on this project by the Inspection Company.

2.1.5. **Lean Concrete Fill**

2.1.5.1. 15 MPa with 125mm slump

2.1.6. **Weeping Tile:** – 100mm diameter perforated Big-O, or approved equal.

2.1.7. **Geotextile Fabric:** - Terrafix 270R or equal.

2.2. **Fabrication**

2.2.1. Mixing, transportation, placing, curing, and protection of concrete in accordance with Division 3

2.3. **Source Quality Control**

2.3.1. All materials shall be subject to test and inspection by a Testing and Inspection Company appointed by the Owner.

2.3.2. Cost of testing will be paid by the Owner.

2.3.3. Provide access to pits or quarries for the personnel of the Inspection Company.

2.3.4. Provide representative samples of materials as may be required by the Inspection Company at no additional cost to the Owner.

**PART 3: EXECUTION**

3.1. **Grubbing and Clearing**

3.1.1. Grub and clear the site of trees, shrubs, existing foundations to be removed, debris and obstructions, unless clearly noted elsewhere to be retained.

- 3.1.2. Remove and dispose of all material listed in items A. away from the site.

**3.2. Stripping and Storage of Topsoil**

- 3.2.1. Carefully strip the topsoil from areas affected by new construction.
- 3.2.2. Stockpile the topsoil on the site at a location or locations approved by the Architect and General Contractor for later use on this project. At the completion of construction, excess material is to be removed from site at the Contractor's expense. Note that because of the 'tight' nature of the site, temporary removal off site of top soil material may be required if storage areas designated by the Architect are used by the General Contractor for other purposes.
- 3.2.3. Maintain topsoil stockpiles separate from any other stockpiles and protect from contamination.
- 3.2.4. Prevent silt runoff from stockpiles and site with the use of silt fences and/or straw bale barricades.

**3.3. Excavation**

- 3.3.1. Footings are designed for a maximum safe allowable bearing pressure of 145 KPa.
- 3.3.2. Notify the Engineer of any unusual soil conditions encountered during excavation so that corrective action may be taken, if necessary.
- 3.3.3. Where excavations for footings are accidentally over-excavated, fill the over-excavated portion with lean concrete fill to the founding elevation shown on the plans, at no additional cost to the Owner.
- 3.3.4. Provide excavations for footings of sufficient width for the construction and inspection of formwork and the satisfactory and safe execution of the work. In general, provide not less than 450 clear of all construction.
- 3.3.5. Trim the bottom of all excavations true to line and grade, and remove all loose, wet, soft or unsatisfactory material.
- 3.3.6. Install footings at lower elevations prior to installing adjacent footings at higher elevations to ensure that bearing capacity of upper levels is not adversely disturbed.
- 3.3.7. Notify the Testing Company when each phase of the excavation is completed so that bearing surfaces may be inspected.
- 3.3.8. All excavations into native subsoil are to be carried out using a smooth-blade bucket to preclude disturbance of the subgrade by normal bucket teeth.
- 3.3.9. Protect all soils supporting footings and slab on grade against penetration of frost and rain before, during and after placement of concrete.
- 3.3.10. Unless noted otherwise on plan the drawings indicate footings bearing down onto the approved undisturbed sand layer at elevation bubbles indicated on the foundation Plan.

- 3.3.11. Below slab-on-grade areas excavate down a minimum of 300 below slab-on-grade or as required to remove topsoil or otherwise unsuitable material and proof roll subgrade with a heavy roller. Sub-excavate any soft or wet spots as identified by the Geotechnical Engineer and replace with granular 'B' material or approved 'PR' material compacted to 98% standard proctor maximum dry density.
- 3.3.12. After construction of forms minimize disturbance of subgrade within footing forms. If soils within footings become disturbed remove all loose material with hand shovels down to sound soil.

**3.4. Pumping and Dewatering**

- 3.4.1. Keep all excavations, pits and trenches free from accumulations of water from all sources, including ground water, perched groundwater, rain and surface water, at all times by pumping or other methods satisfactory to the Geotechnical Engineer. Refer to Soils Report for surface water and ground water control methods.
- 3.4.2. Conduct dewatering operations, when required, in such a manner as to avoid damage to work under construction or existing adjacent structures and so as not to weaken the strength of bearing soils or to endanger the stability of banks or slopes.

**3.5. Backfill and Compaction**

- 3.5.1. After the construction of footings, walls or piers, and the approval of the work by the Consultant, backfill and compact interior side of foundation walls with granular 'B' material to the elevations shown on the drawings.
- 3.5.2. Backfill and compact in equal lifts on each side of walls below grade. Maximum grade difference on opposite sides of non-retaining or basement walls is not to exceed 450. Do not backfill basement walls that are to be laterally supported at the top of the wall until such lateral support, in the form of the first floor framing, is cast and cured.
- 3.5.3. Deposit and spread granular materials in uniform layers not exceeding 300 (loose measurement) in depth.
- 3.5.4. Compact all granular materials to not less than 98% of Standard Proctor Density, except as noted on drawings or specifications. Maintain optimum water content for proper compaction by the addition of water as required.
- 3.5.5. Compact using approved vibratory plate tampers or vibratory rollers, except when working close to silt or other materials which may be adversely affected by vibration; in which case, use approved non-vibratory rollers to avoid disturbance of the sub-grade.
- 3.5.6. Immediately below sidewalks, place a 150 layer of Granular 'A' compacted to 98% of Standard Proctor Density.
- 3.5.7. Backfill below landscaped areas on the exterior side of the wall exclusive of the basement area can consist of approved site excavated materials compacted in 300 lifts to 96% standard proctor maximum dry density. Slope grade away from the building as shown on Architectural site plan and building sections.

- 3.5.8. Backfill exterior side of all foundation walls below sidewalks and paved areas, exclusive of areas adjacent to basement walls, can consist of approved site excavated materials, or imported granular 'B', compacted in 300 deep lifts to 98% standard proctor maximum dry density. Backfill to extend up to the underside of a 150 granular 'A' layer below the sidewalk.
- 3.5.9. Backfill on the interior side of all foundation walls up to the underside of the 200 stone layer to consist of approved pit-run, or granular 'B' material placed and compacted in 300 deep loose lifts to 98% standard proctor maximum dry density.
- 3.5.10. Refer to typical details for backfill adjacent to basement and retaining walls below landscaped areas for minimum width of free draining granular material. This material can consist of free draining pit run or granular 'B' material placed and compacted in 300 deep lifts to 98% maximum standard proctor dry density. Materials directly adjacent to wall to be free of large boulders that may damage waterproofing. Backfill outside of the free drainage zone can be consist of approved site excavated materials placed as indicated in typical details and compacted to 98% standard proctor maximum dry density.
- 3.5.11. Backfill below asphalt or concrete paved areas directly adjacent to basement walls to consist approved pitrun or granular 'B' materials up to the underside of the paving subgrade layer compacted in 300 deep loose lifts to 98% standard proctor density. Fills directly adjacent to wall to be free of large boulders that may damage waterproofing.
- 3.5.12. Use hand operated compaction equipment within the lesser of 3m or the height of the wall, for pit walls and retaining walls.
- 3.5.13. Protect all fill materials supporting slab on grade against penetration of frost and rain before, during and after placement of concrete.
- 3.5.14. Place weeping tile behind all basement, and retaining walls as indicated in on drawings or typical detail. Completely wrap geotextile fabric around stone cover and lap a minimum of 400mm.

**3.6. Sub-Floor Granular Fill**

- 3.6.1. Proof roll all existing fill materials with a heavy roller and subexcavate any soft or wet spots.
- 3.6.2. Provide a minimum of 200mm of 19mm crushed stone material under the slab-on-grade compacted to 100% standard proctor dry maximum density.
- 3.6.3. Fill below 200 crushed stone layer to consist of approved pit run or granular 'B' material down to approved subgrade for footings bearing on undisturbed soil. Compact Granular materials in 300 maximum loose lifts to 98% standard proctor dry density.
- 3.6.4. Take care not to damage any under-floor mechanical and electrical systems.
- 3.6.5. Remove clay, silt, dirt, and construction debris from the granular layers.
- 3.6.6. Ensure all electrical and mechanical piping runs in granular layers below the underside of the floor slab.

**3.7. Grading**

- 3.7.1. Rough grade outside the foundation walls (where applicable) to the lines and grades shown on the final site plan.
- 3.7.2. Rough grade to within 150 below the underside of exterior sidewalks and place layer of Granular 'A'

**3.8. Field Quality Control**

- 3.8.1. All materials and workmanship shall be subject to test and inspection by a Testing and Inspection Company appointed by the Consultant.
- 3.8.2. The cost of testing, except as noted in paragraph 3.08.C will be paid through a cash allowance.
- 3.8.3. Material or workmanship which fails to achieve the specified standards shall be re-compacted or replaced as directed by the Consultant and additional tests made. The cost of such additional testing and the cost of remedial action shall be at no additional cost to the Owner.
- 3.8.4. The foundation subgrade will be inspected by the Inspection Company immediately following final preparation of the excavation by the Contractor. The Inspection Company may direct that the depth of excavation be increased to reach a competent bearing stratum if existing soil conditions at the specified elevation are not satisfactory.

**3.9. Clean Up**

- 3.9.1. At the completion of the work in this Section, remove from the site any excess materials, debris and equipment.

**END OF SECTION**



## **PART 1 - GENERAL**

### **1.1. General Requirements**

- 1.1.1. This section specifies the supply and placement of mechanical seeding in all areas indicated as such on the drawings to the satisfaction of the specifications.
- 1.1.2. Related work elsewhere, **Topsoil and Finished Grading**, Section 02212.

### **1.2. Quality Assurance**

- 1.2.1. Obtain approval of seed mixture in writing from the Consultant before work commences.
- 1.2.2. The contractor must have five (5) years of experience in mechanical seeding work. All crew members must be under the direction of a skilled foreman.

### **1.3. Scheduling**

- 1.3.1. Schedule mechanical seeding to coincide with preparation of soil surface.
- 1.3.2. Recommended schedule for mechanical seeding using grass mixtures to be performed only during the periods of March 1 to June 30 and August 1 to December 31.
- 1.3.3. No work shall be performed when the ground is frozen, wet or otherwise untillable, or when even distribution of materials cannot be obtained.

## **PART 2 - PRODUCTS**

### **2.1. Delivery and Storage**

- 2.1.1. The seed mixture shall be mixed and supplied by a recognized seed house with tested rates for purity and germination of not less than government standard rates.
- 2.1.2. All grass seed specified, shall be mixed and supplied by a recognized seed house with tested rates for purity and germination of not less than government standard rates.
- 2.1.3. Seed shall be packed in a bag clearly showing the name of the supplier and indicating the certified quantities of different types of the mixture. The Consultant may request a test for purity and germination.

### **2.2. Materials**

- 2.2.1. Seed: "Canada pedigreed grade" in accordance with Government of Canada Seeds Act and Regulations, having minimum germination of 75% and minimum purity of 97%.
- 2.2.2. Mixture: "Certified", "Canada No. 1 Lawn Grass Mixture" in accordance with Government of Canada Seeds Act and Regulations with the following mixture composition at a rate of 185kg/Ha.:

20% Kentucky Bluegrass  
50% Creeping Red Fescue  
20% Barry or Pinnacle Ryegrass  
10% Annual Ryegrass

- 2.2.3. Water: Potable and free of impurities that would inhibit germination and growth.
- 2.2.4. Fertilizer: To Canada “Fertilizers Act” and “Fertilizers Regulations”. Adjust nitrogen and potassium on the field according to attached soil test report.

### **PART 3 - EXECUTION**

#### **3.1. Workmanship**

- 3.1.1. Protect areas from trespass until grass is established.
- 3.1.2. Keep site well drained.
- 3.1.3. Perform work under optimum field conditions. Do not undertake seeding operation under adverse conditions including moisture, temperature, wind or scheduling related work.
- 3.1.4. Clean up immediately soil or debris spilled onto pavement and dispose of deleterious materials.

#### **3.2. Preparation of Surfaces**

- 3.2.1. Rough grade soil shall be scarified to a minimum depth of 75mm to produce an even, loose textured surface, free of all stones, roots, branches, etc., large than 25mm.
- 3.2.2. Fine grade areas to be seeded free of humps and hollows. Ensure all areas are free of deleterious and refuse materials. The finished grade shall be smooth, loose textured and free of all stones, roots, branches, etc., larger than 25mm diameter and shall be inspected by the Consultant prior to commencing seeding operations.
- 3.2.3. Areas to be seeded are to be cultivated to a minimum depth of 25mm.

#### **3.3. Fertilizing Program**

- 3.3.1. Fertilizer shall be applied by means of an approved mechanical spreader immediately prior to seeding. The fertilizer shall be well worked into the upper 50mm of soil by discing or harrowing.

#### **3.4. Installation**

- 3.4.1. Obtain Consultant’s approval of topsoil grade and depth before starting seeding.
- 3.4.2. Sow during calm weather (winds less than 6mph) using equipment suitable for the area involved to the approval of the Consultant. Sow half of the required seed in one direction and the remainder at right angles. Incorporate the seed into the soil a minimum depth of 6mm simultaneously or within on half hour after seeding operation. Mix carefully with light chain harrow or wire rake and roll area

immediately afterward with water ballast type lawn or agricultural type roller.

- 3.4.3. Water with fine spray, avoiding washing out seed. Apply enough water to ensure penetration of minimum of 50mm.
- 3.4.4. Re-seed at 2 week intervals where germination has failed.
- 3.4.5. Protect seeded areas from trespass satisfactory to the Consultant.

**3.5. Maintenance During Establishment Period**

- 3.5.1. Perform the following maintenance operations from the time of the seed application until acceptance by Consultant. Such maintenance shall include all measures necessary to establish and maintain grass in a vigorous growth condition.
- 3.5.2. Grass Mixture:
  - 3.5.2.1. Repair and reseed dead or bare spots to allow establishment of seed prior to acceptance.
  - 3.5.2.2. Mow grass to 40mm whenever it reaches a height of 60mm.
  - 3.5.2.3. Fertilized seeded areas after the first cutting to the specified rates.
  - 3.5.2.4. Spread half of the fertilizer in one direction, and the remainder at right angles.
  - 3.5.2.5. Eliminate weeds by mechanical means.
  - 3.5.2.6. Water seeded area to maintain optimum soil moisture level for germination and continued growth of grass. Control watering to prevent washouts.
  - 3.5.2.7. Erosion resulting from contractor's faulty workmanship and / or materials shall be repaired and reseeded at his expense.

**3.6. Inspection**

- 3.6.1. Acceptance inspection will be conducted within sixty (60) days after completion.
- 3.6.2. Where the contractor requests inspection for partial acceptance of mechanical seeding work, the contractor will notify the Consultant in writing at least two (2) days in advance.
- 3.6.3. Partial acceptance will be given when mechanical seeding work has been delayed due to circumstances beyond the control of the contractor or when further mechanical seeding work would be in accordance with good horticultural practice and would jeopardize the performance of work and materials.
- 3.6.4. At the time of inspection for acceptance, all mechanical seeded areas shall have a healthy and even stand of grass, free of thin, poor, or burned out patches.

**3.7. Acceptance**

- 3.7.1. Seeded areas will be accepted by the Landscape Architect provided that:
  - 3.7.1.1. Plants are uniformly established and seed areas are free of rutted, eroded, bare or dead spots and free of weeds.
  - 3.7.1.2. Seeded areas have been mown at least twice.
  - 3.7.1.3. Seeded areas have been fertilized.

3.7.2. Areas seeded in the fall will be accepted in the following spring, one month after the start of the growing season, provided that acceptance conditions are fulfilled.

**3.8. Maintenance During Warranty Period**

3.8.1. Perform the following operations from time of acceptance until end of warranty period:

3.8.1.1. Repair and reseed dead or bare spots to the satisfaction of the Consultant.

**End of Section**

**PART 1 - GENERAL**

**1.1. Related Work**

1.1.1. This section specifies the supply and implementation of maintenance for completed landscape construction, **up to Final Acceptance**.

1.1.2. Related work elsewhere:

Topsoil and Finished Grading, Section 02921

Topsoil, Section 02245

Planting - Trees, Shrubs and Ground covers, Section 02951

Seeding, Section 02486

Sodding, Section 02822

**1.2. Quality Assurance**

1.2.1. Maintenance is to be carried out by the installing contractor or an approved Landscape Maintenance Contractor using only experienced personnel under the direction of a skilled foreman.

1.2.2. The Landscape Maintenance Contractor will be responsible to the installing Landscape Contractor to ensure acceptance of the landscape contract for the one year final acceptance.

1.2.3. Use experienced, qualified personnel under the direction and supervision of a foreman with at least 5 years of Landscape Horticultural experience and a superintendent with at least 10 years of Landscape Horticultural maintenance experience.

1.2.4. Pesticides personnel shall be licensed.

1.2.5. Submit a written report if adjustments to the site are recommended/required for approval by the owner and/or architect.

**1.3. Standards**

1.3.1. All workmanship, materials, maintenance and maintenance techniques shall be in accordance with, or exceed the minimum applicable standards of the requirements of this Section, the Pesticides Act 1984, the Ontario Ministry of the Environment, the Ontario Ministry of Health, and the Ontario Pesticides Advisory Committee. Latest edition at Tender closing date and most stringent conditions apply.

1.3.2. All workmanship shall be first- class and materials new and of best quality. The Contractor shall pay due regard to the crisp, neat, clean, attractive appearance of the finished work. Have regard to local by-laws and regulations concerning the application of pesticides.

**1.4. Requirements of Regulatory Agencies**

1.4.1. Work of this section shall include protection measures consisting of materials, construction, and methods required by the Occupational Health and Safety Act, O-R, 213/91, of the Province of Ontario, and as otherwise imposed by

Jurisdictional Authorities to save persons and property from harm.

**1.5. Product Delivery, Storage and Handling**

1.5.1. Supply manufactured items such as fertilizer, bonemeal, mulch, etc., in standard containers, clearly indicating contents, weight, component analysis, and the name of the manufacturer.

**1.6. Job Conditions**

1.6.1. Proceed with maintenance operations during appropriate weather conditions.

**1.7. Inspection**

1.7.1. The Architect reserves the right to undertake periodic inspections to ensure quality of maintenance.

1.7.2. An inspection of the landscape contract will be made to provide Final Acceptance one year from the date of Provisional Acceptance. All related specifications must be satisfactorily addressed to meet Final Acceptance.

**PART 2 - PRODUCTS**

**2.1. Fertilizer**

2.1.1. Complete commercial slow release sulphur-coated urea fertilizer of approved manufacturer for April fertilizer application and complete commercial fertilizer for June and October fertilizer applications

2.1.2. Fertilizer: slow release 21-7-7

2.1.3. Water soluble 20-20-20 all-purpose fertilizer in a diluted solution may be used alternately upon written approval by the Consultant. Supply rate schedule for Consultant approval.

**2.1.4. RECOMMENDED RATES OF FERTILIZER FOR TREES**

Measure trunk diameter at 1.0 or 1.5m above the ground.  
Rates are based on a complete fertilizer containing 10% nitrogen. Water thoroughly after fertilizing.

TREE TRUNK DIAMETER	QUANTITY OF FERTILIZER PER TREE
50 to 100 mm	0.5 kg
100 to 150 mm	1.5 kg
150 to 200 mm	2.0 kg
over 200 mm	3.0 kg

**2.1.5. RECOMMENDED RATES OF FERTILIZER FOR SHRUBS**

Type of Shrub	Grouped in Beds	Large Specimen
Deciduous	0.5-1.0 kg/10 sq.m	0.25-0.5 kg/plant
Broadleaf Evergreen	0.5-1.0 kg/10 sq.m	0.25 kg/plant
Narrow Leaf Evergreen	0.5-1.0 kg/10 sq.m	0.25-0.5 kg/plant

\* Rates are based on a complete fertilizer containing 10% nitrogen. Water thoroughly after fertilizing.

Take soil samples for chemical soil tests and leaf samples for foliar analysis and have the testing done. Based on test results and within the minimum and maximum rates indicated above, adjust fertilization rates to meet plant nutrient requirements. As requested and as directed by the Owner, apply foliar spray or implant capsules to correct chlorosis.

**2.2. Insect and Disease Control**

- 2.2.1. For trees, shrubs and other planting, address specific diagnosed problems with currently recommended treatments as requested and as indicated by the owner.
- 2.2.2. Undertake regular site inspections and report in writing any problems to the Store Manager, Project Manager and or Architect.
- 2.2.3. The contractor is to provide, together with their tender, a copy of their Proposed Sustainable Pest Management and Monitoring Program for the site.
- 2.2.4. Applications or sprays will be done following authorization by the Owner.
- 2.2.5. Include an annual allowance of \$2000.00 in the tender for the above work. Expenditures of this allowance will be authorized by the Owner.
- 2.2.6. Dormant oil spray in late April/early May and before leaf buds break. Insure that only tolerant plants receive this application.

**2.3. Mulch**

- 2.3.1. >Gro-Bark= or approved alternate.
- 2.3.2. The use of mulch, supplied in bulk, will not be permitted unless approved by the Consultant upon submission of sample and locations of source of supply.

**2.4. Rodent Control**

- 2.4.1. Clay tile, mouse bait stations baited with zinc phosphate - treated cracked corn.
- 2.4.2. Repellents containing Hiram.
- 2.4.3. Trunk wrap and guards

**2.5. Water**

- 2.5.1. Potable and capable of sustaining plant growth.

**PART 3 - EXECUTION**

**3.1. Plant Material Maintenance**

**3.1.1. Trees, Shrubs and Other Planting**

- 3.1.1.1. All plant materials shall be maintained by the Contractor immediately after planting has been installed and shall continue until the date of final acceptance.
- 3.1.1.2. Maintain all vegetation within the limit of contract work. Include both newly planted - young planted materials and well established older trees and shrubs. Instruct in writing any corrective or preventative measures necessary to ensure healthy plant growth. Report in writing any damage to plant materials, however caused.
- 3.1.1.3. The Contractor shall arrange through the landscape subcontractor for a reputable landscape maintenance contractor and meet on site jointly with the Consultant to review ongoing landscape requirements for the duration of the warranty period. The subcontractor shall have available his recommended maintenance schedule for this meeting. At the end of the warranty period, the landscape contractor shall advise the Contractor and the Consultant in writing and arrange a final acceptance site meeting.
- 3.1.1.4. Maintenance shall include all measures necessary to establish and maintain plants in an acceptable, vigorous and healthy growing condition including, but not limited to:

**3.1.2. Landscape Maintenance Schedule**

ACTIVITY	Apr	May	June	July	Aug	Sept	Oct	Nov
Spring Clean Up								
Fertilizers								
Weed Control								
Insect and Disease Control								
Pruning								
Watering								
Mulching								
Accessories								
Removals (Dead Material Only)								
Winter Preparation								



	Specified Schedule
	Schedule as Required

**3.1.3. Planting Maintenance: Trees, Shrubs & Ground Covers**

ACTIVITY	APR	MA Y	JUN E	JUL Y	AU G	SEP	OC T	NO V
Deciduous Trees								
Coniferous Trees								
Deciduous Shrubs								
Coniferous Shrubs								

**3.1.4. Maintenance Activity**

**Spring - April, May**

- 3.1.4.1. Remove all debris from landscaped areas and dispose of off-site.
- 3.1.4.2. Cultivate and neatly trim shrub beds and tree well saucers and dispose of debris off-site
- 3.1.4.3. Remove all dead/dying branches from trees, shrubs and ground covers and replace any dead/dying trees, shrubs or ground covers and dispose of debris off-site
- 3.1.4.4. Fertilize trees, shrubs and ground covers with a soluble soil drench fertilizer (20-20-20) or all-purpose organic commercial fertilizer.
- 3.1.4.5. Fertilize grassed areas with a high nitrogen organic commercial fertilizer (21-7-7 or equal). A combined weed and feed, commercially available fertilizer may be used. Follow manufacturer=s instructions utilizing a rotary fertilizer spreader.
- 3.1.4.6. If grassed areas are thin, aerate, spread sterilized (weed free) topsoil 25cm thick and evenly distribute grass seed with a rotary grass seed spreader. Water evenly, thoroughly and until seed has taken to grass, visually. Sod and water any significant bare spots. Do not apply herbicides to freshly seeded areas.
- 3.1.4.7. Mow grassed areas weekly, including edge trimming. Maintain a maximum height of 60mm. Do not cut more than one third (1/3) of the grass height at any one mowing. Trim and clip edges. Remove clippings after mowing and clipping.
- 3.1.4.8. Apply crab grass prevention prior to seed germination and herbicides monthly as required for general control of weed growth.

- 3.1.4.9. Applications of liquid herbicides, insecticides and fungicides should be undertaken by a licensed practitioner. Apply pesticides in accordance with Federal, Provincial and Municipal regulations as and when required to control insects, fungus and disease.
- 3.1.4.10. Planting of annual flowers in shrub beds and planters if specified is to be undertaken during the period between May 24<sup>th</sup> and June 15<sup>th</sup>.
- 3.1.4.11. Add a fresh layer of mulch to match existing mulch in shrub beds to insure a minimum depth of 75mm.

**Summer – June, July, August**

- 3.1.4.12. Watering of grassed areas to commence on a regular basis and continue with intensity depending on amount of rainfall.
- 3.1.4.13. Mow grassed areas weekly, including edge trimming. Maintain a maximum height of 60mm. Do not cut more than one third (1/3) of the grass height at any one mowing. Trim and clip edges. Remove clippings after mowing and clipping.
- 3.1.4.14. Prune trees when full leaf growth is achieved, removing irregular or obscuring branch growth. Do not remove tree tops / leaders. Dispose of all pruning debris off-site.
- 3.1.4.15. Do not prune Municipal owned trees. If pruning or removal is required, contact Municipality.
- 3.1.4.16. Prune shrubs and ground covers as required, maintaining natural growth habit and form.
- 3.1.4.17. Fertilize trees, shrubs, ground covers and flowers with water soluble organic fertilizer or commercial 20-20-20 or equal. Tree fertilizer spikes are encouraged. Follow manufacturer's instructions. Do not over fertilize!
- 3.1.4.18. Apply organic fertilizer 21-7-7 to all grassed areas using a commercial fertilizer spreader.
- 3.1.4.19. Applications of liquid herbicides, insecticides, fungicides are to be undertaken by a licensed herbicide/insecticide practitioner only and only as required. This applies generally for all plantings and lawns.
- 3.1.4.20. Remove and dispose of debris on a regular basis.
- 3.1.4.21. Major problems related to planting condition or mortalities should be immediately reported in writing to the Store Manager, Project Manager and or Architect.

**Fall – September, October, November**

- 3.1.4.22. Continue watering as required. Deep water evergreen trees.
- 3.1.4.23. Continue light pruning of shrubs if required, remove and dispose of dead or diseased branches.
- 3.1.4.24. Continue to mow grassed areas weekly, including edge trimming. Maintain a maximum height of 60mm. Do not cut more than one third (1/3) of the grass height at any one mowing. Trim and clip edges. Remove clippings after mowing and clipping.
- 3.1.4.25. After flowers have stopped blooming, remove and dispose of off-site.
- 3.1.4.26. Commence clean-up of all fallen leaves and continue until trees are bare. Note: All fallen leaf material is recyclable and is to be disposed of off-site.

- 3.1.4.27. Winter burlap wrap protection is recommended for all upright formed evergreens, evergreen trees and fragile shrubs less than 2 years old against salt spray and winter desiccation. **This is mandatory during fall planting.**
- 3.1.4.28. Clean and remove any fallen leaves from all catch basin grates and, where possible, lift grates and clean out catch basins.
- 3.1.4.29. Apply winterizer fertilizer to all grassed areas.

### **3.2. General Irrigation Maintenance**

- 3.2.1. Watering should take place during the early morning hours (12:00 am to 6:00 am)
- 3.2.2. Irrigation controller (if provided) should be set station to station for the above watering hours (refer to Owner's Manual)
- 3.2.3. Verify all sprinkler settings, overlap, nozzle sizes and operating pressures.
- 3.2.4. Adjust the flow control on automatic valves where necessary.
- 3.2.5. Program the controller into a logical sequence, to maintain a heavy infrequent water cycles as opposed to light frequent settings.
- 3.2.6. Contractor to note and document irrigation activity and report any dry areas, wet areas or damaged hardware to Store Manager, Project Manager and or Architect.
- 3.2.7. Damage caused by maintenance contractor will be repaired immediately at the cost of the contractor.
- 3.2.8. Contractor to monitor rain sensor hardware and report any problems immediately to the Store Manager, Project Manager and or Architect.
- 3.2.9. If no automated irrigation system has been provided, utilize hose bibs on the building in conjunction with buried yard hydrants (quick couplers) for watering operations.
- 3.2.10. Manual watering should ensure deep watering of trees, shrubs, ground covers and grassed areas.
- 3.2.11. Critical watering months are June, July, August.

### **Spring Start Up and Fall Winterization**

- 3.2.12. Flush all lines and ensure that all water is expelled from the system as per manufacture=s specifications.
- 3.2.13. Inspect all visible piping, and walk all buried lines for any leakage.
- 3.2.14. Report all repairs necessary to render the system in good working order shall be completed at this time. Contractor to submit any documentation and or cost estimates of repairs for written approval.
- 3.2.15. Verify all sprinkler settings, overlap, nozzles and operating pressures.

3.2.16. Contractor to replace battery and check electrical connections.

**3.3. Final Acceptance**

3.3.1. Prior to final acceptance the Contractor shall provide the Architect with a complete written maintenance schedule for all plant materials, unless provided for otherwise in the Contract Documents. Include documentation of all dates when maintenance took place during maintenance period, including time and duration.

3.3.2. Notwithstanding any provisions in the Contract Documents, the Contractor shall be responsible for making monthly inspections of all planting during the warranty period and submit a written report of each inspection to the Store Manager, Project Manager and Architect. Written Reports may include:

3.3.2.1. Maintenance work carried out.

3.3.2.2. Development and condition of plant materials.

3.3.2.3. Preventative or corrective measures required which are outside of Contractor's responsibility.

3.3.3. The Contractor shall instruct the Store Manager, Project Manager and Architect in writing of any corrective or preventive measures necessary to ensure healthy plant growth. Any damage or theft to plant materials from any source whatsoever shall be reported in writing to the Architect.

3.3.4. Contractor to remove all Tree Stakes and Hardware after the second growing season.

**3.4. Guarantee**

3.4.1. Guarantee all plant material for a period of one year commencing on the date of provisional acceptance.

3.4.2. During the guarantee period replace all material that is dead or not in satisfactory, healthy growing state or which does not meet the requirements of the specifications, at no extra cost to the contract. The replaced plant does not have an extended guarantee. Final determination of the acceptability of the plants will be made by the Architect.

3.4.3. All replacements must be plants of the same size and species as shown on the plant list, supplied and planted in accordance with the drawings and specifications.

**END OF SECTION**

**PART 1 - GENERAL**

**1.1. Description**

**1.1.1. General Instructions**

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

**1.1.2. Related Work Specified Elsewhere**

1.1.2.1. Division 4 - Masonry

1.1.2.2. Division 9 - Floor Finishes

**1.1.3. Work Installed But Furnished by Other Sections**

**1.2. Applicable Standards**

1.2.1. All standards to be latest issue with amendments.

1.2.2. Ontario Building Code.

1.2.3. CSA Standard CAN3-A23.1, A23.2 and A23.3.

1.2.4. ACI Standard 302, "Recommended Practice for Concrete Floor and Slab Contraction".

1.2.5. ACI Standard 347, "Formwork for Structural Concrete".

**1.3. Shop Drawings**

1.3.1. Examine all drawings forming a part of this contract and conform to the requirements of all such drawings.

1.3.2. 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.

1.3.3. Submit shop drawings in accordance with the General Instructions.

1.3.4. Do not cut or fabricate reinforcing steel material until the Engineer and Architect have reviewed and approved the shop drawings.

1.3.5. 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.

**1.4. Coordination and Cooperation**

1.4.1. Coordinate the work of this section with the General Contractor's scheduling in accordance with the General Instructions.

- 1.4.2. 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.
- 1.4.3. 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.
- 1.4.4. Make good all openings left in construction around pipes, pockets for anchorages, etc., for other trades for where existing concrete must be broken out.
- 1.4.5. Examine Mechanical/Electrical drawings for housekeeping pads, inertia slabs and bases.

#### **1.5. Design and Detailing Criteria**

- 1.5.1. **Formwork** - in accordance with CAN3-A23.1 and the recommendations of A.C.I. Standard 347.
- 1.5.2. **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.
- 1.5.3. **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.
- 1.5.4. Shoring of the composite metal floor deck will not be required.

### **PART 2 - PRODUCTS**

#### **2.1. Materials**

- 2.1.1. **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.
- 2.1.2. **Aggregates**
  - 2.1.2.1. Fine and coarse aggregate materials and grading in accordance with Section 5 of CSA Standard CAN3-A23.1.
- 2.1.3. **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.)
- 2.1.4. **Welded Wire Fabric** - in accordance with CSA Standard G30.5-1967. **Supply in sheets only.**
- 2.1.5. **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".
- 2.1.6. **Premoulded Filler** - 10 mm thick, asphalt impregnated Flexcell as manufactured by G.F. Sternson or approved equal.

- 2.1.7. **Spray-Applied Membrane** - in accordance with ASTM Standard C309, Type 1, Class B - VOCOMP-20 by Meadows.
- 2.1.8. **Vapour Barrier** - 10 mil polyethylene to CAN/CGSB 51.34.
- 2.1.9. **Floor Sealer** - 1 part moisture-cured (non-staining) acrylic - VOCOMP-25 by Meadows.
- 2.1.10. **Grout** - non-ferrous, non-shrink grout.
- 2.1.11. **Superplasticizer** - Melment by Sternson or Conchem S.P.N.
- 2.1.12. **Circular Column Forms** - fibre glass without spiral pattern. Steel forms are not acceptable for this project.
- 2.1.13. **Carborundum Grits** - 8/16 (rice size) grits.
- 2.1.14. **Non-Metallic Integral Hardener** - pre-mixed Colorcron by Master Builders (colours to be selected later).
- 2.1.15. **Plywood** - in accordance with CSA A23.1.
- 2.1.16. **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.
- 2.1.17. **Structural steel support angles** – Pre-manufactured galvanized steel support shelf angles as detailed on drawings

## **2.2. Concrete Mixes**

- 2.2.1. Job-mixed concrete will not be allowed on this project.
- 2.2.2. 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.
- 2.2.3. 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.
- 2.2.4. 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.
  - 2.2.4.1. Date and truck number.
  - 2.2.4.2. Contractor's name.
  - 2.2.4.3. Job designation.
  - 2.2.4.4. Specified concrete strength, slump, air content and admixture.
  - 2.2.4.5. Batch volume.
  - 2.2.4.6. Time of batching.
- 2.2.5. 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%

- 2.2.6. Fine and coarse aggregate grading in accordance with CSA Standard CAN3-A23.1-M77.
- 2.2.7. 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 unless specified by the consultants.**
- 2.2.8. 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.

**2.3. Fabrication of Reinforcing Steel**

- 2.3.1. All reinforcing steel shall be provided and bent by a supplier approved by the Engineer.
- 2.3.2. Fabrication of bends, hooks and other shapes in accordance with CSA Standard CAN3-A23.3-M and the Reinforcing Steel Institute of Ontario Standards.
- 2.3.3. 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.

**2.4. Quality Control**

- 2.4.1. 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**

**3.1. Examination**

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



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

### 3.2. Workmanship

#### 3.2.1. Formwork

- 3.2.1.1. 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.
- 3.2.1.2. 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.
- 3.2.1.3. 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.
- 3.2.1.4. Provide for all openings, offsets, risers, brackets, haunches, depressions and curbs as shown or required in the formwork.
- 3.2.1.5. 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.
- 3.2.1.6. For typical wall surfaces, arrange form ties such that after removal of the forms, no metal is within 25 of the finished surface.
- 3.2.1.7. 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.
- 3.2.1.8. Provide 25 x 25 chamfers on all corners of concrete, exposed to view in the finished structure.
- 3.2.1.9. 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.
- 3.2.1.10. Place continuous 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.
- 3.2.1.11. 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.
- 3.2.1.12. Place continuous pre-manufactured Galvanized steel support shelf angles as detailed on drawings. Anchor steel tails to reinforcing steel to prevent rotation during pours.
- 3.2.1.13. 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.
- 3.2.1.14. Composite steel deck will not require shoring.
- 3.2.1.15. Formwork approved for concreting shall be properly protected until

concrete is placed.

- 3.2.1.16. Exercise particular care in stripping the tops of foundation walls and piers to avoid chipping, spalling, or gouging of concrete edges.
- 3.2.1.17. Stripping of forms shall be in accordance with Section 11 of CSA Standard CAN3-A23.1 and subject to the approval of the Consultant.

3.2.2. **Reinforcing Steel**

- 3.2.2.1. Placing, spacing, splicing and protection of reinforcement in accordance with CSA Standard CAN3-A23.3
- 3.2.2.2. Maintain the cover required for reinforcement as shown on the drawings. Where not specifically shown, refer to CSA Standard CAN3-A23.1
- 3.2.2.3. 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.

3.2.3. **Vapour Barrier**

- 3.2.3.1. After all subgrade work is complete and approved, place vapour barrier for slabs on grade.
- 3.2.3.2. Lap sheeting minimum 150 at all joints and turn up at perimeter walls and piers 100 min.

3.2.4. **Concrete Placing**

- 3.2.4.1. All conveying, depositing and compaction of concrete in accordance with CSA Standard CAN3-A23.1-M.
- 3.2.4.2. 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.
- 3.2.4.3. 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.
- 3.2.4.4. 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.
- 3.2.4.5. Carefully concrete in all piping, sleeves, conduits, etc., furnished by the Mechanical and Electrical trades.
- 3.2.4.6. 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.
- 3.2.4.7. Strike off floor surfaces at the level shown on the drawings by means of previously set, continuous pipe screeding, set on adequate supports.
- 3.2.4.8. 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.
- 3.2.4.9. Ensure that reinforcement, inserts, etc., are not disturbed during concrete placement.

3.2.5. **Concrete Protection and Curing**

- 3.2.5.1. 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.
- 3.2.5.2. Maintain all equipment and materials for the protection and curing of concrete on site, ready to use before concrete placing is started.
- 3.2.5.3. Completely cover slabs with 4 mil polyethylene sheeting, properly lapped at side and edge laps and weighted down.
- 3.2.5.4. 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.

3.2.6. **Cold Weather Requirements**

- 3.2.6.1. All concreting operations during cold weather in accordance with Section 21 of CSA Standard CAN3-A23.1.
- 3.2.6.2. Remove and replace all concrete damaged by frost or freezing at the direction of the Engineer at no cost to the Owner.
- 3.2.6.3. Accelerating chemical admixtures or calcium chloride shall not be used.

3.2.7. **Hot Weather Concreting**

- 3.2.7.1. All concreting operations during hot weather in accordance with Section 21 of CSA Standard CAN3-A23.1.
- 3.2.7.2. The use of a water reducing-retarding chemical admixture in the concrete mix may be required at the Engineer's discretion.

3.3. **Finishing of Horizontal Surfaces**

3.3.1. **Floors**

- 3.3.1.1. 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.
- 3.3.1.2. 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.
- 3.3.1.3. Concrete floors shall be sloped where required to floor drains at 1:50 and/or as directed by the ARCHITECT.
- 3.3.1.4. 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/m<sup>2</sup>. 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.

- 3.3.1.5. Exposed concrete stairs and slabs shall receive two 1.3 kg/m<sup>2</sup> "shakes" of carborundum grits in accordance with the manufacturer's directions, followed by a light broom finish to provide a neat, non-slip surface.

**3.4. Construction Joints**

- 3.4.1. Construction joints shall only be placed in locations approved by the Engineer or as shown on the drawings.
- 3.4.2. Construction joints shall be keyed and dowelled to the adjoining pour as detailed on the drawings.
- 3.4.3. Before placing adjoining concrete at construction joints, clean the existing surface of dirt, laitance and loose aggregate.

**3.5. Isolation Joints**

- 3.5.1. Provide asphalt-impregnated fibreboard as follows:
- 3.5.1.1. At locations shown and noted on the drawings.
- 3.5.1.2. Isolation joints in the walls shall be as shown on the drawings.

**3.6. Control Joints**

- 3.6.1. Provide control joints as follows:
- 3.6.1.1. 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.
- 3.6.1.2. 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.

**3.7. Corrections and Remedial Work**

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

**3.8. Field Quality Control**

- 3.8.1. All materials and workmanship shall be subject to test and inspection by a testing and inspection company appointed by the Architect.
- 3.8.2. The cost of all inspection and testing except as noted hereafter will be paid for by the Owner in accordance with the General Conditions.
- 3.8.3. 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.

- 3.8.4. Provide representative samples of the materials as required by the testing and inspection company at no cost to the Owner.
- 3.8.5. 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:
  - 3.8.5.1. 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.
  - 3.8.5.2. The inspection company shall take concrete tests for:
    - 3.8.5.2.1. Not less than one test for each class of concrete placed each day, and
    - 3.8.5.2.2. Not less than one test for each 100 yards or portion thereof placed in any day.
- 3.8.6. 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.
- 3.8.7. Notify the testing company of the pouring schedule sufficiently in advance so that tests may be made.

**3.9. Clean-up**

- 3.9.1. 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**

**1.1. Description**

**1.1.1. General Requirements**

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

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

1.1.2.1. Section 03300: Concrete grout

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

1.1.3.1. Section 04200: Unit Masonry

**1.2. Quality Assurance**

**1.2.1. Requirements of Regulatory Agencies:**

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

**1.3. References**

**1.3.1. Reference Standards**

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

**1.4. Submittals**

**1.4.1. Affidavits**

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

**1.5. Delivery, Storage and Handling**

1.5.1. Handle and store cementitious materials protected against moisture.

1.5.2. Handle and store all mortar materials to prevent contamination by foreign materials, and damage by freezing or excessively high temperatures.

**1.6. Site Conditions**

**1.6.1. Environmental Requirements:**

- 1.6.1.1. When air temperature is less than 5 °C, mix mortar as specified in the applicable reference standard.
- 1.6.1.2. 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**

**2.1. Materials**

- 2.1.1. 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.

**2.1.2. Cement:**

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

**2.1.3. Sand Aggregate**

**2.1.3.1. For Normal Mixes**

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

**2.1.4. Lime**

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

**2.1.5. Water**

- 2.1.5.1. Verify that water used contains no salts to cause efflorescence.

**2.1.6. Mortar Colouring**

- 2.1.6.1. Lime and alkali-proof, non-fading, mineral oxide pigments manufactured especially for mortar use.
- 2.1.6.2. For "white" mortar, use Federal White.

**2.1.7. Non-Shrink Grout**

- 2.1.7.1. Embecco 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 .

## 2.2. Mixes

- 2.2.1. Mix mortars as specified in CSA Standard A179. Use only dry aggregate. Test for bulking to determine accurate proportioning.
- 2.2.2. **Only** pre-mixed portland cement/lime mortar mixes will be acceptable for this Project. Materials may be pre-bagged or shipped in bulk containers.
- 2.2.3. 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.
- 2.2.4. Use grey mortar unless otherwise specified.
- 2.2.5. **Match colour of mortar to existing concrete masonry units where exposed to view by incorporation of suitable cement and aggregate and colouring.**
- 2.2.6. At glass unit masonry blocks, use "super" white sand and Federal White.
- 2.2.7. Limit quantity of mortar colour to following percentages of cement content by weight.
  - 2.2.7.1. : 15% for mineral oxides
  - 2.2.7.2. : 3% for carbon black.
- 2.2.8. **Concrete Grout:** (for reinforced masonry)
  - 2.2.8.1. Mix one part portland cement with three parts sand with water.

## PART 3 - EXECUTION

### 3.1. Preparation

#### 3.1.1. Protection

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

### 3.2. Mortar Types

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

**End of Section**



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**PART 1 - GENERAL**

**1.1. Description**

**1.1.1. General Requirements**

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

**1.1.2. 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

**1.1.3. 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.

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

1.1.4.1. Section 04100: Mortar

**1.2. System Description**

**1.2.1. Tolerances**

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

- 1.2.1.1.1. Level within 6 mm in any bay or 6m maximum distance, and 13 mm in 12 m or more.
- 1.2.1.1.2. 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.
- 1.2.1.1.3. Opening sizes within 6 mm of designated dimension.
- 1.2.1.1.4. Columns and wall cross-section dimensions within minus 6 mm and plus 13 mm.
- 1.2.1.1.5. With joints to dimensions indicated, but in no case greater than 13 mm.

**1.3. Quality Assurance**

**1.3.1. Requirements of Regulatory Agencies**

- 1.3.1.1. Construct masonry as required by jurisdictional authorities.
- 1.3.1.2. 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.

- 1.3.1.3. 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.

#### 1.4. References

##### 1.4.1. Reference Standards

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

#### 1.5. Submittals

##### 1.5.1. Shop Drawings

- 1.5.1.1. Submit shop drawings of masonry reinforcement.

##### 1.5.2. Samples and Mock Up

- 1.5.2.1. Submit samples of each type of masonry unit specified, and of accessories.
- 1.5.2.2. **Face Masonry Mock Up:** Prior to commencement of exterior cladding, lay up a section of typical wall construction on portion of building wall ready to receive cladding. Provide flashing, anchors, ties and weep procedures. Include two (600mm) lengths of base stone and up to 8 courses of Calcium Silicate Face Brick as specified. Include specified mortar. Mock Up Section should wrap a corner condition to indicate site cutting and breaking of end units at 90 degree turn.

#### 1.6. Delivery, Storage, and Handling

- 1.6.1. Isolate masonry units from contact with ground and other materials until laid, to prevent staining.
- 1.6.2. Ensure that moisture content of concrete masonry units is maintained within specified limits from time of shipment from plant to time of installation.

- 1.6.3. Deliver Calcium silicate brick in protective film.
- 1.6.4. Cover masonry unit stockpiles while stored to prevent exposure to weather. Keep water out of all holes and reglets in units during freezing weather.
- 1.6.5. Handle and store masonry units to prevent soiling and chipping.
- 1.6.6. Deliver products to the place on site as directed, and to meet installation schedule.

**1.7. Environmental Conditions**

**1.7.1. Environmental Requirements**

- 1.7.1.1. 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.
- 1.7.1.2. Do not lay masonry units when air temperature is below -1° C.
- 1.7.1.3. Do not lay masonry during rain unless work is protected by sufficient enclosure.
- 1.7.1.4. Protect new masonry work from direct rays of sun to prevent fast drying and shrinkage.
- 1.7.1.5. 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.
- 1.7.1.6. 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**

**2.1. Materials**

- 2.1.1. Meet specified requirements of CAN/CSA-A370-M84 and CAN/CSA-A371-M84 for materials unless specified otherwise.
- 2.1.2. **Damp-proof Flashing**
  - 2.1.2.1. Polyvinyl chloride flexible flashing membrane, 20mil thick, black; Rodoply by Sternson or Sealtight Flexguard by W.R. Meadows.
- 2.1.3. **Damp-proofing Flashing Lap Cement**
  - 2.1.3.1. To meet specified requirements of flashing manufacturer.
- 2.1.4. **Joint Packing at Walls**
  - 2.1.4.1. Expansion Joint Packing: Glass fibre insulation, rigid board, density of 48 kg/cu.m.

2.1.5. **Joint Reinforcement**

- 2.1.5.1. 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.
- 2.1.5.2. 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.
- 2.1.5.3. For Cavity Walls: Interior wythe shall be single wythe ladder type; hot dipped galvanized.
  - 2.1.5.3.1. New 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.
  - 2.1.5.3.2. New exterior wythe for tie in to existing concrete block shall be Helifix Stainless steel ties.
- 2.1.5.4. For Masonry at Steel Columns: 5.21 mm diameter wire with 1.19 mm diameter wire and 10 mm x 10 mm openings.
- 2.1.5.5. For Type A and B masonry, use stainless steel joint reinforcement. For exterior masonry use stainless steel reinforcement. For interior use mill galvanized.
- 2.1.5.6. Brick Wythe with Metal Stud framing. Bailey Brick Connector ESS-2 with Triangle V Stainless Steel wire min 3/16" diameter. (or approved equal.)

2.1.6. **Dovetail Anchor**

- 2.1.6.1. 25.5 mm x 2 mm steel dovetail anchor, galvanized, with end crimped and bent.

2.1.7. **Dovetail Anchor Slots**

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

2.1.8. **Flexible Anchor**

- 2.1.8.1. 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.

2.1.9. **Weep Holes**

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

2.1.10. **Cavity Sealer**

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

2.1.11. **Sheet Metal**

- 2.1.11.1. 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.
- 2.1.11.2. 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.

2.1.12. **Through Wall Flashing**

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

2.1.13. **Bituminous Paint**

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

2.1.14. **Concrete Masonry Units**

- 2.1.14.1. To meet specified requirements of CSA Standard A165-M83.
- 2.1.14.2. 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.
- 2.1.14.3. 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.
- 2.1.14.4. Provide 100% solid units where required by jurisdictional authorities.
- 2.1.14.5. Moisture controlled ("M") units as approved by Architect.
- 2.1.14.6. **Lightweight Units**
  - 2.1.14.6.1. Of slag aggregate manufacture. For use in all exposed partitions and exterior wall backup.
  - 2.1.14.6.2. Hollow Units: H/7.5/C/M
  - 2.1.14.6.3. Solid Units: S/15/A/M
  - 2.1.14.6.4. American Imperial and Metric as indicated in .3
  - 2.1.14.6.5. Colour: Grey

2.1.14.7. **Face Block Units**

- 2.1.14.7.1. **CMU 1** : Standard Smooth Face to match existing block in texture density and Colour.

2.1.15. **Natural Stone Masonry Units**

2.1.15.1. **Natural Stone Masonry Units (NSMU):** Arriscraft 'Adair' Limestone. Acceptable Alternate: Mosa Dolomitic Limestone, type III High Density – ASTM C 568-08a by OSI Hard Surfaces.

2.1.15.1.1. NSMU 1: Sawn top, bottom side and face. Exposed faces medium dressed.

2.1.15.1.2. Colour: Blue grey veined.

2.1.15.1.3. Size: 190mmx 590mmx 90mm.

2.1.15.1.4. Stone sill, Blue grey veined. 90mm top x 90mm face x 590mm length. Medium dressed on top and face, with 10mm rounded edges on top/front and front sides.

2.1.15.1.5. **Alternate Price Number 1:** Stone sill, Blue grey veined. 190mm top x 90mm face x 590mm length. Medium dressed on top and face, with 10mm rounded edges on top/front and front sides.

2.1.16. **Calcium Silicate Manufactured Brick Units.**

2.1.16.1. **Calcium Silicate Brick Units (CSBU):** Arriscraft Contemporary Brick.

2.1.16.2. CSMBU 1: Smooth all sides except for face with top and bottom mortar frogs. Exposed face to be split face.

2.1.16.3. Colour: Blizzard

2.1.16.4. Size: 80mm x 590mm x 90mm

**PART 3 - EXECUTION**

**3.1. Preparation**

3.1.1. **Shelf Angles**

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

3.1.2. **Protection**

3.1.2.1. 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.

3.1.2.2. Protect exposed external corners of masonry with materials which will not damage or soil finished surfaces.

3.1.2.3. Protect all finished surfaces from mortar droppings.

3.1.2.4. Take particular care to protect faces of concrete unit masonry from mortar droppings and smears as laying proceeds.

3.1.2.5. Turn over or cover scaffolds and mortar board at completion of each day's work to avoid staining of finished surfaces by splashed rain.

**3.2. Laying Masonry**

3.2.1. Lay masonry to meet specified requirements of CAN/CSA-A370-M84 and CAN/CSA-A371-M84, unless otherwise specified.

- 3.2.2. Lay masonry as shown on Drawings, and to minimize cutting of units.
- 3.2.3. Coordinate coursing of dissimilar sized units only as approved by Architect.
- 3.2.4. Use only dry and unfrozen materials.
- 3.2.5. Remove sections of masonry which have been frozen before laying of masonry continues.
- 3.2.6. Lay masonry in running bond with vertical joints of alternate courses in line and as indicated on drawings.
- 3.2.7. Align webs of concrete unit masonry vertically and with thick ends on top.
- 3.2.8. **Joints**
  - 3.2.8.1. Make joints of uniform thickness with vertical joints from course to course maintained plumb.
  - 3.2.8.2. Provide full bed and head joints for shear walls.
  - 3.2.8.3. 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.
  - 3.2.8.4. Form tooled concave joints wherever exposed to view, whether behind cabinets, fittings, 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.
  - 3.2.8.5. Trowel point joints in unparged masonry in contact with earth.
  - 3.2.8.6. Rake out joints of masonry exposed to view to provide for caulking:
    - 3.2.8.6.1. :at juncture of interior and exterior walls with columns.
    - 3.2.8.6.2. :at interior with exterior walls.
    - 3.2.8.6.3. :intersections of walls and partitions where joint reinforcement is installed.
    - 3.2.8.6.4. :at caulked joints where indicated typically.
  - 3.2.8.7. Cut joints off flush where thin-set tile will be applied, and where treatment is not otherwise specified.
  - 3.2.8.8. Ensure that no mortar protrudes from joints on wall surfaces to which insulation vapour retarder or air barrier will be applied.
- 3.2.9. Stop off horizontal runs of walls by racking back 1/2 unit in each horizontal course; do not tooth.
- 3.2.10. 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.
- 3.2.11. Do not wet concrete units or existing brick units.
- 3.2.12. 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.

- 3.2.13. 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.
- 3.2.14. Maintain continuous walls/piers bracing during construction until structure provides support.
- 3.2.15. **Lintels**
- 3.2.15.1. Build in lintels supplied by Section 05100. Set and level lintels on a bed of mortar.
- 3.2.16. **Built In Items**
- 3.2.16.1. 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.
- 3.2.16.2. 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.
- 3.2.16.3. All structural steel columns which require masonry shall be built in solid with masonry.
- 3.2.17. 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.
- 3.2.18. Do not expose open cells, cores or frogs of masonry units to view.
- 3.2.19. Flush surface smooth with mortar masonry against which flashing rests to ensure that it is not punctured.
- 3.2.20. 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.
- 3.2.21. **Bonding**
- 3.2.21.1. Where bond pattern is indicated on Drawings use masonry bonding, or clip headers and install metal bond anchors.
- 3.2.22. **Masonry Anchorage**
- 3.2.22.1. Use dovetail anchors for slots at concrete construction.
- 3.2.22.2. Use flexible anchors at steel structure.
- 3.2.22.3. Build masonry tight to faces of structural members or as indicated on Drawings.
- 3.2.22.4. Bed anchors solidly in mortar joints.



3.2.22.5. Coordinate with Section 03300 to ensure that dovetail anchor slots in concrete are located correctly. Assist in their installation if requested.

3.2.23. **Lateral Support**

3.2.23.1. Lateral support clips are specified in Section 05500.

3.2.23.2. Coordinate with Section 05500 to ensure that lateral supports are located correctly. Assist in their installation if requested.

3.2.24. **Joint Reinforcement**

3.2.24.1. Install joint reinforcement in:

3.2.24.1.1. :solid walls and partitions, including foundation walls, constructed of

3.2.24.1.2. concrete masonry units.

3.2.24.1.3. :single wythes of concrete masonry units in cavity walls.

3.2.24.1.4. :single wythe concrete masonry walls and partitions.

3.2.24.1.5. :Combination solid walls and partitions incorporating concrete masonry

3.2.24.1.6. unit backup.

3.2.24.1.7. :single wythes of brick masonry in exterior cavity walls.

3.2.24.2. Place reinforcement continuously in horizontal joints at 400 mm o.c., beginning with course 400 mm above bearing, unless otherwise specified or indicated.

3.2.24.3. Place reinforcement additionally in courses 200 mm, 400 mm and 800 mm above and below openings, and extending 600 mm beyond jambs of openings.

3.2.24.4. Where changes in wall thickness occur, extend reinforcement of lesser width 450 mm beyond changes of width.

3.2.24.5. Lap reinforcement a minimum of 150 mm at splices.

3.2.24.6. Do not run reinforcement through control or expansion joints.

3.2.24.7. 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.

3.2.24.8. 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.

3.2.25. **Deflection Space**

3.2.25.1. Incorporate a deflection space between tops of non load bearing walls and partitions and structure to prevent transference of structural loads to masonry.

3.2.25.2. Fill deflection space with glass fibre board compressed to 50% of original thickness to completely seal space.

3.2.25.3. Coordinate laying of masonry with installation of lateral support specified in this Section and as provided by Section 05500.

3.2.26. **Cavity Walls**

3.2.26.1. Bond cavity wall wythes with joint reinforcement.

- 3.2.26.2. 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 from another by an airtight seal.
  - 3.2.26.3. 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.
  - 3.2.26.4. 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.
- 3.2.27. **Through Wall Flashings**
- 3.2.27.1. Install flashing at locations indicated on Drawings.
  - 3.2.27.2. Place flashing over sheet metal for support.
  - 3.2.27.3. Coat surface of flashing in contact with masonry with two coats of adhesive.
  - 3.2.27.4. Lap joints between lengths of flashing a minimum of 100 mm and seal with adhesive.
- 3.2.28. **Penetration of Masonry**
- 3.2.28.1. Fill voids of masonry to within 19 mm of structural members, pipes, ducts and conduit that penetrate masonry walls and partitions, unless otherwise indicated.
  - 3.2.28.2. Keep masonry units similarly clear of such penetrations.
  - 3.2.28.3. Finish mortar smooth at face of masonry.
  - 3.2.28.4. 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.
- 3.2.29. **Shrinkage Control Joints**
- 3.2.29.1. Incorporate vertical shrinkage control joints in walls of which concrete masonry units are a part.
  - 3.2.29.2. 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.
  - 3.2.29.3. 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.
  - 3.2.29.4. 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.

3.2.30. **Expansion Joints**

- 3.2.30.1. Incorporate expansion joints in walls where indicated on Drawings.
- 3.2.30.2. Build in metal bellows with joints between lengths lapped a minimum of 50 mm and flanges anchored in joint between wythes.
- 3.2.30.3. 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.
- 3.2.30.4. Leave clean space in joints for caulking as specified in Section 07920.

3.2.31. **Fire Separations**

- 3.2.31.1. Construct fire separation walls tightly to construction at perimeter, and without openings or voids.
- 3.2.31.2. Do not reduce the thickness of masonry fire separations to less than the thickness indicated for the required fire separation rating.

3.2.32. **Fire Protection**

- 3.2.32.1. Install masonry fire protection of structural steel columns as indicated on Drawings, for fire ratings indicated.
- 3.2.32.2. Completely enclose structural steel columns with masonry for their entire length. Do not fill webs.

3.2.33. **Grouted Reinforced Masonry**

- 3.2.33.1. 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.

3.3. **Field Quality Control**

- 3.3.1. 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.
- 3.3.2. 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.
- 3.3.3. Payment for inspection and testing will be made from cash allowance specified in Section 01020.

3.4. **Adjustment and Cleaning**

- 3.4.1. Patch damaged masonry walls which have been rejected.
- 3.4.2. Point all holes in mortar joints except weepholes.
- 3.4.3. Point all voids in concrete unit masonry faces.
- 3.4.4. Cut out defective mortar joints to a minimum depth of 13 mm and repoint.
- 3.4.5. Wash down and brush masonry to remove mortar and stains. Use only detergents, or proprietary masonry cleaners as recommended by brick manufacturer.

- 3.4.6. Clean concrete masonry units with brushes and as otherwise recommended by the supplier to remove mortar and stains.
- 3.4.7. Do not use wire brushes for cleaning.
- 3.4.8. Should specified cleaning methods be insufficient, proceed with other methods only with approval.
- 3.4.9. Protect adjacent materials, construction and finished surfaces from damage while cleaning.
- 3.4.10. Ensure that all efflorescence and mortar deposits are removed from surfaces to receive coating.

**End of Section**

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**PART 1 - GENERAL**

**1.1. Description**

**1.1.1. General Requirements**

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

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

Section 06100 Rough Carpentry  
Section 06200 Finish Carpentry  
Section 06410 Custom Casework  
Section 08421 Tempered Glass Entrance and Partition Systems  
Section 09900 Finish Painting

**1.1.3. Installation of work which shall be supplied by this Section is specified in:**

Section 06200: To Install finished counters

**1.2. Quality Assurance**

**1.2.1. Subcontractor Qualifications**

1.2.1.1. Provide metal fabrications specified in this section only by a fabricator who has adequate plant, equipment, and skilled tradesmen to fabricate and install metal fabrications 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.

**1.2.2. Welder Qualifications**

1.2.2.1. Weld structural components: in steel, to conform to requirements of CSA Standard W59, and by a fabricator fully certified by the Canadian Welding Bureau to conditions of CSA Standard W47.1 and W55.3: in aluminum by a fabricator fully certified by the Canadian Welding Bureau to requirements of CSA Standard W47.2: as applicable.

**1.2.3. Requirements of Regulatory Agencies**

1.2.3.1. Metal fabrications which function to resist forces imposed by dead and live loads shall conform to requirements of jurisdictional authorities.  
1.2.3.2. Submit shop drawings to authorities if required  
1.2.3.3. Construct frames for fire rated doors in accordance with validating label requirements.

**1.3. References**

**1.3.1. Reference Standards**

1.3.1.1. Reference Standards quoted in Contract Documents refer to:  
1.3.1.2. ASTM A276, Specification for Stainless and Heat-Resisting Steel Bars and Shapes.  
1.3.1.3. ASTM A366-72, Specification for Steel, Carbon, Cold Rolled Sheet, Commercial Quality.

- 1.3.1.4. ASTM A780-80, Standard Practice for Repair of damaged Hot Dip Coatings.
- 1.3.1.5. CGSB Specification 1-GP-40M, Primer, Structural Steel, Oil Alkyd Type.
- 1.3.1.6. CGSB Specification 1-GP-108M, Paint, Acid and Alkali Resistant, Black.
- 1.3.1.7. CGSB Specification 1-GP-132M, Primer, Zinc Chromate, Low Moisture Sensitivity.
- 1.3.1.8. CGSB Specification 1-GP-181M, Coating, Zinc Rich, Organic Ready Mix.
- 1.3.1.9. CAN/CSA-G40.20/G40.21-M92, General Requirements for Rolled or Welded Structural Quality Steel
- 1.3.1.10. CAN/CSA-G164-M92, Hot Dip Galvanizing of Irregularly Shaped Articles.
- 1.3.1.11. CSA Standard W47.1-92, Certification of Companies for Fusion Welding of Steel Structures
- 1.3.1.12. CSA Standard W55.3-1965, Resistance Welding Qualification Code for Fabricators of Structural Members used in Buildings.
- 1.3.1.13. CSA Standard W59-M1989, Welded Steel Construction (Metal Arc Welding)

#### **1.4. Submittals**

##### **1.4.1. Shop Drawings**

- 1.4.1.1. Submit shop drawings.

##### **1.4.2. Samples**

- 1.4.2.1. Submit samples of materials, finishes, and typical sections of items as requested by the Architect.

#### **1.5. Delivery, Storage, and Handling**

- 1.5.1. Label, tag, or otherwise mark metal fabrications supplied for installation by other sections to indicate their function, location in building, and shop drawing designation.
- 1.5.2. Protect metal fabrications from damage during delivery, storage, and handling.
- 1.5.3. Deliver metal fabrications to location at building site designated by Contractor and to meet requirements of construction schedule.

### **PART 2 - PRODUCTS**

#### **2.1. Materials**

##### **2.1.1. General**

- 2.1.1.1. Unless detailed or specified otherwise, standard products will be acceptable in construction details and installation to meet intent of drawings and specifications.
- 2.1.1.2. Include all materials, products, accessories, and supplementary parts necessary to complete assembly and installation of metal fabrications specified in this section.

- 2.1.1.3. Incorporate only metals that are free from defects which impair strength or durability, or which are visible. Install only new metals of best quality, and free from rust or waves and buckles, and that are clean, straight, and with sharply defined profiles.
- 2.1.1.4. Refer to Section 01010 for general fastening requirements.

2.1.2. **Metals**

- 2.1.2.1. Steel, Structural Shapes, Plate, Bars: Hot-rolled to meet specified requirements of CAN/CSA-G40.21-M81, Grade 300W.
- 2.1.2.2. Steel, Hollow Structural Sections: Hot Formed, seamless, to meet specified requirements of CAN/CSA-G40.21-M92, Grade 350W, Class H.
- 2.1.2.3. Steel, Sheet: Cold rolled, stretcher levelled, fully pickled, to meet specified requirements of ASTM Specification A366 or SAE Specification 1010.
- 2.1.2.4. Stainless Steel: Type 304 (18-8), to meet specified requirements of ASTM A276 for bars, shapes and mouldings.

2.1.3. **Finishes**

- 2.1.3.1. Prime Paint on Steel: To meet specified requirements of CGSB Specifications 1-GP-40 for oil alkyd type structural steel primer, 1-GP-48 for alkyd metal primer and 1-GP-132 for zinc chromate primer as applicable for specified finish treatments. Refer to Section 09900.
- 2.1.3.2. Zinc Rich Paint: To meet specified requirements of CGSB Specification 1-GP-181.
- 2.1.3.3. Galvanizing: For hollow metal brackets, rain water leaders, overhead door jambs, and bent plate sections - 0.61 kg/sq.m. zinc coating to meet specified requirements of ASTM Specification A120; for irregular sections, zinc coating to meet specified requirements of CSA Standard G164, including Appendix A; unless otherwise indicated.

2.1.4. **Fastenings**

- 2.1.4.1. Steel, cadmium plated screws and bolts.
- 2.1.4.2. Stainless steel, Austenitic 300 series.
- 2.1.4.3. Aluminum, screws and bolts, AA2024 or 6061, and nuts, AA6262.

2.1.5. **Anchors**

- 2.1.5.1. Where exposed to view; to match metal anchored. Stainless steel may be also used with aluminum.
- 2.1.5.2. Where concealed from view; as for exposed anchors, except that galvanized steel may also be used if electrolytic action would not result.

2.1.6. **Bituminous Paint**

- 2.1.6.1. Alkali resisting to meet specified requirements of CGSB Specification 1-GP-108.

## 2.2. Fabrication

### 2.2.1. General

- 2.2.1.1. Fabricate metal fabrications specified in this section with machinery and tools specifically designed for the intended manufacturing processes and by skilled tradesmen.
- 2.2.1.2. Fit and assemble metal fabrications in shop. When this is not possible make a trial shop assembly.
- 2.2.1.3. Incorporate anchors at 600 mm o.c. for metal fabrications located in cast-in-place concrete.
- 2.2.1.4. Incorporate means for fastening of other installations secured to metal fabrications.

### 2.2.2. Construction

- 2.2.2.1. Fabricate metal fabrications with materials, component sizes, metal gauges, reinforcing, anchors, and fasteners of adequate strength to withstand intended use, and within allowable design factors imposed by jurisdictional authorities.
- 2.2.2.2. Ensure that metal fabrications will remain free of warping, buckling, opening of joints and seams, distortion, and permanent deformation.
- 2.2.2.3. Construct items that are part of floor constructions, such as loads for which surrounding floors are designed unless indicated otherwise.
- 2.2.2.4. Ladders shall support at the centre of their treads or rungs a concentrated minimum load of 1.33 kN.

### 2.2.3. Assembly

- 2.2.3.1. Accurately cut, machine, and fit joints, corners, copes, and mitres so that junctions between components fit together tightly and in true planes.
- 2.2.3.2. Conceal fastenings from view unless otherwise indicated on drawings.
- 2.2.3.3. Weld all connections where possible; bolt where not possible, and cut off bolts flush with nuts. Countersink bolt heads, and provide method to prevent loosening of nuts. Ream holes drilled for fastenings.
- 2.2.3.4. Weld joints tight, flush, and in true planes with base metals. Make welds continuous at joints where entry of water into building, or into voids of members or assemblies is possible.
- 2.2.3.5. Grind welds smooth where exposed to view.
- 2.2.3.6. Provide for differential movements within assemblies and at junctions of assemblies with surrounding construction.

### 2.2.4. Finish Work

- 2.2.4.1. Incorporate holes and connections for products installed under other sections of the specifications.
- 2.2.4.2. Cleanly and smoothly finish exposed edges of materials including holes.
- 2.2.4.3. Cap open ends of sections exposed to view, such as pipes, channels, angles, and other similar members.
- 2.2.4.4. Machine or grind components to ensure level bearings.



2.2.5. **Prime Painting of Steel**

- 2.2.5.1. Clean all loose mill scale, rust, dirt, weld flux and spatter from work after fabrication. Grind smooth sharp projections. Unless otherwise specified apply to steel surfaces a shop prime coat of paint. Force paint into corners and cover open areas smoothly with a uniform coating. Deliver metal fabrications to site with primer undamaged. Paint all surfaces except those to be welded in field, encased in concrete, or that are machined or galvanized. Give surfaces that are inaccessible to finish field painting two coats of primer.
- 2.2.5.2. Paint steel members under cover in shop and keep them under cover until paint has dried.

2.2.6. **Galvanized Steel**

- 2.2.6.1. Hot dip galvanize assemblies following their fabrication except where impossible.
- 2.2.6.2. Fabricate items to be galvanized as recommended in Appendix A and Appendix B of CSA Standard G164.
- 2.2.6.3. Paint galvanized surfaces that are cut, welded, or threaded with zinc rich paint to ensure a minimum coating thickness of 0.102 mm, immediately following damage to galvanized protection. Prepare and repair surfaces to meet specified requirements of ASTM Specification A780.

**PART 3 - EXECUTION**

3.1. **Examination**

- 3.1.1. Take site measurements to ensure that metal fabrications fit surrounding construction, around obstructions and projections in place, or as shown on drawings, and to suit service locations.

3.2. **Installation**

- 3.2.1. Install metal fabrications plumb, true, square, straight, level, and accurately and tightly fitted together and to surrounding construction.
- 3.2.2. Provide anchor bolts, bolts, washers and nuts, lag screws, expansion shields, toggles, straps, sleeves, brackets, clips, and other items necessary for secure installation of metal fabrications as required by loading and jurisdictional authorities.
- 3.2.3. Countersink holes provided for wood screws where wood is attached to metal fabrications.
- 3.2.4. Attach metal fabrications to masonry with lead plugs and galvanized steel or other corrosion resistant fastenings to support load with a safety factor of three.
- 3.2.5. Insulate between dissimilar metals; or between metal, and masonry or concrete with bituminous paint to prevent electrolysis.
- 3.2.6. Caulk between components installed by this section to seal joints against passage of air or water, or both. Section 07920 includes caulking between metal fabrications and adjoining construction.

- 3.2.7. Grout metal posts, pickets, balusters, and the like, in metal sleeves cast into concrete, with sulphur, molten lead or quick setting anchor cement, unless detailed otherwise. Fabricate sleeves of 150 mm minimum depth.

**3.3. Adjustment and Cleaning**

- 3.3.1. After erection, touch up primed surfaces that are burned, scratched, or otherwise damaged with prime paint to match shop coat.
- 3.3.2. Repair areas of bare metal and welds on galvanized surfaces with zinc rich paint.
- 3.3.3. Remove damaged, dented, defaced, defectively finished, or tool marked components and replace with new.
- 3.3.4. Refinish shop applied finishes in field only with approval.
- 3.3.5. Clean off dirt on surfaces resulting from installation.

**3.4. Protection**

- 3.4.1. Maintain protection of metal fabrications from time of installation until final finishes are applied or to final cleanup.
- 3.4.2. Protect prime painted, galvanized surfaces from damage.
- 3.4.3. Protect exposed surfaces of prefinished metal which does not receive site finishing with protective coatings or wrappings. Use materials recommended by finishers or manufacturers of metals to ensure that method is sufficiently protective, easily removed, and harmless to the finish.

**3.5. Schedule of Metal Fabrication**

**3.5.1. General**

- 3.5.1.1. Ensure that all drawings and specifications sections, including those for structural, mechanical, and electrical work, are consulted to establish the limits of metal fabrication installations included in this section.

**3.5.2. Table Top Supports – Room 6256**

- 3.5.2.1. Framing: flat plate and angles with dimensions as indicated on drawings.
- 3.5.2.2. Welded construction: Provide welds with an even throughout without irregularities.
- 3.5.2.3. Grind smooth and flush exposed edges of 2 angles and vertical leg plate at centre of table top.
- 3.5.2.4. Fabricate to profile and details as shown.
- 3.5.2.5. Provide countersunk screw holes for attachment of table top to angles and flat reinforcing.
- 3.5.2.6. Location: Room 6256
- 3.5.2.7. Finish: Paint

**3.5.3. Tempered Glass Entrance and Partition Supports**

- 3.5.3.1. Fabrication of components as detailed on drawings.

- 3.5.3.2. Provide secure anchorage through plates into slab above.
- 3.5.3.3. Welded construction.
- 3.5.3.4. Prime painted.

**End of Section**

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**PART 1 - GENERAL**

**1.1. Description**

**1.1.1. General Requirements**

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

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

Section 06200: Finish Carpentry

**1.1.3. 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.

**1.2. Quality Assurance**

**1.2.1. Requirements of Regulatory Agencies**

1.2.1.1. Mark each piece of wood, which is rated non-combustible by fire retardant pressure treatment, with ULC Fire Hazard Classification label.

**1.3. References**

**1.3.1. Reference Standards**

1.3.1.1. Grade lumber in accordance with rules and regulations of the National Lumber Grades Authority.

1.3.1.2. Dimensions of lumber shall conform to dressed sizes specified in CSA Standard O141-91.

1.3.1.3. Reference standards quoted in Contract Documents refer to:

1.3.1.3.1. ASTM E84-81a, Test for Surface Burning Characteristics of Building Materials.

1.3.1.3.2. CAN/CSA O80 Series-M89, Wood Preservation.

1.3.1.3.3. CAN/CSA O141-91, Softwood Lumber.

1.3.1.3.4. CSA Standard B111-1974, Wire Nails, Spikes and Staples.

1.3.1.3.5. CSA Standard O121-M1978, Douglas Fir Plywood.

**1.4. Site Conditions**

**1.4.1. Environmental Conditions**

1.4.1.1. 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.

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**PART 2 - PRODUCTS**

**2.1. Materials**

- 2.1.1. For lumber and fastenings conform to Ontario Building Code, Section 4.3.
- 2.1.2. Grade mark lumber by the appropriate association under authority of the National Lumber Grades Authority.
- 2.1.3. Moisture content of lumber at time of building-in shall not exceed 19%.

**2.1.4. Lumber**

- 2.1.4.1. Spruce-Pine-Fir Species Group Designation, framing lumber, with no more than 15% of next lesser of specified grade included.
- 2.1.4.2. For utility use where concealed: sound and free of imperfections or deficiencies making unsuitable for use.

**2.1.5. Plywood**

- 2.1.5.1. Douglas Fir, in conformance with CSA Standard 0121-M1978.
- 2.1.5.2. For utility use: Unsanded Sheathing Grade.

**2.1.6. Nails, Spikes and Staples**

- 2.1.6.1. 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.

**2.1.7. Fasteners**

- 2.1.7.1. 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.

**2.1.8. Wood Preservative**

- 2.1.8.1. Copper naphthenate or pentachlorophenol solution to meet specified requirements of CSA Standard O80.

**2.1.9. Dampproof Membrane**

- 2.1.9.1. 0.051 mm polyethylene film.

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### **PART 3 - EXECUTION**

#### **3.1. Installation**

##### **3.1.1. General**

- 3.1.1.1. 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.
- 3.1.1.2. 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.
- 3.1.1.3. Cooperate with other Sections to ensure that unity of actions will ensure orderly progress to meet construction schedule.
- 3.1.1.4. 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.
- 3.1.1.5. 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.
- 3.1.1.6. 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.

##### **3.1.2. Blocking, Nailers, Strapping, Furring, Grounds & Miscellaneous Rough Framing**

- 3.1.2.1. 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.
- 3.1.2.2. Cut members into lengths as long as practicable and with square ends.
- 3.1.2.3. 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.
- 3.1.2.4. Verify that grounds required for fastening of components and equipment are located correctly, and that they provide adequate support.
- 3.1.2.5. 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.

#### **3.2. Adjustment**

- 3.2.1. Ensure that bolted fasteners are drawn up tightly.

**End of Section**

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**PART 1 - GENERAL**

**1.1. Description**

**1.1.1. General Requirements**

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

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

Section 06100: Rough Carpentry  
Section 06410: Casework  
Section 09900: Painting & Finishing

**1.1.3. References**

- 1.1.3.1. Conform to CSA Standard 0141-91 for dressed dimensions of wood members.
- 1.1.3.2. Reference standards quoted in Contract Documents refer to:
  - 1.1.3.2.1. ASTM E84-81a, Test for Surface Burning Characteristics of Building Materials.
  - 1.1.3.2.2. CAN3-O188.1-M78, Interior Mat-Formed Wood particleboard
  - 1.1.3.2.3. CAN/CSA-A172-M79, High Pressure, Paper Base, Decorative Laminates
  - 1.1.3.2.4. CAN/CSA-O80 Series-M89, Wood Preservation
  - 1.1.3.2.5. CAN/CSA-O141-91, Softwood Lumber
  - 1.1.3.2.6. CSA Standard O115-1982, Hardwood Plywood
  - 1.1.3.2.7. CSA Standard O121-M1978, Douglas Fir Plywood
  - 1.1.3.2.8. CSA Standard O151-M1978, Canadian Softwood Plywood
  - 1.1.3.2.9. CSA Standard O153-M1980, Poplar Plywood
  - 1.1.3.2.10. CGSB Specification 11-GP-3M, Hardboard
- 1.1.3.3. Fabricate millwork as specified in Finish Carpentry Schedule to meet specified requirements of Custom Quality Standard of either:
  - 1.1.3.3.1. : AWI Specification, Architectural Woodwork Quality Standards and Guide
  - 1.1.3.3.2. Specifications, 1973, by Architectural Woodwork Institute, or
  - 1.1.3.3.3. : AWMAC Specification, Quality Standards for Architectural Woodwork of the
  - 1.1.3.3.4. Architectural Woodwork Manufacturers Association of Canada, Seventh Edition, 1984.

**1.1.4. Submittals**

**1.1.4.1. Shop Drawings**

1.1.4.1.1. Submit detailed shop drawings of all millwork and finished carpentry items.

**1.1.5. Samples**

1.1.5.1. Submit samples of each specified finish wood species, and in each cut if requested.

1.1.6. **Delivery, Storage and Handling**

- 1.1.6.1. Protect materials from damage during handling, delivery, and storage.
- 1.1.6.2. Receive finish hardware supplied by Section 08710 and store, secure against theft.
- 1.1.6.3. 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.

1.1.7. **Site Conditions**

1.1.7.1. **Environmental Requirements**

- 1.1.7.1.1. Ensure that relative humidity in areas where wood materials are stores and installed does not exceed 55%.

1.1.8. **Warranty**

1.1.8.1. **Extended Warranty**

- 1.1.8.1.1. 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**

**2.1. Materials**

2.1.1. **General**

- 2.1.1.1. Provide rough hardware required for finish carpentry specified in this Section. Use non-corrosive hardware at exterior locations.
- 2.1.1.2. 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%.
- 2.1.1.3. Use only adhesive and fastenings that develop sufficient strength for intended use, are non staining, and are unaffected by the environment to which exposed.

2.1.2. **Wood**

- 2.1.2.1. Grade mark softwood and hardwood lumber by the appropriate association under authority of the National Lumber Grades Authority.
- 2.1.2.2. Where not exposed to view, use wood of grades suitable for fabrication, utility and structural needs.
- 2.1.2.3. 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.
- 2.1.2.4. 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.



2.1.2.5. 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.

2.1.3. **Plywood**

2.1.3.1. 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.

2.1.3.2. 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.

2.1.3.3. 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.

2.1.3.4. Poplar: To meet specified requirements of CSA Standard O153-M1980.

2.1.3.5. Birch: Rotary cut Select Grade veneer where transparent or clear finish specified.

2.1.4. **Particleboard**

2.1.4.1. To meet specified requirements of CAN/CSA-O188.1-M78, Grade S.

2.1.5. **Plastic Laminate**

2.1.5.1. To meet specified requirements of CAN/CSA-A172-M79.

2.1.5.2. Colour: Selected from manufacturer's standard solid colour range.

2.1.6. **Hardboard**

2.1.6.1. To meet specified requirements of CGSB Specification 11-GP-3, Type 2.

2.1.7. **Fire Retardant Treatment**

2.1.7.1. 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.

2.1.8. **Wood Preservative**

2.1.8.1. Clear pentachlorephenol, to meet specified requirements of CSA Standard O80 Series-M89.

2.2. **Fabrication**

2.2.1. **General**

2.2.1.1. Assemble fabricated millwork units in mill in units as large as possible. Design units to fit together if site assembly is required.

- 2.2.1.2. 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.
- 2.2.1.3. 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:
  - 2.2.1.3.1. Conceal edge grain of exposed and semi-exposed plywood and particleboard using solid hardwood edges for stain finish or plastic laminate.
  - 2.2.1.3.2. Assemble cabinet body members with adhesive.
  - 2.2.1.3.3. Where permitted, drive power-driven Tee head nails or staples with long dimension parallel to grain.
  - 2.2.1.3.4. Install dust panels between drawers.
- 2.2.1.4. Shop fabricate work of this Section in as large units as possible.
- 2.2.1.5. 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.

2.2.2. **Trim**

- 2.2.2.1. Rout or groove backs of flat trim members.
- 2.2.2.2. Kerf backs of wide flat member.

2.2.3. **Fastening**

- 2.2.3.1. Fasten assemblies with nails generally, but use screws or special fasteners at critical joints where strain, and excessive usage and shrinkage are anticipated, and where required by specified quality grade standards.
- 2.2.3.2. Glue built-up assemblies as well as nailing and screwing.
- 2.2.3.3. Bind nail unless impossible.
- 2.2.3.4. Set finish nails below finished surfaces.

2.2.4. **Plastic Laminate Facing**

- 2.2.4.1. 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.
- 2.2.4.2. Bond plastic laminate to backing with urea formaldehyde adhesive, or by methods of equal or better quality recommended by the plastic laminate manufacturer.
- 2.2.4.3. Seal edges of cutouts with plastic laminate, or where concealed from view by other methods that will prevent entry of moisture into core.
- 2.2.4.4. Apply plastic laminate backing sheet to core on back side of panels faced with plastic laminate.
- 2.2.4.5. Ensure that both face and backing sheet have been sanded in same direction.
- 2.2.4.6. Bond plastic laminate self-edges under pressure, and bevel and finish smooth finished corners.
- 2.2.4.7. Round corners of holes cut through plastic laminate and file them smooth.

2.2.4.8. Make joints only when lengths of plastic laminate facing exceed 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.

2.2.5. **Finishing**

2.2.5.1. 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.

2.2.5.2. Fine sand surfaces level and smooth after fabrication.

**PART 3 - EXECUTION**

**3.1. Examination**

3.1.1. 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.

3.1.2. 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.

**3.2. Preparation**

**3.2.1. Protection**

3.2.1.1. Ensure that finish carpentry materials are protected from damage and deterioration during installation, and otherwise until project completion in accordance with General Conditions.

3.2.1.2. Take particular care that wood made fire retardant by pressure treatment is not exposed to dampness.

**3.3. Installation**

**3.3.1. General**

3.3.1.1. 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.

3.3.1.2. 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.

3.3.1.3. Install finish carpentry plumb, level and straight, and fasten it securely to backing to support itself and anticipated superimposed loads.

- 3.3.1.4. Build finish carpentry into construction as indicated on Drawings or specified in other Section of the Specifications, or both.

3.3.2. **Trim**

- 3.3.2.1. Install in single lengths except where material limitation makes impossible. Stagger joints where they occur and locate over solid backing for fastening.
- 3.3.2.2. Install wood bases after finish flooring is laid.
- 3.3.2.3. Cut returns of stool and apron ends to match face profile.

3.3.3. **Cutting and Fitting**

- 3.3.3.1. Cut moldings with sharp true profiles.
- 3.3.3.2. Cope trim and mouldings at interior corners and at returns.
- 3.3.3.3. Miter trim and mouldings at exterior corners. Glue and lock shop miters that are over 100 mm from heel to point.
- 3.3.3.4. 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.
- 3.3.3.5. Ensure that all cutouts for electrical devices and plumbing are fully coordinated and neatly completed for work under this section and Section 06410.

3.3.4. **Fastening**

- 3.3.4.1. 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.
- 3.3.4.2. Blind nail unless impossible.
- 3.3.4.3. Set finish nails below finished surfaces to receive putty.

3.3.5. **Installation of Doors**

- 3.3.5.1. Install wood doors after finishing of walls.
- 3.3.5.2. Fit wood doors with 2 mm clearance at jambs and heads, and 9.5 mm over finished flooring.
- 3.3.5.3. Trim hinge side of wood doors to fit, and bevel latch edges as required.
- 3.3.5.4. Ensure that top and bottom edges of wood doors are primed under Work of Section 09900 after they are cut to fit.
- 3.3.5.5. Undercut wood doors where indicated on Door Schedule.

3.3.6. **Installation of Finish Hardware**

- 3.3.6.1. Install finish hardware
- 3.3.6.2. Make cuts in wood doors neatly
- 3.3.6.3. Accurately locate and adjust hardware to meet manufacturer's instructions. Use special tools and jigs as recommended.
- 3.3.6.4. Install hardware in wood doors at same locations as for hollow metalwork installed in project.
- 3.3.6.5. Locate door stops to contact doors 75 mm from latch edge.
- 3.3.6.6. Install hardware and trim square and plumb to doors.
- 3.3.6.7. Replace missing hardware to ensure specified installation at time of building completion.
- 3.3.6.8. After installation, replace wrappings for hardware provided by manufacturer.

3.3.6.9. 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.

3.3.7. **Finishing**

3.3.7.1. Sand wood surfaces after installation to leave surfaces in true planes and free of machine or tool marks.

3.3.8. **Wood Preservative**

3.3.8.1. 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.

3.4. **Adjustment and Cleaning**

3.4.1. 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.

3.4.2. 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.

3.4.3. Clean hardware after installation in accordance with supplier's instructions.

3.4.4. Sand and clean woodwork to leave free from finish defects in any exposed part.

**End of Section**

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**PART 1 - GENERAL**

**1.1. Description**

**1.1.1. General Requirements**

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

**1.1.2. Work Performed by Other Sections Related to This Section is Specified in**

Section 04200: Unit Masonry  
Section 07215: Cavity Wall Insulation  
Section 07550: Protected Membrane Roofing

**1.1.3. This Section Specifies Work Which Shall be Performed by**

Section 03300 - Cast-In-Place Concrete  
Section 04200 - Unit Masonry  
Section 07520 - Bitumen Membrane Roofing  
Section 07600 - Flashing and Sheet Metal  
Section 07920 - Sealants and Caulking  
Section 08520 - Aluminum Windows  
Section 09250 - Gypsum Board

**1.2. System Description**

**1.2.1. Air Barrier Retention Requirements**

1.2.1.1. Provide an air barrier to ensure that air is prevented from exfiltration and infiltration between the interior and exterior of the building through exterior wall and roof constructions.

1.2.1.2. Prevent exfiltration and infiltration under all conditions of air pressure differentials resulting from mechanical systems of the building, and barometric pressure and wind forces within limits specified and as imposed by jurisdictional authorities.

**1.2.2. Vapour Permeance Requirements**

1.2.2.1. Incorporate barriers in construction envelope to ensure that air leakage, and water vapour permeance in excess of 0.025 perms, is prevented through them. Seal each crack, joint and penetration by other components with self-adhesive vapour barrier tape to maintain integrity of barrier.

**1.2.2.2. Interface with Adjacent Systems**

1.2.2.3. Coordination between all installers of components of the air barrier system is essential to ensure continuity of the barrier and that junctions between the various components are effectively sealed.

1.2.2.4. Verify with Architect, installation procedures of building products incorporated into air barrier elements including but not limited to, various barrier membranes, sheet metal closers, and sealants as well as continuity with roofing membrane where applicable.

**1.3. Quality Assurance**

**1.3.1. Requirements of Regulatory Agencies**

- 1.3.1.1. Install only vapour barrier material with an inherent fire hazard classification in all its parts that is within limits established by jurisdictional authorities.
- 1.3.1.2. Validate fire hazard classification only by testing laboratories acceptable to jurisdictional authorities.
- 1.3.1.3. Attach Underwriters' Laboratories labels to packages of fire rated materials.

**1.3.2. Mock-Up**

- 1.3.2.1. Install air barrier membrane for mock-up specified in Section 04200.

**1.4. References**

**1.4.1. Reference Standards**

- 1.4.1.1. Reference Standards quoted in Contract Documents refer to:
- 1.4.1.2. ASTM A525-81, Specification for Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process, General Requirements.
- 1.4.1.3. CAN/CGSB-51.33-M80, Vapour Barrier, Sheet, for Use in Building Construction.

**1.5. Submittals**

**1.5.1. Samples**

- 1.5.1.1. Submit 216 mm X 280 mm samples of membranes.

**1.5.2. Affidavits**

- 1.5.2.1. Submit affidavits from vapour retarder and air barrier manufacturers that products meet specified vapour retardation, air barrier requirements if requested.

**1.6. Delivery, Storage and Handling**

- 1.6.1. Package vapour barrier materials and label them to designate manufacturer and type.
- 1.6.2. Store materials in dry areas, protected from wetting and traffic.
- 1.6.3. Ensure that sealants and joint sealing tape are stored at a minimum temperature of 4°C for 12 hours before installation, and that freezable adhesives are stored only at temperatures above 0°C at all times.
- 1.6.4. Do not store air barrier membrane materials in areas with temperatures above 38°C.

**1.7. Site Conditions**

**1.7.1. Environmental Requirements**

1.7.1.1. Do not apply membrane or system components when surface or ambient air temperatures are below 5°C.

**PART 2 - PRODUCTS**

**2.1. Materials**

**2.1.1. Vapour Retarder**

1.1.1.1. Vapour Retarder Membrane Type 1, to meet specified requirements of CAN/CGSB-51.33-M80.

1.1.1.2. Vapour Retarder Adhesive to be suitable for installation conditions and with perm rating providing vapour retardation equal to or better than for Type 1 membrane specified in CAN/CGSB-51.33-M80.

**2.1.2. Air Seal Barrier Generally**

2.1.2.1. When design intent and another material is not indicated typically on Drawings, and where approved by Architect, an air seal barrier may be provided by, but not limited to, the following:

: roofing membrane

: glass

: poured dense concrete

: metals

: suitable sealants

: suitable reinforced asphalt or plastic membranes

2.1.2.2. These materials shall not substitute for a system indicated on Drawings as typical for Project without approval of the Architect.

2.1.2.3. Polyethylene film material when used as a vapour barrier is NOT regarded as being a component of an air seal.

2.1.2.4. Sheet Metal: Galvanized sheet steel to meet specified requirements of ASTM Specification A525, zinc coating designation Z275.

2.1.2.5. Provide air seal barrier sufficient strength to resist forces of wind and air pressure which may act on it. Wind pressure criteria to be established by maximum wind loading requirements of jurisdictional authorities.

**2.1.3. Air Barrier Membrane System**

2.1.1.1. Membrane: self adhesive, sheet, 1 mm minimum thickness, Sealtight Air-Shield by W. R. Meadows, Perm-A-Barrier by W.R. Grace and Company of Canada, or Blueskin SA by Bakor Inc., or Sopraseal Flam 180 by Soprema or approved alternatives. Exoair 110/110LT by Tremco Canada.

2.1.1.2. Primers, mastics, adhesives, to be of manufacturers' standard compatible with membrane.

2.1.1.3. Membrane width shall be not less than 450 mm to suit masonry ties.

**2.1.4. Sealant**

2.1.4.1. To meet specified requirements of Section 07920.



2.1.5. **Joint Tape**

2.1.5.1. Dead soft aluminum foil, 0.05 mm thick, 75 mm wide pressure sensitive by Morgan Adhesives Canada Ltd.

2.1.6. **Foam Insulation**

2.1.6.1. One or two part, polyurethane, with a nominal density of 40 kg/cubic meter, coefficient of linear expansion of 0.00006 mm/m/deg C, water vapour transmission of 73 Ng/Pa5sq.m and thermal conductivity of 0.02 W/mdeg,K.

2.1.6.2. Similar to products as produced by BASF Canada Inc.

**PART 3 - EXECUTION**

**3.1. General**

3.1.1. **Vapour Retarder**

3.1.1.1. Ensure integrity of vapour barrier perm rating and air barriers are maintained. The extreme care that the barriers are sealed where elements penetrate them, and that they extend across and are sealed at junctions between other parts of the barrier system.

3.1.1.2. Apply vapour barrier to cover face of insulation board toward interior of building, and to form an integral monolithic membrane barrier against water vapour and air penetration. Seal barrier to adjacent barrier systems, and take care that it is not punctured during installation.

3.1.1.3. Secure vapour barrier to furring so that joints are sealed.

3.1.2. **Install Air Seal Barriers to Ensure:**

3.1.2.1. That they are supported, secured in a manner to withstand differential air pressure forces without displacement, loss of air seal properties.

3.1.2.2. That continuity of the air seal barrier system is maintained in the exterior walls and roof enclosing the building.

3.1.2.3. That the air seal is maintained intact at junctions of partitions, stack locations and other components with wall and roof constructing, penetrations of the barrier by other construction components, and by careless installation.

3.1.3. Provide airtight seal at penetrations of vapour and air retarder systems, and at junctions of such systems with other construction.

3.1.4. Where shown on drawings, install foam insulation to ensure continuity of vapour retarder, air barrier and insulation systems. Install in sufficient depths in order to match R value of surrounding wall / window / door / roof system.

**3.2. Air Barrier Membrane Installation**

3.2.1. **Preparation**

3.2.1.1. Surfaces to receive membrane to be smooth, clean, dry, in good condition. Remove moisture, grease, machine oil, or other foreign materials.

- 3.2.1.2. Prime surfaces to receive membrane with specified primer either by spraying or by rolling at a rate of 6 to 8 sq.m/L.
- 3.2.1.3. Prime only surfaces which will be covered by membrane in one day.

**3.2.2. Application**

- 3.2.2.1. Apply membrane to primed surfaces to suit masonry ties and as recommended by manufacturer. Install while primer is tacky.
- 3.2.2.2. Roll each sheet of membrane once the sheet is in place.
- 3.2.2.3. All laps shall be not less than 50 mm.
- 3.2.2.4. Re-roll laps, joints to ensuring proper seal.
- 3.2.2.5. Apply a trowelled bead of mastic to termination of day's work.
- 3.2.2.6. Extend membrane as required to provide overlap to waterproofing and roofing.
- 3.2.2.7. This Contractor shall provide overlap and seal membrane to roofing membrane as detailed on Drawings. Coordinate with roofing contractor to ensure compatibility of materials and continuity of membranes
- 3.2.2.8. Extend membrane into door and window opening sufficiently to allow attachment to backup materials, sealing to door and window frames. Mechanically attach membrane to frames.
- 3.2.2.9. Inside corners to receive fillet made of mastic and 300 mm wide reinforcing membrane.
- 3.2.2.10. Outside corners shall receive 300 mm wide reinforcing piece of membrane.
- 3.2.2.11. Gaps or joints wider than 6 mm shall be filled with foam backer rod and then reinforced with 300 mm piece of membrane prior to installation of membrane. Provide for expansion and contraction of structure.
- 3.2.2.12. Use liquid membrane or adhesive to seal around penetrations.
- 3.2.2.13. Air barrier membrane is not designed for permanent exposure. Provide temporary covering of tarpaulins if not covered by insulation within one (1) week.

**3.3. Field Quality Control**

- 3.3.1. The air seal barrier system will be inspected after installation to verify its total integrity.
- 3.3.2. Inform the Architect when portions of the system have been installed and before they are covered by other construction or their accessibility for inspection is otherwise impeded.
- 3.3.3. Arrange to have a technical representative who is familiar with specified products and their installation, on site during application of the materials and to inspect system when completed.

**3.4. Adjustment**

- 3.4.1. Examine completed air seal barrier system. Repair & seal all breaks in system to ensure maintenance of its integrity.

**End of Section**

## **PART 1 - GENERAL**

### **1.1. Description**

#### **1.1.1. General Requirements**

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

#### **1.1.2. Work Performed by Other Sections Related to This Section is Specified in:**

Section 07190: Vapour Retarder and Air Barrier  
Section 09250: Gypsum Board  
Section 08100: Hollow Metal Doors and Frames  
Section 08900: Aluminum Glazing

### **1.2. System Description**

#### **1.2.1. Thermal Insulation Requirements**

1.2.1.1. Incorporate thermal insulation in the construction envelope to ensure a thermal barrier system is maintained in accordance with the requirements of Section 01900.

### **1.3. Quality Assurance**

#### **1.3.1. Requirements of Regulatory Agencies**

- 1.3.1.1. Install only insulation with an inherent fire hazard classification in all its parts that is within limits established by jurisdictional authorities.
- 1.3.1.2. Validate fire hazard classification only by testing laboratories acceptable to jurisdictional authorities.
- 1.3.1.3. Attach Underwriters' Laboratories labels to packages of fire rated materials.

### **1.4. References**

#### **1.4.1. Reference Standards**

- 1.4.1.1. Reference standard quoted in Contract Documents refers to:
- 1.4.1.2. CAN/ULC-S702-97 for Semi Rigid Insulation
- 1.4.1.3. CSA Standard A101-M1983, Thermal Insulation, Mineral Fibre, for Buildings.
- 1.4.1.4. CAN/ULC -S701-97, Type 4 for extruded polystyrene.

### **1.5. Delivery, Storage and Handling**

- 1.5.1. Package insulation materials and label them to meet specified requirements of CSA Standard A101.
- 1.5.2. Store insulation materials in dry areas, protected from wetting and traffic.

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## **PART 2 - PRODUCTS**

### **2.1. Materials**

- 2.1.1. General: Refer to drawings for thickness of insulation required. Where following the specified list choices of materials, the contractor shall select appropriate products from such lists on the basis of their total compatibility when incorporated into the entire assembly, as well as their ability to adhere to other components permanently and in a rigid manner.
  - 2.1.1.1. Rigid Insulation; perimeter insulation, extruded poly styrene.  
Dow 'SM' Owens Corning 'Celfort 300'
  - 2.1.1.2. Semi-rigid insulation: mineral fibre, cavity wall insulation. Roxul 'Cavityrock' Owens Corning 'Fibreglas Type 703'.
  - 2.1.1.3. Foamed in Place insulation: CFC free polyurethane foam as manufactured by Instafoam, Hilti, or approved alternate.
- 2.1.2. Mastic adhesive: solvent based polymer modified liquid applied membrane compatible with insulation to be applied, type as manufactured for the attachment of insulation as manufactured by Bakor (airbloc 21) or approved alternate.
- 2.1.3. Insulation fasteners: soft washer and pin type; direct fasten type; concrete/block back-up/precast: Grey polyethylene washer, corrosion resistant fastener, pin length to suit application as recommended for pin embedment depth as manufactured by Hilti (X-SW 60 Pins) or approved alternate.
- 2.1.4. Insulation attachment to metal studs: galvanized self tapping screws for 12.7mm minimum embedment into metal studs, complete with 25mm diameter plastic retaining washers.

## **PART 3 - EXECUTION**

### **3.1. Examination**

- 3.1.1. Before commencing installation of insulation, ensure that framing is installed to suit dimensions of insulation and to ensure proper support.

### **3.2. Installation**

#### **3.2.1. General**

- 3.2.1.1. Do not install insulation in areas of the building unprotected from water, freezing or similar damaging environmental conditions.
- 3.2.1.2. Fit insulation snug without compression into every void to ensure full thickness for full length of construction, to prevent air movement simultaneously both sides of insulation.
- 3.2.1.3. Install insulation tightly against interior finish construction, except that when pipes and ducts occurs within wall construction install it between exterior finish construction and the pipes or ducts.
- 3.2.1.4. Cut and fit insulation tightly around pipes, conduits, outlet boxes and other similar components.
- 3.2.1.5. Install insulation in one piece for full length of voids. Where this is impossible, join lengths with ends fitted snugly or overlapped.
- 3.2.1.6. Apply insulation to ensure total and complete coverage of all surfaces to be insulated, and in direct contact with such surfaces.

3.2.2. **Wall Insulation**

- 3.2.2.1. Ensure that insulation is supported to prevent settlement.
- 3.2.2.2. Install friction fit batts snugly between framing members.

3.2.3. **Ceiling Insulation**

- 3.2.3.1. Ensure full coverage of suspended ceilings by lapping or snugly joining insulation.

3.2.4. **Semi-rigid Cavity Insulation**

- 3.2.4.1. Install using securement plates provided under Section 04080
- 3.2.4.2. Apply adhesive around openings and edges.
- 3.2.4.3. Fasten insulation to substrates at spacing recommended by manufacturer.

3.2.5. **Foamed-in-Place Insulation**

- 3.2.5.1. Install between window and door frames and all rough openings provided for structural attachments through thermal and air/vapour barrier to provide the integrity of a continuous thermal air/vapour barrier in compliance with OBC.

3.3. **Adjustment**

- 3.3.1. Repair and seal breaks, punctures, and other openings in the vapour barrier by application of pressure sensitive vapour barrier tape. Clean surface before taping, and apply smoothly and in full contact.

**End of Section**

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**PART 1 - GENERAL**

**1.1. Description**

**1.1.1. General Requirements**

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

**1.1.2. Work Performed by Other Sections Related to this Section is Specified in:**

Section 03300: Cast-in-place Concrete  
Section 04200: Unit Masonry  
Section 06101: Rough Carpentry:  
Section 07190: Vapour Retarder and Air Barrier  
Section 07212: Board Insulation:  
Section 07270: Air Barriers  
Section 07920: Sealants and Caulking  
Section 08111: Steel Doors and Frames  
Section 08920: Glazed Aluminum Curtain Walls

**1.2. System Intent**

**1.2.1. Thermal Insulation Requirements**

1.2.1.1. This section specifies requirements for sprayed polyurethane foam primarily intended for use as thermal insulation. Materials of this section shall provide continuity of thermal insulation, of the air barrier, and of the vapour barrier in conformance with the requirements of the OBC.

**1.2.2. Air Barrier Requirements**

1.2.2.1. This section specifies additional requirements for sprayed polyurethane foam insulation intended for use as the main component of an air barrier system.

1.2.2.2. Prevent exfiltration and infiltration under all conditions of air pressure differentials resulting from mechanical systems of the building, and barometric pressure and wind forces within limited specified and as imposed by jurisdictional authorities.

**1.2.3. Vapour Barrier Requirements**

1.2.3.1. This section specifies additional requirements for sprayed polyurethane foam insulation intended for use as the designated vapour barrier system.

1.2.3.2. Incorporate barriers in construction envelope to ensure that air leakage, and water vapour permeance in excess of 0.025 perms, is prevented through them. Seal each crack, joint and penetration by other components to maintain integrity of barrier.

**1.2.4. Interface with Adjacent Systems**

1.2.4.1. Coordination between all installers of components of the sprayed foam insulation system is essential to ensure continuity of the air barrier and that junctions between the various components are effectively sealed.

- 1.2.4.2. Verify with Architect, installation procedures of building products incorporated into sprayed foam insulation system including but not limited to, various barrier membranes, sheet metal closers and sealants, as well as continuity with roofing membrane where applicable.
- 1.2.4.3. Materials of this section shall provide continuity of thermal insulation, of the air barrier, and of the vapour barrier at the building enclosure in conjunction with the work of other sections specified.

### **1.3. Quality Assurance**

#### **1.3.1. Requirements of Regulatory Agencies**

- 1.3.1.1. Install only sprayed foam insulation with an inherent fire hazard classification in all its parts that is within limits established by jurisdictional authorities.
- 1.3.1.2. Validate fire hazard classification only by testing laboratories acceptable to jurisdictional authorities.
- 1.3.1.3. Attach Underwriters' Laboratories labels to packages of fire rated materials, where applicable.
- 1.3.1.4. Completely isolate cavity wall insulation from the interior of the building by non-combustible materials.

#### **1.3.2. Mock-Up**

- 1.3.2.1. Install insulation for mock-up specified in Section 04200.

#### **1.3.3. Contractor Qualification**

- 1.3.3.1. Application of sprayed foam insulation shall be by an application certified by CUFCA/NECA (Canadian Urethane Foam Contractors Association/National Energy Conservation Association) and who has adequate plant, equipment and skilled trades people to perform it expeditiously and is known to have been responsible for satisfactory installation similar to that specified during a period of the immediate past 5 years.
- 1.3.3.2. Provide proof of certification upon request.

#### **1.3.4. Source Quality Control**

- 1.3.4.1. Material manufacturer/distributor must have an on-site quality assurance/control program.
- 1.3.4.2. Maintain at least one (1) copy of installation manual and at least one (1) copy of quality assurance program on site.
- 1.3.4.3. Contractor shall perform daily on-site testing as directed by material manufacturer.

### **1.4. References**

#### **1.4.1. Reference Standards**

- 1.4.1.1. ULC S705.1.01 "Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density, Material Specification.
- 1.4.1.2. ULC S705.1.02 "Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density, Installation.

1.4.1.3. CAN/CGSB-51.80M, One Component Post Expanding Polyurethane Foam Sealing Compound.

**1.5. Submittals**

**1.5.1. Documentation**

1.5.1.1. Submit one (1) copy of a complete package which outlines the Material Manufacturers' quality assurance/control program.

1.5.1.2. Submit one (1) copy of the installation instructions.

1.5.1.3. Submit one (1) copy of the product data, including the material characteristics, performance criteria, limitations and Materials Safety data Sheet.

**1.5.2. Affidavits**

1.5.2.1. Submit affidavits that products and the completed installation meet the specified requirements.

**1.6. Delivery, Storage and Handling**

1.6.1. Package insulation materials and label them to designate manufacturer, type, density and insulation value, and reference standard specification number if applicable.

1.6.2. Store insulation materials in dry areas, protected from wetting and traffic.

1.6.3. Store and install insulation materials subject to damage by water, freezing, sunlight or similar adverse environmental conditions with adequate protection against damage.

1.6.4. Ensure that materials are stored at a minimum temperature of 4°C for 12 hours before installation, and that freezable adhesives are stored only at temperatures above 0°C at all times

**1.7. Site Conditions**

**1.7.1. Environmental Requirements**

**1.7.1.1. Ambient/Substrate Temperature**

1.7.1.1.1. Do not apply insulation or system components when surface or ambient air temperatures are below 5°C.

1.7.1.1.2. Consult Material Manufacturer when there is a difference of 17°C or more between the ambient air temperature and the substrate temperature for recommendations for suitable practices.

**1.7.1.2. Moisture/Humidity**

1.7.1.2.1. Consult Material Manufacturer when the relative humidity rises above 80%.



1.7.1.3. **Wind**

1.7.1.3.1. Insulation shall not be installed on the exterior when wind speeds exceed 24km/h unless wind screens are used adjacent to the immediate work area.

1.8. **Warranty**

1.8.1. **Extended Warranty**

1.8.1.1. Warrant the work of this Section for a period of not less than 10 years.

1.8.1.2. Contractor warrants that the sprayed foam insulation system is suitable for use in this type of installation.

1.8.1.3. Promptly correct, at own expense, defects or deficiencies which become apparent within the warranty period. Without restricting generality of warranty, defects shall include failure to stay in place, loss of thermal value, deterioration of insulation, undue expansion, splitting of materials, staining or other damage to surrounding or adjacent surfaces or materials.

**PART 2 - PRODUCTS**

2.1. **Materials**

2.1.1. **General**

2.1.1.1. Ensure that all materials of an insulation system, and the construction with which it is in contact, are compatible, including but not limited to thru-wall flashings, air barrier systems, roofing membranes.

2.1.2. **Sprayed Foam Insulation**

2.1.2.1. Foam Insulation: sprayed/frothed polyurethane foam to CAN/CGSB-51.23-92, RSI 1.05 (R6/1") at density of 32.8 kg/cu.m. (2lb/cu.ft): Insul - Barrier or approved alternative.

2.1.2.2. Insulation Foam Air Barrier Sealant: Closed cell single component liquid system with density of 27.2 kg./cu.m. (1.7 lb.cu.ft.) RSI 1.0 (R5.7/1") and compressive strength of 10% compression at 96.5 kpa (14 psi);

2.1.2.3. Acceptable products: BASF Waltite, Demilec/ Cornell Heatlock 0240/ Airmetic 0223/ PFSI Polar Foam 7300.

2.1.3. **Firestopping**

2.1.3.1. **Horizontal firestopping**: Preformed angle from minimum 1.2mm (18ga) steel core with zinc coating conforming to ASTM A525 (G90-galvanized). Angle fabrication shall be such that horizontal section of angle perpendicular to substrate shall protrude past the finished face of spray insulation by 13mm to allow for subsequent installation of mineral fibre firestop to this angle by Section 04200.

2.1.3.2. **Vertical firestopping**: Preformed angle from minimum 0.38 (28ga) steel core with zinc coating conforming to ASTM A525 (G90 galvanized). Angle fabrication shall be such that vertical section of angle perpendicular to substrate shall protrude past the finished face of spray insulation for the full depth of the cavity to contact the backside of the veneer to close off the cavity.

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## **PART 3 - EXECUTION**

### **3.1. Examination**

- 3.1.1. Before commencing installation of insulation, ensure that all surfaces to which insulation is to be applied, are clean, reasonably smooth with no abrupt changes in plane, free of grease and with protruding fins of mortar or concrete removed, and that the surfaces are otherwise acceptable for insulation application as specified.
- 3.1.2. Verify that surfaces and conditions are ready to accept the Work of this section. Application of Work of this Section shall be deemed acceptance of existing work and existing conditions. Report in writing defects in substrates which may adversely affect the performance of the foam insulation.
- 3.1.3. Examine joints before sealing to ensure configuration, surfaces and widths are suitable for foam sealant. Report in writing the location of joints which are deemed unacceptable for the application of joint sealant.

### **3.2. General**

#### **3.2.1. Vapour Retarder**

- 3.2.1.1. Ensure specified integrity of vapour barrier perm rating and air barriers are maintained. The extreme care that the barriers are sealed where elements penetrate them, and that they extend across and are sealed at junctions between other parts of the barrier system.

#### **3.2.2. Install Air Seal Barriers to Ensure**

- 3.2.2.1. That they are supported, secured in a manner to withstand differential air pressure forces without displacement, loss of air seal properties.
  - 3.2.2.2. That continuity of the air seal barrier system is maintained in the exterior walls enclosing the building.
  - 3.2.2.3. That the air seal is maintained intact at junctions of partitions, stack locations and other components with wall and roof construction, penetrations of the barrier by other construction components, and by careless foam insulation.
- 3.2.3. Provide airtight seal at penetrations of sprayed foam insulation systems, and at junctions of such systems with other construction.
  - 3.2.4. Where shown on Drawings, install foam insulation to ensure continuity of vapour retarder, air barrier and insulation systems. Install in sufficient depths in order to match R value of surrounding wall/window/door/roof system.

### **3.3. Installation**

#### **3.3.1. Preparation**

- 3.3.1.1. Surfaces to receive foam insulation shall be free of frost, loose or foreign matter which might impair adhesion of materials.

- 3.3.1.2. Prepare surface by brushing, scrubbing, scraping or grinding to remove loose mortar, dust, oil, grease, oxidation, mill scale and other contaminants which will affect adhesion and integrity of the foam insulation system. Wipe down metal surfaces to remove release agents or other non-compatible coatings, using clean sponges or rags soaked in a solvent compatible with the foam insulation. Ensure surfaces are dry before proceeding.
- 3.3.1.3. Prepare joints to receive foam air barrier sealant by brushing, scrubbing, wiping, scraping or grinding to remove loose mortar, dust, oil, grease, solvents, oxidation, mill scale and other contaminants which will affect adhesion and integrity of foam sealant.

3.3.2. **Application**

- 3.3.2.1. Apply foam insulation in strict accordance with manufacturer's written instructions, specifications or recommendations.
- 3.3.2.2. Apply foam insulation only when surfaces and ambient temperatures are within limits prescribed by the material manufacturer.
- 3.3.2.3. Fill joints with foam sealant making allowances for post expansion of foam.
- 3.3.2.4. Finish joints shall be free from air pockets and imbedded foreign materials. Cut back excess foam sealant after cutting flush with surrounding surfaces unless otherwise directed and/or detailed.
- 3.3.2.5. Apply foam insulation to within the following tolerances: +6.4mm (1/4") mm of thicknesses indicated on drawings.
- 3.3.2.6. Finished sprayed foam insulation shall be free of voids and embedded foreign materials.
- 3.3.2.7. Do not allow foam insulation to cover or mark adjacent surfaces. Use masking materials if necessary.
- 3.3.2.8. Remove over-spray and masking materials immediately after foam has cured to hard surface film.
- 3.3.2.9. Clean and make good surfaces soiled or damaged by Work of this section. Consult with Section of Work soiled before cleaning to ensure methods used will not damage their Work.
- 3.3.2.10. Do not permit adjacent Work to damage Work of this Section. Damage to Work of this Section caused by other sections shall be made good by this Section at the expense of the Section which caused the damage.

3.3.3. **Field Quality Control**

- 3.3.3.1. The insulation system will be inspected after installation to verify its total integrity.
- 3.3.3.2. Inform the Architect when portions of the system have been installed and before they are covered by other construction or their accessibility for inspection is otherwise impeded.
- 3.3.3.3. Arrange to have a technical representative who is familiar with specified products and their installation on site during application of the materials and to inspect system when completed.
- 3.3.3.4. Density and adhesion/cohesion tests shall be performed and recorded for each job site/each day/for each batch used/for each substrate.

3.3.4. **Adjustment**

3.3.4.1. Examines completed system. Repair and seal all breaks in system to ensure maintenance of its integrity.

**End of Section**

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**PART 1 - GENERAL**

**1.1. Description**

**1.1.1. General Requirements**

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

**1.1.2. Work Performed by Other Sections Related to This Section is Specified in:**

Section 02200: Earthwork, for excavation and backfilling.  
Section 03300: Cast-in-Place Concrete

**1.2. References**

**1.2.1. Reference Standards**

1.2.1.1. Reference standard quoted in Contract Documents refers to:  
1.2.1.2. CGSB Specification 51-GP-20M, Thermal Insulation, Expanded Polystyrene.

**1.3. Delivery, Storage, and Handling**

- 1.3.1. Store insulation materials in dry areas, protected from wetting, sunlight and traffic. Store insulation board flat, on a flat surface, and to prevent edge damage and placing of materials on top of stored boards.
- 1.3.2. Ensure that insulation board and adhesives are stored at a minimum temperature of 4°C for 12 hours before installation, and that freezable adhesives are stored only at temperatures above 0°C at all times.

**PART 2 - PRODUCTS**

**2.1. Materials**

**2.1.1. Insulation Board**

- 2.1.1.1. Closed-cell, cellular, foamed, smooth skin, extruded polystyrene to meet specified requirements of CGSB Specification 51-GP-20M, Type 4: Styrofoam SM by Dow Chemical Canada Inc., or approved alternative, in thickness indicated on Drawings.
- 2.1.1.2. Cement faced insulation board.
- 2.1.1.2.1. Dow Styrofoam CT board for perimeter foundation walls.
- 2.1.1.3. To meet specified requirements of CSA Standard A101, Type IA, friction fit.

**2.1.2. Adhesive**

- 2.1.2.1. Only as approved by Board supplier; and that can be handled at temperature of 4°C and over, have adequate early and permanent bond and tensile strength for application, and have a service temperature between high and low temperatures to which they will be subjected.

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## **PART 3 - EXECUTION**

### **3.1. Examination**

- 3.1.1. Before commencing installation of insulation, ensure that all surfaces to which insulation board is applied are clean, reasonably smooth with no abrupt changes in plane, free of grease and with protruding fins of mortar or concrete removed, and that the surfaces are otherwise acceptable for insulation application as specified.

### **3.2. Installation**

#### **3.2.1. General**

- 3.2.1.1. Do not install insulation in areas of the building unprotected from water, freezing or similar damaging environmental conditions.
- 3.2.1.2. Fit insulation snug without compression into every void to ensure full thickness for full length of construction, to prevent air movement simultaneously both sides of insulation.
- 3.2.1.3. Install insulation tightly against interior finish construction, except that when pipes and ducts occurs within wall construction install it between exterior finish construction and the pipes or ducts.
- 3.2.1.4. Cut and fit insulation tightly around pipes, conduits, outlet boxes and other similar components.
- 3.2.1.5. Install insulation in one piece for full length of voids. Where this is impossible, join lengths with ends fitted snugly or overlapped.
- 3.2.1.6. Apply insulation to ensure total and complete coverage of all surfaces to be insulated, and in direct contact with such surfaces.

#### **3.2.2. Foundation Wall Insulation**

- 3.2.2.1. Provide cement faced insulation at all exterior face of perimeter foundation walls. Fasten with clips and adhesive.
- 3.2.2.2. Secure insulation by adhesive if backfilling is not immediately placed to retain panels in place.
- 3.2.2.3. Prime surfaces before application of adhesive only where and as recommended by adhesive manufacturer.
- 3.2.2.4. Apply 50 mm diameter pads of adhesive to faces of panels as required to hold board in place on walls.
- 3.2.2.5. Position and press boards into full contact with adhesive, and temporarily hold them in place until adhesive has set.
- 3.2.2.6. Ensure that backfilling is completed within 24 hours, and that it does not dislodge or damage insulation.

#### **3.2.3. Installation of Slab Insulation**

- 3.2.3.1. Lay insulation board over compacted fill for slab base.
- 3.2.3.2. Secure in place to prevent dislodgement when slab is poured.
- 3.2.3.3. Ensure that slab is poured within 24 hours.

**3.3. Protection**

- 3.3.1. Do not expose insulation board to sunlight after installation. Protect it with opaque polyethylene or tarpaulin cover as recommended by manufacturer if backfilling is not completed within 24 hours; and, as soon as practicable, backfill and pour concrete slab.

**End of Section**

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**PART 1 – GENERAL**

**1.1. General Instructions**

- 1.1.1. Read and be governed by conditions of the Contract and Sections of Division 1 and General Conditions.

**1.2. Section Includes**

- 1.2.1. Vapour barrier at under floor slab locations.

**1.3. Submittals**

- 1.3.1. Submit sample and manufacturer's Product data sheets for proposed Products for review by Consultant in accordance with Section 01300.

**1.4. Quality Assurance**

- 1.4.1. Qualifications: Provide work of this section, executed by competent installers with minimum 5 years of experience in application of Products.
- 1.4.2. Conduct a pre-installation meeting in accordance with Section 01201.
- 1.4.3. Quality control shall be in accordance with Section 01400. The independent inspection and testing company shall attend the pre-installation meeting.
- 1.4.4. Manufacturer shall provide field review in accordance with Section 01401.

**PART 2 – PRODUCTS**

**2.1. Materials**

**2.1.1. Vapour Barrier:**

- 2.1.1.1. Vapour barrier membrane shall meet or exceed requirements of ASTM E 1745 Classes A, B & C.
- 2.1.1.2. Maximum Water Vapour Transmission Rate: ASTM E 96, 0.014 Grains/ft<sup>2</sup>/hr.
- 2.1.1.3. Maximum Permeance: ASTM E 96, 0034 Perms
- 2.1.1.4. Resistance to Organisms and Substrates in Contact with Soil: ASTM E 154, Section 13, 0.051 Perms.
- 2.1.1.5. Tensile Strength: ASTM E 154, Section 9, 9 N/mm (52 Lbf/inch)
- 2.1.1.6. Puncture Resistance: ASTM D 1709, Method B, 3,770 Grams.
- 2.1.1.7. Water Vapour: ASTM E 1745, Meets or exceeds Class A.
- 2.1.1.8. Thickness of plastic: ACI 302.1R-06, Not less than 0.38 mm (15 mils).
- 2.1.1.9. Acceptable Products:
- 2.1.1.9.1. 'PERMINATOR', 15 mil, by W. R. Meadows.
- 2.1.1.9.2. 'Stego-Wrap', 15 mil, by Stego Industries.
- 2.1.1.9.3. Griffolyn 'Griffolyn 15 Mil Green'.

**2.1.2. Vapour barrier joint tape:**

- 2.1.2.1. Tape: High density polyethylene tape, pressure sensitive, 100 mm (4") wide.



2.1.2.2. Acceptable products:

2.1.2.2.1. W. R. Meadows 'SEALTIGHT PERMINATOR Tape'.

2.1.3. **Pipe boots:**

2.1.3.1. Construct pipe boots from vapour barrier material and pressure sensitive tape per manufacturer's instructions.

**PART 3 – EXECUTION**

**3.1. Installation**

- 3.1.1. Use sheets of largest practical size to minimize joints.
- 3.1.2. Inspect sheets for continuity. Repair punctures and tears with sealing tape before work is concealed.
- 3.1.3. Overlaps joints 150 mm (6") minimum and tape seal.
- 3.1.4. Installation shall be in accordance with manufacturer's instructions and ASTM E 1643-98.
- 3.1.5. Unroll vapour barrier with longest dimension parallel with direction of pour.
- 3.1.6. Lap vapour barrier over footings and to foundation walls a minimum of 150 mm (6") and tape seal.
- 3.1.7. Centre tape over laps and joints. Keep area of tape adhesion free of dust, dirt, and moisture.
- 3.1.8. Seal penetrations (including pipes) with manufacturer's pipe boot.

**END OF SECTION**

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**PART 1 - GENERAL**

**1.1. Description**

**1.1.1. General Requirements**

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

**1.1.2. Work Performed by Other Sections Related to This Section is Specified in**

Section 04200: Unit Masonry  
Section 07412: Preformed Metal Roofing  
Section 07520: 2 Ply Modified Bitumen Membrane Roofing  
Section 07600: Flashing and Sheet Metal  
Section 07214: Sprayed Foam Insulation  
Section 07190: Vapour and Air Barrier.

**1.1.3. Installation of Work Which Shall be Supplied by This Section is Specified in**

Section 07600: To install prefinished metal flashing.

**1.1.4. This Section Shall Include Performance of Work Which is Specified in**

Section 07190: Vapour Retarder and Air Barrier  
Section 07920: To specify caulking and sealants

**1.2. Quality Assurance**

**1.2.1. Subcontractor Qualifications**

1.2.1.1. The fabrication and erection of preformed metal installation specified in this Section shall be executed by an approved Subcontractor who has had at least five (5) years of experience with similar installations.

**1.3. References**

**1.3.1. Reference Standards**

1.3.1.1. Meet specified requirements of CAN/CSA-S136-M89, Cold Formed Steel Structural Members, and requirements of applicable jurisdictional authorities for each preformed metal system.

1.3.1.2. Requirements specified in this Section are intended to modify, supplement, or clarify specifications contained in CAN/CSA-S136-M89.

1.3.1.3. Recommendations contained in Standard Specifications and Technical Bulletins of the Canadian Sheet Steel Building Institute for materials and performance of system will establish minimum standards for work not specified in CAN/CSA-S136-M89, by jurisdictional authorities, or in this Section.

1.3.1.4. Reference standards quoted in Contract Documents refer to:

1.3.1.4.1. ASTM A446-76, Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, General Requirements.

1.3.1.4.2. ASTM 525-81, Specification for Steel Sheet Zinc

1.3.1.4.3. Coated (Galvanized) by the Hot Dipped Process

- 1.3.1.4.4. General Requirements.
- 1.3.1.4.5. ASTM A780-80, Standard Practice for Repair of Damaged Hot-Dip Coatings.
- 1.3.1.4.6. CGSB Specification 19-GP-5M, Sealing Compound, One Component, Acrylic Base, Solvent Curing.
- 1.3.1.4.7. CAN/CGSB-19.24-M80, Sealing Compound, Multi-Component, Chemical Curing.
- 1.3.1.4.8. CSA Standard G164-M92, Hot Dip Galvanizing of Irregularly Shaped Articles.
- 1.3.1.4.9. CAN/CSA-S136-M89, Cold Formed Steel Structural Members.

#### **1.4. Submittals**

##### **1.4.1. Shop Drawings**

- 1.4.1.1. Submit shop drawings.

##### **1.4.2. Samples**

- 1.4.2.1. Submit 300 x 300 samples of finish coating and profile.

#### **1.5. Delivery, Storage, and Handling**

- 1.5.1. Package materials to protect finished surfaces of siding from staining and marring.
- 1.5.2. Store materials flat at site under protection to prevent staining from the ground or from collection of water on material, or both; and secured against wind damage.
- 1.5.3. Store insulation and adhesives in dry areas, heated as required to prevent damage to adhesives.

#### **1.6. Warranty**

##### **1.6.1. Extended Warranty**

- 1.6.1.1. Warranty contained in GC24 is, with respect to Section 07411, extended from 1 year to 5 years. Without restricting generality of warranty, defects shall include leaking, failure to stay in place under expansion, lifting, deformation, deterioration, etc.
- 1.6.1.2. Contractor hereby warrants that system is suitable for use in this type of installation.

### **PART 2 - PRODUCTS**

#### **2.1. Siding System**

##### **2.1.1. General**

- 2.1.1.1. Siding system shall be one system, applied to vertical surfaces.
- 2.1.1.2. System shall consist of exterior preformed metal skin on galvanized framing and shall include all flashings and closures.

##### **2.1.2. Materials**

- 2.1.2.1. Acceptable manufacturers: Vicwest or approved alternate by Flynn.

2.1.2.2. Exposed preformed metal profile (or matching profile by Flynn).

2.1.2.3. Sub-girts:

2.1.2.3.1. preformed galvanized metal sheet, 1.22mm (18Ga) minimum base steel nominal thickness, notched for drainage.

2.1.2.3.2. Adjustable clips as required to suit site conditions.

2.1.2.4. Accessories: exposed trim, end and flute closures, inverted corner sections, cap pieces etc. shall be of the same metal material, finish, and colour as cladding.

2.1.2.5. Preformed sheet metal:

2.1.2.6. Metal Sheet:

2.1.2.6.1. Aluminum -zinc alloy coated sheet steel to ASTM A792M with coating designation AZM150 to ASTM A924/A924M.

2.1.2.6.2. Accessories and Hardware: Zinc coated steel to match specified requirements of CAN/CSA-G164-92, hot dip galvanized after fabrication.

2.1.2.7. Preformed sheet metal finish for exposed sheet metal: To match existing profile, gauge and colour. Similar to "Channelwall" profile by Vicwest.

## **2.2. Fabrication**

2.2.1. Roll form profiled panels, and other shapes unless impossible because of special design. Use other forming methods only with approval.

2.2.2. Form metal panels with bends sharp and true.

2.2.3. Fabricate to conform to shop drawings, and to allow for structural movements within the systems.

2.2.4. Fabricate systems for use with exposed fasteners wherever possible.

2.2.5. Fabricate miscellaneous framing members of specified materials as required to provide support of metal skin.

2.2.6. Fabricate systems to prevent entry of water into building and from collection within system assembly, and to prevent infiltration of air through system.

2.2.7. Join intersecting parts together to provide tight, accurately fitted joints with adjoining surfaces in true planes.

2.2.8. Fabricate system to conform to requirements of reference standards specified.

2.2.9. Cooperate with applicable Sections to ensure required coordination for installations specified in this Section in conjunction with masonry, structural steel framing, metal deck, membrane roofing, sheet metal work, and similar installations by other Sections.

2.2.10. **Exterior Sheet**

- : Profile: Corrugated 2-2/3" x 7/8" by Vicwest corrugated profile.
- : Thickness: Minimum 0.122 mm (18 gauge)
- : Colour: Vic West Premium Charcoal.
- : Fastening: exposed fasteners with colour of screw heads to match siding colour

**PART 3 - EXECUTION**

**3.1. Examination**

- 3.1.1. Take site measurements to ensure that fabrications are provided to fit structure; surrounding construction; around obstructions and projections in place, or as shown on Drawings and to suit locations of services.
- 3.1.2. Verify that backup and support construction is aligned for proper installation of preformed metal system before commencing erection of metal skin.
- 3.1.3. Before proceeding with application, ensure that:
  - 3.1.3.1. Metal support is constructed smoothly; in true planes and to match whatever is the design intent.
  - 3.1.3.2. Edges of metal are supports to prevent deflection.
  - 3.1.3.3. Adjacent construction and installation of other work to be incorporated is complete.
  - 3.1.3.4. Work which penetrates system has been installed.

**3.2. Erection of Preformed Metal Siding**

- 3.2.1. Erect systems complete with flashings forming part of system, sub-girts, clips, fasteners, closures & caulking to meet same design criteria as specified for fabrication.
- 3.2.2. Cut and flash system penetrations.
- 3.2.3. Erect panels in straight lines that are true, level, and plumb.
- 3.2.4. Provide for differential thermal and structural movement between systems and structure as well as between elements of system.
- 3.2.5. Attach systems to supporting structure and to other siding components with fasteners of the same material and colour as the exterior panels except where other materials are approved.
- 3.2.6. Seal joints within system watertight.
- 3.2.7. Caulk between preformed metal specified in this Section and installations of other Sections to meet specified requirements of Section 07920 and to provide a watertight installation.
- 3.2.8. Erect systems by its fabricator or approved agent.

**3.3. Field Quality Control**

3.3.1. Arrange to have a technical representative of membrane manufacturer who is familiar with specified products and their installation review shop drawings for work of this Section, to be on site during installation of the membrane and perform inspection of membrane before covering.

**3.4. Adjustment and Cleaning**

3.4.1. After erection, touch up galvanized coatings removed or damaged during erection.

3.4.2. Remove damaged, dented, defaced, defectively finished, or tool marked components and replace with new.

3.4.3. Refinish shop applied finishes in field only with approval.

3.4.4. Clean off dirt resulting from erection from surfaces exposed to view.

**End of Section**

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**PART 1 - GENERAL**

**1.1. Description**

**1.1.1. General Requirements**

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

**1.1.2. Work Performed by Other Sections Related to this Section is Specified in**

Section 04200: Forming Reglets.  
Section 04200: Sheet Metal Built In Masonry  
Section 07411: Preformed Metal Siding.  
Section 07520: 2 - Ply Modified Bitumen Membrane Roofing  
Section 07920: Sealants and Caulking, Other Than Sheet Metal Joints  
Section 09900: Painting and Finishing  
Division 15 : Flashings Specified for Mechanical Installations  
Division 16 : Flashings Specified for Electrical Installations

**1.1.3. Supply of Work Which Shall be Installed by This Section**

1.1.3.1. To furnish pre-coated sheet metal

**1.1.4. Installation of Work Which Shall be Supplied by This Section is Specified in**

Section 03300: To install flashing reglets.

**1.1.5. This Section Shall Include Performance of Work Which is Specified in**

Section 07520: To specify field quality control and submission of inspection reports.  
Section 07900: To specify caulking at sheet metal joints.

**1.1.6. Work Included in This Section**

1.1.6.1. Generally the work of this section will include, but will not be limited to the following:  
: all galvanized metal flashings for counter flashings at all parapets, curbs, roof openings not normally exposed to view,  
: all flashings not specifically covered or detailed by other related sections.

**1.2. Quality Assurance**

**1.2.1. Subcontractor Qualifications**

1.2.1.1. Provide sheet metal specified in this Section only by a Subcontractor who has adequate plant, equipment and skilled tradesmen, 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.

### 1.3. References

#### 1.3.1. Reference Standards

- 1.3.1.1. Reference standards quoted in Contract Documents refer to:
- 1.3.1.2. ASTM A525-81, Specification for Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process, General Requirements.
- 1.3.1.3. CGSB Specification 1-GP-108M, Paint, Acid and Alkali Resistant, Black.

### 1.4. Submittals

#### 1.4.1. Samples

- 1.4.1.1. Submit samples of pre-coated finish and sheet metal joints if requested.

### 1.5. Delivery, Storage, and Handling

- 1.5.1. Protect sheet metal during handling and storage to prevent rusting, staining, abrasion of finish coatings, bending and denting.
- 1.5.2. Protect surfaces of pre-coated metal to prevent scratching.

### 1.6. Warranty

#### 1.6.1. Extended Warranty

- 1.6.1.1. Warranty contained in GC24 is, with respect to Section 07600, extended from 1 year to 5 years. Without restricting generality of warranty, defects shall include leaking, failure to stay in place under expansion, lifting, deformation, deterioration, etc.
- 1.6.1.2. Contractor hereby warrants that system is suitable for use in this type of installation.
- 1.6.1.3. Contractor shall arrange with Consultant and/or Owner, about 1 month before warranty expires, to visit site, examine installation specified in this section and make necessary repairs. Should Contractor fail to make such arrangement through no fault or neglect of Owner or Consultant, then period of warranty shall extend to one month after such arrangement is made.

## PART 2 - PRODUCTS

### 2.1. Materials

#### 2.1.1. Galvanized Steel Sheet

- 2.1.1.1. ASTM Specification A525, zinc coating designation Z275; flashings, 0.5 mm thick; cleats and edge strips, 1.6 mm thick; other work in thickness indicated on drawings or specified.

#### 2.1.2. Pre-coated Finish

- 2.1.2.1. Use sheet metal with pre-coated finish where metal is exposed to view.
- 2.1.2.2. Baked enamel or other coatings as may be specified in other sections, applied to galvanized sheet steel in shop by continuous coating line, by Stelco or Dofasco.
- 2.1.2.3. Colour to match new corrugated siding.



2.1.3. **Solder**

2.1.3.1. New, one half pig lead, one half block tin.

2.1.4. **Flux**

2.1.4.1. For galvanized steel, resin type.

2.1.5. **Fasteners**

2.1.5.1. Use only nails, bolts, screws and other fasteners of the same metal and with the same finish as the metal being fastened. Use fasteners of a size suitable for the particular fastening condition and service. Use only approved nails, bolts, screws and other fasteners

2.1.6. **Metal Flashing Reglets**

2.1.6.1. 0.6 mm thick galvanized steel, open type at least 50 mm sloped depth, with receiving slot sloping up 45°, wedges, soft lead.

2.1.7. **Caulking**

2.1.7.1. One or two part polysulphide specified in Section 07920.

2.1.8. **Felt**

2.1.8.1. No. 15 asphalt saturated roof felt, to meet specified requirements of CSA Standard A123.3.

2.1.9. **Building Paper**

2.1.9.1. Smooth, unsaturated quality, rosin-sized paper weighing not less than 0.25 kg/sq.m.

2.1.10. **Bituminous Paint**

2.1.10.1. To meet specified requirements of CGSB Specification 1-GP-108.

**2.2. Fabrication**

2.2.1. Fabricate all possible sheet metal in shop by brake forming, and bench cutting, drilling and shaping.

2.2.2. Form bends with straight sharp lines, angles and arises; and sheets into true planes free from twists, buckles, dents and other visual distortions.

2.2.3. Supply accessories required for installation of sheet metal specified in this Section. Fabricate accessories of same material as sheet metal with which they will be incorporated.

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**PART 3 - EXECUTION**

**3.1. Installation**

**3.1.1. General**

- 3.1.1.1. Install sheet metal exposed to view in straight lines, with junctions aligned and on same plane.
- 3.1.1.2. Install sheet metal wherever possible on runs of equal 2400 mm lengths except where conditions for securing dictates that shorter and equal 1200 mm lengths are preferable.
- 3.1.1.3. Install pre-coated sheet metal wherever possible in minimum lengths of 3600 mm on typical runs, except where conditions for securing dictates that shorter and equal 1200 mm lengths are preferable.
- 3.1.1.4. Supply flashing reglets required by this Section, to other Sections responsible for their installation. Assist others in their location.
- 3.1.1.5. Install sheet metal to prevent entry of water under service and weather conditions.
- 3.1.1.6. Back paint, with two coats of bituminous paint at rate of 1 L/sq.m., sheet metal that is not given pre-coated finish and that comes into contact with another kind of metal, or masonry or concrete.
- 3.1.1.7. Install sheet metal with concealed fastenings. Exposed fastenings will be permitted only as approved when concealed fastenings are impossible. Fasten sheet metal, clips and other components in an approved manner, with fasteners weather tight and evenly and neatly located. Do not use pop rivets.
- 3.1.1.8. Join sheet metal by slip lock seams to permit thermal movement. Space joints evenly where exposed. Lock seam and solder internal corners. Form mitres with standing seams in pre-coated metal.
- 3.1.1.9. At exposed sheet metal, install expansion joints with 200 mm wide hooked covers, bedded in caulking compound, fastened at one side only, and at intervals of approximately 6.0 m., or as otherwise shown on Drawings or approved.
- 3.1.1.10. Install 50 mm X 75 mm cleats where required to fasten sheet metal. Secure each cleat to backing with 2 nails, space cleats at 300 mm o.c. generally.
- 3.1.1.11. Install edge strips in lengths of approximately 2400 mm, continuously, and with 6 mm between each length. Fasten at 300 mm o.c.
- 3.1.1.12. Do not form open joints or pockets that fail to drain water.
- 3.1.1.13. Caulk all reglets and open sheet metal joints that do not mechanically provide weather tight construction, in accordance with Section 07920.
- 3.1.1.14. Apply No. 15 roofing felt under sheet metal installed directly over masonry, concrete, or wood. Secure felt in place, and lap joints 100 mm as sheet metal is installed. Turn up edges 150 mm where used on horizontal surfaces. Lay rosin-sized building paper over felts.
- 3.1.1.15. Secure sheet metal by nailing at 150 mm o.c. where concealed, unless otherwise specified or indicated on Drawings.

**3.1.2. Flashings**

- 3.1.2.1. At masonry: Wedge flashings into joints and reglets with lead at 300 mm o.c. Caulk remainder of joint and reglet.

3.1.2.2. Install metal flashings as indicated on Drawings or as otherwise required where building components penetrate exterior construction, and for which flashing is not specified by other Sections. Fasten by cleats in doubled back edges of drips.

3.1.3. **Roof Edge Trim**

3.1.3.1. Install 0.5 mm thick galvanized steel trim secured by nailing and edge strip.

3.1.4. **Roof Control Joints**

3.1.4.1. Install 0.5 mm thick galvanized sheet cover secured by edge strips to joint movement.

3.1.5. **Copings**

3.1.5.1. Install 0.5 mm thick galvanized steel secured by edge strips.

3.1.6. **Fascias**

3.1.6.1. Install prefinished 0.5 mm thick galvanized steel as indicated on drawings with bottom secured by edge strips to match existing conditions.

3.1.7. **Suppers and Downspouts**

3.1.7.1. Fabricate of prefinished 0.5 mm thick galvanized steel to profiles and sizes to match existing conditions. Install these items using galvanized fasteners.

3.2. **Cleaning**

3.2.1. Remove flux residue completely from surfaces and crevices, remove other deposits, stains or protection and wash metals left unpainted and exposed to view as recommended by the manufacturer of the metal.

**End of Section**

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**PART 1 - GENERAL**

**1.1. Description**

**1.1.1. General Requirements**

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

**1.1.2. Work Performed by Other Sections Related to this Section is specified in**

Section 02050 - Demolition  
Section 06100 – Rough Carpentry  
Section 07600 - Flashing and Sheet Metal  
Division 15 - Roof Drains  
Division 15 - Vent Stack Covers and Flashing

**1.1.3. This Section shall include performance of Work which is specified in**

Section 07600 - For field quality control of flashing installation contiguous with the work of this Section.

**1.1.4. Work Performed by this Section to Meet Requirements of the Following**

Section 07190 - Vapour Retarder and Air Barrier

**1.1.5. Scope of Work**

- 1.1.5.1. To remove the existing roof membrane, insulation, metal flashing, wood cants, and materials down to existing roof deck on existing school.
- 1.1.5.2. Preparation of new and existing decks to receive new roofing.
- 1.1.5.3. Install a new 2-ply modified bitumen membrane roof to the new addition and provide tie in to existing roofing.

**1.2. Quality Assurance**

**1.2.1. Subcontractors Qualifications**

- 1.2.1.1. Execute Work of this Section only by a Subcontractor approved by the membrane manufacturer 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 at least the immediate past five years.
- 1.2.1.2. Install membrane approved by the personnel who have been trained and who are approved by the membrane manufacturer.
- 1.2.1.3. Ensure that the roofing Subcontractor's suppliers and subcontractors have the same qualifications.

**1.2.2. Requirements of Regulatory Agencies**

- 1.2.2.1. Ensure that materials, including adhesives, and roof anchorage meet requirements of jurisdictional authorities.
- 1.2.2.2. Ensure that roofing materials, including adhesives and roof anchorage, are listed by Factory Mutual as approved roofing components; and that details of roofing anchorage conforms to Factory Mutual requirements.

**1.2.3. Source Quality Control**

1.2.3.1. Review Drawings and inform Architect of conditions which will not ensure a satisfactory installation.

1.2.3.2. Arrange for a site meeting for review of installation procedures with a representative of membrane manufacturer.

1.2.4. **Compatibility**

1.2.4.1. Assure that all roofing components are compatible with each other.

1.2.4.2. Ensure that all roofing components are compatible with other systems to which attachment or other physical interface is required.

1.3. **References**

1.3.1. **Reference Standards**

1.3.1.1. Reference standard quoted in Contract Documents refer to:

1.3.1.2. ASTM A525-81, Specification for Steel Sheet, Zinc Coated by Hot Dip Process, General Requirements.

1.3.1.3. ASTM D3686,

1.3.1.4. CGSB Specification 51-GP-20M, Thermal Insulation, Expanded Polystyrene.

1.3.1.5. CGSB Specification 37-GP-56M, Application of Sheet Applied Roofing Membrane.

1.3.1.6. CSA Standard A82.27-M1977, Gypsum Board Products

1.3.1.7. CSA Standard A123-7,

1.4. **Submittals**

1.4.1. **Inspection Company Reports**

1.4.1.1. Submit roof inspection reports as the Work progresses.

1.4.1.2. Upon completion of roofing Work, submit duplicate certificates of acceptance issued by the roofing inspection company.

1.4.2. **Shop Drawings**

1.4.2.1. Submit shop drawings for approval of system and as required for composite membrane.

1.4.3. **Samples**

1.4.3.1. Submit samples and manufacturer's literature before ordering materials and proceeding with the Work.

1.5. **Delivery, Storage, and Handling**

1.5.1. Store materials in dry protected area as recommended by manufacturer to ensure that they are not damaged.

1.5.2. Do not store roofing materials on roof. Store them under cover while roofing Work is not in progress.

1.5.3. Package roofing materials and identify on attached labels the manufacturer, brand, contents, weight as applicable, and product and specification numbers.

- 1.5.4. Store materials in dry protected areas between temperatures of 15°C (60°F) and 27°C (80°F), except for membrane. If materials are exposed to lower temperatures, restore them to specified range prior to use.

**1.6. Site Conditions**

**1.6.1. Environmental Requirements**

- 1.6.1.1. Do not apply any part of the roofing system over damp materials, nor during a period of damp weather, rain, snow, or otherwise inclement conditions.
- 1.6.1.2. Apply membrane and components only when air and surface temperatures are within limits recommended by manufacturer and not less than 5°C (40°F).

**1.7. Warranty**

**1.7.1. Extended Warranty**

- 1.7.1.1. Warranty contained in GC24 is, with respect to Section 07510, extended from 1 year to 10 years. Without restricting generality of warranty, defects shall include leaking, failure to stay in place, undue expansion, lifting, deformation, loosening, failure to adhere, splitting of same, deterioration, blisters, etc.
- 1.7.1.2. Membrane manufacturer will issue a written document in the Owner's name, valid for 10 years, stating that they will repair any leaks in the roofing membrane to restore the roofing system to a dry and watertight condition, to the extent that membrane manufacturing or installation defects caused water infiltration. The warranty must cover entire cost of repairs including labour and materials, for the full duration of the warranty period.
- 1.7.1.3. Contractor will issue a written and signed document in the Owner's name, certifying that the work executed will remain in place and free of any workmanship defect for a period of 10 years, starting from the date of acceptance.
- 1.7.1.4. Contractor shall arrange with Architect and/or Owner, about 1 month before warranty expires, to visit site, examine roofing installation specified in this Section, and make necessary 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**

**2.1. Materials**

**Note:** Use only compatible materials in roofing system.

- 2.1.1. **Sheathing Board** – Confirm application onto new plywood sheathing of premanufactured roof trusses.
- 2.1.2. **Primer (for heat welded of asphalt adhered membranes)** – A blend of elastomeric bitumen, volatile solvents and adhesive enhancing additives used to prime, concrete, metal or gypsum board substrates prior to the application of torch applied or asphalt adhered membranes; Elastocol 500 by Soprema, or approved alternate.
- 2.1.3. **Primer (for self-adhesive membranes)** – Composed of SBS synthetic rubber,

volatile solvents, adhesive enhancing resins used to prime porous and nonporous substrates such as wood, concrete, metal or gypsum board to enhance the adhesion of self-adhered membranes at temperatures above -10°C; Elastocol Stick by Soprema, or approved alternate.

- 2.1.4. **Roofing Asphalt** - Type 2 oxidized asphalt with a softening point between 75°C - 83°C conforming to CSA A123.4M – 79.
- 2.1.5. **Vapour Retarder (Steel deck areas)** – Self-adhesive air/vapour barrier membrane composed of bitumen modified with thermoplastic polymers and high density polyethylene film; Soprapap'r 40 by Soprema, or approved alternate.
- 2.1.6. **Mechanical Fasteners** - Screw fasteners with 3" round galvanized metal stress plates, self-tapping corrosion resistant screw, length as required to ensure minimum 19 mm penetration into deck; Dekfast #14 screws complete with 3" round Galvalume steel insulation plates as manufactured by SFS Intec Inc. or approved alternate.
- 2.1.7. **Membranes –**
  - 2.1.7.1. **Membrane Base Sheet:** A membrane sheet, composed of Styrene Butadiene Styrene (SBS) modified bitumen and reinforced with non-woven polyester mat, weight 180 g/m<sup>2</sup>, thickness of 2.2 mm., with a thermofusible poly film top surface and a lightly sanded underside to meet CGSB 37-GP-56M, Type 2, Class C, Grade 2 for base sheets; Elastophene 180 PS, by Soprema, or as supplied by IKO Roofing Products, Bakor, or other approved manufacturer.
  - 2.1.7.2. **Base Sheet Flashings:** A membrane sheet, composed of Styrene Butadiene Styrene (SBS) modified bitumen and reinforced with a heavy duty glass mat, weight 130 g/m<sup>2</sup>, thickness of 2.5 mm., with a thermofusible poly film top surface and a self adhesive underside protected by a silicone release film, to meet CGSB 37-GP-56M, Type 2, Class C, Grade A for base sheets; Sopraflash Flam Stick as supplied by Soprema, or as supplied by IKO Roofing Products, Bakor or other approved manufacturer.
  - 2.1.7.3. **Membrane Cap Sheet and Flashing Cap Sheet:** A membrane sheet, composed of Styrene Butadiene Styrene (SBS) modified bitumen and reinforced with a non-woven polyester mat, weight 250 g/m<sup>2</sup>, 4 mm thickness, with ceramic mineral granules embedded into top surface and a thermofusible poly film on the underside, meeting CGSB 37-GP-56M Type 1, Class A, Grade 2, for cap sheets; Sopralene Flam 250 GR supplied by Soprema, or as supplied by IKO Roofing Products, Bakor or other approved manufacturer.
  - 2.1.7.4. **Base Sheet Perimeter Membrane:** A membrane sheet, composed of Styrene Butadiene Styrene (SBS) modified bitumen and reinforced with a heavy duty combination of non-woven polyester with glass grid composite, weight 170 g/m<sup>2</sup>, thickness of 2.2 mm., with a lightly sanded top and bottom surface and a 200mm wide selvedge on both sides of the roll, to meet CGSB 37-GP-56M, Type 2, Class C, Grade 2 for base sheets; Perimet'r by Soprema, or as supplied by IKO Roofing Products, Bakor, or other approved manufacturer.
  - 2.1.7.5. **Cap Sheet Starter** - A membrane sheet, composed of Styrene Butadiene Styrene (SBS) modified bitumen and reinforced with a non-woven polyester mat, weight 250 g/m<sup>2</sup>, 4 mm thickness, with ceramic mineral granules embedded into top surface and a thermofusible poly film on the underside, meeting CGSB 37-GP-56M Type 1, Class A, Grade 2, for cap sheets; Starter Flam GR supplied by Soprema, or as supplied by IKO Roofing

Products, Bakor or other approved manufacturer.

- 2.1.8. **Waterproofing Mastic** – Composed of synthetic rubbers, plasticized with bitumen and solvents; Sopramastic by Soprema, or approved alternate.
- 2.1.9. **Asphalt Kettles** - to have thermometer accurately measuring the temperature of the asphalt in the kettle.
- 2.1.10. **Caulking** - CGE Silpruf or DOW 790 Low Modulus Silicone Sealant.
- 2.1.11. **Vent Stack Covers** - Leksuco insulated, tamper proof or approved alternate.

### **PART 3 - EXECUTION**

#### **3.1. Examination**

- 3.1.1. Before proceeding with roofing application, ensure that:
  - 3.1.1.1. All existing roof membrane, insulation, metal flashing and cants have been removed from the designated roof area to receive new roofing systems.
  - 3.1.1.2. Existing roof deck is sound; in true planes; and level, or sloped to drains, whichever is design intent.
  - 3.1.1.3. New roof deck is constructed smoothly; in true planes, and level, or sloped to drains, whichever is design intent.
  - 3.1.1.4. Edges of all panels of metal roof deck are supported to prevent deflection.
  - 3.1.1.5. Roof drains have been set and anchored by others at a level to drain and are connected to drainage system.
  - 3.1.1.6. Roof decks are clean and sufficiently dry for application under specified warranty.
  - 3.1.1.7. Adjacent construction and installation of other work incorporated with roof is completed.
  - 3.1.1.8. Roofing surfaces are free of cracks that are wider than bridging ability of roofing materials.
  - 3.1.1.9. Preparations have been made for bases on which equipment will be installed.
  - 3.1.1.10. Work that penetrates roof has been installed.
- 3.1.2. Defective roofing Work resulting from application to unsatisfactory previously completed Work will be considered the responsibility of those performing the Work of this Section.

#### **3.2. Preparation**

- 3.2.1. Sweep roof deck completely free of dust, dirt and debris.
- 3.2.2. **Protection**
  - 3.2.2.1. Ensure that stored porous materials absorb no moisture. Remove wet materials from Project site.
  - 3.2.2.2. When using adhesives and sealants containing petroleum distillates keep them away from open flames and do not breathe their fumes.
  - 3.2.2.3. Protect membrane from punctures by sharp materials on both their top and bottom sides.



- 3.2.2.4. Protect surrounding work, and adjacent building and other property from damage during roofing operations.
- 3.2.2.5. This Section shall make payment for repair of damage caused by its Work.
- 3.2.2.6. Install temporary blocking and otherwise protect drains during roofing operations, and remove at completion of roofing Work.
- 3.2.2.7. Protect insulation from sunlight at all times while in storage.

### **3.3. Installation**

#### **3.3.1. General**

- 3.3.1.1. Apply roofing in accordance with Drawings, Specifications, requirements of jurisdictional authorities, and material manufacturer's printed directions which shall establish minimum requirements not otherwise specified.
- 3.3.1.2. Roofing system to be installed to meet requirements of Factory Mutual 1-90.
- 3.3.1.3. Apply roofing as soon as possible after new roof has been installed.
- 3.3.1.4. Make adjustments to specified roofing procedures caused by weather and site conditions only when approved.
- 3.3.1.5. Maintain equipment in good working order to ensure control of roofing operations and protection of Work. Use only roofing equipment recommended and approved by membrane manufacturer.

#### **3.3.2. Vapour Retarder (Self-adhesive)**

- 3.3.2.1. Ensure substrate is suitable prior to installation of vapour retarder.
- 3.3.2.2. Beginning at the bottom of the slope, without adhering the membrane, unroll onto the substrate for alignment. Do not immediately remove the silicone release sheet.
- 3.3.2.3. Align the roll parallel to the corrugations of the steel deck. Make sure the membrane overlaps are supported along their entire length. Place a thin sheet of metal spanning the flutes of the deck under any end laps of membrane as support for the lap.
- 3.3.2.4. Peel back approx. 12" at one end of the of the silicone release sheet and adhere this part of the membrane to the deck. Peel back the remaining release sheet at a 45° angle to avoid wrinkles in the membrane.
- 3.3.2.5. If the membrane is not properly aligned, do not try to adjust it. Instead, cut the roll and start again, making sure that it is properly aligned and that it overlaps the end of the misaligned piece by 150mm.
- 3.3.2.6. Overlap adjacent membranes by 75mm (3"). Overlap end laps by 150mm (6"). Stagger end laps by at least 300mm (12").

#### **3.3.3. Vapour Retarder (Mopped)**

- 3.3.3.1. Ensure substrate is suitable prior to installation of vapour retarder.
- 3.3.3.2. Apply a coat of asphalt primer to substrate at a rate of 0.15 to 0.25 L/m<sup>2</sup>. All surfaces to primed must be free of rust, duct, or any residue that may hinder adhesion. Cover primed surfaces with roofing membrane as soon as possible. Allow primer to flash and dry sufficiently before application of membrane.
- 3.3.3.3. Unroll vapour retarder membrane dry onto substrate for alignment purposes. Overlap side laps by 75 mm and end laps by 150 mm. Laps shall be staggered a minimum of 300 mm. Begin work at bottom of slopes.
- 3.3.3.4. Unroll vapour retarder into layer of hot asphalt spread at a rate of 1 kg/m<sup>2</sup> to 1.5 kg/m<sup>2</sup>.

- 3.3.3.5. Apply asphalt on roof at a temperature of about 230°C and heat in kettle to approximately 250°C taking care to never exceed the asphalt flash point temperature. Follow suppliers recommendations. In colder temperatures (below 10°C), warm membranes underside by sweeping a torch over rolls entire width.
- 3.3.3.6. The roof vapour retarder must meet and overlap the air/vapour barrier on adjoining walls to ensure total air/vapour seal. Incorporate heat-resistant air/vapour barrier continuity strip at these overlaps.
- 3.3.3.7. Install vapour retarder membrane at insulation perimeters and around each element piercing the insulation to ensure sealed connections with base sheet at upstands.

#### 3.3.4. **Roof Membrane**

- 3.3.4.1. Provide a 2-ply modified bitumen membrane (mopped base, torch cap) over the overlay board.

##### 3.3.4.2. **Base Sheet:**

- 3.3.4.2.1. Unroll base sheet dry onto substrate with first side lap lined up with centre of drain and parallel to edge of roof. Allow membrane to relax for 15 minutes prior to application. In cold weather (below 10°C) burn the plastic film on the top surface in zag-zag pattern with a propane torch to hasten relaxation.
- 3.3.4.2.2. Overlap side laps by 75 mm, along lines provided for this purpose, and overlap end laps by 150 mm. Stagger end laps by at least 300mm.
- 3.3.4.2.3. Re-roll base sheet and unroll again onto a bed of hot asphalt. Apply asphalt to one half of side only and seal the remaining outside half with a torch. Burn off the poly film at all end laps before adhering with asphalt.
- 3.3.4.2.4. Pour hot asphalt in front of each roll at a temperature of about 230°C and heat in kettle to approx. 250°C taking care not to exceed the flash point of the asphalt. Minimum temperature at point of contact should be 220°C to 230°C. Ensure hot asphalt in kettle is in constant use to avoid distillation.
- 3.3.4.2.5. Do not spread asphalt more than 3 metres in front of each roll. In colder weather (below 15°C) do not spread asphalt more than 1 metre in front of each roll.
- 3.3.4.2.6. Below 10°C heat the membrane underside by sweeping a torch over entire roll's width. Be careful not to direct flame toward the bitumen.
- 3.3.4.2.7. Hot asphalt must never be applied on vertical surfaces at levels higher than 25mm above horizontal base sheet roofing surface.
- 3.3.4.2.8. Avoid forming wrinkles, air pockets or fishmouths.
- 3.3.4.2.9. Install reinforcements at penetrations (drains, stack flashings, cone flashings) at 45° degree angle to the field membrane rolls and in accordance with manufacturer's recommendations.
- 3.3.4.2.10. Always seal overlaps at the end of the workday with propane torch and hot trowel.

##### 3.3.4.3. **Base Sheet Flashing**

- 3.3.4.3.1. Before applying primer or membranes, always remove the plastic film on the section of field membrane to be covered by overlaps.
- 3.3.4.3.2. Apply a coating of primer to parapet, curb, upstand substrates including overlaps and allow to flash-off and dry.

- 3.3.4.3.3. Precut one (1) metre wide pieces of sufficient length to completely cover the parapet, curb, upstand detail complete with a minimum 100mm (4") overlap to the field membrane.
- 3.3.4.3.4. Position pre-cut membrane piece. Peel back 100 to 150mm (4" to 6") of the silicone release paper and adhere this part of the membrane at the top of the parapet, curb or upstand. Gradually peel back the remaining silicone release paper, pressing down on the membrane with an aluminium applicator to ensure good adhesion. Use the applicator to ensure a perfect transition between the upstand and the field surface. Smooth the entire membrane surface with a roller for full adhesion. Fasten outside edge of membrane at face of parapet at 300mm (12") O.C. with round-top roofing nails.
- 3.3.4.3.5. Overlap side laps 75mm (3") and stagger by at least 300mm (12") from base sheet side laps to prevent excessive layering.
- 3.3.4.3.6. Cut off corners at end laps to be covered by the next roll.
- 3.3.4.3.7. Install a reinforcing gusset at all inside and outside corners.
- 3.3.4.3.8. Always seal overlaps at the end of the workday with propane torch and hot trowel.
- 3.3.4.4. **Cap Sheet:**
  - 3.3.4.4.1. Once base sheet is applied and no defects are apparent, proceed with cap sheet installation, starting at the roof drains.
  - 3.3.4.4.2. Begin with a double selvage starter roll. If starter roll is not used, side laps covered in granules must be degranulated by embedding a 100mm (4") side lap in torch-heated bitumen.
  - 3.3.4.4.3. Unroll cap sheet at drain. Carefully centre roll on drain and align side lap parallel to roof edge.
  - 3.3.4.4.4. Weld cap sheet onto base sheet with torch recommended by membrane manufacturer. During application, simultaneously melt both designated contact surfaces so a bead of bitumen is apparent as cap sheet unrolls.
  - 3.3.4.4.5. Avoid overheating.
  - 3.3.4.4.6. Unless overlap widths differ between cap and base sheets, make sure joints between the two layers are staggered by at least 300 mm.
  - 3.3.4.4.7. Overlap cap sheet side laps by 100mm (4") and end laps by 150 mm. Cut off corners at end laps to be covered by next roll. All overlap surfaces must be granule-free or degranulated.
  - 3.3.4.4.8. Complete perfect welds between two membranes. Leave no zone unwelded. In cold weather, adjust welding time to obtain homogenous seam (it may be necessary to slow down in certain cases.)
  - 3.3.4.4.9. Once cap sheet is installed, carefully check all overlapped joints.
  - 3.3.4.4.10. During installation, care should be taken to avoid excessive bitumen bleed-out at joints.
- 3.3.4.5. **Cap Sheet Flashing Installation**
  - 3.3.4.5.1. The cap sheet flashing must be installed in one (1) metre wide strips. The side laps must overlap by 75mm (3") and must be staggered by at least 100mm (4") with respect to the joints of the cap sheet on the field surface, to avoid areas of excessive layering. The overlaps to the field surface must be 150mm (6") minimum and exceed those of the base sheet flashing overlap by at least 50mm (2"). At end laps, angle cut the corners that will be covered by the following piece.

- 3.3.4.5.2. Use chalk line to draw a straight line on the field surface 150mm (6") from the inside of the parapets, curbs, upstands, etc. Using a propane torch and round nose trowel, embed the surface of the granules in the a layer of hot bitumen, starting from the chalk line on the field surface to the bottom edge of the parapet, curb or upstand.
- 3.3.4.5.3. Heat weld cap sheet flashing directly to the base sheet membrane, proceeding from top to bottom. This technique softens both membranes in order to obtain an even, continuous weld.
- 3.3.4.5.4. During installation, be careful not to overheat the membrane or to create excessive bitumen bleed out at the joints.

3.3.5. **Metal Flashings**

- 3.3.5.1. Replace any metal flashing removed from equipment fans, etc., and replace with new metal.
- 3.3.5.2. Fabricate and install metal copings, fascias, and counter flashing as indicated on drawings.
- 3.3.5.3. New counter flashing and cap flashings as detailed shall be coloured metal shapes to match existing flashing if any.
- 3.3.5.4. Fabricate metal flashing and other sheet metal work in accordance with applicable CRCA FL series details. Make allowance for expansion at joints. In general, flat locked seams shall be used. Seal joints watertight. Form sections square, true and accurate to size, free from distortion and other defects. Double back exposed edges at least 12 mm. Flashings to be fastened with clips secured to masonry walls with nail-ins by competent mechanical fasteners or approved equal at 2'.

3.3.6. **Protection of Work**

- 3.3.6.1. At the completion of each day's work, all exposed edges of unfinished roof membrane system must be sealed by means of a temporary water cut off.

3.3.7. **Field Quality Control**

- 3.3.7.1. Arrange for a review of the complete roofing installation by a representative of the membrane manufacturer to ensure that work has been performed in compliance with specified requirements.
- 3.3.7.2. Engage the roofing inspection company selected by the Architect to supervise installation of roofing and to verify its completion in accordance with this Specification for Work included in both Section 07510 and 07600.
- 3.3.7.3. Provide supervision of roofing installation by a representative of the membrane manufacturer.
- 3.3.7.4. Notify designated Owner's representative and roofing inspection company at least seventy-two hours before roofing operations commence, and arrange for a job site meeting to be held the day before the roofing starts with the following present:  
Owner's representative; Contractor's superintendent; roofing inspector; and a principal of the roofing Subcontractor's firm.  
Subsequently, give two working day's prior notice to the roofing inspector of the commencement of each phase of Work, and provide him with materials and installation information as required.
- 3.3.7.5. Payment for roofing inspection will be made from Cash Allowance listed in Section 01020.

3.3.8. **Adjustment and Cleaning**

- 3.3.8.1. Install membrane patches over punctures and tears in membrane in strict accordance with manufacturer's written recommendations.
- 3.3.8.2. Remove all roofer's equipment and debris as Work progresses, and at completion of roofer's Work.
- 3.3.8.3. Remove all debris and soil from all areas and surfaces that was caused from roofing operations.

3.3.9. **Protection**

- 3.3.9.1. Coordinate work to ensure that special protection against damage from traffic or Work performed on top of completed roofing is installed as specified in Section 01220.

**End of Section**

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**PART 1 - GENERAL**

**1.1. Description**

**1.1.1. General Requirements**

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

**1.1.2. Work Performed by Other Sections Related to this Section is Specified in**

Section 04200: Forming Reglets.  
Section 04200: Sheet Metal Built In Masonry  
Section 07411: Preformed Metal Siding.  
Section 07520: 2 - Ply Modified Bitumen Membrane Roofing  
Section 07920: Sealants and Caulking, Other Than Sheet Metal Joints  
Section 09900: Painting and Finishing  
Division 15 : Flashings Specified for Mechanical Installations  
Division 16 : Flashings Specified for Electrical Installations

**1.1.3. Supply of Work Which Shall be Installed by This Section**

1.1.3.1. To furnish pre-coated sheet metal

**1.1.4. Installation of Work Which Shall be Supplied by This Section is Specified in**

Section 03300: To install flashing reglets.

**1.1.5. This Section Shall Include Performance of Work Which is Specified in**

Section 07520: To specify field quality control and submission of inspection reports.  
Section 07900: To specify caulking at sheet metal joints.

**1.1.6. Work Included in This Section**

1.1.6.1. Generally the work of this section will include, but will not be limited to the following:  
: all galvanized metal flashings for counter flashings at all parapets, curbs, roof openings not normally exposed to view,  
: all flashings not specifically covered or detailed by other related sections.

**1.2. Quality Assurance**

**1.2.1. Subcontractor Qualifications**

1.2.1.1. Provide sheet metal specified in this Section only by a Subcontractor who has adequate plant, equipment and skilled tradesmen, 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.

### 1.3. References

#### 1.3.1. Reference Standards

- 1.3.1.1. Reference standards quoted in Contract Documents refer to:
- 1.3.1.2. ASTM A525-81, Specification for Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process, General Requirements.
- 1.3.1.3. CGSB Specification 1-GP-108M, Paint, Acid and Alkali Resistant, Black.

### 1.4. Submittals

#### 1.4.1. Samples

- 1.4.1.1. Submit samples of pre-coated finish and sheet metal joints if requested.

### 1.5. Delivery, Storage, and Handling

- 1.5.1. Protect sheet metal during handling and storage to prevent rusting, staining, abrasion of finish coatings, bending and denting.
- 1.5.2. Protect surfaces of pre-coated metal to prevent scratching.

### 1.6. Warranty

#### 1.6.1. Extended Warranty

- 1.6.1.1. Warranty contained in GC24 is, with respect to Section 07600, extended from 1 year to 5 years. Without restricting generality of warranty, defects shall include leaking, failure to stay in place under expansion, lifting, deformation, deterioration, etc.
- 1.6.1.2. Contractor hereby warrants that system is suitable for use in this type of installation.
- 1.6.1.3. Contractor shall arrange with Consultant and/or Owner, about 1 month before warranty expires, to visit site, examine installation specified in this section and make necessary repairs. Should Contractor fail to make such arrangement through no fault or neglect of Owner or Consultant, then period of warranty shall extend to one month after such arrangement is made.

## PART 2 - PRODUCTS

### 2.1. Materials

#### 2.1.1. Galvanized Steel Sheet

- 2.1.1.1. ASTM Specification A525, zinc coating designation Z275; flashings, 0.5 mm thick; cleats and edge strips, 1.6 mm thick; other work in thickness indicated on drawings or specified.

#### 2.1.2. Pre-coated Finish

- 2.1.2.1. Use sheet metal with pre-coated finish where metal is exposed to view.
- 2.1.2.2. Baked enamel or other coatings as may be specified in other sections, applied to galvanized sheet steel in shop by continuous coating line, by Stelco or Dofasco.
- 2.1.2.3. Colour to match new corrugated siding.

2.1.3. **Solder**

2.1.3.1. New, one half pig lead, one half block tin.

2.1.4. **Flux**

2.1.4.1. For galvanized steel, resin type.

2.1.5. **Fasteners**

2.1.5.1. Use only nails, bolts, screws and other fasteners of the same metal and with the same finish as the metal being fastened. Use fasteners of a size suitable for the particular fastening condition and service. Use only approved nails, bolts, screws and other fasteners

2.1.6. **Metal Flashing Reglets**

2.1.6.1. 0.6 mm thick galvanized steel, open type at least 50 mm sloped depth, with receiving slot sloping up 45°, wedges, soft lead.

2.1.7. **Caulking**

2.1.7.1. One or two part polysulphide specified in Section 07920.

2.1.8. **Felt**

2.1.8.1. No. 15 asphalt saturated roof felt, to meet specified requirements of CSA Standard A123.3.

2.1.9. **Building Paper**

2.1.9.1. Smooth, unsaturated quality, rosin-sized paper weighing not less than 0.25 kg/sq.m.

2.1.10. **Bituminous Paint**

2.1.10.1. To meet specified requirements of CGSB Specification 1-GP-108.

**2.2. Fabrication**

2.2.1. Fabricate all possible sheet metal in shop by brake forming, and bench cutting, drilling and shaping.

2.2.2. Form bends with straight sharp lines, angles and arises; and sheets into true planes free from twists, buckles, dents and other visual distortions.

2.2.3. Supply accessories required for installation of sheet metal specified in this Section. Fabricate accessories of same material as sheet metal with which they will be incorporated.



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**PART 3 - EXECUTION**

**3.1. Installation**

**3.1.1. General**

- 3.1.1.1. Install sheet metal exposed to view in straight lines, with junctions aligned and on same plane.
- 3.1.1.2. Install sheet metal wherever possible on runs of equal 2400 mm lengths except where conditions for securing dictates that shorter and equal 1200 mm lengths are preferable.
- 3.1.1.3. Install pre-coated sheet metal wherever possible in minimum lengths of 3600 mm on typical runs, except where conditions for securing dictates that shorter and equal 1200 mm lengths are preferable.
- 3.1.1.4. Supply flashing reglets required by this Section, to other Sections responsible for their installation. Assist others in their location.
- 3.1.1.5. Install sheet metal to prevent entry of water under service and weather conditions.
- 3.1.1.6. Back paint, with two coats of bituminous paint at rate of 1 L/sq.m., sheet metal that is not given pre-coated finish and that comes into contact with another kind of metal, or masonry or concrete.
- 3.1.1.7. Install sheet metal with concealed fastenings. Exposed fastenings will be permitted only as approved when concealed fastenings are impossible. Fasten sheet metal, clips and other components in an approved manner, with fasteners weather tight and evenly and neatly located. Do not use pop rivets.
- 3.1.1.8. Join sheet metal by slip lock seams to permit thermal movement. Space joints evenly where exposed. Lock seam and solder internal corners. Form mitres with standing seams in pre-coated metal.
- 3.1.1.9. At exposed sheet metal, install expansion joints with 200 mm wide hooked covers, bedded in caulking compound, fastened at one side only, and at intervals of approximately 6.0 m., or as otherwise shown on Drawings or approved.
- 3.1.1.10. Install 50 mm X 75 mm cleats where required to fasten sheet metal. Secure each cleat to backing with 2 nails, space cleats at 300 mm o.c. generally.
- 3.1.1.11. Install edge strips in lengths of approximately 2400 mm, continuously, and with 6 mm between each length. Fasten at 300 mm o.c.
- 3.1.1.12. Do not form open joints or pockets that fail to drain water.
- 3.1.1.13. Caulk all reglets and open sheet metal joints that do not mechanically provide weather tight construction, in accordance with Section 07920.
- 3.1.1.14. Apply No. 15 roofing felt under sheet metal installed directly over masonry, concrete, or wood. Secure felt in place, and lap joints 100 mm as sheet metal is installed. Turn up edges 150 mm where used on horizontal surfaces. Lay rosin-sized building paper over felts.
- 3.1.1.15. Secure sheet metal by nailing at 150 mm o.c. where concealed, unless otherwise specified or indicated on Drawings.

**3.1.2. Flashings**

- 3.1.2.1. At masonry: Wedge flashings into joints and reglets with lead at 300 mm o.c. Caulk remainder of joint and reglet.

3.1.2.2. Install metal flashings as indicated on Drawings or as otherwise required where building components penetrate exterior construction, and for which flashing is not specified by other Sections. Fasten by cleats in doubled back edges of drips.

3.1.3. **Roof Edge Trim**

3.1.3.1. Install 0.5 mm thick galvanized steel trim secured by nailing and edge strip.

3.1.4. **Roof Control Joints**

3.1.4.1. Install 0.5 mm thick galvanized sheet cover secured by edge strips to joint movement.

3.1.5. **Copings**

3.1.5.1. Install 0.5 mm thick galvanized steel secured by edge strips.

3.1.6. **Fascias**

3.1.6.1. Install prefinished 0.5 mm thick galvanized steel as indicated on drawings with bottom secured by edge strips to match existing conditions.

3.1.7. **Suppers and Downspouts**

3.1.7.1. Fabricate of prefinished 0.5 mm thick galvanized steel to profiles and sizes to match existing conditions. Install these items using galvanized fasteners.

3.2. **Cleaning**

3.2.1. Remove flux residue completely from surfaces and crevices, remove other deposits, stains or protection and wash metals left unpainted and exposed to view as recommended by the manufacturer of the metal.

**End of Section**

## **PART 1 - GENERAL**

### **1.1. Description**

#### **1.1.1. General Requirements**

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

#### **1.1.2. Work Related to This Section Performed by Other Sections**

Section 03300: concrete surface preparation

Section 04200: unit masonry

Section 09250: gypsum board partitions

#### **1.1.3. Work Related to This Section Specified Elsewhere**

1.1.3.1. Fire stopping and smoke seals within mechanical assemblies and electrical assemblies are specified in Divisions 15 and 16 respectively.

### **1.2. Quality Assurance**

#### **1.2.1. Requirements of Regulatory Agencies**

1.2.1.1. Install only firestopping with an inherent fire hazard classification in all its parts that is within limits established by jurisdictional authorities.

1.2.1.2. Validate fire hazard classification only by testing laboratories acceptable to jurisdictional authorities.

1.2.1.3. Attach Underwriters' Laboratories labels to packages of fire rated materials.

### **1.3. References**

#### **1.3.1. Reference Standards**

1.3.1.1. Reference standards quoted in Contract Documents refer to:

1.3.1.1.1. CAN4-S115-M85, Standard Method of Fire Tests of Firestop Systems

1.3.1.1.2. CAN4-S101-M85, Standard Methods of Fire Endurance Tests of Building Construction.

### **1.4. Submittals**

#### **1.4.1. Samples**

1.4.1.1. Submit duplicate 300mm x 300mm samples showing actual firestop materials in accordance with Section 01300.

### **1.5. Shop Drawings**

1.5.1. Submit shop drawings to show proposed materials reinforcement, anchorage, fastenings and method of installation. Shop drawing details must accurately reflect actual job conditions.

- 1.5.2. Submit manufacturer's product data for materials and prefabricated devices, providing descriptions sufficient for identification on job site. Submit manufacturer's printed instructions for installation.

**1.6. Delivery, Storage and Handling**

- 1.6.1. Package firestopping materials and label to designate manufacturer and type.
- 1.6.2. Store firestopping materials in dry areas, protected from wetting and traffic.

**PART 2 - PRODUCTS**

**2.1. Materials**

- 2.1.1. Firestopping and smoke seal systems shall be in accordance with CAN4-S115-M85; asbestos-free materials and systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of CAN4-S115-M85 and not to exceed opening sizes for which they are intended.
- 2.1.2. Service penetration assemblies; certified by ULC in accordance with CAN4-S115-M85, and listed in ULC Guide No. 40 U19.
- 2.1.3. Service penetration firestop components; certified by ULC in accordance with CAN4-S115-M85, and listed in ULC Guide No. 40 U19.3 and ULC Guide No. 40 U19.5 under the Label Service of ULC.
- 2.1.4. Firestop systems ratings shall be in accordance with Drawings and as specified herein.
- 2.1.5. Fire resistance rating of installed firestopping assembly not be less than the fire resistance rating of the surrounding floor and wall assembly.
- 2.1.6. Firestopping and smoke seals at openings intended for ease of re-entry such as cables : elastomeric seal; do not use cementitious or rigid seal at such locations.
- 2.1.7. Firestopping and smoke seals at openings around penetrations for pipes, ductwork, and other mechanical items requiring sound and vibration control: elastomeric seal; do not use a cementitious or rigid seal at such locations.
- 2.1.8. Primers - to manufacturer's recommendations for specific material, substrate and end use.
- 2.1.9. Water - potable, clean and free of injurious amounts of deleterious substances.
- 2.1.10. Damming and back-up materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.
- 2.1.11. Sealants for vertical joints: non sagging.

## **2.2. Joint Firestops**

### **2.2.1. Vertical Joints**

2.2.1.1. Type "MW" insulation, packaging marked with ULC label, minimum 95 mm depth, as supplied by Instant Firestop Inc., North York, Ontario.

### **2.2.2. Horizontal Joints**

2.2.2.1. "A/D Firebarrier Mineral Wool" insulation, packaging marked with ULC label, minimum 88 mm depth, as supplied by A/D Fire Protection Systems Inc.

## **2.3. Service Penetrations**

2.3.1. For both horizontal and vertical separations.

2.3.2. Permanent Forming Material: mineral wool insulation minimum density of 70.5 kg/m<sup>3</sup>.

2.3.3. Temporary Forming Material: nominal 25 mm thick, polystyrene boards.

2.3.4. Fire Stop System Component: Type "Fire Stop Sealant, Cat. 2000 or CS 2400" by Dow Corning Canada Inc. or A/D Firebarrier Silicone by A/D Fire Protection Systems Inc. Tremstop Fyre-Sil Silicone by Tremco Canada.

## **PART 3 - EXECUTION**

### **3.1. Preparation**

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

3.1.2. Prepare surfaces in contact with firestopping materials and smoke seals to manufacturer's instructions.

3.1.3. Maintain insulation around pipes and ducts penetrating fire separation.

3.1.4. Mask where necessary to avoid spillage and over coating onto adjoining surfaces.

### **3.2. Installation**

3.2.1. Install firestopping and smoke seal materials and components in accordance with ULC certification and manufacturer's instructions.

3.2.2. Install firestopping assemblies of same fire resistance rating as for the fire resistance rating of the floor or wall or partition.

3.2.3. Seal holes or voids made by through penetrations, poke through termination devices and unpenetrated openings or joints to ensure continuity and integrity of fire separation and maintained.

3.2.4. Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.

- 3.2.5. Tool or trowel exposed surfaces to a neat finish.
- 3.2.6. Remove excess compound promptly as work progresses and upon completion.

3.2.7. **Joint Firestops**

3.2.7.1. **Vertical Joints**

- 3.2.7.1.1. Install specified insulation in one piece in accordance with manufacturers printed recommendations, width of insulation to be not greater than 75% of uncompressed width of insulation, to meet requirements of ULC System No. JF3.

3.2.7.2. **Horizontal Joints**

- 3.2.7.2.1. Install specified insulation to minimum 88 mm depth, uncompressed width of insulation to be 1/3 wider than opening, butt end joints; to meet requirements of ULC System No. JF9.

3.2.8. **Service Penetrations**

- 3.2.8.1. For both horizontal and vertical separations.
- 3.2.8.2. To meet requirements of ULC System No. SP83.
- 3.2.8.3. For floor assembly:
  - 3.2.8.3.1. Install 70 mm mineral wool centred in opening.
  - 3.2.8.3.2. Install 12.7 mm thick firestop component to top side (floor).
- 3.2.8.4. For wall assembly:
  - 3.2.8.4.1. Install 57 mm mineral wall centred in opening.
  - 3.2.8.4.2. Install 12.7 mm thick firestop component to both sides of opening.

3.3. **Inspection**

- 3.3.1. Notify both Architect and authorities having jurisdiction when ready for inspection and prior to concealing or enclosing firestopping materials and service penetration assemblies.

3.4. **Schedule**

- 3.4.1. Install firestop and smoke seal at:
  - 3.4.1.1. Penetrations through fire resistance rated masonry, concrete and gypsum board partitions and walls.
  - 3.4.1.2. Edge of floor slabs at curtain wall and precast concrete panels.
  - 3.4.1.3. Top of fire resistance rated masonry and gypsum board partitions.
  - 3.4.1.4. Intersections of fire-resistance rated masonry and gypsum board partitions.
  - 3.4.1.5. Control and swag joints in fire resistance rated masonry and gypsum board partitions and walls.
  - 3.4.1.6. Penetrations through fire-resistance rated floor slabs, ceilings and roofs.
  - 3.4.1.7. Openings and sleeves installed for future use through fire separations.
  - 3.4.1.8. Around mechanical and electrical assemblies penetrating fire separations.
  - 3.4.1.9. Rigid ducts: firestopping to consist of bead of firestopping materials between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.

**3.5. Clean-up**

- 3.5.1. Remove excess materials and debris and clean adjacent surfaces immediately after application.
- 3.5.2. Remove temporary dams and forming after initial set of firestopping and smoke seal materials.

**End of Section**

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**PART 1 - GENERAL**

**1.1. Description**

**1.1.1. General Requirements**

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

**1.1.2. Work Performed by Other Sections Related to This Section is Specified in**

Section 04200: Raking of Masonry Joints

**1.1.3. 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

**1.2. Quality Assurance**

**1.2.1. Subcontractor Qualifications**

1.2.1.1. 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.

**1.3. References**

**1.3.1. Reference Standards**

- 1.3.1.1. Reference Standards quoted in Contract Documents refer to:
- 1.3.1.2. CGSB Specification 19-GP-5M, Sealing Compound, One Component, Acrylic Base, Solvent Curing.
- 1.3.1.3. CGSB Specification 19-GP-9Ma, Sealing Compound,
- 1.3.1.4. One Component, Silicone Base, Chemical Curing
- 1.3.1.5. CAN/CGSB-19.13-M82, Sealing Compound, One Component, Elastomeric, Chemical Curing.
- 1.3.1.6. CAN/CGSB-19.24-M80, Sealing Compound, Multi-Component, Chemical Curing.

**1.4. Submittals**

**1.4.1. Samples**

1.4.1.1. Submit samples of sealant and backing if requested.

**1.4.2. Product List**

1.4.2.1. Submit manufacturer's and product's name for each sealant which will be used for Project, before commencing joint sealing.



**1.5. Site Conditions**

**1.5.1. Environmental Conditions**

- 1.5.1.1. Apply sealants only to completely dry surfaces, and at air and material temperatures above minimum established by manufacturer's specifications.

**1.6. Warranty**

**1.6.1. Extended Warranty**

- 1.6.1.1. 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.
- 1.6.1.2. 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**

**2.1. Materials**

- 2.1.1. All materials utilized in a sealant system shall be compatible.

- 2.1.2. Specified proprietary products are minimum acceptable quality. Products of other manufacturers of equal or superior quality will be accepted where specifically approved by Architect.

**2.1.3. Sealants**

- 2.1.3.1. Provide sealant formulation recommended by manufacturer for type of joint, substrate and service conditions applicable.
- 2.1.3.2. Refer to Caulking Schedule for utilization of the following sealants.
- 2.1.3.3. Colours of sealants will be selected from manufacturer's standard range.
- 2.1.3.4. Acrylic Solvent Release, One Part, Sealant:
- 2.1.3.4.1. To meet specified requirements of CGSB Specification 19-GP-5.
- 2.1.3.4.2. PTI 738 by P.T.I. Sealants Ltd.
- 2.1.3.5. Two Part Urethane Sealant:
- 2.1.3.5.1. To meet specified requirements of CAN/CGSB-19.24-M80, and as recommended by manufacturer for conditions.
- 2.1.3.5.2. Dymeric 240 by Tremco Canada.
- 2.1.3.6. One Part Urethane Sealant:
- 2.1.3.6.1. To meet specified requirements of CAN/CGSB-19.13-M82, and as recommended by manufacturer for conditions.
- 2.1.3.6.2. Vulkem 45 SSL by Tremco Canada
- 2.1.3.6.3. Tremco Canada Dymonic FC

- 2.1.3.7. Silicone Sealant: One Part Sealant:
  - 2.1.3.7.1. To meet specified requirements of CAN/CGSB-19.13-M82. Tremsil 200 by Tremco (Canada) Ltd., or as otherwise approved.
- 2.1.3.8. Two Part Polyepoxide Urethane Sealant:
  - 2.1.3.8.1. To meet specified requirements of CAN/CGSB-19.24-M80. Dymeric by Tremco (Canada) Ltd.
- 2.1.3.9. One Part Polysulphide Sealant:
  - 2.1.3.9.1. To meet specified requirements of CAN/CGSB-19.13-M82.
- 2.1.3.10. Two Part Polysulphide Sealant:
  - 2.1.3.10.1. For use in joints except where subjected to traffic:
  - 2.1.3.10.2. To meet specified requirements of CAN/CGSB-19.24-M80, non-sag, with a Shore "A" hardness range of 20 to 35.
- 2.1.3.11. Two Part Polysulphide Sealant:
  - 2.1.3.11.1. For use at surfaces subjected to traffic:
  - 2.1.3.11.2. To meet specified requirements of CAN/CGSB-19.24-M80, self-levelling, with a Shore "A" hardness range of 35 to 40.
- 2.1.4. **Primer**
  - 2.1.4.1. 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.
- 2.1.5. **Sealant Backing (Bedding Material)**
  - 2.1.5.1. 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.
- 2.1.6. **Void Filler**
  - 2.1.6.1. Mineral fibre as specified in Section 07200.
- 2.1.7. **Bond Breaker**
  - 2.1.7.1. For installation where minimum specified depth of joints is unobtainable. Pressure sensitive plastic tape, 3M 3266 or #481.

### **PART 3 - EXECUTION**

#### **3.1. Examination**

- 3.1.1. 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.

- 3.1.2. 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.
- 3.1.3. Verify specified environmental conditions are ensured before commencing joint sealing.
- 3.1.4. Defective sealed joints resulting from application to unsatisfactory joint conditions will be considered the responsibility of this Section.
- 3.1.5. **Preparation**
  - 3.1.5.1. 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.
  - 3.1.5.2. 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.
  - 3.1.5.3. Use method of preparation suitable for substrate as recommended by sealant manufacturer, and that does not damage adjacent surfaces.
  - 3.1.5.4. Ensure that releasing agents, coatings or other treatments have either not been applied to joint surfaces, or that they are entirely removed.
- 3.1.6. **Application**
  - 3.1.6.1. 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:
    - 3.1.6.1.1. Perimeter joints of exterior and interior pressed steel opening frames where installed in masonry and a weathertight joint is otherwise required.
    - 3.1.6.1.2. Perimeter joints of exterior and interior aluminum opening frames.
    - 3.1.6.1.3. Perimeter joints of exterior louvre and vent frames.
    - 3.1.6.1.4. Joints between underside of window sills and walls.
    - 3.1.6.1.5. Exposed control joints in masonry walls.
    - 3.1.6.1.6. Exposed expansion joints in masonry walls.
    - 3.1.6.1.7. Exposed control joints in concrete except for floors.
    - 3.1.6.1.8. Exposed expansion joints in concrete.
    - 3.1.6.1.9. Raked joints at masonry wall junctions and masonry to concrete junctions.
    - 3.1.6.1.10. Interior and exterior exposed joints, between dissimilar materials, and not concealed from view.
    - 3.1.6.1.11. Exposed control joints in gypsum/fiber reinforced gypsum panels.
    - 3.1.6.1.12. Joints at wall floor junctions, and at floors unless indicated on Drawings.
    - 3.1.6.1.13. Full length of exterior door saddles.

- 3.1.6.1.14. Close-fitted space between mechanical and electrical ducts, conduits and pipes, and walls and also at floors where fire separations must be maintained.
- 3.1.6.1.15. Joints between base angle and structure at preformed metal siding.
- 3.1.6.1.16. Prime surfaces to receive sealants as required by substrate and manufacturer's specifications to ensure positive and permanent adhesion, and to prevent staining.
- 3.1.6.1.17. Pack joints tightly with sealant backing set at depth specified for sealant. Fill other voids with filler.
- 3.1.6.1.18. Install bond breaker tape in bottom of joints in lieu of sealant backing where proper depth cannot be obtained when backing is installed.
- 3.1.6.1.19. Maintain depth of sealant as follows for joint widths of
  - 3.1.6.1.19.1. : 6 mm (minimum joint width): joint depth 6 mm.
  - 3.1.6.1.19.2. : 6 to 13 mm: depth equal to joint width.
  - 3.1.6.1.19.3. : 13 to 25 mm: depth equal to 1/2 joint width.
  - 3.1.6.1.19.4. : 25 to 50mm: maximum depth of 13 mm.
- 3.1.6.1.20. Install sealant in joints over 50 mm wide only after consultation with and approval of sealant manufacturer.
- 3.1.6.1.21. 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.
- 3.1.6.1.22. Tool surface of joints to a slight concave profile.
- 3.1.6.1.23. Make compounds workable only as manufacturer specifies.
- 3.1.6.1.24. Caulk joints in site painted materials after adjacent surfaces have been painted. Match compound to paint colour.
- 3.1.6.1.25. Do not allow sealants to cover or spot surfaces outside of joints. Use masking tape protection to prevent coating of adjacent surfaces if necessary.

### 3.1.7. **Cleaning**

- 3.1.7.1. Remove sealant smears and drippings, and masking tape immediately on completion of joint sealing.
- 3.1.7.2. 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.
- 3.1.7.3. Instruct Contractor on proper final cleaning methods.

### 3.1.8. **Caulking Schedule**

#### 3.1.8.1.1. **Type 1 Sealant**

- 3.1.8.1.1.1. One or Two Part Polysulphide Sealant, or
- 3.1.8.1.1.2. One or Two Part Urethane Sealant, or
- 3.1.8.1.1.3. One Part Silicone Sealant, or
- 3.1.8.1.1.4. Use at all locations except where another is specified.

#### 3.1.8.1.2. **Type 2 Sealant**

- 3.1.8.1.2.1. Use at exterior joints between window frames and masonry.

3.1.8.1.3. **Type 3 Sealant**

- 3.1.8.1.3.1. One part Clear Silicone Sealant, mildew resistant.
- 3.1.8.1.3.2. Use at joints between:
  - 3.1.8.1.3.2.1. Washroom fixtures and wall,
  - 3.1.8.1.3.2.2. Washroom fixtures, water closets and floor,
  - 3.1.8.1.3.2.3. Countertops and wall,
  - 3.1.8.1.3.2.4. Cabinets and walls and adjacent finishes.

**End of Section**

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**PART 1 - GENERAL**

**1.1. Description**

**1.1.1. General Requirements**

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

**1.1.2. 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

**1.1.3. 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.

**1.2. Quality Assurance**

**1.2.1. Subcontractor Qualifications**

1.2.1.1. 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.

**1.2.2. Requirements of Regulatory Agencies**

- 1.2.2.1. Construct fire rated doors and frames of ratings indicated in accordance with validating label requirements, otherwise required by jurisdictional authorities.
- 1.2.2.2. Ensure hardware and installation meet CAN4-S104 requirements, Standard Method for Fire Tests of Door Assemblies adopted by Insurance Advisory Organization, when applicable.
- 1.2.2.3. Doors and frames indicated as labelled, to meet conditions of NFPA No. 80, for installation, and shall have attached ULC labels.

**1.3. References**

**1.3.1. Reference Standards**

- 1.3.1.1. Reference standards quoted in Contract Documents refer to:
- 1.3.1.2. ASTM A366-72, Specification for Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.
- 1.3.1.3. ASTM A525-81, Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, General Requirements.
- 1.3.1.4. ASTM A526-80, Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.
- 1.3.1.5. ASTM A780-80, Standard Practice for Repair of Damaged Hot-Dip Coatings.

- 1.3.1.6. CGSB Specification 1-GP-132M, Primer, Zinc Chromate, Low Moisture Sensitivity.
- 1.3.1.7. CGSB Specification 1-GP-140M, Primer, Red Lead, Iron Oxide, Oil Alkyd Type.
- 1.3.1.8. CGSB Specification 31-GP-105M, Coating, Conversion, Zinc Phosphate, for Paint Base.
- 1.3.1.9. CGSB Specification 1-GP-181M, Coating, Zinc Rich, Organic, Ready Mix.
- 1.3.1.10. CSA Standard G164-M1981, Hot-Dip Galvanizing of Irregularly shaped Articles.

#### **1.4. Submittals**

##### **1.4.1. Shop Drawings**

- 1.4.1.1. Submit shop drawings.

#### **1.5. Delivery, Storage, and Handling**

- 1.5.1. Brace frame units to prevent distortion in shipment. Protect finished surfaces by sturdy protective wrappings.
- 1.5.2. 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.
- 1.5.3. Repair damage to finishes immediately as it occurs with matching specified finish materials.

### **PART 2 - PRODUCTS**

#### **2.1. Materials**

##### **2.1.1. Steel Sheet**

- 2.1.1.1. 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.

##### **2.1.2. Prime Paint**

- 2.1.2.1. General: Ensure that primers are compatible with specified finish paint.
- 2.1.2.2. Primer: To meet requirements of CGSB Specification 1-GP-132, 1-GP-81, or 1-GP-140.

##### **2.1.3. Galvanizing**

- 2.1.3.1. Full galvanized sheet steel; coating to meet specified requirements of ASTM Specification A525, zinc coating designation Z275.
- 2.1.3.2. Wiped coated sheet steel; zinc wiped coating to meet specified requirements of ASTM Specification A525, zinc coating ZF75.
- 2.1.3.3. Galvanized accessories; zinc coating to meet specified requirements of CSA Standard G164, including Appendix A.

2.1.4. **Zinc Rich Paint**

2.1.4.1. To meet specified requirements of CGSB Specification 1-GP-181.

2.1.5. **Panel Insulation**

2.1.5.1. At exterior: Polyurethane: closed cell rigid board, density; 32 kg/cubic metre.

2.1.6. **Grilles**

2.1.6.1. E.H. Price, Series STG1, steel, prime painted, sizes as shown on Door Schedule.

2.1.7. **Door Bumpers**

2.1.7.1. Single stud rubber at interior openings.

2.1.8. **Door Core Materials**

2.1.8.1. Honeycomb: Structural small cell 25mm (1") maximum Kraft paper 'honeycomb'. Weight: 36.3 (80lb) per ream (minimum). Density: 16.5kg/m<sup>3</sup> (1.03pcf) minimum, sanded to required thickness.

2.1.8.2. 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.

2.1.8.3. Polystyrene: EPS polystyrene, Type 1, density: 16 to 32 kg/m<sup>3</sup> (1 to 2 pcf), thermal values: RSI 1.06 (R 6.0) minimum, conforming to ASTM C578-09e1.

2.1.9. **Adhesives**

2.1.9.1. Heat resistant, single component, polyurethane reactive (water) hot melt, thermoset adhesive.

2.1.9.2. Rigid insulation cores: Heat resistant, epoxy resin based, low viscosity, contact cement.

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

2.1.10. **Acceptable Manufacturers**

2.1.10.1. All Steel Doors 2000 Ltd.

2.1.10.2. Artek Door (1985) Ltd.

2.1.10.3. Daybar Industries Ltd.

2.1.10.4. Fleming-Baron Door Products, an ASSA ABLOY group company.

2.1.10.5. Trillium Steel Doors Limited.

2.1.10.6. Vision Hollow Metal Limited.

2.2. **Door and Frame Systems**

2.2.1. **Exterior Framing**

2.2.1.1. 2.0 mm thick steel frames, fully welded; minimum 170 mm jamb depth.

2.2.1.2. Frame sizing shall be of the metric size shown in Door and Frame Schedules.



2.2.2. **Interior Frames**

- 2.2.2.1. 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.
- 2.2.2.2. For Drywall Partitions: 1.6 mm thick welded construction; throat size to suit partition.
- 2.2.2.3. Frame sizing shall be of the metric size shown in Door and Frame Schedules.

2.2.3. **Doors**

- 2.2.3.1. Interior: Wood by 08210.
- 2.2.3.2. Door sizing shall be of the metric size shown in Door and Frame Schedule or to suit existing openings.

2.3. **Fabrication**

2.3.1. **General**

- 2.3.1.1. Fit & assemble fabrication in shop where possible. Make trial assembly in shop when not possible.
- 2.3.1.2. Fabricate, reinforce and anchor component parts and assemblies, to support loads usage will impose without deflection detrimental to function, appearance or safety.
- 2.3.1.3. Reinforce components to resist stresses imposed by hardware in use.
- 2.3.1.4. Prepare frames and doors for specified hardware with mortises, and reinforcement. Drill and tap to template information. Incorporate steel reinforcement of
  - 2.3.1.4.1. : 1.6 mm thick flush bolts, locks & strikes.
  - 2.3.1.4.2. : 6.4 mm for hinges.
  - 2.3.1.4.3. : 4.8 mm for push/pulls and panic devices.
  - 2.3.1.4.4. : 2.7 mm thick for surface mounted hardware, and door closer brackets and arms.
- 2.3.1.5. Install metal mortar guards of minimum 0.76 mm thick steel at cutouts for hardware in frames installed in masonry walls.
- 2.3.1.6. Reinforce all frames for closers.
- 2.3.1.7. Provide for anticipated expansion and contraction of frames and supports.
- 2.3.1.8. Fit elements at intersections & joints accurately together in true planes, plumb & level.
- 2.3.1.9. Weld frame and door assemblies together. Weld continuously at joint exposed to view or at joints through which air or water could penetrate from the exterior of building to the interior.
- 2.3.1.10. Where welding is impossible, connections may be bolted. Ream drilled holes and leave exposed edges clean and smooth.
- 2.3.1.11. Isolate from each other dissimilar metals, and metal from concrete or masonry or prevent electrolysis.
- 2.3.1.12. 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.

2.3.2. **Pressed Steel Door Frames and Screen Frames**

- 2.3.2.1. Supply frames to suit construction conditions and dimensions indicated on drawings and in Door and Frame Schedule.
- 2.3.2.2. Schedule of fabrication and delivery must be such that it will not delay the project.
- 2.3.2.3. Fabricate interior frames of wipe coat galvanized steel and exterior frames of full galvanized sheet steel.
- 2.3.2.4. Fabricate steel frames in minimum thickness of 1.6 mm thick sheet steel unless otherwise specified or indicated.
- 2.3.2.5. Use 2.0 mm thick sheet steel for exterior frames.
- 2.3.2.6. 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.
- 2.3.2.7. Fabricate removable stops of minimum 0.91 mm thick steel. Do not weld stop corners.
- 2.3.2.8. Install recessed weatherstripping in stops of exterior doors.
- 2.3.2.9. Finish frame with one coat of galvanized primer on zinc coated surfaces exposed to view.
- 2.3.2.10. Where members join at corners, cut mitres and weld continuously along inside of sections.
- 2.3.2.11. Where tubular frame sections meet frame members, join by butt welding.
- 2.3.2.12. 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.
- 2.3.2.13. 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.
- 2.3.2.14. Install 3 bumpers in interior frames at single opening latch jambs, and 2 at double door frame heads.
- 2.3.2.15. Fasten removable stops by countersunk Phillips head screws at approximately 225 mm o.c. symmetrically spaced on stop length.
- 2.3.2.16. Anchor frames at floor by 1.5 mm thick angle clips, welded to frame and provided with two holes for floor anchorage.
- 2.3.2.17. 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.
- 2.3.2.18. For frames in stud walls, weld L clip at bottom of frame for anchor to floor slabs.

2.3.3. **Steel Doors and Panels**

- 2.3.3.1. Fabricate steel doors and panels to a thickness of 45mm (1-3/4"). Unless indicated otherwise.
- 2.3.3.2. **Insulated doors and panels:**
  - 2.3.3.2.1. Face sheets fabricated from 1.5 mm (0.06") 16 gauge steel.
  - 2.3.3.2.2. Insulation core: Polystyrene.
  - 2.3.3.2.3. Longitudinal edges mechanically interlocked.
  - 2.3.3.2.4. Adhesive assisted with edge seams visible.
- 2.3.3.3. **Interior doors and panels:**
  - 2.3.3.3.1. Face sheets fabricated from 1.5 mm (0.06") 16 gauge steel.
  - 2.3.3.3.2. Honeycomb core.

- 2.3.3.3.3. Longitudinal edges mechanically interlocked
- 2.3.3.3.4. Adhesive assisted with edge seams visible.
- 2.3.3.4. **Temperature rise rated doors and panels:**
  - 2.3.3.4.1. Face sheets fabricated from 1.3mm (0.05") 18 gauge steel.
  - 2.3.3.4.2. TRR asbestos free core.
  - 2.3.3.4.3. Longitudinal edges mechanically interlocked.
- 2.3.3.5. 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.
- 2.3.3.6. Formed edges shall be true and straight with minimum radius for the thickness of steel used.
- 2.3.3.7. Lock and hinge edges shall be bevelled 3 mm in 50 mm (1/8" in 2") unless hardware or door swing dictates otherwise.
- 2.3.3.8. 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.
- 2.3.3.9. Prior to shipment, mark each door with an identification number as shown on the approved submittal drawings.
- 2.3.3.10. 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.
- 2.3.3.11. Blank, reinforce, drill and tap doors for mortised, templated hardware. Locate to manufacturer's standard unless indicated otherwise.
- 2.3.3.12. Holes 12.7mm (1/2") and larger shall be factory prepared.
- 2.3.3.13. **Glazing:**
  - 2.3.3.13.1. 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.
  - 2.3.3.13.2. 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 1/4") oval head Tek™ (self-drilling) type at 305 mm (12") on centre maximum.
  - 2.3.3.13.3. 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.
- 2.3.3.14. Fabricate closing stiles of paired doors as indicated or scheduled.
- 2.3.3.15. 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.

## 2.4. **Finishing**

- 2.4.1. File and grind exposed welds smooth so that assemblies have appearance of one piece construction. Fill depressions with metal filler and finished
- 2.4.2. 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.
- 2.4.3. 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**

#### **3.1. Examination**

- 3.1.1. 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.

#### **3.2. Installation**

##### **3.2.1. Pressed Steel Frames**

- 3.2.1.1. Setting up of pressed steel frames in masonry walls is included in Section 06200.
- 3.2.1.2. Building in of pressed steel frames is included in Section 04200 of Specification.
- 3.2.1.3. Setting up and building in of pressed steel frames in metal stud drywall partitions is included in Section 05500 and Section 09250.
- 3.2.1.4. Secure frames to floor construction with two fasteners each jamb, set and brace securely to maintain true alignment until built in.

#### **3.3. Adjustment and Cleaning**

- 3.3.1. Refinish damaged and defective fabrications before completion. Refinish exposed surfaces to ensure that no variation in appearance is discernible.
- 3.3.2. Clean surfaces in preparation for specified finishing at completion of installation.
- 3.3.3. Final cleaning is specified in Section 01710.

**End of Section**

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**PART 1 - GENERAL**

**1.1. Description**

**1.1.1. General Requirements**

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

**1.1.2. Work Performed by Other Sections Related to This Section is Specified in**

Section 06200: Installation of hardware supplied by Section 08710.  
Section 08110: Metal Doors and Frames  
Section 08710: Supply of Hardware  
Section 08800: Glazing  
Section 09900: Painting and Finishing

**1.1.3. Installation of Work Supplied by This Section is Specified in**

Section 06200: To install doors.

**1.2. Quality Assurance**

**1.2.1. Manufacturer Qualifications**

1.2.1.1. Manufacturers approved for fabrication of doors specified in this Section are  
: Super Structure Door Co. of Canada Limited  
: Cambridge Doors  
: Premium Forest  
: Premdor Inc.

**1.2.2. Requirements of Regulatory Agencies**

1.2.2.1. Construct fire rated doors of indicated ratings in accordance with validating label requirements and as otherwise required by jurisdictional authorities.  
1.2.2.2. Ensure that fire rated doors, together with specified frames, hardware and installation, meet requirements of NFPA No. 80, Standard for, Fire Doors and Windows, as adopted by Insurance Advisory Organization, and attach ULC labels for specified rating.

**1.3. References**

**1.3.1. Reference Standards**

1.3.1.1. Reference standards quoted in Contract Documents refer to:  
AWI 7<sup>th</sup> Edition Version 1.2 1999.  
CSA Standard 0132.2-M1977, Wood Doors.

**1.4. Delivery, Storage, and Handling**

1.4.1. Package doors: identify with labels.

1.4.2. Store doors flat at site in piles with bottom face on bottom of piles protected from moisture by water resistant material under skids supporting piles, top of piles covered, and air circulation provided at sides of piles.

- 1.4.3. Protect fire rated doors from moisture continuously from time of manufacture to completion of building.

**1.5. Site Conditions**

**1.5.1. Environmental Requirements**

- 1.5.1.1. Install doors only in areas that have dried out and where no further installation of damp materials is contemplated.
- 1.5.1.2. Moisture readings of building surfaces at storage and installation locations shall not exceed 15%.

**1.6. Warranty**

**1.6.1. Extended Warranty**

- 1.6.1.1. Submit warranty for wood doors specified this Section covering period for 2 years beyond the expiration of the warranty period specified in the General Conditions to the Contract.
- 1.6.1.2. Defects in doors shall include, but not be restricted to, surface blemishes, showing of core ghost lines, splitting, delamination, sagging, deterioration of core, and warping and twisting in excess of deformation allowed by CSA Standard 0132.2.
- 1.6.1.3. Replacement under the warranty shall include fitting, installation, reinstallation of hardware, grilles and glass, and finishing to match replaced door.

**PART 2 - PRODUCTS**

**2.1. General**

- 2.1.1. Wood doors to meet or exceed AWI 7<sup>th</sup> Edition Version 1.2 1999.
- 2.1.2. Doors shall be pre-fitted, bevelled and machines for mortise hardware items as per templates and approved hardware schedules provided.
- 2.1.3. Doors shall be factory finished.
- 2.1.4. Flush Interior Doors: 45mm thick, solid core construction, AWI type construction.

**2.2. Materials**

**2.2.1. Cores of Flush Doors**

- 2.2.1.1. Doors to be on piece core construction, no voids, Stiles and rails to be electrically glue bonded to particle core prior to abrasive sanding.
  - 2.2.1.1.1. Non-rated or 20 minute doors to meet AWI Section 1300, Type PC-5 at a minimum 33lbs/ft<sup>3</sup> particle board type to meet ANSI A208.1 LD-2.
  - 2.2.1.1.2. 45, 60 or 90 minute fire rated doors to meet AWI Section 1300, Type FD-5 mineral core (fire rated), complete with minimum 125mm wide tectonic blocking for closers, flush bolts, mortise pockets and fire exit devices.

2.2.2. **Wood Veneer Facing**

2.2.2.1. Wood Veneer facing: AWI AA Grade plain sawn Birch species. Slip matched.

2.2.2.2. Edge: close grain match Birch face veneer.

2.2.3. **Grilles**

2.2.3.1. Metal: Hart and Cooley No. T980V, prime painted, sizes as shown on Door Schedule.

2.2.4. **Glass stops**

2.2.4.1. Wood glass stops; premium grade Birch.

2.3. **Fabrication**

2.3.1. **General**

2.3.1.1. Fabricate doors, transom panels, side panels, to meet or exceed AWI Quality Standards for premium quality, for service in interior locations, in standard and non-standard sizes, and to designs as indicated on Drawings and Schedules.

2.3.1.2. Fabricate doors 44.5 mm thick of solid core construction unless indicated otherwise on Drawings or Schedules.

2.3.1.3. Incorporate solid wood blocking at locations where hinges, locksets, closures, and similar hardware is installed and applied.

2.3.1.4. Indicate top and hinge side on each door.

2.3.2. **Solid Core Door Construction**

2.3.2.1. Construct solid core doors of 5 or 7 plies.

2.3.2.2. Fabricate of framed construction with particle board cores, minimum density of 450 kg/cu.m. 57 mm minimum top and bottom rails, and minimum 38.1 mm stiles using Type II, urea-water resistant adhesive. Bond rails, stiles and faces to core.

2.3.3. **Edge Strips**

2.3.3.1. Laminate minimum 19 mm vertical edge strips to stiles.

2.3.3.2. Edge strips of stiles shall be of same species and grade as face veneer.

2.3.3.3. Match grain and colour of edge strips to face veneer in doors with stained/clear finishes.

2.3.3.4. Seal door edges in shop.

2.3.3.5. Bevel edges of lock stiles of single-acting doors.

2.3.4. **Glass Lights**

2.3.4.1. Prepare doors to receive glass as indicated on Drawings and Schedules.

2.3.4.2. Fabricate framing and stops as detailed.

2.3.4.3. Glue and mechanically fasten glass stops on exterior side only for security, mechanically fasten glass stops on interior.

2.3.4.4. Glass is specified for installation under the work of Section 08800.

2.3.5. **Door Grilles**

- 2.3.5.1. Prepare doors to receive grilles as indicated on Drawings and Schedules.
- 2.3.5.2. Fabricate framing and stops as detailed.
- 2.3.5.3. Install grilles.

2.3.6. **Panels**

- 2.3.6.1. Fabricate panels for transoms, for side panels, of same core, edge, and facing materials as for doors.
- 2.3.6.2. Rebate top of doors and bottom of transom panels.
- 2.3.6.3. In faces of natural or stained finish, match veneers of panels to adjoining doors. Use full length veneers to attain continuous grain sequence.

2.3.7. **Fire Rated Doors**

- 2.3.7.1. Fabricate fire rated doors for openings and with facings, indicated on Drawings and Schedules.

**PART 3 - EXECUTION**

3.1. **Installation**

- 3.1.1. Installation of wood doors is included in Section 06200.

**End of Section**



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**PART 1 - GENERAL**

**1.1. Description**

**1.1.1. General Requirements**

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

**1.1.2. Work Related to this Section Performed by Other Sections**

Section 08520: Aluminum Windows

**1.1.3. Work Performed by this Section but Specified Elsewhere**

Section 07920: To specify joint sealants.

Section 08800: To specify glazing.

**1.2. System Description**

**1.2.1. Tolerances**

1.2.1.1. 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.

1.2.1.2. 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.

1.2.1.3. Maintain tolerances for glazing as recommended by glass manufacturer.

1.2.1.4. 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.

**1.2.2. Design**

1.2.2.1. The entire exterior skin execution shall be based on the rain screen principle.

1.2.2.2. 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.

1.2.2.3. The air and vapour seals required to eliminate air borne vapour infiltration from the building into the system cavities.

- 1.2.2.4. 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.
- 1.2.2.5. 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.

1.2.3. **Structural Requirements**

- 1.2.3.1. Entrances must withstand a minimum windload of (30 psf) 1500 Pa with a maximum deflection of span/200.

1.2.4. **Performance**

- 1.2.4.1. 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.
- 1.2.4.2. There shall be no water infiltration into the building under 50% of design wind load.
- 1.2.4.3. 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.

1.3. **Quality Assurance**

1.3.1. **Glazing Requirements**

- 1.3.1.1. Conform to recommendations of Flat Glass Marketing Association (FMGA), Glazing Manual 1980 (GM) and Glazing Sealing Systems Manual 1970 (GSSM).

1.3.2. **Subcontractor Qualifications**

- 1.3.2.1. 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

1.3.3. **Welder Qualifications**

- 1.3.3.1. 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.

1.3.4. **Requirements of Regulatory Agencies**

- 1.3.4.1. Conform to requirements of authorities having jurisdiction in the fabrication and installation of components specified in this Section.

#### 1.3.5. Codes and Standards

Except as modified by governing codes and by the Contract Documents, comply with applicable provisions and recommendations of the following:

- 1.3.5.1. CSA W47.2-M1987 for welding of aluminum.
- 1.3.5.2. CSA W59-M1989 for welding of steel.
- 1.3.5.3. AAMA Aluminum Curtain Wall Design Manual.

### 1.4. References

#### 1.4.1. Reference Standards

- 1.4.1.1. Reference standards quoted in Contract Documents refer to:
- 1.4.1.2. ASTM A167-81a, Specification for Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
- 1.4.1.3. ASTM A480-81, Specification for General Requirements for Flat Rolled Stainless and Heat Resisting Steel Plate, Sheet and Strip.
- 1.4.1.4. ASTM A525-76, Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, General Requirements.
- 1.4.1.5. ASTM A780-80, Standard Practice for Repair of Damaged Hot-Dip Coatings.
- 1.4.1.6. CGSB Specification 41-GP-19Ma, Rigid Vinyl Extrusions for Windows and Doors.
- 1.4.1.7. CGSB Specification 79-GP-1M, Screens, Aluminum Frame, Window.
- 1.4.1.8. CGSB Specification 1-GP-108M, Paint, Acid and Alkali Resistant, Black.
- 1.4.1.9. CGSB Specification 1-GP-132M, Primer, Zinc Chromate, Low Moisture Sensitivity.
- 1.4.1.10. CGSB Specification 1-GP-181M, Coating, Zinc Rich, Organic, Ready Mix.
- 1.4.1.11. CAN/CSA3-G40.20/G40.21-M92, Structural Quality Steel.
- 1.4.1.12. CSA Standard G164-M92, Hot Dip Galvanizing of Irregularly Shaped Articles.
- 1.4.1.13. CSA Standard W47.1-92, Certification of Companies for Fusion Welding of Steel Structures.
- 1.4.1.14. CSA Standard W47.2-M1987, Aluminum Welding Qualification Code.
- 1.4.1.15. CSA Standard W59-M1989, Welded Steel Construction (Metal Arch Welding).

### 1.5. Submittals

#### 1.5.1. Shop Drawings

- 1.5.1.1. 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.

- 1.5.1.2. 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

1.5.2. **Samples**

- 1.5.2.1. 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.
- 1.5.2.2. 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.

1.5.3. **Maintenance Instructions**

- 1.5.3.1. Submit maintenance instructions for incorporation into Project Data Book.

1.6. **Delivery, Storage and Handling**

- 1.6.1. 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.
- 1.6.2. Under conditions of high humidity, heating or forced ventilation shall be provided to prevent the accumulation of surface moisture.
- 1.6.3. 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.
- 1.6.4. Protection of this work shall be the responsibility of this Section and the methods used shall be agreed with the Contractor.
- 1.6.5. 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.

**1.7. Warranty**

**1.7.1. Extended Warranty**

1.7.1.1. 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.

1.7.1.2. Without restricting the generality of the warranty, defects shall include failure to maintain true lines, plumbness and weather tightness under all conditions.

1.7.2. 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**

**2.1. Materials**

**2.1.1. Aluminum**

2.1.1.1. Extrusions: AA6063-T5, alloy and temper for framing, and otherwise where not exposed to suit specified and fabricator's requirements.

2.1.1.2. Exposed Anodized Sheet and Plate: AA 5005-H14, alloy and temper, or AA 1100-H14, anodizing quality.

2.1.1.3. Exposed sheets where painted: AA100-H14, alloy and temper.

2.1.1.4. Non-exposed sheets: AA3003-H14, alloy and temper, mill finish, or Alcan "Utility Sheet".

2.1.1.5. Exposed surfaces of aluminum shall be free of die marks, scratches, blisters, "leave-off" marks, or other blemishes which are visible.

**2.1.2. Steel**

2.1.2.1. Steel Framing: To meet specified requirements of CSA Standard G40.21, Grade 300W for rolled sections and Grade 350, Class H, for hollow sections.

**2.1.3. Stainless Steel**

2.1.3.1. ASTM Specifications A480-81, and A167-81a, Type 304.

**2.1.4. Finishes**

2.1.4.1. Anodic clear coating, Architectural Class 1, AA-M12C22A41 (.0007")

**2.1.5. Glass**

2.1.5.1. To meet specified requirements of Section 08800; 25 mm sealed insulating units and as specified herein.

2.1.6. **Glazing Gaskets**

- 2.1.6.1. Either neoprene or 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 Neoprene - TDB-270-1 or equal.

2.1.7. **Glazing Tape**

- 2.1.7.1. Polyisobutylene, with continuous molded-in synthetic rubber shim, in colour selected, Polyshim Tape by Tremco (Canada) Limited, or equivalent as approved.

2.1.8. **Sealants and Sealant Materials**

- 2.1.8.1. To meet specified requirements of Section 07920 and design performance requirements.

2.1.9. **Fastenings**

- 2.1.9.1. 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.

2.1.10. **Exposed Anchors**

- 2.1.10.1. Aluminum or stainless steel with aluminum materials; and otherwise to match metal anchored. Non-exposed: as for exposed or may be galvanized steel.

2.1.11. **Bituminous Paint**

- 2.1.11.1. To meet specified requirements of CGSB Specification 1-GP-108.

2.1.12. **Separator/Slip Gaskets**

- 2.1.12.1. Nylon as suitable for connection detail at moving faces of connections.

2.1.13. **Thermal Separator**

- 2.1.13.1. Solid extruded and thermally resistant sections with a durometer hardness of Shore "A" 50, ±5.

2.1.14. **Supporting Angles, Plates, Bars, Rods and Other Steel Accessories**

- 2.1.14.1. Mild steel CAN3-G40.21-M78, thickness as required to sustain imposed loads and in no case less than 4.8mm thick.

2.1.14.2. 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.

2.1.15. **Thermal Insulation**

2.1.15.1. Rigid glass fibre board, AF530 wall insulation manufactured by Fiberglas Canada Inc. in thickness indicated on Drawings with black coating on outer surface.

2.1.15.2. Loose Insulation: Glass fibre, density of 12 kg/cu.m., by Fiberglas Canada Inc.

2.1.15.3. **Foam Insulation**

2.1.15.3.1. One or two part, polyurethane, with a nominal density of 40 kg/m<sup>3</sup>, coefficient of linear expansion of 0.00006 mm/m/°C, water vapour transmission of 73 Ng/Pa5m<sup>2</sup> and thermal conductivity of 0.02 W/m°K.

2.1.15.3.2. Similar to products as produced by BASF Canada Inc.

2.1.16. **Hardware**

2.1.16.1. Refer to Section 07810.

2.2. **Products**

2.2.1. Specified manufacturers' catalogue references to Windspec Inc. establish the minimum standards for the products listed in this Section.

2.2.2. Unspecified materials which form a part of completed assemblies shall be of manufacturers' standard.

2.2.3. 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  
Alumicor Limited  
Alwind Industries

2.2.4. **Screens and Framing**

2.2.4.1. Framing: 2200 Series or equivalent by Windspec.

2.2.4.2. Finish:

: exterior: Dark Bronze anodized to match existing.

: back sections: Dark Bronze anodized to match existing.

Glazing: 25mm insulating glass units at exterior locations; Type 2.

2.2.4.3. Sills: extruded aluminium, with concealed anchor system or hold down clips, colour and finish to match framing.

2.2.4.4. Style: Combination of mullion depths, glazing rebates and caps as required by Drawings, and including door stops and cut pile weatherstripping.

2.2.5. **Hinged Doors**

- 2.2.5.1. Type: series 2200 thermally broken entrance framing by Windspec. Refer to drawings for dimensions of bottom, mid and top rails and stiles.
- 2.2.5.2. Glass: 25mm insulating glass units at exterior locations.  
Finish: Dark Bronze anodized to match existing.
- 2.2.5.3. Threshold: Extruded aluminum, clear finish, 12mm riser, overall width to match frames.
- 2.2.5.4. Weatherstripping: Cut pile weatherstripping and adjustable door bottoms for exterior doors.
- 2.2.5.5. Door Sweep: KN Crowder W-24S628.
- 2.2.5.6. Hinges: continuous, heavy duty Rotun hinge

2.3. **Fabrication**

- 2.3.1. Ensure glazing rebate provided with depth and width to accommodate specified glass in accordance with glass manufacturer's recommendations. Install glazing gaskets anchored to aluminium extrusions.

- 2.3.2. Provide structural support for air barrier tie-in.

2.3.3. **Framing Members**

- 2.3.3.1. Fabricate generally to dimensions/profiles indicated on drawings. Meet specified requirements and clearances to other construction components.
- 2.3.3.2. 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.
- 2.3.3.3. Provide glass setting, supports and stops to minimize possibility of glass breakage caused by structural inadequacy of frames, stops and frame joints, solar and thermal induced forces, within limitations of specified design performance criteria, as recommended by glass manufacturer.
- 2.3.3.4. Design system to ensure that site glazing may be performed in accordance with construction scheduling within environmental limitations specified in Section 08800.

2.3.4. **Assembly of Units**

- 2.3.4.1. Join members by welding where specified and otherwise where practicable.
- 2.3.4.2. 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.
- 2.3.4.3. 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.
- 2.3.4.4. Join members in shop fabricated units to fit flush with hairline joints.
- 2.3.4.5. Incorporate weepholes to drain off pocketed water. Baffle to prevent entry of driven water to conform to specified performance.



2.3.4.6. Except where shipping makes impossible, fabricate units in shop and ship completely assembled.

2.3.5. **Vapour Retarder and Air Barrier**

2.3.5.1. Maintain integrity of vapour retarder and air barrier system within systems installed by this Section and between systems and adjoining construction.

2.3.6. **Dissimilar Materials**

2.3.6.1. Protect material from electrolytic action when dissimilar metals are in contact with one another with two coats of bituminous paint or other approved means.

2.3.6.2. Protect aluminum concealed in contact with masonry with two coats of bituminous paint.

2.3.7. **Anchors**

2.3.7.1. Incorporate anchorage to structure to support units adequately when subjected to specified loads.

2.3.7.2. Allow for complete adjustment in anchorage for levelling and positioning of units during installation.

2.3.8. **Doors**

2.3.8.1. Fabricate doors with stiles and rails of extruded aluminum with major portions of 3mm minimum thickness.

2.3.8.2. Join stiles to rails with sigma deep penetration welds and mechanical fastening.

2.3.8.3. Provide flush glazing.

2.3.8.4. Incorporate weatherstripping.

2.3.8.5. Provide for master-keyed lock cylinders.

2.3.9. **Fastenings**

2.3.9.1. Where fastenings are exposed to dampness or moisture, use cadmium plated steel for steel-to-steel, aluminium for aluminium-to-aluminium, and stainless steel otherwise or alternatively for all above.

2.3.9.2. 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.

2.3.10. **Thermal Movement**

2.3.10.1. 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.

2.3.11. **Mullions**

2.3.11.1. Fabricate mullions to provide for specified thermal movement without damage to adjacent units.

2.3.12. **Dissimilar Materials**

- 2.3.12.1. Protect material from electrolytic action when dissimilar metals are in contact with one another.
- 2.3.12.2. Protect aluminium concealed in contact with masonry with a heavy coating of bituminous paint.

2.3.13. **Anchors**

- 2.3.13.1. 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.
- 2.3.13.2. Allow for complete adjustment in anchorage for levelling and positioning of units during installation.

2.3.14. **Attachment of Hardware**

- 2.3.14.1. Match hardware fastenings to metal of hardware.
- 2.3.14.2. Attach hardware by bolts or machine screws into tapped reinforcing plates.

2.3.15. **Weatherstripping**

- 2.3.15.1. Secure weatherstripping in place by mechanical means only, and in a manner to enable its removal and replacement without special tools.
- 2.3.15.2. Ensure that continuity of weatherstripping is maintained around openings.
- 2.3.15.3. 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.
- 2.3.15.4. Install adjustable sweeps at bottom rails of doors.

2.3.16. **Thermal Break**

- 2.3.16.1. Incorporate a thermal break in frames in which insulating glass units are installed.

2.3.17. **Finishing**

- 2.3.17.1. 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**

**3.1. Examination**

- 3.1.1. 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.

- 3.1.2. Ensure that anchors and inserts, installed by others, are adequate to meet specified requirements, and make adaptations before installation.

### **3.2. Installation**

#### **3.2.1. General**

- 3.2.1.1. Coordinate fabrication of components specified in this Section with requirements of other Sections to ensure proper anchorage and fitting.
- 3.2.1.2. 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.
- 3.2.1.3. Do not force units into place, nor superimpose on them loads for which they were not designed.
- 3.2.1.4. Install vapour retarder and air barrier to ensure complete continuity and integration of vapour retarder and air barrier system.
- 3.2.1.5. Provide structural support for air barrier to prevent its displacement or its loss of seal when subjected to forces specified for design performance.
- 3.2.1.6. Install metal flashing to drain cavities in system. Secure flashings permanently to prevent displacement, leaks, and noise.
- 3.2.1.7. Provide for thermal movement to take place between shop fabricated assemblies and between assemblies and adjacent construction.
- 3.2.1.8. Secure units by non-corrosive anchorage materials. Use of wood or fibre is not acceptable.
- 3.2.1.9. Conceal anchors, clips, blocking, and all other attachments.
- 3.2.1.10. Install reinforcing and supporting members as indicated and required structurally as part of the work of this Section.
- 3.2.1.11. 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.
- 3.2.1.12. 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.
- 3.2.1.13. Install units with consideration for finish variations. Abrupt variations of appearance or colour in adjacent components will not be acceptable without approval before installation.
- 3.2.1.14. Coat all damaged prime painted surfaces of anchorage with rust inhibiting paint after welding is completed.
- 3.2.1.15. Apply two coats zinc rich paint to metal surfaces bared by removal of galvanizing.
- 3.2.1.16. Apply one coat of prime paint to metal surfaces bared by removal of shop applied primer.

#### **3.2.2. Welding**

- 3.2.2.1. 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.
- 3.2.2.2. Detailed welding procedure covering specified welds on erection and shop drawings may be requested for approval by the Consultant.
- 3.2.2.3. Take precautions during welding to prevent damage or staining of adjacent surfaces.
- 3.2.2.4. Remove prime paint from surfaces to be welded.

3.2.3. **Caulking**

- 3.2.3.1. 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.

3.2.4. **Glazing**

- 3.2.4.1. 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.

3.3. **Adjustment and Cleaning**

3.3.1. **Adjusting**

- 3.3.1.1. Adjust doors to operate smoothly and fit tightly when closed and locked.  
3.3.1.2. Adjust hardware to operate smoothly, with proper tension and lubricate.  
3.3.1.3. Ensure that weatherstripping does not cause binding to prevent closing and locking, and that it makes weathertight contact.  
3.3.1.4. Adjust closers after doors are glazed, and other hardware and vestibule doors are installed.

3.3.2. **Cleaning on Completion of Installation**

- 3.3.2.1. Remove deposits which affect appearance or operation of units.  
3.3.2.2. Remove protective materials.  
3.3.2.3. Clean interior and exterior surfaces by washing with clear water; or with water and soap or detergent; followed by a clear water rinse.  
3.3.2.4. Clean and restore stained metal surfaces in accordance with manufacturer's recommendations. Replace if cleaning is impossible.  
3.3.2.5. Final cleaning is specified in Section 01710.

3.4. **Protection**

- 3.4.1. 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.
- 3.4.2. 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.
- 3.4.3. Remove protection from metal glazing surfaces before installation of glass.
- 3.4.4. Maintain protection from time of installation to final clean up in accordance with Sections 01040 and 01500.

**End of Section**

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**PART 1 - GENERAL**

1.1. **Description**

1.1.1. **General Requirements**

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

1.1.2. **Work Related to this Section Performed by Other Sections**

1.1.2.1 Section 07240: Composite Building Panels

1.1.2.2 Section 08460: Aluminium Curtain Wall, Screens and Entrances

1.1.2.3 Section 08800: Glass and Glazing

1.1.3. **.3 Work Performed by this Section but Specified Elsewhere**

1.1.3.1 Section 07920: To specify joint sealants.

1.1.3.2 Section 08800: To specify glazing.

1.2. **.2 System Description**

1.2.1. **Tolerances**

1.2.1.1 Fabricate frames to a tolerance of + 1.5mm for vertical, horizontal, and diagonal dimensions of units under 1830mm, and + 3mm for dimensions greater than 1830mm.

1.2.1.2 Erect component parts within following tolerances

1.2.1.2.1 Variations from plumb:3mm maximum variation in storey height or 3m run, cumulative

1.2.1.2.2 Variations from level:3mm maximum variation in any bay or 6m run, non-cumulative

1.2.1.2.3 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:

1.2.1.2.4 Offsets in end-to-end or edge-to-edge alignment of adjoining members:1.5mm maximum offset in any alignment.

1.2.1.3 Maintain tolerances for glazing as recommended by glass manufacturer.

1.2.1.4 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.

1.2.2. **Design**

1.2.2.1 The entire window installation shall be based on the rain screen principle.

1.2.2.2 The system shall provide:

1.2.2.2.1 Such gaskets, baffles, overlaps and seals as required to provide a rain screen barrier to effectively deter rain water entry into cavities.

1.2.2.2.2 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.

- 1.2.2.3 The air and vapour seals required to eliminate air borne vapour infiltration from the building into the system cavities.
- 1.2.2.4 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.
- 1.2.2.5 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.

1.2.3. **Structural Requirements**

- 1.2.3.1 Window systems must withstand a minimum windload of (30 psf) 1500 Pa with a maximum deflection of span/200.

1.2.4. **Performance**

- 1.2.4.1 Air infiltration shall not exceed 3.05 to the power of negative four cu.m/s/sq.m. of curtain wall at 75 Pa pressure difference.
- 1.2.4.2 There shall be no water infiltration into the building under 50% of design wind load.
- 1.2.4.3 No condensation shall form on any interior surfaces of the aluminium members before any of the exposed area of the 25mm sealed units reaches the dew point temperature.

1.3. **Quality Assurance**

1.3.1. **Glazing Requirements**

- 1.3.1.1 Conform to recommendations of Flat Glass Marketing Association (FMGA), Glazing Manual 1980 (GM) and Glazing Sealing Systems Manual 1970 (GSSM).

1.3.2. **Contractor Qualifications**

- 1.3.2.1 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.
- 1.3.2.2 Perform Work of this Section by only one of the following Subcontractors:
  - 1.3.2.3 Kawneer
  - 1.3.2.4 Windspec Inc.
  - 1.3.2.5 Alwind Ltd
  - 1.3.2.6 Alumicor

1.4. **Quality Assurance**

1.4.1. **Requirements of Regulatory Agencies**

- 1.4.1.1 Conform to requirements of authorities having jurisdiction in the fabrication and installation of components specified in this Section.

1.5. **References**

1.5.1. **Reference Standards**

- 1.5.1.1 Reference standards quoted in Contract Documents refer to:
- 1.5.1.2 ASTM A167-81a, Specification for Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
- 1.5.1.3 ASTM A480-81, Specification for General Requirements for Flat Rolled Stainless and Heat Resisting Steel Plate, Sheet and Strip.
- 1.5.1.4 ASTM A525-76, Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, General Requirements.
- 1.5.1.5 ASTM A780-80, Standard Practice for Repair of Damaged Hot-Dip Coatings.
- 1.5.1.6 CGSB Specification 41-GP-19Ma, Rigid Vinyl Extrusions for Windows and Doors.
- 1.5.1.7 CGSB Specification 1-GP-108M, Paint, Acid and Alkali Resistant, Black.
- 1.5.1.8 CGSB Specification 1-GP-132M, Primer, Zinc Chromate, Low Moisture Sensitivity.
- 1.5.1.9 CGSB Specification 1-GP-181M, Coating, Zinc Rich, Organic, Ready Mix.
- 1.5.1.10 CAN3-G40.21-M81, Structural Quality Steel.
- 1.5.1.11 CSA Standard G164-M1981, Hot Dip Galvanizing of Irregularly Shaped Articles.

1.6. **.5 Submittals**

1.6.1. **.1 Shop Drawings**

- 1.6.1.1 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.
- 1.6.1.2 Shop drawings will contain the minimum following details:
  - 1.6.1.2.1 :jamb, head, and sill of units at junctions of facings, including air vapour seal
  - 1.6.1.2.2 :structure required for system that is supplied with system and not part of building structure
  - 1.6.1.2.3 :anchorage system
  - 1.6.1.2.4 :dielectric separator details
  - 1.6.1.2.5 :separator/slip gasket details
  - 1.6.1.2.6 :thermal separator details
  - 1.6.1.2.7 :flashing details

1.6.2. **.2 Samples**

- 1.6.2.1 Submit samples of unit frame profiles, glass and glazed sample assembly and insulated metal panel assembly prior to fabrication of units. Sample acceptance will be for colour, appearance, glazing methods only.

1.6.2.2 Submit samples for each finish and colour required. Submit samples finished on the specified alloy on 600mm lengths of extrusions or 600mm square of sheet or plate, showing maximum range or variation in colour and shade, and matching the Architect's samples in each case. Sample submittal and acceptance shall be for colour, texture and specular gloss.

1.6.3. **Maintenance Instructions**

1.6.3.1 Submit maintenance instructions for incorporation into Project Data Book.

1.7. **Delivery, Storage and Handling**

- 1.7.1. 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.
- 1.7.2. Under conditions of high humidity, heating or forced ventilation shall be provided to prevent the accumulation of surface moisture.
- 1.7.3. 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.
- 1.7.4. Protection of this work shall be the responsibility of this Section and the methods used shall be agreed with the Contractor.
- 1.7.5. 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 aluminium 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 aluminium 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 aluminium finish.

1.8. **Warranty**

1.8.1. **Extended Warranty**

- 1.8.1.1 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.
- 1.8.1.2 Without restricting the generality of the warranty, defects shall include failure to maintain true lines, plumbness and weather tightness under all conditions.
- 1.8.1.3 Warrant sash balances 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.
- 1.8.2. 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.



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## **PART 2 - PRODUCTS**

### 2.1. **Materials**

#### 2.1.1. **Aluminum**

- 2.1.1.1. Extrusions: AA6063-T5, alloy and temper for framing, and otherwise where not exposed to suit specified and fabricator's requirements.
- 2.1.1.2. Exposed Anodized Sheet and Plate: AA 5005-H14, alloy and temper, or AA 1100-H14, anodizing quality.
- 2.1.1.3. Exposed sheets where painted: AA100-H14, alloy and temper.
- 2.1.1.4. Non-exposed sheets: AA3003-H14, alloy and temper, mill finish, or Alcan "Utility Sheet".
- 2.1.1.5. Exposed surfaces of aluminum shall be free of die marks, scratches, blisters, "leave-off" marks, or other blemishes which are visible.

#### 2.1.2. **Steel**

- 2.1.2.1. Steel Sheet: Galvanized steel sheet to meet specified requirements of ASTM Specification A525, zinc coating designation ZF275.

#### 2.1.3. **Stainless Steel**

- 2.1.3.1. ASTM Specifications A480-81, and A167-81a, Type 304.

#### 2.1.4. **Finishes**

- 2.1.4.1. Anodic clear coating, Architectural Class 1, AA-M12C22A41 (.0004")

#### 2.1.5. **Glass**

- 2.1.5.1. To meet specified requirements of Section 08800; 25 mm sealed insulating glass units and single glazing and as specified herein.

#### 2.1.6. **Glazing Gaskets**

- 2.1.6.1. Either neoprene or 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:
  - 2.1.6.2. For EPDM - TDB-460-1 or equal.
  - 2.1.6.3. For Neoprene - TDB-270-1 or equal.

#### 2.1.7. **Glazing Tape**

- 2.1.7.1. Polyisobutylene, with continuous molded-in synthetic rubber shim, in colour selected, Polyshim Tape by Tremco (Canada) Limited, or equivalent as approved.

#### 2.1.8. **Sealants and Sealant Materials**

- 2.1.8.1. To meet specified requirements of Section 07920 and design performance requirements.

2.1.9. **Fastenings**

2.1.9.1. 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.

2.1.10. **Exposed Anchors**

2.1.10.1. Aluminum or stainless steel with aluminum materials; and otherwise to match metal anchored. Non-exposed: as for exposed or may be galvanized steel.

2.1.11. **Bituminous Paint**

2.1.11.1. To meet specified requirements of CGSB Specification 1-GP-108.

2.1.12. **Separator/Slip Gaskets**

2.1.12.1. Nylon as suitable for connection detail at moving faces of connections.

2.1.13. **Thermal Separator**

2.1.13.1. Solid extruded and thermally resistant sections with a durometer hardness of Shore "A" 50,  $\pm 5$ .

2.1.14. **Supporting Angles, Plates, Bars, Rods and Other Steel Accessories**

2.1.14.1. Mild steel CAN3-G40.21-M78, thickness as required to sustain imposed loads and in no case less than 4.8mm thick.

2.1.14.2. 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.

2.1.15. **Thermal Insulation**

2.1.15.1. Rigid glass fibre board, AF530 wall insulation manufactured by Fiberglas Canada Inc. in thickness indicated on Drawings with black coating on outer surface.

2.1.15.2. Loose Insulation: Glass fibre, density of 12 kg/cu.m., by Fiberglas Canada Inc.

2.1.15.3. **Foam Insulation**

2.1.15.3.1 One or two part, polyurethane, with a nominal density of 40 kg/m<sup>3</sup>, coefficient of linear expansion of 0.00006 mm/m/°C, water vapour transmission of 73 Ng/Pa5m<sup>2</sup> and thermal conductivity of 0.02 W/m<sup>2</sup>K.

2.1.15.3.2 Similar to products as produced by BASF Canada Inc.

2.1.16. **Aluminum Sills**

2.1.16.1. Extruded aluminum sections, of same thickness and of same finish and colour as window framing.

2.1.17. **Hardware**

2.1.17.1. 619 nickel finish.

2.1.18. **Screens**

2.1.18.1. To CGSB 79 - GP - #11M

2.1.18.2. Fiberglass mesh in an independent, removal aluminum frame, positioned in between vertical double hung slider units, or interior face for awning units, or exterior face for hopper units.

2.2. **Products**

2.2.1. Specified manufacturers' catalogue references to Windspec Inc. establish the minimum standards for the products listed in this Section.

2.2.2. Unspecified materials which form a part of completed assemblies shall be of manufacturers' standard.

2.2.3. 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:

2.2.3.1.1 Kawneer

2.2.3.1.2 Alwind Industries Ltd.

2.2.3.1.3 Alumicor

2.2.4. **Fixed Framing**

2.2.4.1. Framing: 2200 Series thermally Broken Curtain Wall System

2.2.4.2. Frame Depth: 100mm.

2.2.4.3. Material Thickness: .070 inches

2.2.4.4. Finish: clear anodized

2.2.4.5. Glazing: Insulating glass units. Refer to drawings and Section 08800 for types, locations and details.

2.2.4.6. Spandrel Panels: Refer to drawings and Section 08800 for types, locations and details.

2.2.4.7. Sills: extruded, aluminium sills, clear anodized finish.

2.2.5. **Projected Ventilator Windows**

2.2.5.1. Framing: 2200 Series thermally Broken Curtain Wall System

2.2.5.2. Frame Depth: 100mm.

2.2.5.3. Material Thickness: .070 inches

2.2.5.4. Style: Top hinged, projected out

2.2.5.5. Finish: clear anodized

2.2.5.6. Glazing: Insulating glass units. Refer to drawings and Section 08800 for types, locations and details.

2.2.5.7. Screens: as specified to fit on interior face

2.2.5.8. Hardware: at each vent provide the following items:

2.2.5.8.1 :2 - heavy duty four bar hinges with restrictors to prevent projection of window frame out by more than 100mm.

2.2.5.8.2 :2 - cam handles

2.2.5.8.3 :2 - strikes (keeper). To be approved by the Architect.

2.2.5.8.4 :1 – under screen push bar

2.2.5.9. Units shall include drip deflectors to prevent the infiltration of wind driven rain at the perimeter of the operable vents.

2.2.5.10. Weather stripping: two lines of extruded elastomeric weather stripping retained in extruded splines in window frame and on all four sides of each vent

2.3. **Fabrication**

2.3.1. Ensure glazing rebate provided with depth and width to accommodate specified glass in accordance with glass manufacturer's recommendations. Install glazing gaskets anchored to aluminium extrusions.

2.3.2. Provide structural support for air barrier tie-in.

2.3.3. **Framing Members**

2.3.3.1. Fabricate generally to dimensions/profiles indicated on drawings. Meet specified requirements and clearances to other construction components.

2.3.3.2. Reinforce members and joints with steel plates, bars, rods or angles for rigidity and strength as needed to fulfil performance requirements. Use concealed stainless steel fasteners for jointing that cannot be welded.

2.3.3.3. Provide glass setting, supports and stops to minimize possibility of glass breakage caused by structural inadequacy of frames, stops and frame joints, solar and thermal induced forces, within limitations of specified design performance criteria, as recommended by glass manufacturer.

2.3.3.4. Design system to ensure that site glazing may be performed in accordance with the construction schedule and within the environmental limitations specified in Section 08800.

2.3.4. **Assembly of Units**

2.3.4.1. Join members by welding where specified and otherwise where practicable.

2.3.4.2. 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.

2.3.4.3. 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.

2.3.4.3.1 Grind exposed welds flush, to match adjacent metal.

2.3.4.4. Join members in shop fabricated units to fit flush with hairline joints.

2.3.4.5. Incorporate weepholes to drain off pocketed water. Baffle to prevent entry of driven water to conform to specified performance.

2.3.4.6. Except where shipping makes impossible, fabricate units in shop and ship completely assembled.

2.3.5. **Vapour Retarder and Air Barrier**

2.3.5.1. Maintain integrity of vapour retarder and air barrier system within systems installed by this Section and between systems and adjoining construction.

2.3.6. **Dissimilar Materials**

- 2.3.6.1. Protect material from electrolytic action when dissimilar metals are in contact with one another with two coats of bituminous paint or other approved means.
- 2.3.6.2. Protect aluminium concealed in contact with masonry with two coats of bituminous paint.

2.3.7. **Anchors**

- 2.3.7.1. Incorporate anchorage to structure to support units adequately when subjected to specified loads.
- 2.3.7.2. Allow for complete adjustment in anchorage for levelling and positioning of units during installation.

2.3.8. **Fastenings**

- 2.3.8.1. Where fastenings are exposed to dampness or moisture, use cadmium plated steel for steel-to-steel, aluminium for aluminium-to-aluminium, and stainless steel otherwise or alternatively for all above.
- 2.3.8.2. 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

2.3.9. **Thermal Movement**

- 2.3.9.1. 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.

2.3.10. **Mullions**

- 2.3.10.1. Fabricate mullions to provide for specified thermal movement without damage to adjacent units.

2.3.11. **Dissimilar Materials**

- 2.3.11.1. .1 Protect material from electrolytic action when dissimilar metals are in contact with one another.
- 2.3.11.2. .2 Protect aluminium concealed in contact with masonry with a heavy coating of bituminous paint.

2.3.12. **Anchors**

- 2.3.12.1. 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.
- 2.3.12.2. Allow for complete adjustment in anchorage for levelling and positioning of units during installation.

2.3.13. **Attachment of Hardware**

- 2.3.13.1. Match hardware fastenings to metal of hardware.
- 2.3.13.2. Attach hardware by bolts or machine screws into tapped reinforcing plates.

2.3.14. **Weatherstripping**

2.3.14.1. Secure weather-stripping in place by mechanical means or into formed recesses with keys, and in a manner to enable its removal and replacement without special tools.

2.3.14.2. Ensure that continuity of weather-stripping is maintained around openings.

2.3.15. **Thermal Break**

2.3.15.1. Incorporate a thermal break in frames.

2.3.16. **Finishing**

2.3.16.1. 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.

2.3.17. **Sills**

2.3.17.1. Fabricate sills of extruded aluminium as indicated on drawings and finish as specified for frames.

2.3.17.2. Include jamb deflectors.

2.3.17.3. Fabricate sills in minimum length of 3650 mm or as required by openings or closing lengths. Include cover and splice plates at joints. Sills shall extend full length of any masonry opening on which they are seated.

2.3.17.4. Prefabricate mitred, reinforced and sealed corner sections.

2.3.17.5. Incorporate for concealed anchorage of sills, and means for adjustment of level and position during installation.

2.3.18. **Horizontal Metal Siding**

2.3.18.1. Fabricate portions of the work to incorporate requirements for horizontal metal siding where shown on the Drawings.

**PART 3 - EXECUTION**

3.1. **Examination**

3.1.1. 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.

3.1.2. Ensure that anchors and inserts, installed by others, are adequate to meet specified requirements, and make adaptations before installation.

3.2. **Installation**

3.2.1. **General**

3.2.1.1. Coordinate fabrication of components specified in this Section with requirements of other Sections to ensure proper anchorage and fitting.

- 3.2.1.2. 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.
- 3.2.1.3. Do not force units into place, nor superimpose on them loads for which they were not designed.
- 3.2.1.4. Coordinate with Other Contractors, make provisions, and install vapour retarder and air barrier to ensure complete continuity and integration of vapour retarder and air barrier system.
- 3.2.1.5. Provide structural support for air barrier to prevent its displacement or its loss of seal when subjected to forces specified for design performance.
- 3.2.1.6. Install metal flashing to drain cavities in system. Secure flashings permanently to prevent displacement, leaks, and noise.
- 3.2.1.7. Provide for thermal movement to take place between shop fabricated assemblies and between assemblies and adjacent construction.
- 3.2.1.8. Secure units by non-corrosive anchorage materials. Use of wood or fibre is not acceptable.
- 3.2.1.9. Conceal anchors, clips, blocking, and all other attachments.
- 3.2.1.10. Install reinforcing and supporting members as indicated and required structurally as part of the work of this Section.
- 3.2.1.11. Seal metal-to-metal joints between components included in the work of this Section to ensure a weather tight assembly, and in accordance with sealant manufacturer's specifications.
- 3.2.1.12. Install insulation where aluminium is exposed to the exterior to ensure that thermal conductance to interior of building is no more than thermal conductance of insulating glass units.
- 3.2.1.13. Install units with consideration for finish variations. Abrupt variations of appearance or colour in adjacent components will not be acceptable without approval before installation.
- 3.2.1.14. Coat all damaged prime painted surfaces of anchorage with rust inhibiting paint after welding is completed.
- 3.2.1.15. Apply two coats zinc rich paint to metal surfaces bared by removal of galvanizing.
- 3.2.1.16. Apply one coat of prime paint to metal surfaces bared by removal of shop applied primer.

3.2.2. **Operable Windows**

- 3.2.2.1. Install windows plumb, level and in accordance with shop drawings, by qualified experienced workers and to conform to fabricator's instructions.
- 3.2.2.2. Do not force window units into place, nor superimpose on them loads for which they were not designed.
- 3.2.2.3. Provide for thermal movement to take place between windows and adjacent construction.
- 3.2.2.4. Secure windows by non-corrosive and inorganic anchorage materials.
- 3.2.2.5. Conceal anchors, clips, blocking, and all other attachments.
- 3.2.2.6. Install reinforcing and supporting members as specified or indicated for units specified in this Section.

3.2.3. **Caulking**

- 3.2.3.1. Caulk joints between frame members and sills and adjacent construction as a part of the work of this Section and in accordance with Section 07921 of the specifications.

3.2.4. **Glazing**

- 3.2.4.1. Install glass and composite building panels in units, as part of work of this Section and in accordance with Sections 07240 or Section 08800 of these specifications. Include manufacturer's standard glazing components to create prime seals.

3.3. **Adjustment and Cleaning**

3.3.1. **Adjusting**

- 3.3.1.1. Adjust operating units to operate smoothly and fit tightly when closed and locked.
- 3.3.1.2. Adjust hardware to operate smoothly, with proper tension and lubricate.
- 3.3.1.3. Ensure that weatherstripping does not cause binding to prevent closing and locking, and that it makes weather tight contact.

3.3.2. **Cleaning on Completion of Installation**

- 3.3.2.1. Remove deposits which affect appearance or operation of units.
- 3.3.2.2. Remove protective materials.
- 3.3.2.3. Clean interior and exterior surfaces by washing with clear water; or with water and soap or detergent; followed by a clear water rinse.
- 3.3.2.4. Clean and restore stained metal surfaces in accordance with manufacturer's recommendations. Replace if cleaning is impossible.
- 3.3.2.5. Final cleaning is specified in Section 01710.

3.4. **Protection**

- 3.4.1. 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.
- 3.4.2. 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.
- 3.4.3. Remove protection from metal glazing surfaces before installation of glass.
- 3.4.4. Maintain protection from time of installation to final cleanup in accordance with Sections 01040 and 01500.

**End of Section**



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**PART 1 - GENERAL**

**1.1. Description**

**1.1.1. General Requirements**

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

**1.1.2. Work performed by other Sections Related to this Section is specified in**

Section 06410: Cabinet hardware as specified by schedule.

**1.1.3. Hardware Specified This Section, Supplied Only, Installed by Other Sections**

Section 06200: Finish Carpentry: To install hardware other than as specified.

1.1.4. Selected hardware supplier will become a Subcontractor of the Contractor.

**1.2. Quality Assurance**

1.2.1. Requirements of Regulatory Agencies:  
Install only ULC or ULI listed hardware for fire rated doors and frames.

**1.3. Submittals**

**1.3.1. Samples**

1.3.1.1. Submit samples of each hardware item.

**1.3.2. Templates**

1.3.2.1. Submit templates to Contractor for use by installers and fabricators as required for proper location and installation of hardware.

**1.3.3. Maintenance and Operating Instructions**

1.3.3.1. Submit maintenance, operating and installation instructions for installation purposes and for incorporation in Project Data Book.

**1.4. Delivery, Storage, and Handling**

1.4.1. Package hardware and label with description of contents and installation location. Refer to hardware list designation, and with door number when applicable.

1.4.2. Deliver hardware to location at building site designated by Contractor.

**1.5. Warranty**

**1.5.1. Extended Warranty**

1.5.1.1. Warranty contained in GC24 is, with respect to Section 08710, extended from 1 year to 5 years.

- 1.5.1.2. Contractor hereby warrants that system is suitable for use in this type of installation.
- 1.5.1.3. 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**

### **2.1. Products**

- 2.1.1. Finish hardware fabricated of same materials shall have consistent colour and finish throughout Project.
- 2.1.2. Supply with specified hardware screws, bolts, expansion shields, inserts, and other items and parts required for complete installation and functioning.
- 2.1.3. Reference Hardware Group List for types of hardware used on this project.

## **PART 3 - EXECUTION**

### **3.1. Examination**

- 3.1.1. 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.

### **3.2. Installation**

- 3.2.1. Provide instructions required for preparation of doors and frames to the appropriate fabricators.
- 3.2.2. Provide instructions required for installation of hardware to Section 06200, and other Sections as applicable.
- 3.2.3. Provide assistance and supervision of installation when requested.

### **3.3. Adjustment**

- 3.3.1. 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**

**1.1. Description**

**1.1.1. General Requirements**

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

**1.1.2. This Section specifies work which shall be performed by:**

Section 08440: Aluminum Framed Glazing Systems

**1.2. References**

**1.2.1. Reference Standards**

- 1.2.1.1. Reference Standards quoted in Contract Documents refer to:
- 1.2.1.2. CAN/CGSB-12.20 - M89
- 1.2.1.3. CAN/CGSB-12.1-M79, Glass, Safety, Tempered or Laminated.
- 1.2.1.4. CAB/CGSB-12.3-M76, Glass, Polished Plate or Float, Flat, Clear.
- 1.2.1.5. CAN/CGSB-12.8-M76, Insulating Glass Units.
- 1.2.1.6. CAN/CGSB-12.10-M76, Glass, Light & Heat Reflecting
- 1.2.1.7. CGSB Specification 19-GP-5M, Sealing Compound, One Component, Acrylic Base, Solvent Curing.
- 1.2.1.8. CAN/CGSB-19.13-M82, Sealing Compound, One Component, Elastomeric, Chemical Curing.
- 1.2.1.9. CAN/CGSB-10.24-M80, Sealing Compound, Multi-Component, Chemical Curing.

**1.3. Submittals**

1.3.1. Submit Samples in accordance with section 01300

1.3.2. Submit two 216 mm x 280 mm samples of each specified type of glass, including tinted glass.

**1.4. Site Conditions**

**1.4.1. Environmental Conditions**

- 1.4.1.1. Proceed with glazing only when glazing surfaces are accumulating no moisture from rain, mist or condensation.
- 1.4.1.2. When temperature of glazing surface is below 4°C, obtain approval of glazing methods and protective measures which will be used during glazing operations.

## 1.5. Warranty

### 1.5.1. Extended Warranty, Insulating Glass Units

- 1.5.1.1. Warrant insulating glass covering the period for four years beyond the expiration of the warranty period specified in the General Conditions to the Contract. 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.
- 1.5.1.2. 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

### 2.1. Materials

- 2.1.1. 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.
- 2.1.2. Glass:
- 2.1.2.1. **Single Glazed Interior Units**
- 2.1.2.1.1. Warm edge,
  - 2.1.2.1.2. IGMAC Certified.
  - 2.1.2.1.3. Float
  - 2.1.2.1.4. Glass Thickness: 6mm minimum or as required to meet design requirements.
  - 2.1.2.1.5. Glass Type: Tempered as required to meet design requirements.
- 2.1.2.2. **Insulating Glass Units:**
- 2.1.2.2.1. Warm edge, hermetically sealed, minimum 13 mm air space - air filled, double sealed (primary to be polyisobutylene, secondary to be polysulphide or structural silicone glazed units), desiccant filled Bayform "Thermal Edge" spacer (black) with splice connectors at corner of each glass unit.
  - 2.1.2.2.2. IGMAC Certified.
  - 2.1.2.2.3. Low E coating:
  - 2.1.2.2.4. Acceptable Products:
    - 2.1.2.2.4.1. AGC/AFGD'Comfort Ti-AC 40'
    - 2.1.2.2.4.2. PPG 'Solarban 60'
    - 2.1.2.2.4.3. Cardinal 'LoE2 -172'
    - 2.1.2.2.4.4. Versalux
    - 2.1.2.2.4.5. Viracon 'Solarscreen 2000 VE 1-2M'
  - 2.1.2.2.5. Glass Thickness: 6mm minimum or as required to meet design requirements.
  - 2.1.2.2.6. Glass Type: Annealed, heat strengthened, or tempered as required to meet design requirements.

2.1.2.3. **Performance Requirements:**

- 2.1.2.3.1. Visible light: 68 - 70%.
- 2.1.2.3.2. Winter night-time Metric U-value = 1.7
- 2.1.2.3.3. Shading Coefficient: within 0.43 - 0.46.
- 2.1.2.3.4. Solar heat gain coefficient: within 0.37 - 0.40.
- 2.1.2.3.5. Glass Colour: Tinted, unless otherwise noted.
- 2.1.2.3.6. Light Bronze as selected by the architect.
- 2.1.2.3.7. **Type 1** exterior lite: tinted, tempered, body colour by architect.
- 2.1.2.3.8. interior lite: clear, low emissivity coating on third surface
- 2.1.2.3.9. **Type 2** exterior lite: tinted, tempered, body colour by architect
- 2.1.2.3.10. interior lite: clear, tempered, low emissivity coating on third surface of interior lite

2.1.2.4. **Wired Glass:**

- 2.1.2.4.1. Polished Georgian wired plate, to CAN/CGSB-12.11M90, type 1 wire mesh style 6mm thickness. As and where noted GL-6 - Sand blasted with clear coat finish.

2.1.2.5. **Heat Treated Safety Glass:**

- 2.1.2.5.1. Tempered glass to meet specified requirements of CAN/CGSB-12.1-M90 for Types 1 and 2 transparent and tinted, Herculite K, by PPG Canada Inc.
- 2.1.2.5.2. Tempering shall be performed in a convection type oven.
- 2.1.2.5.3. Tempering and heat strengthened glass shall be treated prior to application of reflective or paint coatings.
- 2.1.2.5.4. Tempered glass tempered to minimize distortion. Roll-wave distortion not to exceed 0.127mm from peak to valley.
- 2.1.2.5.5. Orient tempered glass in manner to achieve consistent appearance.
- 2.1.2.5.6. Thickness: 6mm

2.1.2.6. **Annealed (float) glass:**

- 2.1.2.6.1. Clear, annealed glass, 6mm thick minimum as required to meet design requirements. To CAN/CGSB-12.3 - M 91, Glazing Quality. As and where noted - Acid Etched or sand blasted with clear coat finish.

2.1.2.7. **Mirrors:**

- 2.1.2.7.1. Annealed glass to ASTM C 1503.
- 2.1.2.7.2. Grade: Mirror cut size.
- 2.1.2.7.3. Quality: Mirror select quality, allowable distortion shall be less than 80degrees vision interference angle to ASTM 1036-01.
- 2.1.2.7.4. Colour: Clear
- 2.1.2.7.5. Thickness: 6mm.
- 2.1.2.7.6. Exposed edges shall be ground and polished.

2.1.2.8. Products supplied by AFG Glass Inc. are considered as acceptable alternatives.

2.1.2.9. **Glazing Accessories**

- 2.1.2.9.1. Glazing Gaskets: Preformed, EPDM, Silicone compatible, 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.
- 2.1.2.9.2. Setting Blocks: Neoprene, of durometer hardness of Shore "A" 40 to 50.

- 2.1.2.9.3. Spacer Shims: Neoprene, of durometer hardness of Shore "A" 40 to 50.
- 2.1.2.9.4. Safety Film: 14 mil. Security Film, Armourcoat Glass Guard as supplied by Ultimate Reflections - Contact: Scott Hagle (519)476-8584 or (519)690-2636.
- 2.1.2.9.5. Glass Clamps: CRL - Z series glass clamps 10mm - 12mm glass thickness. Brushed Nickle as supplied by C.R. Laurence.
- 2.1.2.10. **Glazing Sealants**
  - 2.1.2.10.1. Any of the following specified sealants as utilized for approved glazing system will be acceptable.
  - 2.1.2.10.2. Incorporate sealants as incorporated in manufacturer's standard glazing systems as approved.
  - 2.1.2.10.3. Ensure that glazing sealants are completely compatible with insulating glass unit sealants.
  - 2.1.2.10.4. One Part Acrylic Glazing Sealant: To meet specified requirements of CGSB Specification 19-GP-5, in glazing hardness grade.
  - 2.1.2.10.5. One Part Silicone Glazing Sealant: To meet specified requirements of CAN/CGSB-19.13-M82, in glazing hardness grade.
  - 2.1.2.10.6. One Part Polysulphide Glazing Sealant: To meet specified requirements of CAN/CGSB-19.13-M82, in glazing hardness grade.
  - 2.1.2.10.7. Two Part Polysulphide Sealant: To meet specified requirements of CAN/CGSB-19.24-M80, in glazing hardness grade.

### **PART 3 - EXECUTION**

#### **3.1. Installation**

##### **3.1.1. General**

- 3.1.1.1. Install materials in accordance with manufacturer's specification, and ensure that each material in a glazing system is compatible with the others.
- 3.1.1.2. Ensure that projections have been removed from rebates and that sufficient width and depth clearances are provided for specified glass.
- 3.1.1.3. Remove stops and store during glazing to avoid damage to them.
- 3.1.1.4. Remove excess glazing sealants from adjacent surfaces, including glass, during working life of material, and by methods not harmful to the surfaces.
- 3.1.1.5. Collect broken glass and cuttings in boxes and remove from site.
- 3.1.1.6. Do not set any glass without glazing beds or gaskets.

##### **3.1.2. Glass**

- 3.1.2.1. Install glass in thicknesses to comply with Ontario Building Code requirements.
- 3.1.2.2. 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.
- 3.1.2.3. Ensure that glass edges are clean cut, not nipped or seamed.
- 3.1.2.4. Do not cut or nip tempered glass to fit. Replace oversize or flared lights with entirely new units of proper dimensions.

3.1.3. **Glazing Preparation and Methods**

- 3.1.3.1. Clean glazing rebate surfaces of all traces of dirt, dust, or other contaminants.
- 3.1.3.2. Use glazing sealants without addition of thinners and from only containers with seals unbroken until opened for use.
- 3.1.3.3. Prime all glass rebates for materials affected.
- 3.1.3.4. When glazing commences, arrange for the presence of a technical representative of the glazing materials manufacturer to advise on procedures and methods.
- 3.1.3.5. Ensure that glazing sealants and tapes are in full contact with glazing surfaces.
- 3.1.3.6. Tool gunned sealants with a slight bevel away from glass faces.

3.1.4. **Positioning Glass**

- 3.1.4.1. Support glass, in lights of over 2540 mm perimeter, by two setting blocks, one at each quarter point of each light.
- 3.1.4.2. 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.
- 3.1.4.3. Set shims to allow a space of no less than 6 mm between shim edges and sight lines.
- 3.1.4.4. Spacer shims are not required where glazing tape is used.

3.1.5. **Bedding at Fixed Stops**

- 3.1.5.1. Apply sealants in sufficient beads that when glass is pressed into place they ooze out slightly.
- 3.1.5.2. 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.
- 3.1.5.3. 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.
- 3.1.5.4. 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.
- 3.1.5.5. 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.

3.1.6. **Bedding at Stop Beads**

- 3.1.6.1. Apply sealants to glazing face of stop. Press stops into place using spacer shims, and tool sealant at a slight bevel away from glass face. Fasten stops if design requires.
- 3.1.6.2. 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.

3.1.7. **Adjustment and Cleaning**

- 3.1.7.1. 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.
- 3.1.7.2. Final cleaning of glass is specified by Section 01710.
- 3.1.7.3. 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.

3.1.8. **Protection**

- 3.1.8.1. 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**



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**PART 1 - GENERAL**

**1.1. Description**

**1.1.1. General Requirements**

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

**1.1.2. 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

**1.1.3. Supply of Work Installed by This Section is Specified in:**

Division 15: To furnish access panels.

**1.2. System Description**

**1.2.1. Tolerances**

1.2.1.1. 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.

1.2.1.2. 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.

**1.3. Quality Assurance**

**1.3.1. Requirements of Regulatory Agencies**

1.3.1.1. 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.

**1.4. References**

**1.4.1. Reference Standards**

1.4.1.1. Reference standards quoted in Contract Documents refer to:

1.4.1.2. ASTM A116-81, Specification for Zinc Coated (Galvanized) Iron or Steel Farm Field and Railroad Right-of-Way Wire Fencing.

1.4.1.3. ASTM 153-80, Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

1.4.1.4. ASTM A525-81, Specification for Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process, General Requirements.

1.4.1.5. ASTM C475-64, Standard Specification for Joint Treatment Materials for Gypsum Wallboard Construction.

1.4.1.6. ASTM C646-76a, Specification for Steel Drill Screw for the Application of Gypsum Sheet material to Light-Gauge Steel Studs.

1.4.1.7. CGSB Specification 1-GP-118M Finish, Interior, Alkyd, Flat.

- 1.4.1.8. CAN/CSA-A82.27-M91, Gypsum Board.
- 1.4.1.9. CAN/CSA-A82.31-M91, Gypsum Board Application.

**1.5. Delivery, Storage, and Handling**

- 1.5.1. Package finish materials.
- 1.5.2. Store materials in protected dry areas. Store board flat in piles with edges protected.
- 1.5.3. Ensure that finish metal members are not bent, dented, or otherwise deformed.
- 1.5.4. Deliver products supplied only by this Section to those responsible for installation, to the place they direct, and to meet installation schedules.
- 1.5.5. Package fire rated materials with Underwriters' Laboratories labels attached.

**1.6. Site Conditions**

**1.6.1. Environmental Requirements**

- 1.6.1.1. 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.
- 1.6.1.2. 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**

**2.1. Materials**

**2.1.1. Gypsum Board**

- 2.1.1.1. To meet specified requirements of CAN/CSA-A82.27.
- 2.1.1.2. Plain Gypsum Board: With tapered edges.

**2.1.2. Joint Materials**

- 2.1.2.1. **Gypsum Board Joint Reinforcing Tape**: 50 mm wide glass, fibre mesh.
- 2.1.2.2. **Fiberbond Joint Reinforcing Tape**: 50 mm wide, cross laminated fibre tape.
- 2.1.2.3. **Gypsum Board Joint Compounds**:
  - 2.1.2.3.1. Latex, resin base, possessing good adhesion, mixed with fresh, unadulterated water having no detrimental effect on compounds.
  - 2.1.2.3.2. Durabond 45 in powder form to be mix on site in accordance with Manufacturer's printed instructions

2.1.3. **Galvanizing**

- 2.1.3.1. **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.
- 2.1.3.2. **Wiped Coating**: ASTM Specification A525 zinc coating designation ZF75.
- 2.1.3.3. **Hot Dipped**: Zinc coating by hot dipping after fabrication to provide a uniform coating of not less than 2.0 ounces per square foot.

2.1.4. **Fastenings and Ties**

- 2.1.4.1. **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.
- 2.1.4.2. **Tie Wire**: 1.6 mm dia. galvanized soft annealed steel wire.

2.1.5. **Furring System**

- 2.1.5.1. **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.
- 2.1.5.2. **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.
- 2.1.5.3. **Metal trim**: 13 mm, J - trim, no. 200-A; 13 mm, L - trim, No. 200-B, both as manufactured by Canadian Gypsum Company Inc.
- 2.1.5.4. **Control Joints**: No. 093 as manufactured by Canadian Gypsum Company Inc.
- 2.1.5.5. At areas of high humidity, use zinc coated runners, furring channels and accessories.

2.1.6. **Partition System**

- 2.1.6.1. **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.
- 2.1.6.2. **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.
- 2.1.6.3. **Control Joints**: No. 093 as manufactured by Canadian Gypsum Company Inc.

2.1.7. **Ceiling Hanger System**

- 2.1.7.1. **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 .

2.1.7.2. **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.

2.1.8. **Sealant**

2.1.8.1. **Acoustical Sealant:** As manufactured by Tremco Manufacturing Co. (Canada) Ltd. or Presstite Acoustical sealant No. 579.64 as manufactured by Inmont Presstite Ltd.

2.1.8.2. **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**

**3.1. Examination**

- 3.1.1. 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.
- 3.1.2. 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.
- 3.1.3. 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.
- 3.1.4. Verify that channels installed for rigid insulation are located properly and are well secured.

**3.2. Installation**

3.2.1. **General**

- 3.2.1.1. 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.
- 3.2.1.2. Install systems in accordance with approved manufactured' specifications and printed directions, as applicable for materials incorporated.
- 3.2.1.3. Do not install metal framing, trim, casings, or accessories which have been bent, dented, or otherwise deformed.
- 3.2.1.4. Securely attach trim, casings, framing, and accessories.

- 3.2.1.5. 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.
- 3.2.1.6. Provide continuous backing for all edges of board.
- 3.2.1.7. Erect supporting and finish materials to dimensions indicated on Drawings; plumb, level, straight, and square to adjoining elements.
- 3.2.1.8. Provide for movement at intersections with structural members to avoid transference of loads to systems.
- 3.2.1.9. Make allowances for thermal movements in systems.
- 3.2.1.10. Do not support systems from, nor make attachment to, ducts, pipes, conduit, or the support framing installed by other Sections.
- 3.2.1.11. Install materials with the minimum of joints.
- 3.2.1.12. Splice, framing members only where continuous lengths are not available from manufacturer.
- 3.2.1.13. 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.
- 3.2.1.14. 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.
- 3.2.1.15. 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.
- 3.2.1.16. Provide fire stopping; bulkheads over doors, frames, screens, and changes in ceiling levels; stair soffits; furred beams; pipe spaces; all as indicated on Drawings.

3.2.2. **Suspended Ceiling Framing and Furring**

- 3.2.2.1. 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.
- 3.2.2.2. 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.
- 3.2.2.3. 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.
- 3.2.2.4. 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.

- 3.2.2.5. 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.
- 3.2.2.6. Secure cross furring to supports with double wire ties or approved equivalent attachment. Splice by nesting and tying together with 200 mm overlap.
- 3.2.2.7. 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.
- 3.2.2.8. 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.

3.2.3. **Metal Stud Framing**

- 3.2.3.1. 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.
- 3.2.3.2. Provide partition runners with deep flanges at heads of partitions where deflection and/or creep of structure will occur.
- 3.2.3.3. Butt, not mitre, runners at wall intersections and corners. Lap runners and screw channels together.
- 3.2.3.4. 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.
- 3.2.3.5. 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.
- 3.2.3.6. 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.
- 3.2.3.7. 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.
- 3.2.3.8. Double studs at all control joints.
- 3.2.3.9. Erect three studs at corner and intermediate intersections of partitions.
- 3.2.3.10. Install partition runners at heads and sills of openings in partitions. Form 150 mm bends in runners and secure bent portion to studs.
- 3.2.3.11. Splice studs by nesting, with an 200 mm minimum lap, and fastened with one screw in each flange.
- 3.2.3.12. Ensure that electrical boxes are not installed back to back in same stud space.
- 3.2.3.13. Install blocking for bases, frames and supports before board in applied.

- 3.2.3.14. 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.
- 3.2.3.15. 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.
- 3.2.3.16. Unless shown otherwise on Drawings, partitions, together with gypsum board facings, shall extend above ceilings to underside of structure above.

3.2.4. **Accessories**

- 3.2.4.1. At External Corners: Install corner beads secured to framing at 150 mm o.c. on alternate flanges.
- 3.2.4.2. 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.
- 3.2.4.3. 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.
- 3.2.4.4. Install casings and thermal breaks at junctions of gypsum board with exterior door, window, or screen frames.

3.2.5. **Application of Gypsum Board to Framing**

- 3.2.5.1. 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.
- 3.2.5.2. Apply board with long dimension perpendicular to supports except at stud partitions where they shall parallel studs.
- 3.2.5.3. 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.
- 3.2.5.4. 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.
- 3.2.5.5. Tightly butt board joints, without force, and align them neatly.
- 3.2.5.6. 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.
- 3.2.5.7. Do not install board in close proximity to hot pipes or heating ducts.
- 3.2.5.8. Fasten board to metal support members by metal drywall screws.

- 3.2.5.9. 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.
- 3.2.5.10. 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.
- 3.2.5.11. Install board with casing bead at termination of gypsum board edge abutting adjoining surfaces to provide for differential movement at internal corners

3.2.6. **Finishing of Joints and Depressions at Gypsum Board**

- 3.2.6.1. 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.
- 3.2.6.2. 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.
- 3.2.6.3. At bevelled joints, apply cover coat 180 mm wide, level coat 250 mm wide, and skim coat 300 mm wide.
- 3.2.6.4. 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.
- 3.2.6.5. 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.
- 3.2.6.6. At External Corners: Fill to nose of corner bead with joint filler and topping cement as specified for bevelled joints.
- 3.2.6.7. At Casing Beads: As specified for bevelled joints.
- 3.2.6.8. At Board Fasteners: Fill holes and depressions with 2 coat application of joint filler.

3.2.7. **Caulking**

- 3.2.7.1. Caulk between casing beads and other construction where junction exposed to view.
- 3.2.7.2. 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.
- 3.2.7.3. Clean joints, and prime and install sealants in accordance with the requirements of Joint Sealants, Section 07920.



**3.3. Adjustment and Cleaning**

- 3.3.1. 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.
- 3.3.2. Make good to cut-outs for services and other installations, fill in defective joints, holes and other depressions with joint compound.
- 3.3.3. Make good defective board installations, and ensure that surfaces are smooth, evenly textured and within specified tolerances to receive finish treatments.
- 3.3.4. Clean off beads, casings and other metal trim, and leave all surfaces ready for specified finishes.

**End of Section**

## **PART 1 - GENERAL**

### **1.1. Description**

#### **1.1.1. General Requirements**

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

#### **1.1.2. Work Performed by Other Sections related to this Section is specified in:**

Section 04200 – Unit Masonry  
Section 09250 - Gypsum Drywall

### **1.2. Material Supply**

1.2.1. All tile will be supplied by owner from surplus stock.

### **1.3. Quality Assurance**

#### **1.3.1. Subcontractor Qualifications**

1.3.1.1. Perform tile installation 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 during a period of at least the immediate past five years.

### **1.4. References**

#### **1.4.1. Reference Standards**

- 1.4.1.1. Reference standards quoted in Contract Documents refer to:
- 1.4.1.2. ANSI A108.1-1976, American National Standard Specifications for Installation of Ceramic Tile.
- 1.4.1.3. ANSI A118.1-1976, American National Standards Specifications for Dry-Set Portland Cement Mortar. ANSI A118.3-1976, American National Standard Specifications for Chemical Resistant Water-Cleanable Tile-Setting and Grouting Epoxy.
- 1.4.1.4. ASTM C206-79, Specification for Finishing Hydrated Lime.
- 1.4.1.5. ASTM C207-79, Specification for Hydrated Lime for Masonry Purposes. CAN/CGSB-75.1-M77, Tile, Ceramic.
- 1.4.1.6. CAN/CSA-A5-M83, Portland Cements.

### **1.5. Submittals**

#### **1.5.1. Samples**

1.5.1.1. Submit 300mm x 300mm panels, or at least 4 units, of tile selected at random from stock.

1.5.2. **Maintenance Instructions**

1.5.2.1. Submit maintenance instructions for incorporation in Project Data Book.

1.6. **Site Conditions**

1.6.1. **Environmental Requirements**

1.6.1.1. Install tile only when base surfaces and air temperatures have been maintained between 10°C and 21°C for 72 hours preceding installation and until setting materials have cured.

1.7. **Warranty**

1.7.1. **Extended Warranty**

1.7.1.1. Submit a warranty of tile products and installation specified in this Section covering the period for one year beyond the expiration of the warranty period specified in the General Conditions to the Contract.

**PART 2 – PRODUCTS**

2.1. **Materials**

2.1.1. **Setting**

- 2.1.1.1. Floor Tile – TEC 382 mortar.
- 2.1.1.2. Portland Cement: To meet specified requirements of CAN/CSA-A5-M83.
- 2.1.1.3. Hydrated Lime: To meet specified requirements of ASTM Specification C206 or C207 for Type S.
- 2.1.1.4. Sand: To meet specified requirements of CSA Specification A82.56, passing 1.6mm sieve. Use white sand for white grout.
- 2.1.1.5. Water Potable, containing no contaminants which cause efflorescence.
- 2.1.1.6. Additives: for mortar: to meet specified requirements of ANSI Standard A118.4 and CGSB Specification 71-GP-30M, Type 2; acrylic latex; Keraply by Mapei.
- 2.1.1.7. for grout: to meet specified requirements of ANDI Standard A118.6, Kerapoxy by Mapei.
- 2.1.1.8. Colour Pigment: Non-fading mineral oxides or carbon black emulsion, unaffected by lime or cement, and which will not stain tile.
- 2.1.1.9. Primer: To meet requirements of supplier of bond coat.
- 2.1.1.10. Dry Curing Grout: Premixed, dry set, as recommended by tile supplier.

2.1.2. **Porcelain Floor Tile**

- 2.1.2.1. PCT1- Field Tile: Max Basaltina 24 x 24 Mocha Mat – MAXBST6308 BY Centura
- 2.1.2.2. PCT2- Highlight Tile: Max Basaltina 24 x 24 Nero Mat – MAXBST6305 BY Centura
- 2.1.2.3. Grout Colour: 927 Light Pewter

2.1.3. **Ceramic Wall Tile**

2.1.3.1. PCT 3 – Field: Piemme 12 x 24 Purestone Grigio Natural - KPUS03 by Centura

2.1.3.2. PCT 4 – Accent Tile: Max Basaltina 1 x 2 Mocha Mosaic (Matte) – MAXBST300MO12 By Centura.

2.1.3.3. Grout Colour: 903 Birch

2.1.4. **Grout**

2.1.4.1. Accucolour XT Floor Grout.

2.1.5. **Cleaner**

2.1.5.1. To meet specified requirements of #1000 Series of Terrazzo, Tile and Marble Association of Canada.

2.1.6. **Galvanizing**

2.1.6.1. To meet specified requirements of ASTM Specifications A525, AF275 Coating Designation for sheet steel: A153 Class B.3 Coating, for hardware, Class 3 Coating, for wire and rods.

2.1.7. **Flooring Accessories**

2.1.7.1. Schluter finishing strip. Finish to be brushed aluminum.

2.1.7.1.1. Porcelain Tile to VCT: Schluter Systems RENO-RAMP. Provide accessible slope.

2.1.7.1.2. Porcelain Tile to Porcelain Tile: Schluter Systems SCHIENE.

**PART 3 – EXECUTION**

3.1. **Examination**

3.1.1. Ensure that environmental conditions and backing surfaces have been provided according to specified requirements.

3.1.2. Defective tile installation resulting from application to unsatisfactory surfaces will be considered the responsibility of this Section.

3.2. **Preparation**

3.2.1. **Protection**

3.2.1.1. Prevent traffic and construction by other Sections on newly laid tile by barricading areas for at least 48 hours following installation.

### 3.3. Installation

#### 3.3.1. General

- 3.3.1.1. Install tile in accordance with details and specifications of Terrazzo, Tile and Marble Association of Canada Installation Manual 200-1979, Ceramic Tile, as applicable, and otherwise in accordance with ANSI Specification A108.1
- 3.3.1.2. Lay out tile according to architectural drawings such that fields are centered on areas, with no tiles of less than half size included. Maintain heights of panels in full courses to nearest indicated dimension.
- 3.3.1.3. Lay tile on vertical surfaces with joints plumb and level.
- 3.3.1.4. Lay tile on floors with joints parallel to walls, at right angles to each other except where pattern is indicated on drawings.
- 3.3.1.5. Lay tile so that wall and floor joints are in line.

#### 3.3.2. Setting

- 3.3.2.1. Place as much tile as possible in one operation before setting bed reaches initial set.
- 3.3.2.2. Clean back and remove bed when it has set before tile is laid.
- 3.3.2.3. Prime entire backing surface for bond coats.
- 3.3.2.4. Immediately prior to applying mortar bed over concrete or concrete block, evenly saturate substrate with clean water.
- 3.3.2.5. Line up joints between tile installed on stairs from tread to tread.

#### 3.3.3. Tile

- 3.3.3.1. Leave or cut openings to correct sizes to receive accessories, fittings, or other items built into tile.
- 3.3.3.2. Cut and grind tile accurately, and without damage, to fit openings, at intersections and against trim finish. Rub exposed cut edges smooth with abrasive stone.
- 3.3.3.3. Drill tile for hardware and for pipes where possible. Otherwise at pipes and fittings, fit tile closely so that escutcheons cover cuts.
- 3.3.3.4. Extend tile into recesses at windows, doors, or other openings.
- 3.3.3.5. Extend wall tile behind fittings, mirrors and other applied items of a fixed nature, by a sufficient amount to ensure overlap.
- 3.3.3.6. Joint Width: 1.6mm wide between ceramic tile units.
- 3.3.3.7. Provide joints coloured to match tile.

#### 3.3.4. Grouting

- 3.3.4.1. Remove spacers, strings, ropes or pegs before grouting.
- 3.3.4.2. Grout tile joints in accordance with grout manufacturer's directions and to fill joints solidly.
- 3.3.4.3. Fill all gaps and skips, cover setting bed completely. Ensure finish grout is uniform in colour, smooth and without voids, pinholes or low spots.
- 3.3.4.4. Damp cure grout for at least 72 hours.

3.3.5. **Adjustment**

- 3.3.5.1. Before Project completion, remove and replace defective, damaged, loose, and unbonded tile; and point defective joints.
- 3.3.5.2. Wash tile surfaces with water.
- 3.3.5.3. Wash unglazed surfaces with #1000 Series cleaner. Use 5% solution of muriatic acid only when preceded and followed by a complete drenching of clean water, and only when other cleaning methods are insufficient.

3.4. **Cleaning**

3.4.1. **Cleaning on Completion of Installation**

- 3.4.1.1. Remove deposits which affect appearance.
- 3.4.1.2. Remove protective materials.
- 3.4.1.3. Clean surfaces by washing with clear water; or with water and soap or detergent; followed by a clear water rinse.
- 3.4.1.4. Clean and restore stained metal surfaces in accordance with manufacturer's recommendations. Replace if cleaning is impossible.
- 3.4.1.5. Final cleaning is specified in Section 01711.

3.5. **Extra Stock**

- 3.5.1. At the completion of the work, provide ten (10) new, clean packaged ceramic floor tiles of each colour to be turned over to the owner.
- 3.5.2. At the completion of the work, provide an equivalent to 3 sq. m. of wall coverage, clean packaged ceramic wall tiles of each colour to be turned over to the owner.

**End of Section**

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**PART 1 - GENERAL**

**1.1. Description**

**1.1.1. General Requirements**

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

**1.1.2. Work Performed by Other Sections Related to This Section is Specified in:**

Section 09250: Gypsum Drywall, Bulkheads, Ceilings  
Drawings: Mechanical Services  
Drawings: Electrical Fixtures

**1.2. System Description**

**1.2.1. Tolerances**

1.2.1.1. Install ceilings within 3.2 mm of dimensioned height above floor unless approved otherwise. Level within maximum tolerance of 3mm in 3 m.

1.2.1.2. 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.

**1.3. Quality Assurance**

**1.3.1. Subcontractor Qualifications**

1.3.1.1. 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.

**1.4. References**

**1.4.1. Reference Standards**

Reference standards quoted in Contract Documents refer to:  
CAN/CSA-A82.27-M91, Gypsum Board Products

**1.5. Submittals**

**1.5.1. Samples**

1.5.1.1. Submit two samples of each specified acoustical board and exposed grid material.

**1.6. Delivery, Storage, and Handling**

1.6.1. Package finish materials.

1.6.2. Store materials in protected dry area.

1.6.3. Ensure that finish metal members are not bent, dented, or otherwise deformed.

**1.7. Site Conditions**

- 1.7.1. Install acoustical ceilings in areas closed and protected against weather, maintained at no less than 10°C.
- 1.7.2. 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**

**2.1. Materials**

**2.1.1. Accessories**

- 2.1.1.1. 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.

**2.1.2. Hangers**

- 2.1.2.1. 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.

**2.1.3. 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.

**2.1.4. Exposed Tee Ceiling Grid System**

- 2.1.4.1. Two directional, 610 mm X 1220 mm.
- 2.1.4.2. Main Beams: 0.508 mm steel, bulb tees.
- 2.1.4.3. Cross Tees: 0.508 mm steel, with tongues to interlock with main beams.
- 2.1.4.4. Wall Moulding: Angle section to match tees.
- 2.1.4.5. Finish: Baked vinyl enamel, white.

**2.1.5. Acoustical Units**

- 2.1.5.1. 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.



2.1.5.2. **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**

**3.1. Examination**

3.1.1. 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.

**3.2. Installation**

3.2.1. 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.

3.2.2. Install hangers before sprayed fireproofing.

3.2.3. Install hanger anchoring devices in appropriately drilled holes.

3.2.4. Screw apply hanger anchoring devices to metal floor deck.

3.2.5. Do not use through the roof hangers.

3.2.6. Do anchor hangers from or make attachment to, ducts, pipes, conduit, or the support framing installed by other Sections.

3.2.7. 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.

3.2.8. 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.

3.2.9. 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.

- 3.2.10. Frame around recessed fixtures, diffusers, grilles, and openings.
- 3.2.11. Maintain true surface planes, and component and joint lines throughout each area.
- 3.2.12. Butt joints between components tightly together.
- 3.2.13. 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.
- 3.2.14. Brace system to maintain alignment of grid.
- 3.2.15. Install acoustical panels in exposed tee system. Cut panels neatly to fit off-module grid, with sufficient clearances to ensure removal without damage.
- 3.2.16. Do not install acoustical units with broken or marred edges exposed to view.
- 3.2.17. Install hold-down clips at each panel. Adapt installation to provide ceiling access where required for services.
- 3.2.18. Mark access panels in an unobtrusive manner.
- 3.2.19. Where retention clips are specified for Type 3 ceilings, install clips in accordance with manufacturers' written instructions.

**3.3. Adjustment and Cleaning**

- 3.3.1. Clean soiled/dicoloured surfaces of exposed ceiling surfaces on ceiling installation completion.
- 3.3.2. Replace components which are visibly damaged, marred, or uncleanable.

**3.4. Extra Stock**

- 3.4.1. Provide 2 sealed cartons of each specified acoustical board for Owner's use. Deliver to site at conclusion of project.

**End of Section**

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**PART 1 - GENERAL**

**1.1. Description**

**1.1.1. General Requirements**

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

**1.1.2. Work Performed by Other Sections Related to This Section is Specified in:**

**1.2. Quality Assurance**

**1.2.1. Subcontractor Qualifications**

1.2.1.1. 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.

**1.3. References**

**1.3.1. Reference Standards**

- 1.3.1.1. Reference standard quoted in Contract Documents refer to:
- 1.3.1.2. CSA Standard A126.1-M1984, Vinyl Asbestos and Vinyl Composition Floor Tile.
- 1.3.1.3. CSA Standard A126.3-M1984, Sheet Vinyl Flooring Products.

**1.4. Submittals**

**1.4.1. Samples**

- 1.4.1.1. Submit samples of each specified flooring, base, stair, and accessories that are specified.
- 1.4.1.2. Submit full size tiles 300 x 300.
- 1.4.1.3. Submit 216 mm X 280 mm pieces of sheet goods.
- 1.4.1.4. Submit base and accessories in lengths of 300 mm.

**1.4.2. Affidavits**

1.4.2.1. 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.

**1.4.3. Maintenance Instructions**

1.4.3.1. Submit maintenance instructions for incorporation in Project Data Book.

**1.5. Delivery, Storage, and Handling**

1.5.1. Package flooring materials and identify contents of each package.

- 1.5.2. Store materials for a minimum 48 hours immediately before installation at not less than 19 degrees C.

**1.6. Site Conditions**

**1.6.1. Environmental Requirements**

- 1.6.1.1. 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.
- 1.6.1.2. Ensure that adequate ventilation is provided during installation of flooring and curing of adhesive.
- 1.6.1.3. 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**

**2.1. Materials**

- 2.1.1. Provide each flooring material from same production run for one area and from same manufacturer for entire project.

**2.1.2. Flooring**

- 2.1.2.1. 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.
- 2.1.2.2. **Rubber Base:** Roppe 100mm high Pinnacle.

**2.1.3. Resilient Base - Rubber:**

- 2.1.3.1. Top Set: Cove bottom, 2 mm thick, grooved back, preformed external corners.
- 2.1.3.2. Straight: Butted Bottom, 2 mm thick, grooved back, Site Formed Corners.
- 2.1.3.3. Base Height: 100 mm as specified in Room Finish Schedule for each base type.
- 2.1.3.4. Colours: Solid as selected from manufacturer's standard range, not more than 2 colours.

**2.1.4. Flooring Accessories**

- 2.1.4.1. Ensure that accessories are compatible with, and match appearance and thickness of abutting flooring materials.

2.1.5. **Filler/Subfloor Preparation**

2.1.5.1. 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.

2.1.5.1.1. Assume an overall average levelling compound thickness of 4mm.

2.1.5.1.2. Provide for shotblasting of all existing surfaces in preparation for filler and levelling compound.

2.1.5.1.3. Provide Bonding agent as recommended by manufacturer.

2.1.5.1.4. Levelling Compound: Ardex K15

2.1.5.1.5. Cementitious bulk concrete filler: Ardex

2.1.6. **Primers and Adhesives**

2.1.6.1. 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

2.1.7. **Cleaner**

2.1.7.1. Neutral chemical compound that will not damage tile or affect its colour.

2.1.8. **Floor Protection**

2.1.8.1. 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**

**3.1. Examination**

3.1.1. Test substrate to ensure that moisture level and acid-alkali balance does not exceed limits recommended by adhesive manufacturer.

3.1.2. Ensure that environmental conditions have been provided as requested and specified.

3.1.3. 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.

3.1.4. Defective resilient flooring resulting from application to unsatisfactory surfaces will be considered the responsibility of this Section.

**3.2. Preparation**

3.2.1. Remove dirt, soil, oil, grease, and other deposits which would lessen the adhesive bond of flooring, and which would telegraph through flooring.

3.2.2. Remove chalking and dusting from concrete surfaces with wire brushes.

- 3.2.3. Remove prime paint and adhesives in accordance with the manufacturer's requirements.
- 3.2.4. Fill all defects such as cracks, depressions and scars from damage with filler. Level to smooth surface.
- 3.2.5. Prime subfloors in accordance with the manufacturer's requirements.
- 3.2.6. Protection: Prevent traffic and work on newly laid floors by barricading until adhesive cures.

### **3.3. Installation**

#### **3.3.1. General**

- 3.3.1.1. Lay each material in accordance with manufacturer's specification.
- 3.3.1.2. Lay flooring with joints closely butted. Scribe, cut and fit around floor outlets and openings, door frames, and heavy equipment supports.
- 3.3.1.3. Cut flooring and bases to fit within 0.4 mm of abutting surfaces were exposed to view.
- 3.3.1.4. Avoid abrupt variations in shades between adjacent flooring material. Do not install units that are off-colour or contain untypical pattern variations.
- 3.3.1.5. Carry floor patterns through openings.
- 3.3.1.6. Roll flooring with three-section, 45 kg roller, in two directions from centre of area. Maintain rollers clean and polished.

#### **3.3.2. Adhesives**

- 3.3.2.1. Apply adhesive uniformly over surfaces with a notched trowel, at rate recommended by manufacturer.
- 3.3.2.2. Cover only an area into which flooring can be set during working time of adhesive. Do not lay flooring over hardened adhesive.
- 3.3.2.3. Use only waterproof type adhesive in all areas where plumbing fixtures or floor drains are installed.
- 3.3.2.4. Protect adjacent surfaces from soil by adhesive.
- 3.3.2.5. Clean trowels and maintain profile of notches as installation of flooring progresses to ensure a constant rate of application.

#### **3.3.3. Resilient Tile Flooring**

- 3.3.3.1. Lay tile with joints as directed by architect.
- 3.3.3.2. Lay tile in square pattern with grain of adjacent units running in same monolithic direction.
- 3.3.3.3. Lay out tile so that perimeter units are at least one half tile in width except where room irregularities make it impossible.

#### **3.3.4. Resilient Bases**

- 3.3.4.1. Install bases in lengths as long as possible: do not make up runs of short lengths.
- 3.3.4.2. In areas where bases are indicated, install them on built-in fitments, columns, walls.
- 3.3.4.3. Cut and mitre internal corners.
- 3.3.4.4. Double cut seams between adjoining lengths.

- 3.3.4.5. Apply adhesive to wall, masked to prevent spreading above base, and firmly bed base in place.
- 3.3.4.6. Press top set base down to force cove against flooring.
- 3.3.4.7. Install straight base before flooring, with bottom edge against subfloor and top edge level.
- 3.3.4.8. Install top set base in all areas except as noted on Drawings.

3.3.5. **Reducer/Transition Strips**

- 3.3.5.1. Install strips at terminations of flooring where edges are exposed to view.
- 3.3.5.2. Install strips in straight lines and relate their terminations to significant building features and within tolerance of 3 mm in 3 m.
- 3.3.5.3. Install strips under doors at openings.
- 3.3.5.4. Cut and fit strip terminations to profile of abutting construction.
- 3.3.5.5. Secure strips to subfloor with contact bond adhesive to ensure complete bond.

3.4. **Adjustment, Cleaning, Sealing, and Waxing**

- 3.4.1. Replace defective resilient flooring installations so that there is no discernible variation in appearance between installed and replaced materials.
- 3.4.2. Clean off excess adhesive as installation of flooring progresses and before it sets.
- 3.4.3. Clean resilient flooring, but no sooner than 48 hours following installation. Use neutral floor cleaner where required, and proceed as recommended by manufacturer.
- 3.4.4. Clean floors on a regular basis at least once per week if no other protection is provided.
- 3.4.5. Clean floors before acceptance by Owner.
- 3.4.6. Provide sealer, plus 5 (five) coats of wax applied according to manufacturer's technical specifications prior to final acceptance.

3.5. **Protection**

- 3.5.1. 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.
- 3.5.2. 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.

3.6. **Extra Stock**

- 3.6.1. 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**

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**PART 1 - GENERAL**

**1.1. Description**

**1.1.1. General Requirements**

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

**1.1.2. Work Performed by Other Sections related to this Section is specified in:**

Section 03300 - Cast-In-Place Concrete  
Section 04200 - Unit Masonry  
Section 09250 - Gypsum Drywall

**1.2. Quality Assurance**

**1.2.1. Subcontractor Qualifications**

1.2.1.1. Apply coatings specified in this Section only by a Subcontractor as applicable who has adequate equipment and skilled tradesmen to perform it expeditiously, is an applicator approved by supplier of wall coating applied, and is known to have been responsible for satisfactory installations similar to that specified during a period of at least the immediate past two years.

**1.2.2. Requirements of Regulatory Agencies**

1.2.2.1. Coatings shall meet fire hazard classification requirements of jurisdictional authorities for each material in each installation location as applicable.  
1.2.2.2. Apply coatings that require fire hazard classification exactly as specified in Underwriter's Laboratory test specification that validates specified rating.  
1.2.2.3. Fire hazard classification shall not exceed  
: for Flame Spread: 25 for exits and 150 elsewhere.  
: for Smoke Developed: 50 for exits and 300 elsewhere.

**1.2.3. Mock-Up**

1.2.3.1. Apply a sample of each finished coating system to each substrate material to provide mock-up as specified in Section 01400. Remove samples disapproved because of failure to meet specified appearance and provide a new sample area.  
1.2.3.2. Each sample application shall cover an area of 9sq.m or the entire surface of the designated wall, whichever is the lesser.

**1.3. References**

**1.3.1. Reference Standards**

1.3.1.1. Reference standards quoted in Contract Documents refer to:  
CGSB Specification 1-GP-186, Coating System, Interior, High Build, Glazed.



**1.4. Submittals**

**1.4.1. Samples**

1.4.1.1. Submit 216 mm x 280 mm samples of each specified coating, in each colour and texture to match existing colour schemes in areas of renovation.

**1.4.2. Maintenance Instructions**

1.4.2.1. Submit maintenance instructions for incorporation in Project Data Book.

**1.5. Delivery, Storage and Handling**

1.5.1. Package, seal, and label each coating material to show manufacturer's and product name, fire hazard classification, and colour.

1.5.2. Store materials at site in an area specifically set aside for purpose that is locked, ventilated, and maintained at a minimum temperature of 10 deg.C.

1.5.3. Ensure that health and fire regulations are complied with in storage area, and during handling and application.

**1.6. Site Conditions**

**1.6.1. Environmental Requirements**

1.6.1.1. Do not apply coatings over substrates that contain over 14% moisture.

1.6.1.2. Apply coating only

: with surface temperatures at a minimum of 0 deg.C for 24 hours before during application, and for 24 hours following application or until cured.

: when no dust is being raised.

: in well-ventilated and broom clean areas.

**1.7. Warranty**

**1.7.1. Extended Warranty**

1.7.1.1. Submit a warranty for the work of this Section covering the period for (4) four years beyond the expiration of the warranty period specified in the General Conditions to the Contract.

**PART 2 - PRODUCTS**

**2.1. Materials**

2.1.1. Each material used in the application of each coating system shall be as recommended or manufactured by the supplier of the coating.

2.1.2. High Build Type Inorganic Non-Cementitious Coating:

To meet specified requirements of CGSB Specification 1-GP-186.

Ev-Rok by Canadian Everguard Division of Sternson Limited or equivalent coatings by:

MacNaughton-Brooks Products Limited, Duron Canada Limited or Everspec Surfaces Limited.

- 2.1.3. Colours and textures will be selected to match proposed colours and textures in finish schedule.

### **PART 3 - EXECUTION**

#### **3.1. Examination**

- 3.1.1. Verify that specified environmental conditions are ensured before commencing application of coating.
- 3.1.2. Test surfaces for moisture content and acid-alkali balance to ensure that they are suitable for application.
- 3.1.3. Ensure that surfaces to receive coatings have been provided by other Sections as specified; that they will not adversely affect execution, permanence, or quality of coatings; and that they can be put into acceptable condition by means of preparation specified in this Section. Surfaces to be finished are shown on Drawings or in Finish Schedule.
- 3.1.4. Defective coatings resulting from application to unsatisfactory surfaces will be considered the responsibility of this Section.

#### **3.2. Preparation**

- 3.2.1. Following his acceptance of surfaces, coating applicator shall be responsible for surface preparation not specified as the responsibility of other Sections.
- 3.2.2. Clean, prime and seal surfaces as recommended by coating manufacturer.
- 3.2.3. Cover or mask surfaces adjacent to those receiving coating to protect materials and surfaces installed by other Sections, and property from damage and soil.
- 3.2.4. Materials soiled by coatings during application and storage, and from which soil cannot be completely removed, shall be replaced by this Section.

#### **3.3. Application**

##### **3.3.1. General**

- 3.3.1.1. Apply special coating in accordance with coating manufacturer's specifications and by an applicator approved by the manufacturer to the surfaces indicated on Drawings or in Finish Schedule.
- 3.3.1.2. Coating manufacturer shall supervise application.
- 3.3.1.3. Before coating application commences, arrange for a site meeting, in accordance with Section 01200, at which conditions of surfaces as built and possible adaptations required to suit, and use of materials and application procedures, shall be discussed between Contractor, Special Coatings Subcontractor, Architect, and representatives of materials manufacturer.
- 3.3.1.4. Place cloths and other disposable finishing materials, that are a fire hazard, in closed metal containers, and remove from building every night.
- 3.3.1.5. Post "No Smoking" signs and ensure that spark-proof electrical equipment is used in areas where inflammable materials are being applied.
- 3.3.1.6. Post "Wet Coating" signs throughout freshly finished areas and remove when finishes are cured.

- 3.3.1.7. Erect barriers to prevent the entry and presence of personnel not performing special coatings application during application of coatings, and for 24 hours following completion of application.
- 3.3.1.8. Apply coatings with no runs, laps, voids, or other marks or irregularities, and with uniform colour, sheen and texture.
- 3.3.1.9. Make clean true junctions with no visible overlap between adjoining applications of coatings.
- 3.3.1.10. Match colours and textures of approved samples.
- 3.3.1.11. Apply each successive coat only after the previous coat has dried.

3.3.2. **Filler**

- 3.3.2.1. Apply to concrete unit masonry. Apply in minimum thickness to provide a smooth and level substrate for finish coating.

3.3.3. **Primer**

- 3.3.3.1. Apply as recommended by coating manufacturer for substrate and finish coating. Apply in minimum thickness of 7 mil.

3.3.4. **Finish Coating**

- 3.3.4.1. Apply as recommended by manufacturer. Apply in minimum thickness of 7 mil.

3.3.5. **Glaze Coating**

- 3.3.5.1. Apply as recommended by manufacturer. Apply in minimum thickness of 7 mil.

- 3.3.6. Apply coatings to a total thickness of 21 mil.

3.4. **Field Quality Control**

- 3.4.1. Verify by Tooke thickness gauge, and in the presence of the Architect, that thicknesses of completed coatings meet specified requirements.

3.5. **Adjustment and Cleaning**

- 3.5.1. Touch up and refinish minor defective coatings. Refinish entire coated surface where finish is damaged or otherwise unacceptable.
- 3.5.2. Remove promptly as coating application progresses, spilled or spattered coating materials from surfaces of products and property of other Sections. Do not mar surfaces while removing.
- 3.5.3. Leave storage and mixing areas clean and in same condition as equivalent spaces in Project.
- 3.5.4. Final cleaning is specified in Section 01710.

**End of Section**

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**PART 1 - GENERAL**

**1.1. Description**

**1.1.1. General Requirements**

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

**1.1.2. Scope of Work**

1.1.2.1. 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.

1.1.2.2. 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.

**1.1.3. Related Work Specified Elsewhere**

Section 06200: Finishing of Millwork

**1.2. Quality Assurance**

**1.2.1. Subcontractor Qualifications**

1.2.1.1. 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.

1.2.1.2. 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.

**1.2.2. Requirements of Regulatory Agencies**

1.2.2.1. Apply coatings that require fire hazard classification exactly as specified in Underwriters' Laboratories test specification that validates specified rating.

1.2.2.2. Coatings shall meet fire hazard classification requirements of jurisdictional authorities for each material in each installation location as applicable.

1.2.2.3. Fire retardant coatings to meet fire hazard classification requirements of jurisdictional authorities for each installation location.

1.2.2.4. Fire hazard classification ratings shall not exceed for:

1.2.2.4.1. Flame Spread: 25 for exits, 150 otherwise

1.2.2.4.2. Smoke Developed: 50 for exits, 300 otherwise.

1.2.3. **Mock-Up**

- 1.2.3.1. 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.

1.2.4. **Inspection**

- 1.2.4.1. A painting inspector may be appointed by the Consultant in order to provide independent inspection of all painting and testing where required.
- 1.2.4.2. 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.
- 1.2.4.3. 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.

1.3. **Submittals**

1.3.1. **Approvals**

- 1.3.1.1. 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.

1.3.2. **Colour Schedule**

- 1.3.2.1. Paint and colours shall be selected by the Architect.
- 1.3.2.2. Before any painting is to commence, the architect shall furnish a colour schedule showing where the various colours and finishes shall be applied.

1.3.3. **List of Materials**

- 1.3.3.1. 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.

1.3.4. **Affidavits**

- 1.3.4.1. 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.

1.3.5. **Samples**

- 1.3.5.1. 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.

1.3.6. **Inspection Reports**

- 1.3.6.1. A painting inspector shall review and submit reports on the quality of the painting contract.

1.4. **Guarantee**

- 1.4.1. 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.
- 1.4.2. 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.

1.5. **Delivery, Storage, and Handling**

- 1.5.1. 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.
- 1.5.2. 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.
- 1.5.3. 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.
- 1.5.4. 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.

1.6. **Site Conditions**

1.6.1. **Environmental Requirements**

- 1.6.1.1. Apply painting materials only when air and surface temperatures exceed 5°C, except for:
- 1.6.1.1.1. 7°C for latex paint at interior locations
  - 1.6.1.1.2. 10°C for latex paint at exterior locations
  - 1.6.1.1.3. 21°C for lacquers and enamels
- 1.6.1.2. 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.

- 1.6.1.3. 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.
- 1.6.1.4. Test moisture of surfaces by electronic Moisture Meter.
- 1.6.1.5. Do not apply finishes when dust is raised.
- 1.6.1.6. Do not apply finishes on porous surfaces as concrete, plaster, gypsum board, pipe insulation, masonry, containing over 12% moisture.
- 1.6.1.7. Masonry and Concrete Blocks must be installed at least 28 days prior to painting and must be visually dry on both sides before painting commences. This is not to be construed as including a "wetting down" process for Latex.
- 1.6.1.8. Concrete Floors shall be tested for moisture by a simple "cover patch test".
- 1.6.1.9. 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.
- 1.6.1.10. 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.

#### **1.7. Protection**

- 1.7.1. 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.
- 1.7.2. 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.
- 1.7.3. Waste, cloths and material which may constitute a fire hazard shall be placed in closed metal containers and removed daily from the site.
- 1.7.4. 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**

#### **2.1. Materials**

- 2.1.1. 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.
- 2.1.2. 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.
- 2.1.3. Only "top line" products produced by their manufacturers are acceptable.

## 2.2. Mixing

- 2.2.1. 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.
- 2.2.2. 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

### 3.1. Examination

- 3.1.1. Prior to commencement of work of this section, thoroughly examine all surfaces scheduled to be painted.
- 3.1.2. Test all surfaces for moisture content with an electronic moisture meter. Test surfaces of materials containing lime for acid-alkali balance.
- 3.1.3. Maintain at site at all times until applications are completed a moisture meter, hygrometer and thermometer to verify surface and environmental conditions.
- 3.1.4. 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.
- 3.1.5. 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.
- 3.1.6. Continuation of painting after first coat on drywall, plaster, structural steel and miscellaneous metal surfaces, shall imply acceptance of surfaces.

### 3.2. Preparation

#### 3.2.1. General

- 3.2.1.1. Vacuum clean interior areas immediately before finishing work commences.
- 3.2.1.2. 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.
- 3.2.1.3. Remove rust from damaged surfaces primed by other Sections or previously painted and reprime.
- 3.2.1.4. 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.
- 3.2.1.5. 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.



### 3.2.2. Surface Preparation

- 3.2.2.1. 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.
- 3.2.2.1.1. **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.
- 3.2.2.1.2. **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.
- 3.2.2.1.3. **Concrete Floors:** Shot blast and etch.
- 3.2.2.1.4. **Galvanized Steel and Iron:** Washing (Etching).
- 3.2.2.1.5. **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.
- 3.2.2.1.6. **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.
- 3.2.2.1.7. **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.

### 3.2.3. New Material

- 3.2.3.1. **Aluminum** (unfinished)
- 3.2.3.1.1. 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.
- 3.2.3.2. **Asphalt, Creosote, Tar & Bituminous Surfaces**
- 3.2.3.2.1. Remove dirt, oil, grease, sand if necessary for adhesion key. Apply Latex based sealer or primer.
- 3.2.3.3. **Canvas & Cotton Insulated Coverings:**
- 3.2.3.3.1. Remove dirt, grease and oil, test for moisture content of 12% or less.
- 3.2.3.4. **Copper**
- 3.2.3.4.1. Painted: Remove surface contamination by steam, high pressure water or xylene solvent washing. Apply Vinyl etching primer then paint immediately, as per Manufacturers: Direction.
- 3.2.3.4.2. 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.

3.2.3.5. **Drywall**

3.2.3.5.1. Remove contamination, prime surface to show defects if any (defects to be repaired by others). After defects remedied carry on with paint coatings.

3.2.3.6. **Galvanized Steel**

3.2.3.6.1. Remove surface contamination, wash metal with xylene solvent and apply coat of an approved etching type primer.

3.2.3.7. **Zinc Coated Steel**

3.2.3.7.1. Remove surface contamination and prepare surface to material manufacturer's instructions for priming. Refer to Chapter 3 of CPCA.

3.2.3.8. **Masonry Surfaces and Concrete**

3.2.3.8.1. 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.

3.2.3.8.2. 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.

3.2.3.9. **Plaster**

3.2.3.9.1. Hairline cracks, small holes and imperfections shall be corrected by the Plastering Contractor. Wash and neutralize high alkali surfaces where they occur.

3.2.3.10. **Structural and Miscellaneous Steel**

3.2.3.10.1. 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.

3.2.3.11. **Wood Plywood & Millwork**

3.2.3.11.1. 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.

3.2.4. **Previously Painted Surfaces**

3.2.4.1. **Interior**

3.2.4.1.1. Surfaces must be clean and dry and free of all grease, wax and dirt.

3.2.4.1.2. Remove grease, wax and dirt by washing with a good quality household cleaner. Rinse with clean water and let dry thoroughly before painting.

3.2.4.1.3. Remove all loose or peeling paint by scraping - feather edges with medium sandpaper.

3.2.4.1.4. 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.

- 3.2.4.1.5. Sand glossy surfaces lightly with fine sandpaper to ensure proper adhesion.
- 3.2.4.1.6. Seal porous surfaces, such as flat latex, with Latex Sealer, especially if refinishing with velvet or eggshell enamels to prevent "flashing" or uneven gloss.
- 3.2.4.2. **Exterior**
  - 3.2.4.2.1. Surfaces must be clean and dry and free of all grease, wax, dirt and mildew.
  - 3.2.4.2.2. 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.
  - 3.2.4.2.3. Remove all loose or peeling paint by scraping.
  - 3.2.4.2.4. Patch holes and cracks with an exterior patching compound.
  - 3.2.4.2.5. Re-caulk all open joints or cracks to prevent moisture entering wood or masonry.
  - 3.2.4.2.6. Spot prime bare areas with the appropriate primer before painting.
  - 3.2.4.2.7. Remove excess caulk by washing and/or sanding. Chalky surfaces to be sealed with a coat of Exterior Alkyd Primer.
  - 3.2.4.2.8. Glossy surfaces should be dulled by light sanding with fine sandpaper to ensure proper adhesion.
- 3.2.5. **Application**
  - 3.2.5.1. **General**
    - 3.2.5.1.1. Method of paint application shall be generally by the accepted trade method.
    - 3.2.5.1.2. Painting coats specified are intended to cover surfaces satisfactorily when applied in strict accordance to recommendations.
    - 3.2.5.1.3. Apply each coat at the proper consistency.
    - 3.2.5.1.4. Each coat of paint, shall be slightly darker than preceding coat unless otherwise approved.
    - 3.2.5.1.5. Sand lightly between coats to achieve an anchor for the required finish.
    - 3.2.5.1.6. Do not apply finishes on surfaces that are not sufficiently dry.
    - 3.2.5.1.7. Each coat of finish should be dry and hard before a following coat is applied unless the manufacturer's directions state otherwise.
    - 3.2.5.1.8. 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.
    - 3.2.5.1.9. Finish glazing rebates before glazing commences.
    - 3.2.5.1.10. Do not paint caulked joints.
    - 3.2.5.1.11. 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.

### 3.2.5.2. General Colour Requirements

- 3.2.5.2.1. Refer to the Colour/Room Finish Schedule for type and extent of finishes.
- 3.2.5.2.2. 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.
- 3.2.5.2.3. Exterior and interior steel frames and trim generally will be of a different colour than adjacent walls.
- 3.2.5.2.4. 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.
- 3.2.5.2.5. 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.
- 3.2.5.2.6. This section shall figure on:
  - 3.2.5.2.6.1.1. 2 different light colours
  - 3.2.5.2.6.1.2. different dark colours (deep and bright included)  
Black Included.

### 3.2.5.3. Priming and Backpriming

- 3.2.5.3.1. 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.
- 3.2.5.3.2. Interior woodwork which is to receive paint or enamel finish shall be backprimed upon arrival at the job site with enamel undercoating paint.
- 3.2.5.3.3. Stain, or gloss varnish reduce as per manufacturer's directions.
- 3.2.5.3.4. Top and bottom edges of wood and metal doors shall be primed with undercoating, stain or varnish, depending on the finish specified.

### 3.2.5.4. Painting

- 3.2.5.4.1. 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.
- 3.2.5.4.2. 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.
- 3.2.5.4.3. Use only brushes for enamels and varnishes, and for painting wood.
- 3.2.5.4.4. 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.
- 3.2.5.4.5. Use only unadulterated paint. Thin paint as specified by manufacturer.
- 3.2.5.4.6. 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.

- 3.2.5.4.7. Do not paint metal access and electrical panels when they are closed. Paint when open and leave open until dry.
- 3.2.5.4.8. 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.

3.2.5.5. **Staining**

- 3.2.5.5.1. 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.
- 3.2.5.5.2. Tint filler to match wood.
- 3.2.5.5.3. Where indicated in these specifications or on Drawings, wood is to receive either a "wiped" stain or solid stain.
  - 3.2.5.5.3.1. 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.
  - 3.2.5.5.3.2. "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.

3.2.5.6. **Field Quality Control**

- 3.2.5.6.1. 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.
- 3.2.5.6.2. Alkali content tests, and such other tests as shall be necessary, shall be performed by the Painter in collaboration with the painting inspector.
- 3.2.5.6.3. 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.
- 3.2.5.6.4. Painting Inspector to submit reports of each site visit.

3.2.5.7. **Cleaning**

- 3.2.5.7.1. 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.

3.2.5.8. **Extra Stock**

3.2.5.8.1. 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.

3.2.5.9. **Painting and Finishing Schedule**

3.2.5.9.1. **General**

- 3.2.5.9.1.1. 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.
- 3.2.5.9.1.2. Finish interior surfaces, including objects within each area unless otherwise excluded, as indicated on Finish Schedule.
- 3.2.5.9.1.3. Wall surfaces partially finished with other finish materials shall have remainder of surfaces finished as for surrounding surfaces.
- 3.2.5.9.1.4. An additional finish coat is required for dark colours and pastel colours.
- 3.2.5.9.1.5. Finish equipment, panels, fitments, services, structure, attachments, accessories, prime coated hardware, or similar appurtenances on or near finished surfaces to match finish of the surface.
- 3.2.5.9.1.6. 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.
- 3.2.5.9.1.7. Finish interiors of alcoves, recesses, closets, cupboards, fitments, and similar spaces to match adjacent surfaces unless otherwise indicated.
- 3.2.5.9.1.8. 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.
- 3.2.5.9.1.9. Finish exposed wood and exposed ferrous metals, whether primed or galvanized or not, on surfaces that are indicated as unfinished.
- 3.2.5.9.1.10. 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.

3.2.5.9.2. **Include Finishing of the Following Surfaces by This Section**

- 3.2.5.9.2.1. Steel lintels where exposed to view.
- 3.2.5.9.2.2. Interior ferrous metal hardware, fasteners and accessories, new and existing.
- 3.2.5.9.2.3. Interior galvanized hardware, fasteners and accessories, new and existing.
- 3.2.5.9.2.4. Exterior ferrous metal hardware, fasteners and accessories, new and existing.
- 3.2.5.9.2.5. Exterior galvanized hardware, fasteners and accessories.
- 3.2.5.9.2.6. 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.
- 3.2.5.9.2.7. Paint exposed plywood edges of new and existing doors to match stained finish.
- 3.2.5.9.2.8. Paint new and existing metal door grilles to match door faces.
- 3.2.5.9.2.9. New and existing sheet metal ducts in interior spaces where exposed to view.
- 3.2.5.9.2.10. Sprinkler system except for heads where exposed to view.
- 3.2.5.9.2.11. Access doors, new and existing.
- 3.2.5.9.2.12. Baseboard units, new and existing.
- 3.2.5.9.2.13. Convect cover covers, new and existing.
- 3.2.5.9.2.14. Prime painted louvres, grilles, and diffusers at interior.
- 3.2.5.9.2.15. Prime painted louvres, grilles, and diffusers at exterior.
- 3.2.5.9.2.16. Prime painted fire hose and extinguisher cabinets.
- 3.2.5.9.2.17. Prime painted electrical panel doors and frames.
- 3.2.5.9.2.18. Paint new and existing piping and conduit exposed to view in finished areas. Colours to match adjacent surfaces.
- 3.2.5.9.2.19. Ensure that no colour coding or other identification of services that are applied by others are painted over by this Section.
- 3.2.5.9.2.20. Fill pipes.
- 3.2.5.9.2.21. Electrical service entry.
- 3.2.5.9.2.22. Mechanical, electrical and other equipment and accessories on roof including any existing items.

3.2.5.9.3. **Surfaces That Do Not Require Finishing**

- 3.2.5.9.3.1. Painting or finishing of the following surfaces is not included in this Section:

3.2.5.9.3.2. 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.

3.2.5.9.4. **Gloss**

3.2.5.9.4.1. Gloss value shall be determined in accordance with ASTM D523 Tentative Method of Test for 60° specular gloss.

3.2.5.9.4.2. Gloss required for each surface is noted on Room Finish Schedule.

3.2.5.10. **Finish Formula Schedule**

3.2.5.10.1. **General**

3.2.5.10.1.1. 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.

3.2.5.10.2. **Exterior Woodwork** (Fences, Plywood, Partitions)

3.2.5.10.2.1. Ext. 1-A, Exterior Alkyd Finish, premium grade.

3.2.5.10.2.2. Ext. 1-D, Exterior Solid Colour Stain Finish, premium grade.

3.2.5.10.2.3. Ext. 1-F, Exterior Fire Retardant

3.2.5.10.3. **Exterior Wood Trim** (Doors, Door and Window Frames, Fascia)

3.2.5.10.3.1. Ext. 2-A, Exterior Alkyd Finish, premium grade.

3.2.5.10.3.2. Ext. 2-G, Exterior Pigmented Polyurethane Finish Type 2, premium grade.

3.2.5.10.4. **Exterior Concrete, Concrete Block, Masonry, Stucco, Stone**

3.2.5.10.4.1. Ext. 6-A, Latex Finish, Stucco, Bricks and Render, premium grade.

3.2.5.10.4.2. Ext. 6-B, Latex Finish, Concrete Block, premium grade.

3.2.5.10.5. **Exterior Structural and Misc. Steel** (Factory Primed)

3.2.5.10.5.1. Ext. 11-A, Alkyd Finish, premium grade.

3.2.5.10.5.2. Ext. 11-C, Aluminum Paint Finish, premium grade.

3.2.5.10.5.3. Ext. 11-D, Two Component Epoxy Finish, premium grade.



3.2.5.10.6. **Exterior Galvanized Metal** (Zinc Coated Steel).

- 3.2.5.10.6.1. Ext. 12-A, Alkyd Finish, premium grade.
- 3.2.5.10.6.2. Ext. 12-B, Aluminum Finish, premium grade.
- 3.2.5.10.6.3. Ext. 12-C, Bituminous Finish (Unexposed - next to concrete), Custom grade.

3.2.5.10.7. **Exterior Aluminium** (Flashings, misc. work, downpipes, etc.)

- 3.2.5.10.7.1. Ext. 13-A, Alkyd Finish on Exposed Aluminum, premium grade.
- 3.2.5.10.7.2. Ext. 13-C, Bituminous Finish on unexposed aluminum, custom grade.

3.2.5.10.8. **Exterior Copper**

- 3.2.5.10.8.1. Ext. 14-A, exposed Alkyd Finish, premium grade.
- 3.2.5.10.8.2. Ext. 14-C, Bituminous Finish unexposed next to concrete or wood, premium grade.

3.2.5.10.9. **Exterior Steel - High Heat**

- 3.2.5.10.9.1. Ext. 15-B, Heat Resistant Enamel Finish, follow manufacturer's recommendations for application.

3.2.5.10.10. **Interior Wood** (wood trim, benches, wood doors and frames, cabinets etc.)

- 3.2.5.10.10.1. Int. 1-B, Latex Finish, premium grade.
- 3.2.5.10.10.2. Int. 1-C, Semi Transparent Alkyd Stain Finish, premium grade.
- 3.2.5.10.10.3. Int. 1-D, Semi Transparent Stain Polyurethane Varnish, premium grade.
- 3.2.5.10.10.4. Int. 1-I, Clear Polyurethane, premium grade.
- 3.2.5.10.10.5. Int. 1-J, Fire Retardant Solvent Base Pigmented Finish, follow manufacturers' instructions to apply.
- 3.2.5.10.10.6. Int. 1-K, Fire Retardant Clear Finish, follow manufacturers' instructions to apply.
- 3.2.5.10.10.7. Int. 1-L, Chemical Resistant Finish Shelving, Cupboards, Etc, premium grade.

3.2.5.10.11. **Interior Plaster, Drywall Etc.**

- 3.2.5.10.11.1. Int. 4-B, Latex Finish, premium grade.
- 3.2.5.10.11.2. Int. 8-D, 1 coat: Glidden Professional, GP 1000 High Hide Interior Primer Sealer
- 3.2.5.10.11.3. coats: Glidden Professional, 4426 Tru-Glaze-WB 4426 Waterborne Epoxy Semi-Gloss Coating
- 3.2.5.10.11.4. Int. 4-G, Fire Retardant Coating Latex. Follow manufacturers' recommendations for application.

3.2.5.10.12. **Interior Canvas And Cotton Insulation Coverings** (pipes, and ductwork, boilers)

3.2.5.10.12.1. Int. 5-B, Aluminum Paint Finish, premium finish.

3.2.5.10.12.2. Int. 5-C, Latex Finish, premium grade.

3.2.5.10.13. **Interior New Acoustic Plaster, Tile and Textured Ceilings**

3.2.5.10.13.1. Int. 6-C, Custom grade.

3.2.5.10.14. **Interior Concrete, Masonry, Stucco.**

3.2.5.10.14.1. Int. 7-A, Latex Finish, premium grade.

3.2.5.10.14.2. Int. 7-D, Water Based Tile-Like Finish on Smooth Concrete, premium grade.

3.2.5.10.15. **Interior Concrete Block, and Concrete Brick**

3.2.5.10.15.1. Int. 8-A, Latex Finish, premium grade.

3.2.5.10.15.2. Int. 8-D, 2 coats: Glidden Professional, 4426 Tru-Glaze-WB 4426 Waterborne Epoxy Semi-Gloss Coating

3.2.5.10.16. **Interior Structural And Misc. Steel** (Factory-Primed)

3.2.5.10.16.1. Int. 12-A, Alkyd Finish, premium grade.

3.2.5.10.16.2. Int. 12-D, Two Component Epoxy Finish, premium grade.

3.2.5.10.17. **Interior Galvanized Metal** (Zinc Coated Steel)

3.2.5.10.17.1. Int. 13-A, Alkyd Finish, premium grade.

3.2.5.10.17.2. Int. 13-D, Latex Finish, premium grade.

3.2.5.10.18. **Interior High Heat Steel** (Boilers, Breeching, pipelines. etc.)

3.2.5.10.18.1. Int. 14-B, Heat Resistant Enamel Finish, follow manufacturers' instructions for application.

3.2.5.10.18.2. Int. 14-E, Heat Resistant Enamel Finish, for temp. between 315 to 425 deg. C. follow manufacturers' instructions for application.

3.2.5.10.19. **Interior Aluminum**

3.2.5.10.19.1. Int. 15-A, Alkyd Finish, premium grade.

**End of Section**

## **PART 1 - GENERAL**

### **1.1. Description**

#### **1.1.1. General Requirements**

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

#### **1.1.2. Work performed by other Sections related to this Section is specified in:**

Section 08800: Mirrors  
Division 15: Plumbing fixtures  
Division 16: Service for electric dryers

### **1.2. Submittals**

#### **1.2.1. Shop Drawings**

1.2.1.1. Submit shop drawings

#### **1.2.2. Samples**

1.2.2.1. Submit samples of accessories that are requested.

### **1.3. Delivery, Storage and Handling**

1.3.1. Package accessories and label with description of contents and installation location.

1.3.2. Deliver accessories where designated at site by Contractor.

## **PART 2 - PRODUCTS**

### **2.1. Products**

2.1.1. Specified manufacturer's catalogue references to Bobrick Washroom Equipment establish minimum acceptable standards for products specified in this section except where another manufacturer is specifically listed.

2.1.2. Unspecified materials which form a part of complete assemblies shall be of manufacturer's standard.

#### **2.1.3. Toilet Tissue Dispenser**

Location:	At each new water closet as noted in drawings.
Mounting:	Surface
Operation:	Dual roll with theft resistant spindle
Finish:	satin finish on cast aluminum
Model:	B-274

2.1.4. **Mirrors**

Location: As indicated on drawings.  
Size: 460 x 760.  
Frame: 19 mm wide, Type 304 stainless steel, satin finish.  
Glass: 6 mm thick Tempered and plate/float glass, electronically plated.  
Model: B-290 1830

2.1.5. **Tilt Mirrors**

Location: As indicated on drawings.  
Size: 460 x 760.  
Frame: 19 mm wide, Type 304 stainless steel, satin finish.  
Glass: 6 mm thick tempered and plate/float glass, electronically plated.  
Model: B-293 1830

2.1.6. **Soap Dispensers**

Location: As indicated on drawings.  
Mounting: surface  
Finish: Stainless Steel, satin finish  
Model: B-2111

2.1.7. **Soap Dishes**

Location: In room 103B  
Mounting: Semi-recessed  
Finish: Stainless Steel, satin finish.  
Model: B-7680

2.1.8. **Electric Hand Dryers**

Location: As indicated on drawings.  
Mounting: Surface  
Finish: Stainless steel satin finish on exposed trim, porcelain enamel in colours to be selected (maximum 2 colours per project)  
Electrical: 115 volt, 20 amp, single phase, 2300 watt  
Operation: automatic  
Model: B-7017

2.1.9. **Electric Hair Dryers**

Location: In room 103B  
Mounting: Surface  
Finish: Stainless steel satin finish on exposed trim, porcelain enamel in colours to be selected (maximum 1 colours per project)  
Electrical: 115 volt, 20 amp, single phase, 2300 watt  
Operation: manual, push button  
Model: B-7817.

2.1.10. **Paper Towel Dispensers**

Location: As indicated on drawings.  
Mounting: surface  
Finish: Stainless Steel, satin finish  
Model: B-262

2.1.11. **Waste Disposal**

Location: As indicated on drawings.  
Mounting: semi recessed  
Finish: Type 304 stainless steel, satin finish  
Model: B-367034

2.1.12. **Sanitary Napkin Disposal**

Location: As indicated on drawings.  
Mounting: surface  
Operation: hinged top cover with full length piano hinge keyed bottom access door with full length piano hinge  
Finish: Type 302 stainless steel, satin finish  
Model: B-270

2.1.13. **Towel/Robe Hooks**

Location: In room 103B  
Mounting: surface  
Materials: Type 304 stainless steel for flanges, concealed wall plates, mounting brackets, post and cap complete with lock screws.  
Finish: satin finish  
Model: B-76727

2.1.14. **Shower Curtain Rod**

Location: In room 103B  
Mounting: surface  
Materials: Rod - heavy duty, 20 gauge, Type 304 stainless steel, 30 mm diameter  
Flanges - 65 mm square, Type 304 stainless steel  
Finish: satin finish  
Model: B-6047

2.1.15. **Shower Curtain**

Location: In room 103B  
Mounting: surface  
Materials: opaque, matte white vinyl, 0.2 mm thickness, with nikel plated brass grommets spaces at 152 mm on centre, bottoms and edges hemmed  
Model: 204-2 complete with 204-1 stainless steel curtain hooks

2.1.16. **Shower Seat**

Location: In room 103B  
Mounting: surface  
Operation: self locking mechanism  
Finish: Frame - Type 304 stainless steel, satin finish  
Seat - solid phenolic slats  
Model: B-5191

2.1.17. **Grab Bars**

2.1.17.1. **Type 1**

Location: As indicated on drawings.  
Mounting: surface with exposed flanges, for horizontal and vertical installation  
Material: 18 gauge, type 304 stainless steel, 32 mm diameter  
Finish: polished ends with peened grips  
Model: B-490 x 610 mm

2.1.17.2. **Type 2**

Location: As indicated on drawings.  
Mounting: surface with exposed flanges  
Material: 18 gauge, type 304 stainless steel, 32 mm diameter  
Finish: polished ends with peened grips  
Model: B-4961 and to suit dimensions on floor plan

2.1.18. **Baby Change Station**

Location: As indicated on drawings.  
Mounting: As per manufacturers requirements  
Model: Koala – KB100

**2.2. Fabrication**

- 2.2.1. Include reinforcing, anchorage and mounting devices required for the installation of each product.
- 2.2.2. Fit joints and junctions between components tightly and in true planes, conceal and weld joints where possible.
- 2.2.3. Fabricate products with materials and component sizes, metal gauges, hardware, reinforcing, anchors, and fastenings of adequate strength to ensure that products will remain free of warping, buckling, opening of joints and seams, and distortion within limits of intended use.

**2.3. Installation**

- 2.3.1. Provide manufacturer's handling instructions, anchorage information, roughing-in dimensions, and templates for installation of products specified in this Section.
- 2.3.2. Install products only as specified by manufacturer..3 Install grab bars in accordance with OBC.
- 2.3.3. Verify location and mounting heights of products with Architect before roughing-in or installation.

- 2.3.4. Install products plumb, level, straight, tight and secure to mounting surfaces, and centred between joints on masonry and tile walls.
- 2.3.5. Attach accessories to walls with only
  - : 38 mm long expansion shields in solid masonry or in concrete.
  - : toggle bolts in cells of hollow masonry units.
  - : sheet metal screws into metal framing and finish of fastened products where exposed to view.
  - : the attachment of toilet tissue dispensers shown back-to-back shall be bolted through metal partition.

**2.4. Adjustment and Cleaning**

- 2.4.1. Adjust operating units to ensure free-acting, tightly closing, and properly functioning operation. Lubricate as required.
- 2.4.2. Refinish damaged or defective products so that no variation in surface appearance is discernible. Refinish products at site only if approved.

**End of Section**



**Chorley + Bisset**  
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**PHASE 2 RENEWAL**

**CHATHAM**

**ONTARIO**

**ST. CLAIR CATHOLIC DISTRICT SCHOOL BOARD**

**CHORLEY + BISSET LTD**  
**CONSULTING ENGINEERS**  
**LONDON                      ONTARIO**

**FILE NO. 8391**  
**APRIL 2018**

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DETAIL SHEETS

<u>Detail No.</u>	<u>Title</u>
1	Identification of Piping Systems
2	Typical Detail of Automatic Air Vent
3	Air Seal for Drains from Air Handling Equipment
4	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 **MECHANICAL SYSTEMS COMMISSIONING**
- 1.2.1 The mechanical systems of this project will be thoroughly commissioned by a Third Party Commissioning Agent engaged by the Owner. Assist and cooperate with the commissioning agent as required. Include all related costs in the Base Bid.
- 1.3 **VISITING SITE**
- 1.3.1 Visit the site and be familiar with working conditions and work involved before submitting Bids. Refer to "Instructions to Bidders" regarding mandatory site visits during the bidding period. No extras will be granted due to lack of a thorough preliminary investigation of the site.
- 1.3.2 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.
- 1.3.3 Contractors visiting for site investigation must sign in at the main office. Upon arrival, review and sign the on-site Designated Substances Report prior to site investigation.
- 1.4 **CONTRACT DRAWINGS**
- 1.4.1 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.
- 1.4.2 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.
- 1.4.3 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.
- 1.4.4 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.
- 1.4.5 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.

- 
- 1.4.6 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.
- 1.4.7 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.
- 1.4.8 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.
- 1.4.9 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. See Detail Sheet at end of this Section.
- 1.5 **SHOP DRAWINGS**
- 1.5.1 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.
- 1.5.2 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.
- 1.5.3 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.
- 1.5.4 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.
- 1.5.5 Submit one reviewed set of Shop Drawings with each set of Maintenance and Operating Instructions.
- 1.5.6 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.

- 
- 1.5.7 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.
- 1.5.8 Ensure at least one copy of the reviewed Shop Drawings is kept on site at all times for reference.
- 1.5.9 Prepare all Drawings in SI units.
- 1.6 **FIELD DRAWINGS**
- 1.6.1 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.
- 1.6.2 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.
- 1.6.3 If the General Contractor separates the Fire Protection Sprinkler System work from the other work of Division 15, the General Contractor assumes full responsibility for this coordination work including the preparation of the Field Drawings.
- 1.7 **AS-BUILT DRAWINGS**
- 1.7.1 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.
- 1.7.2 Revise and maintain the prints as work progresses. Show all revisions, relocations and changes, to scale. Use colour markings.
- 1.7.3 Have the marked prints on site for review by the Consultant at all times. Monthly draws will not be approved unless all changes have been shown.
- 1.7.4 Submit completed As Built Drawings disks in AutoCAD 2010 format and one set of Reproducible Drawings with the Operating and Maintenance Manuals.
- 1.7.5 For the purposes of Contract payments, marked prints of As Built Drawings will be assumed to have a value of \$10,000.00. 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.
- 1.8 **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.



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- 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 CAN-ULC S115 "Standard Method of Fire Test for Firestop Systems".
- 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 Rated Assemblies".
- 1.9.4 Submit one sample of the components of each firestop system to the Consultant for review.
- 1.10 **MAINTENANCE AND OPERATING INSTRUCTIONS**
- 1.10.1 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.
- 1.10.2 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 approved 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. 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.
- 1.10.4 The following information is to be contained within the Sections:
- 1.10.4.1 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. Copy of all natural gas fitter tags.

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- 1.10.4.2 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.
- 1.10.4.3 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.
- 1.10.4.4 A complete list of all air filter sizes, quantities and types, corresponding with unit designations.
- 1.10.4.5 Copies of warranties.
- 1.10.4.6 Complete control diagrams, wiring diagrams and description of control system and the functioning of the system.
- 1.10.4.7 Copy of the project Testing and Balancing Report.

#### 1.11 REGULATIONS AND PERMITS

- 1.11.1 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.
- 1.11.2 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 and Safety Act.
- 1.11.3 Submit copies of CRN Certificates for all boilers and registered pressure vessels. Arrange and pay for TSSA certification of all boilers with a heating surface area greater than 2.78 m<sup>2</sup> (30 ft<sup>2</sup>).
- 1.11.4 Arrange and pay for TSSA inspection and certification for all piping systems and equipment regulated by TSSA.

#### 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.

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- 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 Mechanical 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 Mechanical Contractor shall have an office representative (not site personnel) at each site meeting and deficiency review. Attendance at these meetings is mandatory.

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**1.15      PROGRESS DRAWS**

1.15.1      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.

**1.16      WARRANTY**

1.16.1      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.

1.16.2      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 unless specified or shown otherwise.

**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 or foundation walls.

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. Use sprinkler proof 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.

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**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. Flashing is for Division 15 use only.
- 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 line and EPDM base seal. Size seals to suit pipe diameter.

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- 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 and fixtures. 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 minimum 3.0 m (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.



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- 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.

### 3.6 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.
- 3.6.4.3 Sleeves through beams will be permitted only as directed by the Consultant.
- 3.6.4.4 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.
- 3.7 **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. For all penetrations through a Mechanical Room floor, provide a minimum W rating - Class 1 in addition to the fire resistance rating.
- 3.8.3 At each fire stopping penetrating location, provide a fire stopping identification label indicating the system number installed, products used, date installed and the installer's name. Locate label on penetrating service at the penetration location.
- 3.8.4 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. 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

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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.

- 3.8.5 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 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.

- 3.12.2 Paint all steel framework provided by this Division with a chromium oxide primer.

- 3.12.3 Paint all exterior piping. Use two coats of paint. Use colours as selected by the Consultant.

- 3.12.4 Paint all gas piping. Use bright yellow colour. Use two coats of paint.

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**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.

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 **Fire Protection Systems:** Test in accordance with current NFPA and Risk Management Services (RMS) recommendations.

3.17.4 **H.W. Heating - 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.

3.17.5 **Natural Gas:** Test in accordance with latest CSA B149.1.

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**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 Systems to be tested are:

- Rooftop Air Handling Unit(s)
- Controls
- Fluid Cooler
- Heat Pump System

3.18.4 The manufacturer's representative must be present for the test period and submit a Certificate of Operation to the Consultant.

3.18.5 Comply with all requirements of Section 15990, "Commissioning".

**3.19 START-UP SERVICES**

3.19.1 Provide the services of a qualified person to be on call and available to the site within one hour, for 3 weeks 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 and cooling units, and all air handling equipment with a vacuum cleaner when building is completed.

3.21.5 Steam clean all existing convectors and wall-fin elements in the rooms where changes have been made. Do this after all other work has been completed.

3.21.6 For each new filter bank, provide one extra set of filters.

### 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 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 ALTERNATIVE, SEPARATE, UNIT AND IDENTIFIED PRICES

3.26.1 Refer to Division 1 Specifications.



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**3.27 CASH ALLOWANCES**

- 3.27.1 Include in the Base Bid price, cash allowances of:
- 3.27.1.1 \$3,000.00 to cover the cost of having the local utility supply the water meter.
- 3.27.1.2 \$70,000.00 to cover the cost of Section 15900 "Controls" and Section 15990 "Controls Commissioning".
- 3.27.2 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.

**3.28 PHASING**

- 3.28.1 The work on this project is to be phased to enable continuous operation of the Owners facilities. See the Architectural Drawings and Specifications regarding the proposed phasing of the work. Provide for temporary services, connections, bypasses, etc. to enable the phasing as described. Carry all associated costs in the Bid.

**3.29 FIRE SAFETY IN EXISTING BUILDINGS**

- 3.29.1 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.

**3.30 DEFICIENCY REVIEW**

- 3.30.1 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.
- 3.30.2 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.

**3.31 TEMPORARY WATER SERVICE**

- 3.31.1 Provide a Reduced Pressure type backflow preventer at each temporary water service connection used for construction purposes. Completely remove all temporary facilities once permanent systems are tested and operational.

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**3.32 LIST OF MECHANICAL SUBCONTRACTORS AND MANUFACTURERS**

3.32.1 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.

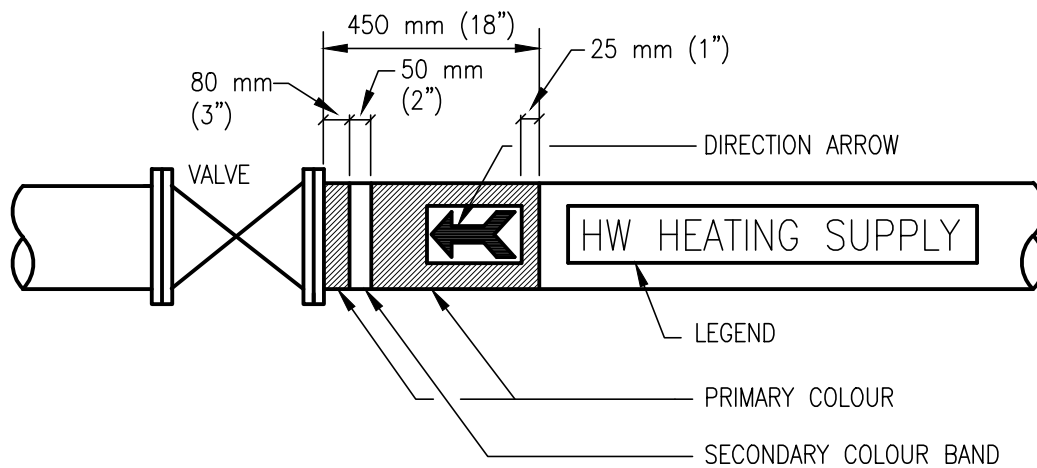
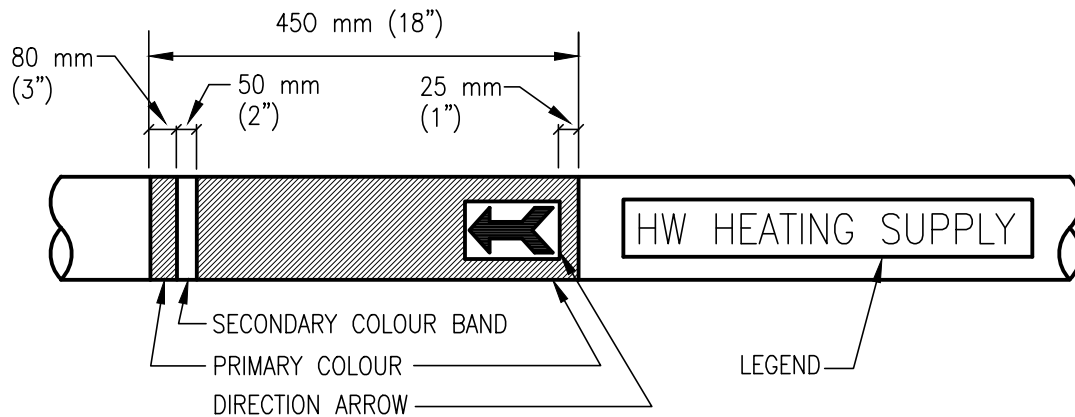
**3.32.2 Subcontractors**

Controls  
Insulation  
Sheet Metal  
Sprinkler System  
Testing and Balancing

**3.32.3 Manufacturers**

Acoustical Plenums  
Circulating Pumps  
Exhaust Fans  
Floor and Roof Drains  
Fluid Cooler  
Grilles, Registers and Diffusers  
Heat Exchangers  
Heat Pumps  
Heaters  
Noise and Vibration Control  
Plumbing Brass  
Plumbing Fixtures  
Rooftop Air Handling Unit

**END OF SECTION**



10mm (3/8") COPPER  
OVERFLOW PIPE

AUTOMATIC AIR VENT  
(LOCATE IN CONVENIENT  
AND ACCESSIBLE LOCATION)

BALL VALVE

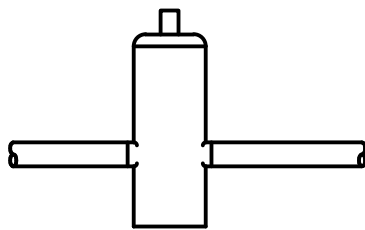
AIR CHAMBER

MAIN

RUN TO A CONVENIENT  
FLOOR DRAIN OR SERVICE  
SINK IN JANITORS CLOSET

BALL VALVE

RISER



FOR AIR VENT ON LEVEL  
PIPING USE AIR CHAMBER  
AS ABOVE.

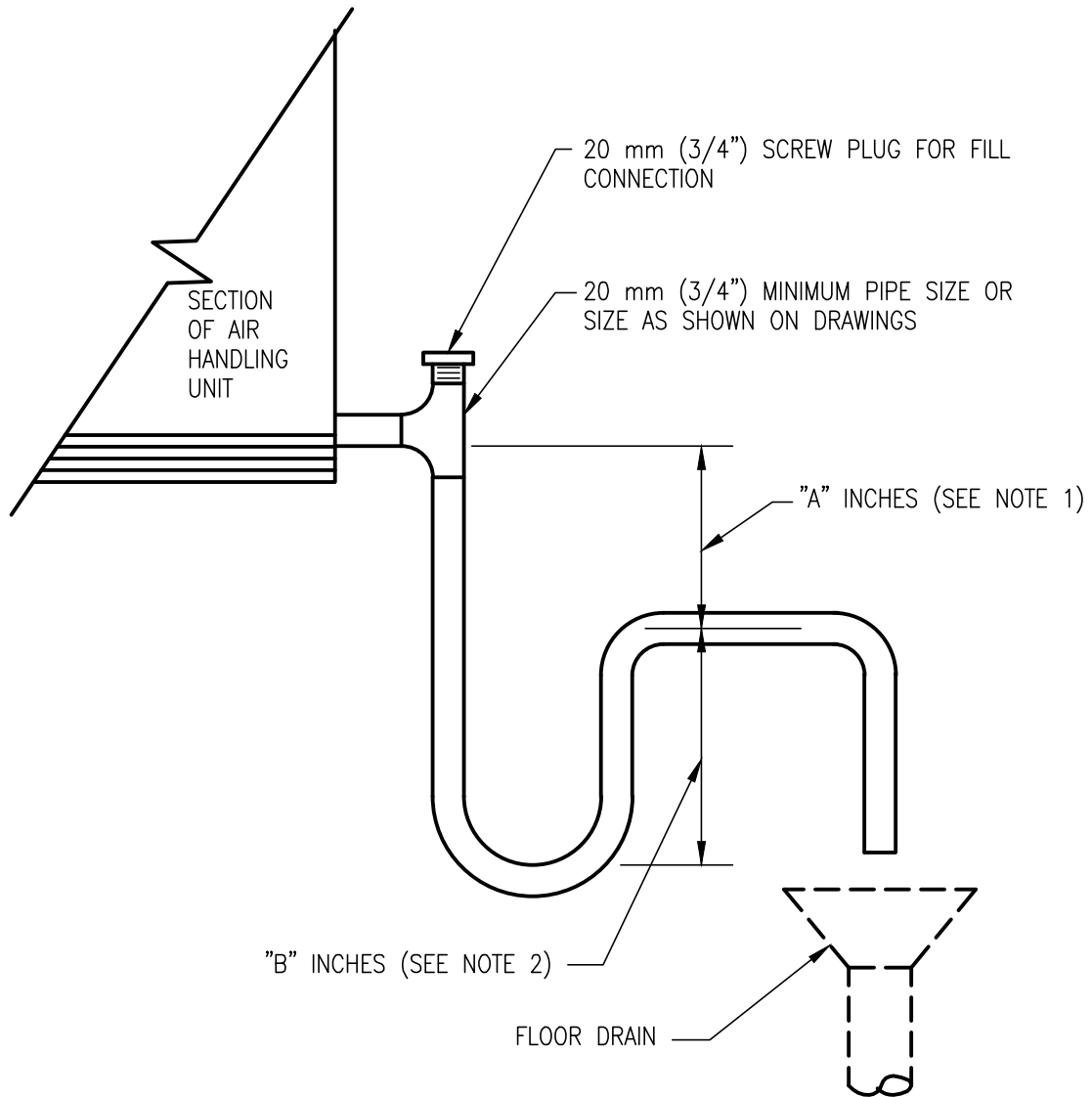


**Chorley + Bisset**  
CONSULTING ENGINEERS

TITLE

TYPICAL DETAIL OF  
AUTOMATIC AIR VENT

DETAIL NO.



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)

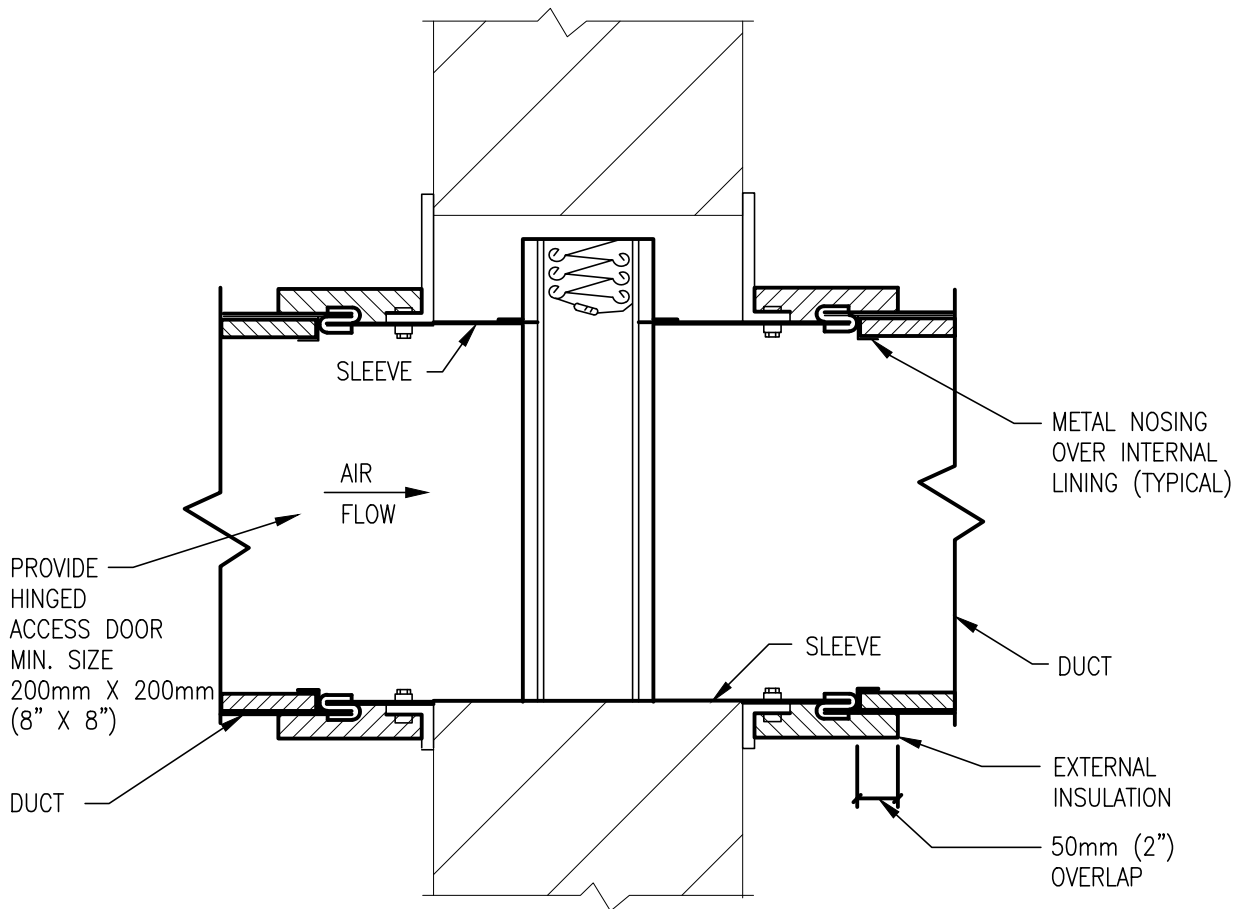


**Chorley + Bisset**  
CONSULTING ENGINEERS

TITLE

AIR SEAL FOR DRAINS FROM  
AIR HANDLING EQUIPMENT

DETAIL NO.



**Chorley + Bisset**  
CONSULTING ENGINEERS

TITLE

DUCT LINER INSTALLATION AT FIRE DAMPER

DETAIL NO.

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Water Systems .....	3.5

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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 water source heat pump system is being installed to serve the Building.
- 1.2.2 **Hot Water Heating System:** The existing hot water heating system is being extended to serve new the perimeter heaters, force flow heaters and the heat pump system heat exchanger.
- 1.2.3 **Energy Recovery Ventilation Systems:** A new rooftop air handling unit will provide ventilation air and exhaust air for the renovated area.
- 1.2.4 **Supply Air, Return Air and Exhaust Air:** Heat pumps will supply and return air from the spaces. Various exhaust systems will serve the building.
- 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.  
C. J. Zettler & Associates Ltd.
- 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 and pumps. 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, rebalance the entire existing system as required.
  - 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 three copies of completed reports to the Consultant. A copy of the final report is 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 electronic pdf version of report, complete with index page, indexing tabs and cover page.
- 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 will be supplied by fan supplier.

- 
- 3.4.2 For each rooftop air handling unit provide static pressure profile including pressure drop across each individual unit component (i.e. coils, filter banks, fans, energy recovery wheels, etc) as well as static pressure in intake plenums, discharge supply ducts and return air ducts. Include the exhaust fan pressure differential whether exhaust fan is located within air handling unit or not.
  - 3.4.3 Make pitot tube traverse of main supply and return air ducts to measure total air quantities.
  - 3.4.4 Seal duct access holes with plugs. Do not use duct tape to seal access holes.
  - 3.4.5 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.
  - 3.4.6 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.
  - 3.4.7 Record data as specified in Clause "Balancing Data".

### 3.5 WATER SYSTEMS

- 3.5.1 Prior to testing and balancing of these systems:
  - 3.5.1.1 Verify that all strainers are clean.
  - 3.5.1.2 Check expansion tanks and ensure that the systems are not air bound and are completely filled with water as required.
  - 3.5.1.3 Check air vents at coils and high points of the systems to verify that all are installed and operating freely.
  - 3.5.1.4 Position all automatic valves, hand valves, and balancing valves for full flow through coils, heat exchangers, heat pumps, individual room heating elements, etc.
- 3.5.2 Measure and adjust circulating water pump flow capacities to design quantities. For variable speed pumping systems, assist controls trade in setting static pressure controls at minimum required pressure. Record static pressure setting.
- 3.5.3 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.
- 3.5.4 Mark and record flow readings of balancing devices. Where flow measuring devices are not installed, balance using design temperature differences.
- 3.5.5 Record data as specified in Clause "Balancing Data".

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**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 Pumps:**

Manufacturer  
Model and/or Serial number  
Rated flow rate  
Rated Head  
Measured discharge pressure (full flow and no flow)  
Measured suction pressure (full flow and no flow)  
Measured L/s (gpm)  
Operating Head  
Operating rpm  
Performance curve by manufacturer  
Static Pressure Setpoint (Variable Speed Systems)

**3.6.1.4 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

### 3.6.1.5 **Fluid Coolers:**

Manufacturer and type  
 Model and/or Serial number  
 Design water flow rate  
 Design water temperatures (entering and leaving)  
 Design air temperature entering (dry bulb and wet bulb)  
 Measured water flow rate  
 Measured water temperatures (entering and leaving)  
 Measured air temperature entering and leaving (dry bulb and wet bulb)  
 Motor and fan information as previously specified  
 Date and time measurements taken

### 3.6.1.6 **Heat Transfer Elements (Coils, Heat Exchanger 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)

### 3.6.1.7 **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**

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Vibration Control Equipment .....	3.1

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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 WORK**
- 1.2.1 Provide sound attenuators in air systems where shown.
- 1.2.2 Provide vibration controls for all rotating and reciprocating equipment.
- 1.2.3 Provide vibration isolation for piping that is connected to equipment where vibration isolation is specified.
- 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:
- Sound Attenuators
  - Vibration Control Equipment
- 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 **SOUND ATTENUATORS**
- 2.2.1 Use Vibro Acoustics Ltd. materials and equipment. See Schedules for types, performance and details.
- 2.2.2 Use outer casings fabricated from minimum 16 gauge and perforated interior baffles from 24 gauge ASTM A 653/A 653M, G90 galvanized steel. Line inside of sound attenuators with Tedlar or Vibar lining and provide acoustic spacer.
- 2.2.3 Attenuator performance, including static pressure loss, insertion loss and generated noise to be determined in accordance with ASTM E-477-06a testing in an NVLAP accredited test facility.
- 2.2.4 All casing seams and joints shall be lock-formed and sealed or stitch welded and sealed to provide leakage-resistant construction. Airtight construction shall be achieved by use of a duct-sealing compound supplied and installed by the contractor at the jobsite.
- 2.2.5 All perforated steel shall be adequately stiffened to insure flatness and form. All spot welds shall be painted.

- 2.2.6 **Fire-Performance Characteristics:** Assemblies, including acoustic media fill, film liners, sealants, and acoustical spacers, shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested in accordance with OBC requirements.
- 2.2.7 Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2007.
- 2.2.8 Media shall be of acoustic quality, shot-free glass fibre insulation with long, resilient fibres bonded with a thermosetting resin. Glass fibre density and compression shall be as required to ensure conformance with laboratory test data. Glass fibre shall be packed with a minimum of 15% compression during silencer assembly. Media shall be resilient such that it will not crumble or break, and conform to irregular surfaces. Media shall not cause or accelerate corrosion of aluminum or steel.
- 2.2.9 The acoustic media shall be completely wrapped with Vibar film liner to help prevent shedding, erosion and impregnation. The wrapped acoustic media shall be separated from the perforated metal by a factory installed 1/2" thick acoustically transparent spacer.
- 2.2.10 All acoustical splitters shall be internally radiused and aerodynamically designed for efficient turning of the air. Half and full splitters are required as necessary to achieve the scheduled insertion loss. All elbow silencers with a turning cross-section dimension greater than 48" shall have at least two half splitters and one full splitter.
- 2.2.11 **Shipping Protection:** Silencers shall be shipped with factory-installed end caps to prevent contamination during shipping.
- 2.2.12 Sound attenuator pressure rating to be minimum 2.0 kPa (8" w.c.), or to match upstream ductwork construction on higher pressure systems.
- 2.2.13 The products of the following manufacturer which meet this Specification will be considered equal, subject to requirements of Clause "Material and Equipment":
- EH Price  
Ruskin  
VAW  
VMC Group  
Vibron
- 2.3 **VIBRATION CONTROL EQUIPMENT**
- 2.3.1 **General:** Use Vibro Acoustics Limited materials and equipment. See Schedules for types, details and static deflections.
- 2.3.2 **Springs:** All springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. All springs except internal nested springs shall have an outside diameter not less than 0.8 of the compressed height of the spring. Ends of springs shall be square and ground for stability. Laterally stable springs shall have kx/ky ratios of at least 0.9. All springs shall be fully colour coded to indicate capacity.
- 2.3.3 **Spring Hanger Supports:** Model SHR, vibration isolator hanger supports with steel springs and welded steel housings. Hangers shall be designed for a minimum of 15 degree angular misalignment from vertical before support rod contacts housing.

- 2.3.4 **Open Spring Isolators:** Model FS open type spring isolators with equal stiffness in the horizontal and vertical planes. Springs shall be supported either with a neoprene cup or a metal base plate complete with a ribbed neoprene pad, minimum 6 mm (0.25") thick, bonded to the base plate.
- 2.3.5 **Restrained Spring Isolators:** Model CSR laterally stable, vertically restrained type spring isolators with welded steel housings and heavy top plates for supporting equipment. Springs shall be supported either with a neoprene cup or a metal base plate complete with a ribbed neoprene pad, minimum 1/4" (6 mm) thick, bonded to the base plate. Housings shall include vertically restraining limit stops. Minimum clearance around the restraining bolts and between the housing and the spring shall be 1/2" (13 mm). Top plate and restraining bolts shall be out of contact with the housing during normal operation and neoprene grommets shall be incorporated to minimize short-circuiting of restraining bolts. Provide level adjustment.
- 2.3.6 **Type "S" Bases:** Provide bases large enough to support both equipment and driving motor, complete with motor slide rails where applicable. Bases shall be of welded construction with cross members to form an integral support platform. Structural steel members shall be designed to match supported equipment. Vibration bases for fans shall have adjustable motor slide rails as indicated on the schedule, and accommodate motor overhang. Bases shall be painted or hot-dipped galvanized for complete corrosion resistance.
- 2.3.7 **Vibration Isolation Pads**
- 2.3.7.1 Isolator pads shall be selected to ensure that deflection does not exceed 20% of isolator free height.
- 2.3.7.2 **Type "N" Neoprene Pads:** Use minimum 10 mm (0.375") thick neoprene pads with ribbed geometry on both sides.
- 2.3.7.3 **Type "NSN" Neoprene Pads:** Use minimum 10 mm (0.375") minimum thick ribbed neoprene pads bonded to each side of a 3.5 mm (10 ga) minimum galvanized metal plate.
- 2.3.8 The products of the following manufacturer which meet this Specification will be considered equal, subject to requirements of Clause "Material and Equipment":
- VAW  
Vibron
- 3 Execution
- 3.1 **VIBRATION CONTROL EQUIPMENT**
- 3.1.1 Provide Vibration Control Equipment as directed in the Schedule on the Drawings. Install in accordance with manufacturer's recommendations.
- 3.1.2 Select and locate vibration isolation equipment to give uniform loading and deflection, according to weight distribution of equipment.

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- 3.1.3 Coordinate size, dowelling, and reinforcing of concrete equipment housekeeping pads and piers with vibration isolation and wind restraint device manufacturer to ensure adequate space and prevent edge breakout failures. Pads and piers must be adequately dowelled in to structural slab.
- 3.1.4 Coordinate locations and sizes of structural supports with locations of vibration isolators and wind restraints (e.g., roof curbs, cooling towers, air-cooled chillers, etc.).
- 3.1.5 Block and shim all bases level so that all ductwork, piping and electrical connections can be made to a rigid system at the proper operating level, before isolators are adjusted. Ensure that there are no rigid connections or incidental physical contacts between isolated equipment and the building structure or nearby systems.
- 3.1.6 There shall be no rigid contact of isolated piping, ductwork, or equipment with shaft walls, floor slabs, partitions, or conduits.
- 3.1.7 Where recommended by the manufacturer, isolator base plates shall be bolted to the structure or foundation. Bolting shall incorporate neoprene bushings and washers.
- 3.1.8 Mount fans, as indicated on the Drawings, on structural steel vibration bases common to both fan and motor. There shall be a minimum operating clearance of 1" (25 mm) between steel bases and the structure.
- 3.1.9 Provide height-saving brackets where recommended by the manufacturer for equipment stability, or operating height requirements.

### 3.2 PIPING ISOLATION

- 3.2.1 Support all piping connected to isolated equipment with spring hanger supports on at least the first three support points. Unless specified or shown otherwise, use a static deflection of twice the deflection of the isolated equipment, but not more than 50 mm (2") at the first support point; use a static deflection of 25 mm (1") at remaining isolated support points.
- 3.2.2 Spring hanger isolators shall be cut in to the hanger rods and installed after the system is filled. Alternatively, provisions must be made to ensure piping does not change height during installation and start-up.
- 3.2.3 Isolator hangers shall be installed with the housing a minimum of 1/4" (6 mm) below but as close to the structure as possible. Where isolator hangers would be concealed by non-accessible acoustical sub ceiling, install the hangers immediately below the sub ceiling for access.

### 3.3 SOUND ATTENUATORS

- 3.3.1 Unless shown otherwise, install silencers at Mechanical Room wall, floor or ceiling.
- 3.3.2 Where silencers are located at outside wall of Mechanical Room, externally treat the first 1000 mm (36") length of silencer from the noise barrier (wall, floor or ceiling) as indicated below.

- 
- 3.3.3 Where silencers are remote from Equipment Room or inside Equipment Room, externally treat the ductwork between the attenuator and noise barrier (wall, floor or ceiling), as well as the first 1000 mm (36") of silencer adjacent to treated ductwork, as indicated below:
- 3.3.3.1 **Rectangular or Square Silencers and Ductwork:** Apply a 25 mm (1") layer of Fiberglas AF-545 board insulation to outside of silencers and ductwork. Hold in place with clips and adhesive. Cover with two layers of 16 mm (5/8") drywall. Stagger, tape and plaster all joints. Seal all around joint between external cover and noise barrier. Use Tremco Acrylic Latex Caulk. Pack openings to within 12 mm (1/2") of surface with closed cell, round polyethylene joint packing.
- 3.3.3.2 **Circular Silencers and Ductwork:** Apply a 25 mm (1") layer of Fiberglas AW250 flexible insulation to outside of silencer and ductwork. Fill all voids with insulation to provide a uniform diameter. Hold in place with clips and adhesive. Cover with 20 gauge galvanized sheet metal. Seal all around joint between external cover and noise barrier. Use Tremco Acrylic Latex Caulk. Pack openings to within 12 mm (1/2") of surface with closed cell, round polyethylene joint packing.
- 3.4 **INSPECTION**
- 3.4.1 Provide the services of a factory trained representative of the noise and vibration control manufacturer to make a thorough inspection of each system after startup. Submit a written report to the Consultant.

**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".
- 1.1.2 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.
- 1.1.3 **Environmental Requirements:** Maintain ambient temperature and conditions required by manufacturers of adhesives, mastics and insulation cements.
- 1.1.4 **Quality Assurance:** Insulation materials must be manufactured at facilities certified and registered to ISO 9000 Quality Standard.
- 1.1.5 **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.
- 1.1.6 **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 services within Equipment Rooms, Service Corridors, plus all other areas of the building where the services are not enclosed within ceilings or shafts. It also refers to ductwork inside horizontal and vertical architectural enclosures across the roof and down the faces of the building.
- 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:
- Aluminum Covering
  - Canvas Covering
  - Duct and Piping Insulation Types, noting application for each product
  - Finishing Cement
  - Fire Protection Insulation
  - Lagging Adhesive
  - Lavatory Drain Insulation
  - 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)

## 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 LAVATORY DRAIN INSULATION

2.4.1 Use McGuire ProWrap seamless lavatory insulation kits, manufactured of anti-microbial closed cell moulded vinyl material.

2.4.2 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause "Material and Equipment":

Truebro

## 2.5 PIPE INSULATION

### 2.5.1 Piping

2.5.1.1 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.

2.5.1.2 In areas exposed to view, finish with Johns-Manville, Zeston 2000 PVC (20 mil) 0.51 mm thickness "Cut and Curled" jacketing. Use Zeston "Perma-Weld" solvent welding adhesive to permanently seal all PVC joints. Taping or tacking of jackets will not be accepted. Use white jackets.

2.5.2 **Valves and Fittings:** Insulate valves and fittings with factory precut Johns Manville Hi-Lo temp insulation inserts or Johns Manville Microlite 16 kg/m<sup>3</sup> (1 lb/ft<sup>3</sup>) density glass fibre insulation. Finish with Johns Manville Zeston 2000 PVC insulated fitting covers 0.51 mm (20 mil) thickness or finishing cement. Use Zeston “Perma-Weld” solvent welding adhesive to permanently seal all PVC joints. Use white covers.

2.5.3 **Pipe Thickness Schedule**

Pipe Insulation Schedule

Fluid Design Operating Temperature Range (°C)	Insulation Conductivity		Nominal Diameter (mm)				
	Conductivity Range Btu-in (hr.ft <sup>2</sup> °F)	Mean Rating Temperature (°C)	less than 25	25 to 32	40 to 80	100 & 150	200 & up
Heating System (Hot Water)							
60 - 93	0.036 - 0.042	52	40	40	50	50	50
Domestic Hot Water							
40 & greater	0.035 - 0.040	38	25	25	40	40	40
Domestic Cold Water (Sanitary, Storm and Condensate Drains)							
4 - 24	0.033 - 0.039	24	25	25	25	25	25

2.5.4 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause “Material and Equipment”:

- CertainTeed
- Johns Manville
- Knauf
- Manson
- Ottawa Fibre
- Owens Corning
- Roxul

2.6 **AIR DUCTS**

2.6.1 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<sup>2</sup>ft<sup>2</sup>°F) in accordance with ASTM C 518. Use 40 mm (1-1/2”) thickness.

2.6.2 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/m<sup>3</sup> (3 lb/ft<sup>3</sup>) 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<sup>2</sup>ft<sup>2</sup>°F) at 24°C (75°F) mean temperature. Use 40 mm (1-1/2") thickness.

2.6.3 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause "Material and Equipment":

CertainTeed  
Johns Manville  
Knauf  
Manson  
Ottawa Fibre  
Roxul

## 2.7 FINISHING CEMENT

2.7.1 Use Ryder hydraulic setting finishing cement.

## 2.8 LAGGING ADHESIVE

2.8.1 Use white Childers CP-50A HV or Fosters 81-42W water based fire retardant lagging adhesive.

## 2.9 CANVAS COVERING

2.9.1 Use UL listed fabric 1.83 kg/m<sup>2</sup> (6 oz/ft<sup>2</sup>) fire retardant canvas covering.

## 2.10 ALUMINUM COVERING

2.10.1 Use 0.41 mm (0.016") aluminum jacket with integral moisture barrier or Venture Tape Model 1579CW-E zero permeability, 0.45 mm (0.0175") thick, self adhesive multi-ply embossed aluminum cladding for piping exposed to the weather. Use Venture Tape Model 1577CW-E tape, minimum 100 mm (4" width) at all butt joints and longitudinal joints.

2.10.2 Use 0.41 mm (0.016") aluminum jacket with integral moisture barrier or Venture Tape Model 1579CW-E zero permeability, 0.45 mm (0.0175") thick, self adhesive multi-ply embossed aluminum cladding for ductwork exposed to the weather. Use Venture Tape Model 1577CW-E tape, minimum 100 mm (4" width) at all butt joints and longitudinal joints.

2.10.3 Venture Tape Model 1577CWWME zero permeability, 0.20 mm (0.008") thick, self adhesive multi-ply embossed white laminate cladding may be used in lieu of canvas covering for ductwork within the building envelope that is exposed to view. Use Venture Tape Model 1576CW-E tape, minimum 100 mm (4" width) at all butt joints and longitudinal joints.

- 
- 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 **Storm Drainage System:** Insulate horizontal sections of rainwater leaders including all elbows connecting to vertical piping. Where horizontal sections connect to roof drains, also insulate underside of drains and drain bodies, including any vertical piping between underside of drain and drain body.
- 3.3.2 **Sanitary Drainage System:** Insulate horizontal sections from combination drains, floor drains, open hub drains, water closets and urinals from fixture to point of connection with soil stacks.
- 3.3.3 **Other Systems:** Insulate the following piping systems in their entirety:
- Hot Water Heating
  - Domestic Cold Water
  - Domestic Hot Water
  - Domestic Hot Water Recirculation
  - Condensate Drains
- 3.3.3.1 Use the following Mean Rating Temperatures when selecting insulation thicknesses:
- Hot Water Heating : 60 - 93°C (141 - 200°F)

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### 3.3.4 Insulation Application

3.3.4.1 **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.

3.3.4.2 **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.

### 3.3.4.3 Fittings and Valves

3.3.4.3.1 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.

3.3.4.3.2 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.

3.3.4.3.3 **Cold Systems:** Provide a continuous vapour barrier on the insulation for the following systems:

- domestic cold water
- condensate drains

3.3.4.3.4 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.

3.3.5 **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. Use white jackets.

## 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.

3.4.1.3 Externally insulate all ductwork specifically identified on the Drawings.

3.4.1.4 Externally insulate all supply ductwork in Mechanical Rooms (including Boiler Room). Externally insulate all outside air and combustion air intake ducts.

3.4.1.5 Externally insulate all heat pump 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.

3.4.1.6 Externally insulate the first 1.5 m (5') of exhaust ductwork adjacent to outside walls or roof.

3.4.1.7 Externally insulate exhaust ductwork on fluid cooler outlet.

3.4.1.8 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 and oval 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. Provide 25 mm x 25 mm (1" x 1") galvanized steel sheet metal angle corner bead over duct insulation along all duct corners. 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.

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.

## 3.5 **LAVATORY DRAIN INSULATION**

3.5.1 Insulate drain and supply pipes on all barrier free lavatories. Use moulded offset drain and water supplies covers.

## 3.6 **REMOVAL OF ASBESTOS INSULATION**

3.6.1 Remove existing pipe insulation containing asbestos fibre where shown on Drawings. Follow the Ontario Ministry of Labour's Latest Requirements. Re-insulate in accordance with this Section.

**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:** Provide a wet type automatic sprinkler system to completely protect the renovated parts of the building, as shown on the Drawings. Design and build the system in accordance with the requirements of NFPA 13, the Ontario Building Code and the Owner's Insurance Underwriter, Risk Management Services (RMS). Follow RMS guidelines for Occupancy Hazard Classification. System to be sized to protect the entire building.
- 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:
- Backflow Preventer
  - Fire Department Connection
  - Fire Extinguishers and Cabinets
  - Sprinkler Heads
  - Supervisory Valves and Flow Switches
- 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 RMS 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 RMS approved, may be used. Ensure wall thickness of pipe is in accordance with NFPA No. 13 for the type of connections used.
- 2.3 **VALVES**
- 2.3.1 Use only Underwriters' Laboratories of Canada Listed valves.

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**2.4 SUPERVISED VALVES**

2.4.1 Use ULC listed Tyco Model BFV gear operated butterfly valves or equivalent, designed to initiate electrical signals to indicate any valve position other than fully open. Equip valves with 2 sets of 120 volt SPDT supervisory switches for connection to fire alarm system.

2.4.2 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment".

Victaulic

**2.5 FLOW SWITCHES**

2.5.1 Use ULC listed Potter Electric Signal Co. vane type water flow detector or equivalent, complete with adjustable time delay and designed to initiate electrical signals to indicate a water flow condition. Equip detector with 2 sets of 120 volt SPDT supervisory switches for connection to fire alarm system.

**2.6 FIRE EXTINGUISHERS AND CABINETS**

2.6.1 Use National Fire Equipment Ltd. Badger Advantage Model No. ADV-5550, 2.3 kg (5 lb) multi-purpose dry chemical extinguishers with a rating of 3A40BC. Provide complete with wall brackets.

2.6.2 Where fire extinguisher cabinets are shown, use National Fire Equipment Ltd., Model CE950-3-SS fully recessed fire extinguisher cabinet, 225 mm x 610 mm x 150 mm (9" x 24" x 6"). Use 18 gauge steel tub with 18 gauge 304 stainless steel door with satin finish and 5 mm (3/16") Duolite safety glass. Use doors with rounded corners, concealed hinges, and flush latch.

2.6.3 The following manufacturer of the above equipment will be considered equal subject to requirements of Clause "Material and Equipment":

Wilson & Cousins

**2.7 SPRINKLER HEADS**

2.7.1 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, including Gym, 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)
- Dry type sprinkler, chrome finish and chrome escutcheon, where shown on the Drawings (designated low temperature)

2.7.2 Use wire sprinkler guards with baked synthetic red enamel finish where shown on the Drawings.

2.7.3 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
- sprinkler wrench
- sprinkler wrench for concealed sprinklers

2.7.4 The following manufacturers of the above equipment will be considered equal, subject to the requirements of Clause "Material and Equipment":

Grinnell Fire Protection Systems  
Reliable Automatic Sprinkler Co.  
Tyco Fire and Building Products  
Victaulic  
Viking Corp.

## 2.8 FIRE DEPARTMENT CONNECTION

2.8.1 Use recessed flush-mounted siamese fire department connection with polished chrome finish.

2.8.2 Provide for each connection, two 65 mm (2-1/2") female hose connections with double clapper, caps and chains. Use threads conforming to local fire department standards. Include straightaway check valve and automatic drip discharging to nearest floor drain.

2.8.3 Designate connection with plaque having raised letters at least 25 mm (1") high cast-on plate or cast-on fitting.

2.8.4 The following manufacturer of the above equipment will be considered equal, subject to the requirements of Clause "Material and Equipment":

National Fire Equipment Ltd.

## 2.9 SPRINKLER SYSTEM TEST CONNECTION

2.9.1 Provide a 2" hot dip galvanized steel pipe and turned down elbow with threaded outlet outside of the building, at the exterior wall of the sprinkler room, for discharge to outdoors during testing. Provide a cast iron wall plate with galvanized or chrome finish to cover rough wall opening.

## 2.10 BACKFLOW PREVENTER

2.10.1 **Double Check Valve Type (DCVA):** Watts No. 709 double check valve assembly, tested and certified under ASSE Standard 1015 and CSA B64.5, with brass or cast epoxy coated body and stainless steel working parts and primary and secondary check valves. Check valve seats and disks to be replaceable. Provide OS&Y supervised valves on inlet and outlet. Device to be complete with cUL and FM listing.

2.10.2 The following manufacturers of the above equipment will be considered equal subject to requirements of Clause "Material and Equipment":

Apollo  
Wilkins/Zurn  
Febco  
Wilkins/Zurn

3 Execution

### 3.1 **INSTALLATION**

3.1.1 **Sprinkler System:** Provide complete system designed, constructed, installed and tested in accordance with NFPA 13, RMS and the Ontario Building Code.

### 3.2 **WATER SERVICE**

3.2.1 Connect sprinkler systems to water services provided by Outside Services Contractor and by Section 15400.

3.2.2 Provide an approved pressure gauge on each system on inside of building with range 0 - 690 kPa (0 - 100 psig).

3.2.3 A hydrant flow test was performed on March 13, 2018. See the Appendix for the Flow Results. Base system design on flow test results. Include a suitable safety factor as dictated by NFPA 13 and RMS.

### 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 renovated areas of the building areas. Coordinate the preparation of these Drawings with all other trades to avoid conflict with other services. Sprinkler system to be sized to eventually protect the entire building.

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 2012 OBC. That individual will be designated herein as the Fire Protection Engineer for the project. Submit Fire Protection Engineer's proof of liability insurance with Shop Drawings.

3.3.3 The Fire Protection Engineer will apply his or her seal to all Fire Protection Drawings prepared for construction. The Fire Protection Engineer will be responsible for General Review during Construction for the work of this Section, in accordance with the 2012 OBC.

3.3.4 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.

- 3.3.5 Piping is to be sized to suit available pressure from the municipal water main system without use of a fire pump. Use low pressure requirement sprinkler heads where required.
- 3.3.6 Provide sufficient number of sprinkler heads, whether shown on the drawings or not, to achieve coverage as required by NFPA 13 and RMS.
- 3.3.7 Prepare the Drawings in AutoCAD 2010. Show sprinkler heads on Architectural Reflected Ceiling Plans. Architect will provide AutoCAD drawing files for overlays.
- 3.3.8 Before starting installation, submit six copies of Fabrication Drawings and Hydraulic Calculations to RMS 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.
- 3.3.9 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.
- 3.3.10 Where architectural reflected ceiling plans show ceilings which are not continuous from wall to wall, provide sprinkler coverage both above and below ceiling.

#### 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, in accordance with NFPA 13 requirements. Provide air vents, flushing and test connections as required by NFPA 13 and RMS.

#### 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, 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.
- 3.6.2 On the main sprinkler system control valve in the Mechanical Room provide a white rectangular sign with 25 mm (1") high red letters stating "MAIN SPRINKLER CONTROL VALVE - DO NOT CLOSE". Secure this sign to the valve or piping so it is not easily removed and is visible to approaching personnel.

#### 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, NFPA 13 and RMS requirements. Notify Consultant a minimum of 48 hours in advance of each test so arrangements can be made to have these tests witnessed. Note that work may progress in a phased manner and the systems will need to be tested and made operational in phases.

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.

**END OF SECTION**



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## HYDRANT FLOW TEST REPORT

Location: **Our Lady of Fatima**  
**545 Baldoon Rd,**  
**Chatham**

Date: **March 13, 2018**

Test by: **Jamie Tomes, C&H Fire Suppression Systems Inc.**

Witness: **Chatham-Kent PUC Hydrant Operators (x2)**

Test #1.

HYD # (Static Hydrant):

Static Reading: **72psi**

Residual Reading: **65psi**

HYD # (Flowing Hydrant):

Nozzle Size **2.5"**

Discharge Coefficient **0.9**

Flow **1130USgpm**

Test #2.

HYD # (Static Hydrant):

Static Reading: **72psi**

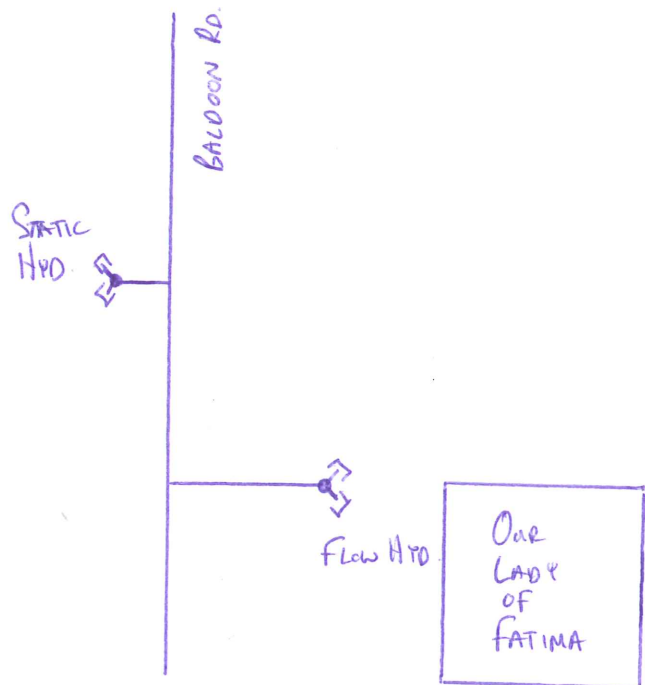
Residual Reading: **61psi**

HYD # (Flowing Hydrant):

Nozzle Size **2x2.5"**

Discharge Coefficient **0.9**

Flow (Total) **1680USgpm**



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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:** Provide a new system complete with connections to fixtures and equipment requiring cold water connections as shown and/or as specified. Connect to the existing system where shown on the drawings.
- 1.2.2 **Domestic Hot Water:** Extend the existing system complete with connections to fixtures and equipment requiring hot water connections as shown and/or as specified.
- 1.2.3 **Domestic Hot Water Recirculation:** Extend the existing system complete with connections as shown and/or as specified.
- 1.2.4 **Sanitary Drainage:** Extend the existing soil and waste drainage system complete with connections to fixtures and equipment as shown and/or as specified.
- 1.2.5 **Storm Drainage:** Revise the existing system complete with connections as shown on the drawings.
- 1.2.6 **Natural Gas:** Extend the existing natural gas piping system complete with connections to equipment as shown and/or specified.
- 1.2.7 **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:
- Backflow Preventers
  - Cleanouts
  - Expansion Tanks
  - Floor Drains
  - Flow Control Valves
  - Plumbing Fixtures
  - Pressure Gauges
  - Rooftop Piping Supports
  - Shock Absorbers
  - Strainers
  - Thermometers
  - Trap Seal Valves
  - Vacuum Breakers
  - 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 **Domestic Water Piping (Hot, Cold, HW Recirc. System)**
- 2.2.3.1 Use hard drawn copper, Type "L" to ASTM B88, with soldered or flanged joints and bronze or copper fittings.
- 2.2.3.2 Use Class 150 cast copper solder fittings to ANSI/ASME B16.18 or wrought copper and lead free copper alloy solder fittings to ANSI/ASME B16.22. Use Class 150 lead free cast bronze flanged fittings to ANSI/ASME B16.24.
- 2.2.3.3 For below grade piping only, use copper tube, soft annealed, Type "K", to ASTM B88, or Rehau PEXa polyethylene piping. All below grade piping to be in long lengths with no buried joints, encased in a protective PVC sleeve. No fittings to be located within sleeve.
- 2.2.4 **Storm Drainage Piping:** Use cast iron Class 4000 pipe and fittings to CSA B70, with mechanical joints. Mechanical joints to be rubber compression gasket type with stainless steel clamps and hardware. For below grade piping only, use PVC pipe and fittings to CSA B181.2, with solvent cement joints.
- 2.2.5 **Sanitary Drainage Piping (Including Vent Piping):** Use cast iron Class 4000 pipe and fittings to CSA B70, with mechanical joints, or seamless copper Type DWV pipe to ASTM B306 with cast or wrought copper fittings and soldered joints. Mechanical joints to be rubber compression gasket type with stainless steel clamps and hardware. For below grade piping only, use PVC pipe and fittings to CSA B181.2, with solvent weld joints.
- 2.2.6 **Natural Gas Piping:** Above grade, both inside and outside the building, use Schedule 40 black steel pipe with malleable iron or steel fittings. All materials must meet the requirements of CSA B149.1.
- 2.2.6.1 **Indirect Drainage and Condensate Draining Piping:** Use seamless copper Type DWV pipe to ASTM B306 with cast or wrought copper fittings and soldered joints.
- 2.3 **CLEANOUTS**
- 2.3.1 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.

- 2.3.2 For line cleanouts, use Watts CO-450-RD epoxy coated cast iron cleanout ferrule complete with countersunk threaded brass plug, stainless steel wall access cover and stainless steel vandal resistant screw.
- 2.3.3 For stack cleanouts, use Bibby Ste Croix cast iron Barret style stack cleanout with gasketed cast iron cover.
- 2.3.4 In floor with vinyl or similar finish, use Watts CO-200-T-1-34 epoxy coated cast iron floor cleanout with round adjustable nickel bronze access cover and frame, tile recess and secondary closure plug.
- 2.3.5 In porcelain, ceramic and other quarry tile floors, use Watts CO-200-S-1-34 epoxy coated cast iron floor cleanout with square adjustable nickel bronze access cover and frame, and secondary closure plug.
- 2.3.6 In concrete floors or carpeted floors, use Watts CO-200-RX-4-34 epoxy coated cast iron floor cleanout with round adjustable heavy duty ductile iron access cover and frame, and secondary closure plug.
- 2.3.7 In terrazzo floors use Watts CO-200-US-1-34 epoxy coated cast iron floor cleanout with square adjustable nickel bronze access cover and frame, with recess for terrazzo and secondary closure plug.
- 2.3.8 In floors with surface membranes, use Watts CO-100-C-RFC-7-1-34 epoxy coated cast iron cleanout with anchor flange, cast iron reversible membrane clamp, and RFC satin nickel bronze cleanout top with surface membrane clamp.
- 2.3.9. 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:** No aluminum components will be permitted. Provide flashing clamps on all drains installed in floors with membranes. Confirm membrane floor locations with Division 1.
- 2.4.2 **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.
- 2.4.3 **Floor Drains in Finished Areas Not Specifically Designated (Drawing Reference FD):** Watts 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.
- 2.4.4 **Mechanical Room (Drawing Reference FD):** Watts FD-300-50 cast iron floor drain with adjustable 180 mm (7") diameter CI strainer and heavy duty cast iron grate.

- 2.4.5 **Funnel Floor Drains in Finished Floor (Drawing Reference FFD):** Watts FD-200-EG-1 cast iron floor drain with adjustable heavy duty cast iron grate. Provide separate cast iron "P" trap and Type NB, 100 mm x 230 mm (4" x 9") oval funnel.
- 2.4.6 **Funnel Floor Drains in Unfinished Floor (Drawing Reference FFD):** Watts 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.
- 2.4.7 In floors with surface membrane, use Watts FD-100-C-FC7-1 with strainer and surface membrane clamp.
- 2.4.8 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

For sizes 65 mm (2-1/2") and over, Use Class 150 Stainless Steel A351 CF8M Body, SS Ball & Stem, PTFE packing, Hypatite or PTFE seats, locking lever operated.

Kitz 150UTBZM (Full Port)

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 **Hose Bibbs c/w Cap & Chain :** For sizes 20 mm (3/4") and 13 mm (1/2") 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.

Hose bibb Brass fitting to ASTM C49300 (Lead Free Brass) and Cap & Chain.

- Screwed Ends - Kitz 858
- Solder Ends - Kitz 859

2.5.7.4 **Drain Hose Connections:** Use Kitz 68C bronze body ball valve, 4140 kPa (600 psig) CWP complete with brass threaded cap and chain.

2.5.7.5 **Frostproof Wall Hydrants:** Watts HY-725 with recessed box, vacuum breaker and hinged cover.

## 2.5.8 **Natural Gas Systems Isolation Valves**

2.5.8.1 For sizes 50 mm (2") and under, use Kitz Model 58, Class 150 ball valve with 4140 kPa (600 psig) water oil or gas pressure rating , cast brass body to ASTM C37700, full port, TFE seats, double "O" Ring or teflon packing, chrome plated brass ball, lever handle. Must be CGA approved to 125 psig.

2.5.8.2 For sizes 65 mm (2-1/2") to 200 mm (8") use Kitz 150SCTBZM, Class 150 flanged full port ball valve with cast steel body, stainless steel ball and stem, RPTFE packing and seats, locking lever handle. Must be CGA approved to 125 psig.

2.5.9 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)

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**2.6 FLOW CONTROL VALVES (FCV)**

- 2.6.1 Use Griswold Controls Model "R Valve" automatic flow control valve, lead free forged brass body valve, removable stainless steel regulator cartridge and two pressure/temperature taps in body. Assembly to have minimum 2760 kPa (400 psig) water oil or gas pressure rating. Valve to be factory set to maintain specific flow rate at differential pressures between 7 and 100 kPa (1 and 14 psi). Use line sized valves. Flow rates are indicated on Drawings.
- 2.6.2 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

FDI

**2.7 THERMOMETERS**

- 2.7.1 WEISS 9VS35 vari-angle thermometer 225 mm (9") dual scale complete with separable well or WEISS 35ZL3 80 mm (3-1/2") dial type thermometer, stainless steel case and adjustable bracket. Temperature range: hot water 0 - 100°C (32 - 210°F) cold water 0 - 40°C (32 - 100°F).
- 2.7.2 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

Ashcroft  
Baker  
Cambridge  
Taylor  
Terice  
Winters

**2.8 PRESSURE GAUGES**

- 2.8.1 WEISS LF4S-1 100 mm (4") liquid filled, stainless steel case, gauge accuracy 1% middle half, ANSI B40 Grade A, brass movement, bourdon tube and socket. Use range twice the normal operating pressure of the system, so that the pointer is normally at the mid-point of the range. Provide gauges with dual unit scales.
- 2.8.2 WEISS TC14 "T" handle brass gauge cocks, threaded both ends, 2100 kPa (300 psig) water. Include WEISS PSN-B brass pressure snubber.
- 2.8.3 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

Ashcroft  
Baker  
Cambridge  
Taylor  
Terice  
Winters

---

**2.9 SHOCK ABSORBERS**

2.9.1 Provide Watts LF15M2 Series lead free shock absorbers ahead of all solenoid valves, flush valves, or other quick-closing valves. Provide in other locations where shown on Drawings.

2.9.2 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.  
Zurn

**2.10 BACKFLOW PREVENTERS**

2.10.1 **Reduced Pressure Type (RP):** Watts LF909 Series backflow preventers with intermediate atmospheric vent, tested and certified under A.S.S.E. Standard 1012 and CSA B64.4, with stainless steel body and stainless steel working parts, strainer and primary and secondary check valves. Check valve seats and discs to be replaceable. For sizes 2-1/2" and larger use Watts Model 957 stainless steel backflow preventers. Use assemblies with OS&Y rising stem gate valves.

2.10.2 **Double Check Valve Type (DCVA):** Watts No. 757 double check valve assembly, tested and certified under A.S.S.E. Standard 1015 and CSA B64.5, with brass or cast epoxy coated body and stainless steel working parts, strainer and primary and secondary check valves. Check valve seats and disks to be replaceable.

2.10.3 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

Conbraco  
Febco  
Wilkins / Zurn

**2.11 ESCUTCHEON PLATES**

2.11.1 Provide one piece, brushed aluminum escutcheon plates at all points where pipes pass through walls, floors or ceilings into finished areas.

**2.12 TRAP SEAL VALVES**

2.12.1 Use only Proset trap guard drain inserts for floor drains, in lieu of priming through the use of trap seal valves.

**2.13 STRAINERS**

2.13.1 Spirax Sarco, Y type with 20 mesh bronze or stainless steel removable screen. Bronze bodies, screwed for sizes 50 mm (2") and under. Cast iron bodies, flanged for all larger sizes. Maximum P.D. 6 Pa (2' W.G.). Use line size strainers.

2.13.2 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":



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S. A. Armstrong  
A. S. Leitch  
Morrison Brass  
Zurn

## 2.14 **PRESSURE RELIEF VALVES**

2.14.1 For tanks, use Watts Series N240 A.S.M.E. temperature and pressure relief valves. Size valves to suit equipment heating rating.

2.14.2 For pipelines, use Watts Series 174A A.S.M.E. pressure relief valves. Size valves to suit equipment heating rating.

2.14.3 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

Braukmann  
Conbraco

## 2.15 **HOT WATER RECIRCULATION PUMP**

2.15.1 Use all bronze or stainless steel circulating pump as shown on the schedule on the Drawings.

2.15.2 The following manufacturer of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

Armstrong  
Bell + Gossett

## 2.16 **EXPANSION TANKS**

2.16.1 Use Amtrol diaphragm type expansion tanks with heavy duty butyl rubber bladder removable for inspection. Build tanks to ASME code for 1000 kPa (150 psig) working pressure. Provide shutoff cocks and drain cock. Tanks to be NSF approved, suitable for use in potable water system.

2.16.2 See Equipment Schedule for capacities and details.

2.16.3 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

Air-Trol  
Armstrong

## 2.17 **ROOFTOP PIPING SUPPORTS**

2.17.1 Use RoofTop Blox polypropylene piping supports with Unistrut style fasteners and styrofoam insert base.

2.17.2 The following manufacturer of the above equipment will be considered equal subject to requirements of Clause "Material and Equipment":

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Portable Pipe Hangers

## 2.18 PLUMBING FIXTURES

### 2.18.1 General

2.18.1.1 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.

2.18.1.2 All plumbing fixtures, faucets and supplies to meet NSF 372, with lead content below 0.25%.

2.18.1.3 Provide rigid spouts in all faucets except in kitchen and staff room.

2.18.1.4 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.

2.18.1.5 Use factory chrome plated items for all visible parts of the fixture trim including faucets, escutcheons, waste, strainers, traps, supplies, stops, etc.

2.18.1.6 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, Eljer, Kohler
- Plumbing Brass - Chicago Faucets, Delta Commercial, T&S
- Flush Valves - Sloan, Zurn
- Water Closet Seats - Beneke, Centoco, Viceroy
- Stainless Steel Sinks - Novanni Commercial, Franke Kindred
- Thermostatic Mixing Valves - Acorn, Bradley, Chicago Faucets, Delta Commercial, Lawler, T&S
- Mop Sinks - Acorn, Fiat, Stern Williams
- Drinking Fountains - Acorn, Elkay, Franke Kindred, Halsey Taylor, Oasis
- Eyewash Stations - Acorn, Bradley, Guardian, Haws

### 2.18.2 Fixture Carriers

2.18.2.1 **Water Closet:** Watts ISCA Series enamelled or epoxy coated, heavy duty cast iron carriers with metal couplings. Exact model number will vary depending on wall space available, mounting height of fixture and required stack connections.

2.18.2.2 **Urinals:** Watts Model CA-311 heavy duty urinal carrier for support of urinal independent of wall.

2.18.2.3 **Lavatories:** Watts Series 400 heavy duty carriers to support all wall hung lavatories independent of the wall.

- 2.18.2.4 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
- 2.18.3 **Water Closet (Drawing Reference WC1) (Wall Hung Flush Valve)**
- 2.18.3.1 **Bowl:** American Standard High Efficiency FloWise AFWall Model 3351-128, wall hung, 4.8 litres per flush, for flush valve, vitreous china water closet with elongated syphon jet flush action bowl, fully glazed 50 mm (2") ball pass internal trapway, 254 mm x 304 mm (10" x 12") large water surface, 40 mm (1-1/2") top spud.
- 2.18.3.2 **Flush Valve:** Sloan "Regal" 111-1.28-YO flush valve, 4.8 litres per flush, chrome plated, factory set flow, quiet action diaphragm type with non-hold open feature, vacuum breaker, back-check angle stop with seat bumper.
- 2.18.3.3 **Seat:** Centoco No. 1500STSCC elongated, extra heavy duty solid plastic white open front seat less cover, with stainless steel check hinges, stainless steel posts, washers and nuts.
- 2.18.4 **Water Closet (Drawing Reference WC2) (Wall Hung Barrier Free Flush Valve)**
- 2.18.4.1 **Bowl:** American Standard High Efficiency FloWise AFWall Model 3351-128, wall hung, 4.8 litres per flush, for flush valve, vitreous china water closet with elongated syphon jet flush action bowl, fully glazed 50 mm (2") ball pass internal trapway, 254 mm x 304 mm (10" x 12") large water surface, 40 mm (1-1/2") top spud. Mount 406 mm (16") to top of rim.
- 2.18.4.2 **Flush Valve:** Sloan "Regal" 111-1.28-YG flush valve, 4.8 litres per flush, chrome plated, factory set flow, quiet action diaphragm type with non hold open feature, vacuum breaker, back-check angle stop with extended seat bumper.
- 2.18.4.3 **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.
- 2.18.5 **Water Closet (Drawing Reference WC3) (Floor Mount Barrier Free Flush Valve)**
- 2.18.5.1 **Bowl:** American Standard High Efficiency FloWise Madera Model 3461-128 floor mount, barrier free, 420 mm high, 4.8 litres per flush, for flush valve, vitreous china water closet with elongated syphon jet flush action bowl, fully glazed 50 mm (2") ball pass internal trapway, 254 mm x 304 mm (10" x 12") large water surface, 40 mm (1-1/2") top spud. Use brass floor flange.
- 2.18.5.2 **Flush Valve:** Sloan "Regal" 111-1.28-YG flush valve, 4.8 litres per flush, chrome plated, factory set flow, quiet action diaphragm type with non hold open feature, vacuum breaker, back-check angle stop with extended seat bumper.
- 2.18.5.3 **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.

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- 2.18.6 **Urinal (Drawing Reference UR1)(Wall hung, BF, Electronic)**
- 2.18.6.1 **Urinal:** American Standard High Efficiency FloWise Washbrook Model 6501.125 barrier free, vitreous china, 0.5 litre per flush, washout flush action, 20 mm (3/4") top spud, integral flush spreader, open trap, stainless steel removable strainer and 50 mm (2") outlet connection.
- 2.18.6.2 **Flush Valve:** Sloan "Regal" 186-0.125 ES-S Optima, hard wired electronic flush valve, 0.5 litre per flush, chrome plated, factory set flow, quiet action diaphragm type with non-hold open feature, vacuum breaker, back-check angle stop, chrome plated wall cover plate and sensor, EL-154 transformer.
- 2.18.7 **Lavatory (Drawing Reference LA1) (Counter Mount)**
- 2.18.7.1 **Lavatory:** American Standard 9494.001 Cadet, barrier free vitreous china countertop basin, self-rimming with overflow, 100 mm (4") centres.
- 2.18.7.2 **Faucet:** Chicago Faucets Ecast 802-VE34VPABCP faucet, chrome plated, 100mm (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 80mm (3") lever handles. Connect tempered water to faucet using Lawler Model 516 thermostatic mixing valve with in-line check stops. Temperature range 35°C to 46°C (95°F to 115°F). Locate valve in block wall behind surface mounted access door.
- 2.18.7.3 **Supplies:** McGuire H170BVRB supplies, heavy pattern, chrome plated, polished, short rigid horizontal integral sweat tubes with vandalproof loose key ball valve angle stops, escutcheons and braided flexible risers.
- 2.18.7.4 **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.
- 2.18.8 **Lavatory (Drawing Reference LA2) (Wall Hung Barrier Free)**
- 2.18.8.1 **Lavatory:** American Standard 0954.000 Murro, barrier free vitreous china wall-hung basin with overflow, for concealed wall hanger, 100 mm (4") centres.
- 2.18.8.2 **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. Connect tempered water to faucet using Lawler Model 516 thermostatic mixing valve with in-line check stops. Temperature range 35°C to 46°C (95°F to 115°F). Locate valve in block wall behind surface mounted access door.
- 2.18.8.3 **Supplies:** McGuire H170BVRB supplies, heavy pattern, chrome plated, polished, short rigid horizontal integral sweat tubes with vandalproof loose key ball valve angle stops, escutcheons and braided flexible risers.
- 2.18.8.4 **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.

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- 2.18.9 **Single Compartment Sink (Drawing Reference SS1) (Classrooms)**
- 2.18.9.1 **Sink:** Franke Kindred Commercial LBS6808, 521 mm x 508 mm x 203 mm (20" x 20-1/2" x 8") 20 gauge, Type 302 stainless steel single bowl countertop sink, with backledge drilled for 200 mm (8") centre faucet set. Sink complete with 90 mm (3-1/2") crumb cup strainer and 40 mm (1-1/2") tailpiece, self-rimming with gasket and hold down clamps.
- 2.18.9.2 **Faucet:** Chicago Faucets Ecast 1100-GN8AVPA-369CP 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 rigid gooseneck spout with 8 lpm (2.2 gpm) flow aerator outlet and cast brass lever handles. Provide stops on supply piping and wall escutcheons.
- 2.18.9.3 **Waste:** Cast brass P trap, 40 mm (1-1/2"), with unions, cleanout and escutcheon.
- 2.18.10 **Drinking Fountain (Drawing Reference DF1, with water bottle filler)**
- 2.18.10.1 Use Franke Model KEPAC-SBF-STN, barrier free combination drinking fountain and water bottle filler. Unit is to be wall hung, lead-free, 18 gauge stainless steel with no. 4 satin finish, flexible bubbler guard, strainer, push pad manual activation, external stream height adjustment. Mechanically activated wall mounted bottle filler cabinet recessed in to frame with brushed stainless steel finish. Surface mount frame assembly.
- 2.18.10.2 **Supply:** Use McGuire HST11LK supply, chrome plated loose key with straight stop.
- 2.18.10.3 **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.
- 2.18.11 **Mop Service Sink (Drawing Reference MS1)**
- 2.18.11.1 **Sink:** Stern Williams Serviceceptor SB 900 Mop Sink, 610 mm x 610 mm x 305 mm deep (24" x 24" x 12") floor mounted, precast terrazzo, with one piece stainless steel cast integral cap on all four sides and integral drain with strainer. "PB" splash panels, stainless steel for two sides.
- 2.18.11.2 **Faucet:** Chicago Faucet Ecast 897-RCF service sink faucet, rough chrome 8" (203 mm) centres, wall-mounted, solid cast brass lead-free body, 1/4 turn ceramic disc valve cartridges, cast brass lever handles, body mounted vacuum breaker, integral stops, 36" (915 mm) hose and hanger, wall brace and pail hook.
- 2.18.11.3 **Waste:** 80 mm (3") cast iron "P" trap.
- 2.18.12 **Eyewash Station (Drawing Reference EW1)**
- 2.18.12.1 **Eyewash:** Haws 7460BT AXION MSR Emergency Eye/Face Wash, wall hung, stainless steel bowl, Axiom MSR eye/face wash single 14 lpm (3.7 gpm) laminar inverted flow design head, volume regulator, in-line stainless steel strainer, stainless steel push handle, chrome plated brass ball valve with stainless steel trim, all factory assembled, wall hanger and emergency sign.

2.18.12.2 **Tempering Water Blending System:** Haws Model TWBS.EW lead free eyewash tempered water blending system including mixing valve, bypass valve and temperature gauge, factory piped and pressure tested. Locate valve within ceiling space or adjacent millwork.

3 Execution

### 3.1 SANITARY AND STORM 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%

3.1.4 Use only lead free solder and fluxes.

### 3.2 UNIT DRAIN CONNECTIONS

3.2.1 Connect up all drains, blowdowns, condensate drains from fan cabinets, pumps, coils, condensers, etc. Run drains to combination drains or open hub drains without crossing or interfering with walkways. See Detail Sheet in Section 15001, "Mechanical General Provisions" for drains from air handling equipment.

### 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.

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- 3.5.2 Conceal cleanouts in finished walls with access doors. Wall cleanout access doors to be installed minimum 200mm (8") above finished floor. 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 base.

### 3.6 FLOOR DRAINS

- 3.6.1 Connect all floor drains, combination drains, running traps, and open hubs to trap seal valves.
- 3.6.2 Connect all floor drains into sanitary drainage systems unless specifically shown otherwise.

### 3.7 WATER PIPING

- 3.7.1 Use only lead free solder and fluxes.
- 3.7.2 Connect required service to plumbing fixtures, hose bibbs, etc., as shown or as specified.
- 3.7.3 After installation, thoroughly flush out complete system of water piping and remove all scale, etc.
- 3.7.4 Arrange with local utility for supply and installation of domestic water meter. Provide all necessary valves and piping in accordance with Utility's requirements.

### 3.8 VALVES

- 3.8.1 Install a valve at takeoff point in each main branch which takes off from main and in all locations shown.
- 3.8.2 Install drain valves with hose connections at all low points and at all branch valves for upfeed risers.
- 3.8.3 Use line size valves unless noted otherwise.
- 3.8.4 Use ball valves on all plumbing line 65 mm (2-1/2") and smaller. Use butterfly valves in larger lines.

### 3.9 PLUMBING FIXTURES

- 3.9.1 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.

- 3.9.2 Where fixture connections pass into walls, floors, or ceilings, provide proper escutcheons.
- 3.9.3 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.
- 3.9.4 Unless shown otherwise, use the following sizes of hot and cold water and waste connections to fixtures:

<u>Fixture</u> mm (in)	<u>Hot Water</u> mm (in)	<u>Cold Water</u> mm (in)	<u>Waste</u> mm (in)
Lavatory	15 (1/2)	15 (1/2)	32 (1-1/4)
Water Closet (Flush Valve)	----	25 (1)	80 (3)
Urinals (Flush Valve)	----	20 (3/4)	40 (1-1/2)
Mop Sink	15 (1/2)	15 (1/2)	80 (3)
Hose Bibb	----	15 (1/2)	----
Sink	15 (1/2)	15 (1/2)	40 (1-1/2)
Wall Hydrants	----	20 (3/4)	----
Eyewash	20 (3/4)	--	40 (1-1/2)
Drinking Fountain	----	15 (1/2)	32 (1-1/4)

- 3.9.5 Caulk all around bases of water closets, lavatories, wash fountains and other built-in equipment. Seal all edges which abut walls and floors.
- 3.9.6 Mount fixtures with finished floor to rim dimensions as follows:

<b>Drawing Reference</b>	<b>Height mm (in)</b>
WC1	410 (16)
WC2	375 (15)
UR1	480 (19)
LA2	840 (33)
DF1	at JK/SK: 610 (24) bubbler height others at 760 (30) bubbler height

- 3.9.7 Confirm all mounting heights with Architect prior to roughing in.

### 3.10 NATURAL GAS PIPING

- 3.10.1 Install in accordance with the latest CAN/CSA-B149.1, Natural Gas and Propane Installation Code and subsequent supplements, and the latest Ministry of Energy & Resources Management Regulations.



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- 3.10.2 Provide vents to atmosphere for all safety devices and regulators, as required by Code.
- 3.10.3 Generally, do not install piping concealed within walls. Where this is required, install all piping which is concealed in concrete or masonry walls, or piping which passes through walls or floors, in pipe sleeves so that pipe can be removed or tested in compliance with Code. For piping in other walls, ensure access doors are provided.
- 3.10.4 Make a copy of all gas fitter tags for inclusion in the O+M manuals. Laminate all gas fitter tags before securing them to the system.
- 3.11 **VACUUM BREAKERS AND BACKFLOW PREVENTERS**
- 3.11.1 Provide vacuum breakers and backflow preventers on all plumbing fixtures and equipment where required by Ontario Plumbing Code.
- 3.11.2 Size vacuum breaker to suit maximum design flow rates of fixture or equipment served.
- 3.11.3 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.
- 3.12 **ROUGHING-IN**
- 3.12.1 Where shown on Drawings, rough-in hot and cold water systems, drain and vent. Cap off all piping and provide shutoff valves on hot and cold water piping.
- 3.13 **EXISTING SYSTEMS**
- 3.13.1 Maintain systems in operation throughout construction, using temporary systems where shown. Disconnect existing systems only when temporary or permanent replacement systems are operational.
- 3.13.2 Construct the temporary systems to the same standards of material and installation as the permanent systems.
- 3.14 **STERILIZATION OF POTABLE WATER SYSTEMS**
- 3.14.1 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.
- 3.14.2 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.
- 3.14.3 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 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.

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- 3.14.4 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.
- 3.14.5 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:** A water source heat pump system will be installed to serve the renovated areas of the building. The system is sized to serve the entire building. The system includes heat pumps, circulating pumps, a fluid cooler and heat exchanger.
- 1.2.2 **Hot Water Heating System:** The existing hot water heating system will be extended to serve the renovated areas of the building.
- 1.2.3 **Heat Recovery System:** A rooftop heat recovery ventilation system will serve the renovated area.
- 1.3 **SHOP DRAWINGS**
- 1.3.1 Submit Shop Drawings in accordance with Section 15001, Clause "Shop Drawings", for the following equipment and materials:
- Air Separators
  - Automatic Air Vents
  - Combination Shutoff and Balancing Valves
  - Convector
  - Expansion Tanks
  - Flexible Connectors
  - Fluid Cooler
  - Force Flow Heaters
  - Gauges
  - Heat Exchangers
  - Heat Pumps
  - Pressure Control Systems
  - Pumps
  - Rooftop Air Handling Unit
  - Strainers
  - Thermometers
  - Unit Heaters
  - Vacuum Breakers
  - 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".

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## 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 (Use only lead free 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 **Butterfly Valves**

2.3.2.1 Use iron body valves with 2" extended neck to allow for insulation, lug type having bi-directional pressure rating of 1380 kPa (200 psi). Stem to be stainless steel with positive retention mechanism. Valve to have aluminum bronze disc and molded or bonded style EPDM seat. Valve to be capable of providing bi-directional "Dead End Service" at full rated pressure with the down stream flanged removed. Valve is suitable for both chilled water and hot water operation. Valve to be manufactured in accordance to MSS-SP-67, MSS-SP-25 and API-609.

2.3.2.2 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

Kitz / Toyo  
Keystone / Tyco  
Nibco

### 2.3.3 **Ball Valves**

2.3.3.1 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.

2.3.3.2 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

### 2.3.4 **Check Valves**

2.3.4.1 **Copper Pipe:** For sizes 50 mm (2") and under use 860 kPa (125 psig) / 200 W.O.G. bronze body to ASTM B62 Y-pattern swing type disc, screw cap, bronze trim valves with solder ends. Kitz 23, Toyo 237, Jenkins 4093J..

#### 2.3.4.2 **Steel Pipe**

2.3.4.2.1 For sizes 50 mm (2") and under use 860 kPa (125 psig) / 200 W.O.G. bronze body to ASTM B62 Y-pattern swing type disc, screw cap, bronze trim valves with screwed ends. Kitz 22, Toyo 236, Jenkins 4092J.

2.3.4.2.2 For sizes 65 mm (2-1/2") and over, use Class 125 / 200 W.O.G. cast iron body to ASTM A126 Class B, bronze trim, bolted cover, swing type disc, flanged. Kitz 78, Toyo 435A, Jenkins 587J.

#### 2.3.4.3 **On Pump Discharge**

2.3.4.3.1 For sizes 50 mm (2") and under, use 1030 kPa (150 psig) APCO or Mueller Steam Specialty spring checks.

2.3.4.3.2 For sizes 65 mm (2-1/2") and over, use 1030 kPa (150 psig) Moygro, Mueller Steam Specialty, Duo-Check or Bell & Gossett spring checks.

### 2.3.5 **Combination Balancing and Shutoff Valves**

2.3.5.1 Use T&A combination balancing and shutoff valves with ANSI flanges and locking adjustment.

2.3.5.2 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.

2.3.5.3 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.

### 2.3.6 **Drain Hose Connections**

2.3.6.1 Full port, bronze body ball valves with stainless steel stems and ball – Kitz 68 with brass hose adaptor, cap and chain.

2.3.6.2 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":

Zurn

## 2.5 **THERMOMETERS**

2.5.1 WEISS 9VS35 vari-angle thermometer 225 mm (9") dual scale complete with separable well or WEISS 35ZL3 80 mm (3-1/2") dial type thermometer, stainless steel case and adjustable bracket. Temperature range: hot water 0 - 100°C (32 - 210°F) cold water 0 - 40°C (32 - 100°F).

2.5.2 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":



Ashcroft  
Baker  
Cambridge  
Taylor  
Terice  
Winters

## 2.6 PRESSURE GAUGES

- 2.6.1 WEISS LF4S-1 100 mm (4") liquid filled, stainless steel case, gauge accuracy 1% middle half, ANSI B40 Grade A, brass movement, bourdon tube and socket. Use range twice the normal operating pressure of the system, so that the pointer is normally at the mid-point of the range. Provide gauges with dual unit scales.
- 2.6.2 WEISS TC14 "T" handle brass gauge cocks, threaded both ends, 2100 kPa (300 psig) water. Include WEISS PSN-B brass pressure snubber.
- 2.6.3 Use maximum 3/8" pipe connections for piping pressure gauges.
- 2.6.4 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

Ashcroft  
Baker  
Cambridge  
Taylor  
Terice  
Winters

## 2.7 GAUGE COCKS

- 2.7.1 Use Terice Type FFG No 735 needle valve of polished brass for 2100 kPa (300 psig) operating pressure, threaded both ends.

## 2.8 VACUUM BREAKERS

- 2.8.1 Use Spirax Sarco Type VS 15 mm (1/2") thermostatic air vents.

## 2.9 FLEXIBLE CONNECTORS

- 2.9.1 For connections to vertical inline circulating pumps, use Kinflex Model FTC rubber spherical pump connectors with restraining tie rods.
- 2.9.2 In other locations, 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)

2.9.3 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

Thorburn Equipment  
Vibrant Power

## 2.10 AUTOMATIC AIR VENTS

2.10.1 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.

2.10.2 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

Hoffmann

## 2.11 HEAT EXCHANGERS

2.11.1.1 Use AIC, vertical, high efficiency, shell and coil heat exchangers fabricated of 316 L stainless steel. Units to be manufactured of helically corrugated tube bundles and one piece shell. Design pressure for both shell and tube circuits to be 1724 kPa (250 psig).

2.11.1.2 See Equipment Schedules for details and capacities. Units to be designed, tested and manufactured to ASME Code Sec. VIII, Div. 1 and be U or UM and CRN stamped.

## 2.12 EXPANSION TANKS

2.12.1 Use Amtrol, ASME certified diaphragm type expansion tanks with heavy duty butyl rubber bladder removable for inspection. Build tanks to Provincial Codes for 862 kPa (125 psig) working pressure. Provide shutoff cocks and drain cock.

2.12.2 See Equipment Schedule for details.

2.12.3 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

Armstrong  
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**2.13 PRESSURE CONTROL SYSTEMS**

2.13.1 Use Watts No. 909 Series backflow preventer with strainer, pressure reducing valve and pressure gauge, all connected with brass nipples. Provide Watts AG Series air gap with EL Series elbow fan vent line.

2.13.2 Use Watts pressure relief valves. For tanks, use Watts Series N240 ASME temperature and pressure relief valves. For pipelines, use Watts Series 174A ASME pressure relief valves. Size valves to suit heating equipment rating.

2.13.3 The following manufacturers of the above equipment will be considered equal, subject to the requirements of Clause "Materials and Equipment":

Conbraco  
Zurn

**2.14 AIR SEPARATORS**

2.14.1 Use Armstrong Model VA line size Vortex Air Separators with steel shells designed for 860 kPa (125 psig) working pressure.

2.14.2 The following manufacturer of the above equipment will be considered equal, subject to the requirements of Clause "Material and Equipment":

Bell & Gossett  
Spirax Sarco

**2.15 WALL-FIN CONVECTORS**

2.15.1 Use minimum 16 gauge steel casings complete with Series 40, 108 mm x 108 mm (4-1/4" x 4-1/4") aluminum fins on 32 mm (1-1/4") copper tube. Use sloped top, bottom inlet, stamped top outlet configuration. Coat casings with baked on primer and finish exterior surfaces with baked on enamel of Architect's choice from standard colour chart. See Equipment Schedule for capacities and details. Provide wall-to-wall cabinets where shown on the Drawings.

2.15.2 Provide manual air vents with all units. Chrome plate exposed vent assemblies.

2.15.3 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

Engineered Air  
Rittling  
Sigma  
Trane

**2.16 FORCE FLOW HEATERS**

2.16.1 Use Sigma cabinet unit heaters. Refer to Equipment Schedule for types, sizes and capacities.

2.16.2 Use cabinets suitable for mounting arrangements indicated in Schedule. Equip cabinets with return and discharge grilles to suit unit arrangement and installation.

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- 2.16.3 Furnish heating coils with aluminum fins mechanically bonded to seamless copper tubing. Roll or braze tubes into cast iron or steel headers and test to 2070 kPa (300 psig) pressure.
- 2.16.4 Provide units complete with direct drive forward curved fan, coil, 25 mm (1") thickness MERV 8 pleated type filter, casing, split capacitor type motor, speed controller and automatic air vent. Provide a spare set of filters with each unit.
- 2.16.5 Provide cabinet enclosure fabricated from 1.52 mm (16 gauge) steel coated inside and out with baked on primer and finished on exterior surfaces with baked on enamel of a colour selected from the manufacturer's standard colours.
- 2.16.6 Ceiling units access doors to be hinged and chained.
- 2.16.7 Provide a starter with three speed controller. Mount controller inside unit for wall-mounted types. For ceiling applications, provide starter suitable for remote recessed wall installation.
- 2.16.8 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":
- Engineered Air  
Rittling  
Trane

## 2.17 UNIT HEATERS

- 2.17.1 Use Sigma unit heaters. See Equipment Schedule for types, sizes and capacities.
- 2.17.2 Use minimum 1.21 mm (18 gauge) steel casings. Fit horizontal units with adjustable louvre fin diffusers. Equip vertical units with adjustable louvre cone diffusers. Coat all surfaces with baked on primer and finish exterior surfaces with baked on enamel.
- 2.17.3 Use coils with aluminum fins mechanically bonded to copper tubing. Braze tubes to headers and grade to achieve gravity drainage. Test coils to 2585 kPa (375 psig) pressure, and mount in casings with provision for thermal expansion.
- 2.17.4 Use four blade propeller direct drive fans with steel blades riveted to hub. Provide finger guard.
- 2.17.5 Provide air vents on all upfeed units.
- 2.17.6 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":
- Engineered Air  
Rittling  
Trane

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**2.18 RADIANT CEILING PANELS**

- 2.18.1 Furnish Sigma linear radiant ceiling system consisting of panels of type, size and capacity shown on Drawings. Base panel capacities on 21°C (70°F) air temperature, 66°C (150°F) average water temperature and 71°C (160°F) entering water temperature. Use panel widths as shown on the Drawings.
- 2.18.2 Fabricate radiant panels from 1.52 mm (16 gauge) extruded aluminum with 12 mm (1/2") copper tubing mechanically attached to the top of the panel. Secure the copper tubes with aluminum saddles extending minimum half way around the tubes and bond the tubes to the saddles with non-hardening heat conductive paste. Operating weight of panels is to be no more than 10.5 kg/m<sup>2</sup> (2.15 lb/ft<sup>2</sup>).
- 2.18.3 Factory finish with standard off-white paint.
- 2.18.4 Provide panel circuiting to match the end connection arrangements indicated on the floor plan Drawings. Panels to run wall to wall.
- 2.18.5 Furnish panels with 360° interconnecting loops and 180° return "U" bands as required to suit the arrangements shown on the Drawings.
- 2.18.6 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

Airtex  
Airtite  
Frenger  
Rittling

**2.19 SMALL CIRCULATING PUMPS**

- 2.19.1 Use Bell & Gossett e60 radially split, dry motor, in-line circulators. Pumps to have stainless steel impeller and bearing plate and shaft. Submit pump curves with Shop Drawings. Use a single manufacturer only for all pumps. Use only 1,800 rpm motors. Use NEMA premium efficiency motors for motors 1 hp and larger.
- 2.19.2 In addition to the one year full warranty as specified in Section 15001 "Mechanical General Provisions", provide an additional two year warranty on parts.
- 2.19.3 The following manufacturers of the above equipment will be considered equal, subject to the requirements of Clause "Materials and Equipment":

Armstrong  
Grundfos

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- 2.20      **PUMPS**
- 2.20.1    **Base-Mounted Pump**
- 2.20.1.1   Use Bell & Gossett model e1535 base-mounted pump, radially split case design in cast iron bronze fitted construction with enclosed type bronze impeller keyed to shaft. Pump shall be equipped with an internally flushed mechanical seal assembly. Seal assembly shall have a brass housing, seat gasket, stainless steel spring, and be of a carbon ceramic design with the carbon face rotating against a stationary ceramic face. Provide replaceable shaft sleeve to cover wetted area of shaft under bearing and permanently ball bearings. Use flexible coupler between pump and motor, and provide an OSHA 1910.219 compliant coupling guard to shield the coupler during operation. Coupler guard shall contain viewing windows for inspection. Design pump for 1200 kPa (175 psig) maximum working pressure. Mount pump and motor on common base plate. See Equipment Schedule for capacities and details.
- 2.20.2    **Motors and Pump Curves:** Provide motors which are non-overloading over the complete range of the pump curve. Submit pump curves with the Shop Drawings.
- 2.20.3    The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":
- Armstrong  
          Grundfos
- 2.21      **VERTICAL IN-LINE CIRCULATING PUMPS (Drawing Reference CP-302A/B)**
- 2.21.1    Use Bell & Gossett vertical in-line, split coupled centrifugal pumps designed for minimum 1034 kPa (150 psig) working pressure. Use radially split casing design with cast iron casings and all bronze impellers. Provide pumps with outside mechanical seals and split type spacer couplings to permit seal servicing without disturbing pump, motor or electrical wiring. Provide stainless steel shaft. See Equipment Schedule for Series, capacities and details.
- 2.21.2    Use NEMA Premium Efficiency, inverter duty motors. Provide motor which is non-overloading over the complete range of the pump curve. Submit pump curve with the Shop Drawings.
- 2.21.3    In addition to the one year full warranty as specified in Section 15001 "Mechanical General Provisions", provide an additional two year warranty on parts.
- 2.21.4    **Pump Accessories**
- 2.21.4.1   Provide Suction Diffuser on inlet of each pump, complete with pot type elbow strainer sized to match pump inlet flange. Use cast iron body, steel guide vanes, strainer of 3 mm (1/8") stainless steel mesh, plus a fine mesh brass startup strainer. Inlet to match pipe size indicated. Design for maximum working pressure of 1034 kPa (150 psig).
- 2.21.5    The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

Armstrong  
Grundfos

## 2.22 HEAT PUMPS

- 2.22.1 Use Daikin 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. Use 2-stage heat pumps as indicated ins schedule on drawing.
- 2.22.2 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.
- 2.22.3 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.
- 2.22.4 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. PSC motors will be acceptable on nominal 3/4 ton and 1 ton sizes only.
- 2.22.5 For each heat pump, provide Belimo 1030 kPa (150 psi) bronze body, full port ball style control valves and actuators with stainless steel ball and stem and teflon seals. Use two way, on/off control valves, non-spring return, and provide wire harness for field connection to heat pump controller. When wired to heat pump controller, controller to open valve prior to starting compressor.
- 2.22.6 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.
- 2.22.7 Provide means of remotely resetting each individual heat pump from the 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.
- 2.22.8 Units to have microprocessor based control system. Unit control logic to provide heating and cooling operation as required by the thermostat. Control systems 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:

- emergency shutdown
- night setback override
- pump restart on night setback

The microprocessor control board to include the following diagnostic functions:

- normal mode
- high pressure fault
- low temperature fault
- condensate overflow
- brown-out
- load shed
- unoccupied mode
- emergency shutdown

Provide "Fan", "Cool", "Heat" inputs and dry contacts for alarm output.

- 2.22.9 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.
- 2.22.10 Provide 25 mm (1") thick throwaway filters serviceable from either side with a duct collar for ducted return connections. Provide additional set of filters for each unit.
- 2.22.11 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.
- 2.22.12 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.
- 2.22.13 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

Florida Heat Pump  
Trane  
Carrier  
Climate Master



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- 2.23 **ROOFTOP AIR HANDLING UNIT (Drawing Reference RTU-101)**
- 2.23.1 Use Daikin Rebel rooftop units specifically designed for outdoor application with a weatherproof cabinet. Cooling capacity, heating capacity and fan performance shall be AHRI certified. Complete unit shall be ETL- Canada listed.
- 2.23.2 The unit shall undergo a complete factory run test prior to shipment. The factory test shall include final balancing of the supply and exhaust fan assemblies, a refrigeration circuit run test, a unit control system operations checkout, test and adjustment of the gas furnace, a unit refrigerant leak test and a final unit inspection.
- 2.23.3 **Casing**
- 2.23.3.1 Panels and access doors shall be constructed as a 25-mm (1") nominal thick, thermally broken double wall assembly, injected with foam insulation for an R-value of not less than R-7. The outer casing shall be constructed of galvanized steel, phosphatized and painted with a polyester resin topcoat with a natural beige color. Finished panel surfaces must withstand a minimum 750-hour salt spray test in accordance with ASTM B117 standard for salt spray resistance.
- 2.23.3.2 Unit base shall overhang the roof curb for water runoff and shall have a formed recess that seats on the roof curb gasketing to provide a positive weather tight seal.
- 2.23.3.3 Service doors shall be provided for the fan section, filter section, control panel section, and heating vestibule in order to provide user access to unit components. All service access doors shall be mounted on multiple, stainless steel hinges and shall be secured by a latch system. Removable service panels secured by multiple mechanical fasteners are not acceptable. Service doors must be lockable with stainless steel bolt and lock nut.
- 2.23.3.4 Unit cabinet shall be designed to operate at total static pressures up to 5 inches w.g.
- 2.23.4 **Filters:** The filter section shall be provided with a 100 mm (4") final filter rack. Provide Camfil 30/30 MERV 8A filters and a spare set of final filters.
- 2.23.5 **Fans**
- 2.23.5.1 Supply and exhaust fans shall be single width, single inlet centrifugal Airfoil type. The fan wheel shall be Class II construction with aluminum fan blades that are continuously welded to the hub plate and end rim. Fans shall be direct drive.
- 2.23.5.2 Fan assemblies shall be statically and dynamically balanced for quiet operation. Provide slide out rails for servicing and maintenance of the fan.
- 2.23.5.3 The fan motor shall be a totally enclosed ECM motor that is speed controlled by the rooftop unit controller. Motor safeties shall include thermal overload protection and phase failure protection. Motors shall be premium efficiency, inverter duty. Fan assemblies shall be a slide out type for servicing and maintenance.
- 2.23.5.4 The supply fan shall be capable of airflow modulation from 30% to 100% of the scheduled designed airflow. The fan shall not operate in a state of surge at any point within the modulation range.

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**2.23.6 Cooling Coil**

2.23.6.1 Evaporator coils shall be multi row type fabricated from seamless copper tubing mechanically bonded to high efficiency aluminum plate fins. Each evaporator coil refrigerant circuit shall be fed with an electronically controlled expansion valve. All cooling coils shall have an interlaced coil circuiting that keeps the full coil face area active at all load conditions.

2.23.6.2 Provide a stainless steel sloped primary drain pan under the cooling coil and beyond the leaving side of the coil and underneath the cooling coil connections. The drain pan shall have a minimum slope of 1/8" per foot and be connected to a stainless steel drain connection extending through the base. Polymer drain pans will not be accepted.

**2.23.7 Economizer**

2.23.7.1 Unit shall be provided with an outdoor air economizer section. The economizer shall include outdoor, return, and exhaust air dampers. The outdoor air hood shall be factory installed and constructed from galvanized steel finished with the same durable paint finish as the main unit. The hood shall include moisture eliminator filters to drain water away from the entering air stream

2.23.7.2 The economizer operation shall be fully integral to the mechanical cooling and allow up to 100% of mechanical cooling if needed to maintain the cooling discharge air temperature. The outside and return air dampers shall be sized to handle 100% of the supply air volume. The dampers shall be opposed blade design. Damper blades shall be gasketed with side seals to provide an air leakage rate of 4 cfm / square foot of damper area at 1" differential pressure per ASHRAE 90.1 Energy Standard.

2.23.7.3 A barometric exhaust damper shall be provided to exhaust air out of the back of the unit. A bird screen shall prevent infiltration of rain and foreign materials. Exhaust damper blades shall be lined with vinyl gasketing on contact edges.

2.23.7.4 Control of the dampers shall be by a factory installed direct coupled actuator. Damper actuator shall be of the modulating, spring return type. A comparative enthalpy control shall be provided to sense and compare enthalpy in both the outdoor and return air streams to determine if outdoor air is suitable for "free" cooling. If outdoor air is suitable for "free" cooling, the outdoor air dampers shall modulate in response to the unit's temperature control system.

**2.23.8 Energy Recovery Section**

2.23.8.1 The energy recovery cassette is to be rated in accordance with ARI Standard 1060 and must bear the ARI certification symbol.

2.23.8.2 The energy recovery cassette is to contain a total energy recovery heat wheel constructed of a light weight polymer material with permanently bonded desiccant coating. The energy recovery wheel media must be capable of removal from the cassette and replacement without the use of tools. Wheel media to be cleanable using hot water or light detergent without degrading the efficiency.

2.23.8.3 Provide defrost control and rotation detection controls.

2.23.8.4 The exhaust fan to be backward inclined type. Fan and motor to be dynamically balanced. A backdraft damper is to be included with the exhaust fan. Outside air and exhaust air filters to be 50 mm (2") thick, pleated, MERV 8.

2.23.9 **Condensing Section**

2.23.9.1 Outdoor coils shall have seamless copper tubes, mechanically bonded to aluminum plate-type fins. The fins shall have full drawn collars to completely cover the tubes. A sub-cooling coil shall be an integral part of the main outdoor air coil.

2.23.9.2 Fan motors shall be ECM type. The rooftop controller shall proportionally control the speed of the condenser fan motors to maintain the head pressure of the refrigerant circuit within acceptable limits. Mechanical cooling shall be provided to 0° F. Motor safeties shall include thermal overload protection and phase failure protection.

2.23.9.3 The condenser fan shall be dynamically designed for low noise generation with low tip speeds. Fan blade shall be of a composite material.

2.23.9.4 The unit shall have a single inverter driven scroll compressors. The unit controller must control the speed of the compressor to maintain the discharge air temperature. Unit must be capable of operating at 20% of cooling capacity or lower, except nominal 5 ton units for which modulation down to 30% will be acceptable.

2.23.9.5 The refrigeration circuit shall have both low and high pressure safety switches. Temperature sensors shall be provided for measuring suction and discharge temperature of the refrigerant.

2.23.9.6 Refrigerant circuit shall have a bypass valve between the suction and discharge refrigerant lines for compressor startup under low head pressure conditions. When there is a call for mechanical cooling the bypass valve shall open to equalizing the suction and discharge pressures. When pressures are equalized the bypass valve shall close and the compressor shall be allowed to start.

2.23.9.7 Each circuit shall be dehydrated and factory charged with Refrigerant 410A and oil.

2.23.10 **Natural Gas Fired Heating Section**

2.23.10.1 The rooftop unit shall include a natural gas heating section. The gas furnace design shall be a natural gas fired heating module factory installed downstream of the supply air fan in the heat section. The heating module shall be a tubular design with in-shot gas burners.

2.23.10.2 The heat exchanger tubes shall be stainless steel. The module shall be complete with a furnace controller and control valve capable of 10:1 modulation. Unit shall be able to modulate heating output down to 10%.

2.23.10.3 The module shall have an induced draft fan that will maintain a negative pressure in the heat exchanger tubes for the removal of the flue gases.

2.23.10.4 Each burner module shall have two flame roll-out safety protection switches and a high temperature limit switch that will shut the gas valve off upon detection of improper burner manifold operation. The induced draft fan shall have an airflow safety switch that will prevent the heating module from turning on in the event of no airflow in the flue chamber.

2.23.11 **Electrical**

2.23.11.1 Each unit shall be wired and tested at the factory before shipment. Wiring shall comply with CSA standards. All wiring shall be number coded per the electrical wiring diagrams. All electrical components shall be labeled according to the electrical diagram and be CSA recognized.

2.23.11.2 A terminal block shall be provided for the main power connection and a terminal board shall be provided for the low voltage control wiring. Knockouts shall be provided in the bottom of the main control panel for field wiring entrance. Branch short circuit protection, 115-volt control circuit transformer and fuse, system switches, and a high temperature sensor shall also be provided with the unit.

2.23.11.3 Each compressor and condenser fan motor shall be furnished with contactors and internal thermal overload protection. Supply fan motors shall be supplied with external overload protection.

2.23.12 **Controls**

2.23.12.1 Each unit shall be equipped with a Daikin MicroTech III microprocessor based control system. The unit control system shall include all required temperature and pressure sensors, input/output boards, main microprocessor and operator interface. The unit control system shall perform all unit control functions including scheduling, unit diagnostics and safeties.

2.23.12.2 The DDC control system shall permit starting and stopping of the unit locally or remotely. A set of contacts shall be provided for unit enable/disable, outside air damper minimum position, discharge air temperature reset, and general alarm status.

2.23.12.3 The unit control system shall have the ability to communicate with an independent Building Management System (BMS) via a direct BACnet MSTP or LONworks communication connection, coordinate with section 15900. The independent BMS system shall have access to "read only" variables and "read & write" variables. Communications shall not require field mounting of any additional sensors or devices at the unit. The BMS system shall be capable of interacting with the individual rooftop controllers in the following ways:

- Monitor controller inputs, outputs, set points, parameters and alarms
- Set controller set points and parameters
- Clear alarms
- Reset the discharge air temperature set point

2.23.12.4 The controller shall have a 4 line x 20 character display with all information and instructions shown in plain English. A keypad shall allow information and controls to be accessed. The microprocessor shall have a programmable time clock, store current and past alarm conditions.

- 2.23.12.5 The display shall provide the following information:
- Unit status including # of stages or % capacity for fans, heating, cooling and economizer.
  - Supply, return, outdoor, and space air temperature
  - Duct and building static pressure; the control contractor is responsible for providing and installing sensing tubes
  - Inverter compressor speed and refrigeration circuit pressures and temperatures
  - Outside air damper position and economizer mode
  - Cooling and heating changeover status
  - Occupied, unoccupied, and dirty filter status
  - Date and time schedules
  - Alarm faults
- 2.23.12.6 The following set points shall be adjustable:
- Control mode (Off / Auto / Cool Only / Fan Only / Heat Only)
  - Occupancy mode (Auto / Tenant Override / Occupied / Unoccupied)
  - Changeover mode (return air, space temperature or network signal)
  - Cooling and heating discharge air temperature control
  - Compressor lockouts and timers
  - Economizer changeover (enthalpy or dry bulb)
  - Scheduling
  - Building static pressure control
- 2.23.12.7 The unit DDC controller shall provide building static pressure control. The unit controller shall provide proportional control of the exhaust fans from 25% to 100% of the supply air fan designed airflow to maintain the adjustable building pressure set point.
- 2.23.12.8 Supply air reset options shall include; return air temperature, outdoor air temperature, space temperature, airflow (VAV), network signal, external signal (1-5 vdc or 0-20 mA)
- 2.23.13 **Roof Curb:** Each unit shall be provided with a prefabricated 14 gauge spring isolation roof curb with minimum 25 mm (1") static deflection. Provide roof curb adaptor to suit existing roof opening for previously installed rooftop unit. Site verify dimensions of existing roof opening.
- 2.23.14 **Startup Service and Warranty:** Manufacturer shall furnish a factory trained service technician to perform the unit startup. Manufacturer shall provide instruction to the owner's personnel on the operation and maintenance of the unit. Factory technician to provide copy of start up log to owner and to demonstrate operation and maintenance to owners' representative. The warranty period shall commence at the date of initial startup and shall continue for a period of one (1) year not to exceed eighteen (18) months from shipment. Manufacturer's warranty shall include all parts and labour to install parts. Provide an additional 4 years parts only warranty for compressor and refrigeration system leaks.
- 2.23.15 The following manufacturer of the above equipment will be considered as an equal, subject to requirements of Clause "Material and Equipment":

Engineered Air

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- 2.24 FLUID COOLER (Drawing Reference FC-502)**
- 2.24.1 Provide a Baltimore Air Coil closed circuit fluid cooler, model, capacity and details as indicated on the Schedule on the Drawings.
- 2.24.2 Configure unit as shown on the Drawings. Size fan motor to suit ducted inlet and outlet conditions.
- 2.24.3 Use a cooler with a centrifugal fan assembly built into the unit, with all moving parts factory-mounted and aligned. Use hot-dip galvanized steel construction with all edges given a protective coat of zinc-rich compound. Provide additional coat of zinc-chromated aluminum paint applied to the complete unit.
- 2.24.4 Provide a combination pan-fan section which consists of heavy gauge hot-dip galvanized steel angle framework, Type 304 stainless steel V-shaped, self-cleaning water basin with centrifugal fan mounted beneath the sloping undersides of the pan. Locate fans and motors in dry entering air stream. Enclose fan section in acoustical galvanized steel panels.
- 2.24.5 With standard pan accessories, include circular access doors and strainer. Use large area lift-out hot-dip galvanized steel strainer with perforated openings sized smaller than spray nozzle orifices, and mounted in an assembly baffled to prevent cavitation. Provide a mechanical float water level control package consisting of a float and water makeup valve.
- 2.24.6 Provide 1/2 NPT, type 304 stainless steel chemical feed injection port in basin above the maximum water line. Locate close to spray pump connection. Provide a threaded connection on each side of the unit for makeup water to the basin.
- 2.24.7 Statically and dynamically balance the forward curved centrifugal fans. Provide compound curve inlet rings for efficient air entry, and discharge cowls within the pan for increased fan efficiency and to prevent water from entering the fan. Mount fan on a steel fan shaft having solid bearing journals on both ends. Mount the fan shaft in heavy duty grease packed self-aligning ball bearings with eccentric locking collars. Use relubricable ball bearings with cast iron housing. Extend bearing grease lines to access side of fluid cooler. Fan shaft is to be split with a central coupling, for easier future replacement.
- 2.24.8 Provide 1750 rpm, inverter duty, NEMA premium efficiency TEFC ball bearing fan motors with 1.15 service factor suitable for outdoor and variable frequency drive service. Mount motors on easily adjusted heavy duty motor bases. Locate so that the drives and motors are in a protected position under the pan side.
- 2.24.9 Design V-belt fan drive for minimum 150% of the motor nameplate horsepower. Enclose drive and all moving parts with removable hot-dip galvanized steel screens.
- 2.24.10 Distribute water evenly over the coil area through spray trees consisting of Schedule 40 PVC headers and removable PVC branches. Hold the branches and plastic spray nozzles in place with snap-in rubber grommets providing for quick removal of individual nozzles or complete branches for cleaning or flushing. Include provision for measuring spray pressure externally.

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- 2.24.11 Construct eliminators from hot dipped galvanized steel, and ensure they are removable in easily handled sections. Direct discharge air away from the fans and limit draft loss to less than 0.002% of total water circulated. PVC eliminators will not be accepted.
- 2.24.12 Use cooler coil of prime surface hot-dip galvanized steel. Coil must be completely drainable. Factory test coil at 2400 kPa (350 psig) air pressure under water.
- 2.24.13 Provide close-coupled, bronze fitted centrifugal spray water pump equipped with mechanical seals, mounted on pan and piped to the suction strainers and distribution system. Use galvanized steel piping external to the cooler. Install pump vertically to allow complete drainage.
- 2.24.14 Provide discharge damper and operator. Operator to be Belimo type AF, 24 volt, 60 hertz, spring return type, to be controlled by BCS. Use TAMCO low leakage type damper, thermal break, aluminum frame, aluminum blades and side and edge seals.
- 2.24.15 Division 16 will provide VFD for fan motor and starter for pump.
- 2.24.16 Provide insulated straight discharge hood with access doors.
- 2.24.17 All structural elements and panels to be manufactured from hot dipped galvanized steel. Exterior to have zinc-chromatized aluminum finish applied after assembly.
- 2.24.18 The following manufacturer of the above equipment will be considered as an equal, subject to requirements of Clause "Material and Equipment":

Evapco

### 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 Install all control valves, fittings, water temperature sensors and flow switches supplied by Section 15900 "Controls".. See Section 15900 "Controls" for equipment supplied.
- 3.1.1.4 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.

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**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 PRESSURE CONTROL SYSTEMS - WATER**

- 3.4.1 Provide pressure control systems in accordance with Detail Sheet included with Section 15001 "Mechanical General Provisions". Install air gap and special elbow as specified for backflow preventers.
- 3.4.2 Set reducing valve to hold an excess pressure at highest point of system of 35 kPa (5 psi).

**3.5 THERMOMETERS AND PRESSURE GAUGES**

- 3.5.1 Mount all thermometers and gauges so they are easily readable from the floor.
- 3.5.2 Where this is impossible, for thermometers, provide remote reading dial type thermometers; for gauges extend pressure sensing line with gauge to a location which is easily readable from the floor.
- 3.5.3 Provide gauge cocks for each pressure gauge.

**3.6 PUMPS**

- 3.6.1 Install pumps as shown and in accordance with manufacturer's recommendations. Provide vibration isolation equipment as specified under Section 15240, "Noise and Vibration". See Detail Sheet included with Section 15001, "Mechanical General Provisions".
- 3.6.2 After one month's operation, remove all startup strainers and replace with new units; clean all permanent style strainers. Return startup strainers to Owner.
- 3.6.3 Wall mounted circulating pumps are to be mounted no higher than 1370 aff.



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**3.7 HEAT EXCHANGERS**

3.7.1 Follow manufacturer's installation recommendations. Support units from wall brackets independently from piping. Use flexible connections on all piping to heat exchangers as shown on Drawings.

**3.8 CONVECTORS**

3.8.1 Make connections to elements with brass seated unions. Install a shutoff valve on each supply and combination shutoff and balancing valve on each return. Provide manual air vent. Locate control valves above accessible ceilings or behind access doors.

**3.9 FORCE FLOW HEATERS**

3.9.1 Make connections to elements with brass seated unions. Install a shutoff valve on each supply and balancing valve on each return. Locate control valves above accessible ceilings or behind access doors.

3.9.2 Provide mounting frames to support cabinet force flow heaters from main structure and to allow flush mounting.

**3.10 UNIT HEATERS**

3.10.1 Make connections to units with brass seated unions. Install a shutoff valve on each supply and balancing valve on each return.

**3.11 VIBRATION CONTROL EQUIPMENT**

3.11.1 Install all vibration control equipment supplied by Section 15240, "Noise and Vibration Control", for equipment provided by this trade.

3.11.2 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.

**3.12 ROOFTOP AIR HANDLING UNITS**

3.12.1 Comply with manufacturer's rigging and installation instructions for unloading the units and moving to the final location.

3.12.2 Assemble all sections in accordance with manufacturer's recommendations and under manufacturer's representative's supervision. Seal all joints between sections and all pipe and conduit penetrations. Use caulking as recommended by manufacturer for seams. Use rubber grommets and retaining plates for pipes and conduits. Fill all grease lines.

3.12.3 Provide individual deep seal traps for drains from outside air intake and cooling coil. See Detail Sheet included with Section 15001, "Mechanical General Provisions". For rooftop units, pipe condensate drain discharge to nearest roof drain.

3.12.4 Pipe vent openings on each coil and bring together outside cabinet. Provide a pet cock on each vent connection.

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- 3.12.5 Provide all piping for coils.
- 3.12.6 Provide the services of the unit manufacturer's service representative to supervise assembly work, inspect the final assemblies, and supervise startup.
- 3.13 **ROOF CURB INSULATION**
- 3.13.1 Provide roof attenuation under roof-mounted units as follows:
- 3.13.2 Mount all new rooftop units on prefabricated roof curb and roof curb adaptor.
- 3.13.3 Inside the curb and curb adaptor, apply two layers of 25 mm (1") thick, 4.5 lb/ft<sup>3</sup> density, insulating board on roof deck. Stagger board joints. Butt board sections tightly to sides of ductwork and curb.
- 3.13.4 Seal all board joints and edges with acoustic sealant.
- 3.13.5 Advise Consultant when this work is complete, for his review. Seal joints to satisfaction of Consultant.
- 3.14 **FLUID COOLER**
- 3.14.1 Install tower as directed by manufacturer.
- 3.14.2 Arrange and pay for the services of a factory trained representative to supervise installation of fluid cooler and be present at startup to calibrate all components during initial testing and operational period.
- 3.14.3 Use flexible connectors to connect all pipes to fluid cooler. Size connectors to accommodate deflection of spring vibration isolators.
- 3.15 **HEAT PUMP SYSTEM**
- 3.15.1 Provide the services of a factory trained representative to be present at system startup and to instruct the Owner in system operation.
- 3.15.2 Install isolators which are supplied with individual heat pump units.
- 3.15.3 Install heat pumps so that they can easily be removed for servicing.
- 3.15.4 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. See Section 15715, "Water Treatment".
- 3.16 **ACCESS DOORS**
- 3.16.1 Provide access doors with quick fastening latches for access to all dampers, coils, thermostats, valves and any other concealed devices which require servicing.
- 3.17 **COMBINATION SHUTOFF AND BALANCING VALVES**
- 3.17.1 Provide water flow balancing valves and flow meters in all locations shown. Install in accordance with manufacturer's recommendations.

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**3.18 FLEXIBLE CONNECTORS**

3.18.1 Install flexible connectors where shown. See Detail Sheet included with Section 15001, "Mechanical General Provisions" for pump isolation.

**3.19 AIR AND WATER SYSTEM TESTING AND BALANCING**

3.19.1 Cooperate with and assist the air and water testing and balancing company. See Section 15200, "Testing and Balancing".

3.19.2 Change wire taps on individual heat pump units to allow for proper air balancing.

3.19.3 Be responsible for the initial alignment and tension of all fan pulleys and belts.

3.19.4 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.

**3.20 WATER TREATMENT SYSTEMS**

3.20.1 Install all water treatment equipment as shown and in accordance with manufacturer's recommendations. Provide all necessary piping and accessories. See Section 15715, "Water Treatment".

3.20.2 Mechanical Contractor to flush, drain, clean and refill heating system, provide bypasses, etc, as directed by Water Treatment Contractor. See Section 15001 "Mechanical General Provisions".

**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 Provide pre-operational cleaning of hot water heating and heat pump loop water systems.
- 1.2.2 Provide chemical treatment systems for hot water heating and heat pump water systems.
- 1.3 **SHOP DRAWINGS**
- 1.3.1 Submit Shop Drawings in accordance with Section 15001, Clause "Shop Drawings" for the following equipment and materials:
- all chemicals including MSDS (include in operations and maintenance manuals)
  - pot feeders
  - micron filters
  - chemical feed tanks
  - chemical feed pumps
  - flow meters
  - test cabinet
- 2 Products
- 2.1 **GENERAL**
- 2.1.1 Use chemicals and chemical feed equipment as supplied by Keytech Water Management, (800) 265-2772; Cell 519-630-4649, Attention Dave Denton (ddenton@keytech.ca).
- 2.1.2 The work of this project is to be performed only by skilled factory-trained technicians under the direction of experienced engineers, all of whom shall be properly trained and qualified for this work and who are employed directly by the firms listed above.
- 2.2 **PRE-OPERATIONAL CLEANING**
- 2.2.1 Provide an adequate quantity of cleaning solutions to thoroughly clean all new piping and associated equipment by removing sludge, oil, dirt and debris. Cleaning products to be used for cleaning and flushing of all new piping systems (excluding domestic water and drains). Cleaning and flushing procedure to be as per manufacturer's instructions and must be performed under the supervision of a manufacturer's representative. Once cleaning is complete, provide a letter certifying that systems have been properly cleaned.
- 2.2.2 Ensure Mechanical Contractor provides temporary piping connections, bypasses and strainers as required for introduction of cleaning chemicals and removal of debris. Isolate boilers from cleaning chemicals.

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**2.3 CLOSED WATER SYSTEMS**

- 2.3.1 For each system, furnish a bypass pot feeder with heavy cast iron body with a working pressure of 1390 kPa (200 psig) and 7.5 L (2 USg) capacity, for adding corrosion inhibitor to the system. For each feeder include two 20 mm (3/4") isolating globe valves and one 20 mm (3/4") drain valve.
- 2.3.2 Provide pH meter for heating water system.
- 2.3.3 For each system, install corrosion coupons in two 19 mm (3/4") tee fittings on upstream side of pot feeder. Include one mild steel corrosion coupon and one copper corrosion coupon. For heating water system, also provide one aluminum coupon. Provide a totalizing make up meter, Drew model 9244-01-1 on makeup water system.
- 2.3.4 For each system, furnish a bypass micron filter with capacity to handle 2.5 to 5.0% of the system flow rate. Include six sets of 20 micron filter cartridges.
- 2.3.5 Provide sufficient new system cleaner CSW 600 to initially clean the closed system.
- 2.3.6 Provide sufficient CSW 311 nitrite-based corrosion inhibitor to maintain required control levels in closed system(s) for a period of twelve (12) months after turnover. Control of system pH is critical - follow all instructions of boiler supplier.
- 2.3.7 Provide a makeup water meter for each system. Meter to be manufactured from cast bronze and have both a totalizing registers and a 10 gpc contacting head.

**2.4 FLUID COOLER SPRAY OPEN LOOP**

- 2.4.1 Provide a complete pre-fabricated wall-mounted chemical feed and bleed-off system for the prevention of scale and corrosion in the open recirculating condenser water system. Use automatic feed equipment to feed biocides to the system.
- 2.4.2 **Equipment**
- 2.4.2.1 Use pre-fabricated, wall-mounted microprocessor controlled chemical feed unit, containing sample lines, conductivity controller, chemical feed pump, solenoid bleed valve and manual bleed valve.
- 2.4.2.2 Provide all required chemical feed pumps to dispense liquid water treatment chemicals directly from the shipping container or bulk holding tank. The pumps to be an electronic metering diaphragm type, with a high impact polypropylene body, teflon faced, pypalon backed diaphragm, ceramic ball check valves and chemical resistant fittings. Each pump to have a rated maximum output capacity of 22 USgpd with fully adjustable stroke length and pulse frequency controls. Chemical resistant polyethylene tubing and a stainless steel injection quill with isolation valve and tee will be provided.
- 2.4.2.3 Convert the recirculated water conductivity value to a 4 - 20 mA output. This unit to allow visual display of current rating on a backlit digital LCD display. It should allow field calibration of conductivity probe to a reference standard. The unit must be able to temperature compensate the conductivity value.

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- 2.4.2.4 Provide a conductivity probe with a graphite electrode. This probe will be accurate to  $\pm 1\%$  in the range of 0 - 10,000  $\mu\text{S}/\text{cm}$  and have a working range of 0 - 10,000  $\mu\text{S}/\text{cm}$ . It is to have a resolution of 1  $\mu\text{S}/\text{cm}$ . This to be able to sustain temperature ranging from 32°F - 158°F.
- 2.4.2.5 Provide water meter. The meter to be manufactured from cast bronze and have both a totalizing registers and a 10 gpc contacting head.
- 2.4.2.6 One 3/4 Asco normally closed solenoid valve and one 3/4 Dole Flow Regulator Fitting allowing 8.0 USgpm.
- 2.4.3 **Sequence of Operation:** Use the conductivity cell to read the specific conductance of the continuously flowing sample and control the chemical pump and solenoid bleed-off valve operation. Feed the chemical inhibitor directly into the system from its drum "as received".
- 2.4.4 Provide controller and all required equipment to feed biocides automatically to the system.
- 2.4.5 **Chemicals:** All biocides provided for control of algae, slime or other micro-biological growth, must be registered under the Pest Control Product Act, 1979. No non-registered biocide will be acceptable. Provide P.C.P.A. registration number with Shop Drawings.
- 2.5 **TEST EQUIPMENT**
- 2.5.1 Provide the following:
- 2.5.1.1 Test cabinet fabricated from steel panels with baked on enamel finish. Size cabinet to accommodate three titration tests and contain all associated test control reagent bottles and equipment.
- 2.5.1.2 Test sets for nitrile, pH, and organics.
- 3 Execution
- 3.1 **GENERAL**
- 3.1.1 Provide supervision and assistance during the installation, cleaning and startup procedures, and develop an appropriate water conditioning program to control corrosion, scale, algae and suspended solids. Arrange for the water conditioning company to instruct the operating personnel for a period of not less than one day duration before acceptance of the installation by the Consultant. Provide four copies of written operating instructions on the treatment dosages, control charts and test procedures.
- 3.1.2 Include a site visit twice a month by the treatment supplier for the first year's operation, to check operation. Conduct tests of all pertinent water treatment systems and submit a written report on same.
- 3.1.3 **Treatment Supplies:** Supply all chemicals required for initial cleaning and startup of the systems and a year's supply of inhibitor chemicals for normal operation.



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### 3.2 FLUSHING AND STERILIZATION

- 3.2.1 Flush hot water heating and heat pump loops.
- 3.2.2 Flush water piping with water flowing at a velocity of not less than 1.8 m/sec (6 ft/sec) for a period of 15 minutes or longer as required to remove all dirt, scale, and cuttings from the entire length of the piping.
- 3.2.3 Thoroughly clean sections of new piping which cannot be isolated for flushing purposes, prior to fabrication, and also where possible after welding of joints, by swabbing the interior of the pipe with swabs soaked with a caustic solution to remove all loose scale, oil and dirt from the entire length of the piping.
- 3.2.4 Allow for all labour and chemicals for pipe flushing for each phase of construction. Coordinate all work with Piping Contractor.

### 3.3 PRE-OPERATIONAL CLEANING

- 3.3.1 Clean all hot water and glycol heating and heat pump piping.
- 3.3.2 Prior to chemical cleaning, inspect the systems to ensure removal of heavy debris and excessive oil or dirt. Install temporary strainers on the suction of each circulating pump. Where necessary, make provision for temporary connections between supply and return mains in the distribution system to permit circulation of the cleaning solution. Provide a 25 mm (1") pipe connection on the suction side of the circulating pumps of each system for the admission of the cleaning solution.
- 3.3.3 Flush the systems to remove loose dirt and hydrostatically test to detect excessive water losses. Check rotation of all circulating pumps.
- 3.3.4 Fill the systems with water and cleaner at a 1% concentration, or as specifically recommended by the manufacturer. Circulate for 72 hours at a temperature between 21°C - 60°C (70°F - 140°F).
- 3.3.5 Drain systems, refill with fresh water and circulate for a minimum of four hours to flush out remaining chemical solution.
- 3.3.6 Following flushing, drain and refill systems with fresh, clean water. Adjust inhibitor levels to required concentrations.
- 3.3.7 Submit a report to the Consultant to certify that the systems are clean.
- 3.3.8 Allow for all labour and chemicals for pipe cleaning for each phase of construction and for final cleaning and fill. Coordinate all work with Piping Contractor.

### 3.4 CLOSED WATER SYSTEMS

- 3.4.1 Install the chemical feed pumps, makeup water meters and filters as required. Include isolation, venting and drain valves in accordance with installation drawings and on-site instruction by the water treatment representative.
- 3.4.2 Treat systems with corrosion inhibitor. Do this immediately after completion of pre-operational cleaning.

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3.4.3 Install cartridges in the filters.

3.5 **COOLER SPRAY SYSTEM**

3.5.1 Treat system with corrosion inhibitor and algaecides. Do this immediately after completion of pre-operational cleaning.

3.5.2 Set up control system. Adjust valves.

3.5.3 Provide the services of a qualified water treatment specialist to inspect the final installation and to certify that the system is properly installed, set up, and operating properly. Submit report to the Consultant.

3.6 **TEST EQUIPMENT**

3.6.1 Mount cabinet 1200 mm (48") between floor and underside of cabinet. Provide Owner with full testing and record keeping instructions.

**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 System:** A water source heat pump system serves the renovated areas of the building.
- 1.2.2 **Energy Recovery Systems:** A new rooftop energy recovery ventilation system serve the renovated area of the building.
- 1.2.3 **Exhaust Air Systems:** Various exhaust systems serve the building.
- 1.2.4 **Outside Air Intake Plenums:** Large outside air plenums serve the fluid cooler.
- 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
  - gas vents
  - grilles, registers and diffusers
  - insulated panels
  - kitchen hood
  - range hoods
- 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.

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- 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.).
- 2.2.5 **Round - Medium Pressure:** Fabricate according to current SMACNA standards for static pressures in duct up to 1490 Pa (6" W.G.). Use Alpha or Plascad spiral round ducts. Use machine formed fittings. Use conical type takeoffs. Where round ductwork is shown internally lined, use Alpha or Plascad acoustic thermal duct consisting of Alpha free-flow spiral duct lined with 50 mm fibreglass insulation and 28 gauge steel perforated interior liner.
- 2.2.5.1 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.
- 2.2.6 **Flexible Type Round Ducts**
- 2.2.6.1 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/m<sup>3</sup> (0.75 lb/ft<sup>3</sup>) density fibreglass and bidirectional reinforced metallized film outer vapour barrier.
- 2.2.6.2 Flexible ductwork will not be permitted where exposed to view.
- 2.2.6.3 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  
EH Price  
Nailor  
Ruskin

## 2.4 BACKDRAFT DAMPERS

2.4.1 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.

2.4.2 The following manufacturer of the above equipment will be considered as equal, subject to requirements of Clause "Material and Equipment":

Alumavent  
Price  
Nailor

## 2.5 INTERNAL DUCT LINING

2.5.1 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/ft/°F) at 23.9°C (75°F).

2.5.2 The following manufacturers of the above equipment will be considered as equal, subject to requirements of Clause "Material and Equipment":

Knauf  
Manson  
Fiberglas

## 2.6 DUCT ACCESS DOORS

2.6.1 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.

2.6.2 For insulated ducts, use doors factory insulated with 25 mm (1") thick fibreglass insulation.

- 2.6.3 The following manufacturer will be considered equal, subject to the requirements of Clause "Material and Equipment":

Alumavent  
Price  
Nailor  
Ruskin

## 2.7 FLEXIBLE DUCT CONNECTORS

- 2.7.1 Use Duro Dyne "Durolon" or Ventfabrics "Ventlon" pre-assembled flexible duct connectors with 150 mm (6") fabric width.

- 2.7.2 The following manufacturer will be considered equal, subject to the requirements of Clause "Material and Equipment":

Thorburn

## 2.8 GRILLES, REGISTERS AND DIFFUSERS

- 2.8.1 Use manufacturer of grilles, registers and diffusers shown in schedule on drawings. Provide types, accessories and finishes as noted in the Equipment Schedules. See Drawings for sizes.

- 2.8.2 The following manufacturers of the above equipment will be considered as equal, subject to requirements of Clause "Material and Equipment":

Standard GRD's:	Kreuger Nailor Price Titus Tuttle & Bailey
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High Induction GRD's:	KlimaKontor NAD Klima Trox
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## 2.9 BALANCING DAMPERS

- 2.9.1 For ducts 930 cm<sup>2</sup> (144 in<sup>2</sup>) 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.

## 2.10 DUCT SEALER

- 2.10.1 Use Duro Dyne DSW water based high pressure duct sealer.

- 2.10.2 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

## 2.11 BIRDSCREENS

2.11.1 Use 12 mm x 12 mm (1/2" x 1/2") galvanized steel wire mesh mounted in reinforced steel frame.

## 2.12 INSULATED PANELS

2.12.1 Use Vibron 100 mm (4") thick, thermally broken panels with no through metal connections between the inside and outside of the panel. Fabricate with 18 gauge galvanized steel outer sheet and a solid 20 gauge galvanized steel inner sheet. Provide full floors, fabricated from 14 gauge galvanized steel outer and inner sheets. Fully frame and stiffen each panel with 1.7 mm (1/16") thick galvanized steel channels. Pack with high density acoustical-thermal insulating material. Finished panel weights to be not less than 26.8 kg/m<sup>2</sup> (5.5 lb/ft<sup>2</sup>). Coordinate installation of floor drains with Section 15400.

2.12.2 Design panel connectors to permit any one panel to be removed without disturbing any adjacent guide.

2.12.3 Use 610 mm x 1524 mm (24" x 60") access doors which are galvanized steel both sides and packed with high density acoustical-thermal 50 mm (2") thick insulating material. Mount doors in 12 gauge galvanized steel angle frames. Provide air seals for each door. Provide all necessary hardware. All hardware to be heavy duty type zinc plated.

2.12.4 The following manufacturer of the above equipment will be considered as an equal, subject to requirements of Clause "Material and Equipment":

Price  
VAW  
Vibro-Acoustics

## 2.13 EXHAUST AND TRANSFER AIR AIR FANS

### 2.13.1 General

2.13.1.1 See Equipment Schedules for types, details and capacities.

2.13.1.2 Provide felt edged backdraft dampers on all systems which are not provided with automatic control dampers.

2.13.1.3 Size V-belt drives for 150% of motor nominal horsepower. Provide belt guards.

2.13.1.4 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.

2.13.1.5 Use arrangement and motor location to suit fan location.

- 2.13.1.6 Use bearings of ball bearing type, grease lubricated. Provide extended grease fitting where required for easy access.
- 2.13.1.7 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. Submit certified Fan Performance Curves and fan sound level ratings based on A.M.C.A. Standards to the Consultant with Shop Drawings.
- 2.13.2 **Roof-Mounted Exhaust Fans:** Use Cook, Model 90, centrifugal exhaust fan with spun aluminum housing. Mount motor and drive housing on vibration isolators and seal from exhaust air stream. Provide prefabricated sound curb with a minimum height of 380 mm (15"). Provide spark-proof wheel. Provide birdscreen and safety disconnect switch.
- 2.13.3 **In-Line Fans (Drawing Reference TF):** Use Panasonic direct-driven in-line type centrifugal fan. Use heavy gauge formed steel housing with duct mounting collars. Provide hanging brackets for spring isolators. Provide disconnect switch.
- 2.13.4 The following manufacturers of the above equipment will be considered as an equal, subject to requirements of Clause "Material and Equipment":
- |                            |                                          |
|----------------------------|------------------------------------------|
| Roof-Mounted Exhaust Fans: | Carnes<br>Cook<br>Jenn Air<br>Penn Barry |
| In-Line Exhaust Fans:      | Fan Tech                                 |
- 2.14 **TURNING VANES**
- 2.14.1 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").
- 2.15 **ROOFTOP AIR HANDLING UNIT AND HEAT PUMPS**
- 2.15.1 See Drawings and refer to Section 15600 "Liquid Heat Transfer".
- 2.16 **LOUVRES**
- 2.16.1 Use Price Model DE635, 150 mm (6") deep, size as shown on Drawing. Use 2.0 mm (0.081") louvre blades and 4.2 mm (0.164") frames fabricated from extruded aluminum. Provide 13 mm (1/2") square mesh aluminum birdscreen on interior face of louvre. Finish with factory-applied baked enamel. Custom colour to be selected by the Architect.
- 2.16.2 Louvres to be AMCA certified with minimum free area of 0.805 m<sup>2</sup> (8.66 ft<sup>2</sup>) for a 1220 mm x 1220 mm (4"x 4") panel.
- 2.16.3 Louvres to have a water penetration of maximum 0.085 g (0.003 oz) per 0.093 m<sup>2</sup> (1 ft<sup>2</sup>) when tested for 15 minutes to AMCA Standard 500.
- 2.16.4 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

Alumavent  
Greenheck  
Ruskin

## 2.17 BRICK VENT

2.17.1 Use Greenheck, Model BVF or BVE, sizes as noted on the Drawings. Use model BVF for installation in existing walls and model BVE for installation in new walls. Construct using 40 mm (1-1/2") deep, 45° drainable blade type louvres with storm stops. Use 3.0 mm (0.125") louvre blades and 3.0 mm (0.125") frames, fabricated from extruded aluminium. Provide square mesh insect screen on interior face of louvre. Architect to select colour.

2.17.2 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

Ventex

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. Unless specified otherwise, construct ALL other ductwork to Low Pressure duct standards. Construct all ducts designated on Drawings as round to Medium 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 Install dampers and duct sensors as supplied by Section 15900, "Controls".
- 3.1.1.11 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.
- 3.1.1.12 Install ductwork to maximize clear floor to ceiling heights.
- 3.1.1.13 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.
- 3.1.1.14 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.
- 3.1.1.15 Apply one coat zinc chromate primer over all welded surfaces.
- 3.1.1.16 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.
- 3.1.1.17 Install duct smoke detectors supplied by Division 16.
- 3.1.1.18 Seal all transverse joints, longitudinal seams and duct wall penetrations to SMACNA Seal Class A standards.
- 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.
- 3.1.3 **Medium Pressure Ductwork**
- 3.1.3.1 Fabricate and install according to current SMACNA standards for 1490 Pa (6" W.G.) pressure class.

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### 3.1.3.2 **Round Ductwork**

- 3.1.3.2.1 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.
- 3.1.3.2.2 Make all joints in ductwork exposed to view using "Spiralmate" round duct connector system or equivalent.
- 3.1.3.2.3 Rotate spiral seams on duct-to-duct joints so that the seam provides a continuous helical pattern across the joint.
- 3.1.3.2.4 Fasten diffuser collars to duct using pop rivets. Provide a finishing fillet of elastomer seal at the collar-duct junction.
- 3.1.3.2.5 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 90° 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 welded pin 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 plenums are not specified, internally line outside air intake ducts 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, heat pumps and fluid cooler with preassembled duct connectors.

### 3.6 INSULATED PANELS

3.6.1 Fabricate all outside air plenums and other plenums where specifically noted using insulated panels.

3.6.2 Provide coordinated Erection Drawings and assembly instructions. Submit as Shop Drawings for review before starting any assembly work. Co-ordinate installation of floor drains with Section 15400.

3.6.3 Fabricate entire plenum assemblies with double wall panels. Frame all required openings. Entire assembly must be self supporting.

3.6.4 Seal panels to adjacent surfaces to make airtight seals. Use mastic sealant as recommended by panel manufacturer.

3.6.5 Use only zinc plated fasteners.

### 3.7 TESTING AND BALANCING

3.7.1 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.

3.7.2 Provide additional balancing dampers where required by the Testing and Balancing Company.

3.7.3 Be responsible for the initial alignment and tension of all fan pulleys and belts.

3.7.4 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.

### 3.8 DUCT LEAK TESTING

3.8.1 Duct leakage tests are specified in Section 15200, "Testing and Balancing".

3.8.2 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.

3.8.3 Ensure all required duct access doors are installed before tests are started.

3.8.4 Immediately correct defects discovered during test and arrange for retesting until satisfactory results are obtained.

**END OF SECTION**

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- 1 General
- 1.1 **CASH ALLOWANCE**
- 1.1.1 The work of this section is included in a Cash Allowance. Conform to the requirements of Section 15001, "Mechanical General Provisions".
- 1.1.2 For the work of this Section, use only Durell. Contact Gary Vieira at (519) 652-5502.
- 1.1.3 The work of this project is to be performed only by skilled factory-trained technicians under the direction of experienced engineers, all of whom shall be properly trained and qualified for this work and who are employed directly by the firms listed above.
- 1.2 **SCOPE OF WORK**
- 1.2.1 Provide an electronic/electric, direct digital control (DDC) system to make the mechanical and electrical systems controls completely operational.
- 1.2.2 **General Description of System Architecture:** DDC system shall incorporate a system interface panel and primary (master) control panel to be located in the penthouse mechanical room, complete with necessary interface hardware and software to allow communication over the intranet via Web Browser using TCP/IP protocol. Provide a UPS for the interface panel and primary control panel to condition power and provide 20 minutes of uninterrupted power to avoid loss of communication during temporary power outage. The UPS shall be Power Ware Model 3115 420-650-Va. The UPS and all DDC equipment shall be powered through dedicated circuit(s) from the nearest power panel. The primary panel shall communicate to field panels and terminal equipment controllers through a vendor supplied Local Area Network (LAN). All controllers shall be capable of standalone operation on loss of communication with the primary panel and/or the interface panel. The interface panel's sole purpose shall be the conversion of controller communication to TCP/IP - no points shall reside on this panel.
- 1.2.3 Coordinate installation of an ethernet connection to school's server with the Owner's IT Department. This connection to be used to connect to School Board's WAN system.
- 1.2.4 Supply for installation by others, the following:
- Wells for temperature sensors
  - Control valves
  - Control dampers
- 1.2.5 The Controls Subcontractor is responsible for arranging, coordinating and supervising the installation of the above devices in a suitable manner and location.
- 1.2.6 Wire components of temperature control system in accordance with the requirements of Division 16. Include wiring between control components and electrical circuits of fans, pumps, and any other equipment or apparatus as indicated in this section or required for the proper functioning of controls as described in this section. Provide necessary transformers, relays, etc. to accomplish specified control function. All controls provided by this Section to be wired by this Section.

1.2.7 Provide a minimum of 10% spare points of the total available points, for each type of point, for future use. If each point shall necessitate an addition of a circuit card inside the panel, the necessary additional cards for the installation of these 10% of spare points shall be handed over to the Owner. These cards shall be new and exempt of any manufacturer's defects and be compatible for each type of point.

1.2.8 Controls Contractor must attend site meetings every other week.

1.2.9 Remove all redundant control systems in areas of work. Turn over existing controllers to SCCDSB.

1.2.10 Where existing systems are modified, the existing control system serving these systems should be updated to provide control of these new components to provide a fully functional and independent existing control system.

### 1.3 **COMMISSIONING**

1.3.1 Commission the entire system as described in Section 15990, "Building Control System Commissioning". Work is to be performed only by skilled factory-trained technicians under the direction of experienced engineers, all of whom shall be properly trained and qualified for this work and who are employed directly by the firms listed above.

### 1.4 **SHOP DRAWINGS AND SUBMITTALS**

1.4.1 Controls Contractor must submit a list of schedule milestones with the project shop drawings, indicating phasing of controls installation, e.g. at substantial completion of mechanical room piping, controls contractor requires X additional days for terminations, testing and commissioning, etc.

#### 1.4.2 **Direct Digital Control System Hardware**

1.4.2.1 A complete bill of materials of equipment to be used indicating quality, manufacturer, model number, and other relevant technical data.

1.4.2.2 Manufacturer's description and technical data, such as performance curves, product specification sheets, and installation/maintenance instructions for the items listed below and other relevant items not listed below:

Direct Digital Controller (Controller panels)  
Transducers/Transmitters  
Sensors (Including Accuracy Data)  
Actuators  
Control Valves  
Control Dampers  
Switches

1.4.2.3 Wiring Diagrams and layouts for each control panel. Show all termination numbers.

1.4.2.4 Schematic diagrams for all field sensors and controllers. Provide floor plans of all sensor locations and control hardware.

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**1.4.3 Central System Hardware and Software**

1.4.3.1 Complete Bill of material and equipment used, indicating quantity, manufacturer, model number, and other relevant technical data.

1.4.3.2 Schematic Diagrams for all control, communication, and power wiring. Provide a schematic drawing of the central system installation. Label all cables and ports with computer manufacturers model numbers and functions. Show all interface wiring to the control system.

1.4.3.3 Riser diagrams of wiring between central control unit and all control panels.

**1.4.4 Controlled Systems**

1.4.4.1 A complete description of the operation of the control system, including sequences of operation. The description shall include a reference to the schematic diagram of the controlled system.

1.4.4.2 A point list for each system controller including both inputs and outputs (I/O), point number, the controlled device associated with the I/O point, and the location of the I/O device. Software flag points, alarm points, etc.

**1.4.5 Maintenance Data**

1.4.5.1 In addition to requirements specified in 15001 "Mechanical General Provisions", upon completion of the work, the control manufacturer shall provide three sets of Maintenance Data to the Mechanical Contractor for inclusion in Project Maintenance Manuals and affix a fourth, plastic coated set near or at the appropriate control panel. Maintenance Data to include the following:

1.4.5.2 Copies of the complete, approved, Shop Drawings

1.4.5.3 Copy of the Electrical Safety Final Inspection Certificate

1.4.5.4 Project Record Drawings

1.4.5.5 As-built versions of the submittal Shop Drawings

1.4.5.6 Operations Manual with procedures for operating the control systems, including logging on/off, alarm handling, producing point reports, trending data, overriding computer control, and changing set points and other variables

1.4.5.7 Licences, guarantees, and warranty documents for all equipment and systems.

**1.5 ACCEPTANCE PROCEDURES**

1.5.1 Upon completion of the system, the Controls Contractor to indicate in writing to the Consultant that the acceptance procedure can commence.

**1.6 TRAINING**

1.6.1 Provided training to the Owner's designated representatives. Training to cover the complete operation of the Building Control System. These representatives to be at the following levels of technical expertise:

- 
- Custodian
  - Maintenance Mechanical Trades
  - Maintenance Controls Trade
  - Central Control System Operator

1.6.2 The instruction to consist of both hands-on and classroom training at the site.

## 1.7 **WARRANTY**

1.7.1 All controls, equipment and material to be unconditionally warranted for a period of one years from the date of Substantial Completion. The warranty period is to commence on the date of Substantial Completion.

1.7.2 Provide warranty service at no cost to the Owner for the warranty period. This to include, but not limited to the following:

- Emergency repair service on regular working hour basis during warranty.
- Replacing defective parts and components as required.
- Servicing by factory trained and employed service representatives of system manufacturer.

## 1.8 **WIRING, CONDUIT AND CABINETS**

1.8.1 All of the installation requirements, be they temporary or permanent, to comply with the Canadian Electrical Code and all local and Provincial codes.

1.8.2 For future expansion purposes, the Contractor to ensure that wires are available in all conduits to accommodate the addition of possible future points to maximum capability of panel.

1.8.3 The Contractor to supply, install and connect all conduits, boxes and wiring between the different components related to the Control System, including all required line voltage to the equipment. All power to be from appropriately sized dedicated circuits from the nearest electrical panel with space provided by the Contractor. Circuits to be identified inside each control panel and on Shop Drawings using the same code. Provide circuit breaker lock-offs and clearly mark breaker(s) with "BCS".

1.8.4 All high voltage wiring, 50 volts or more, to be a minimum of #12 gauge copper stranded TNN, run in conduit. All low voltage wiring, less than 50 volts, to be a minimum of #18 gauge copper stranded TEW-105.

1.8.5 All signal and communications wiring for the local field panels to be multi conductor, shielded twisted pairs, with ground drain wire. All drain wires to be grounded at the panel end. The other end to be protected from grounding with a dielectric material/electrical tape.

1.8.6 If wiring picks up unwanted noise, correct problem by replacing or rerouting wire at no additional expense to the Board.

1.8.7 Wiremold and/or raceway may not be used unless specifically approved by the Consultant and as specified in Division 16100.

- 
- 1.8.8 FT6 wiring is to be acceptable in all rooms except Mechanical and Electrical Rooms, and exposed areas (refer to reflected ceiling plans). Wiring to be installed parallel to building lines or approved by the Consultant. In areas where cable tray or other raceway has been provided by other trades for communications, coordinate with other trade and locate wiring in raceway.
- 1.8.9 Use thin-walled Electrical Metallic Tubing (EMT) conduit complete with T & B 5120 Series watertight steel ring couplings and connectors in all Mechanical Rooms and Electrical Rooms, and set screw connectors and couplings in all other exposed installations in finished areas. OZ/Gedney 7000 Series/Crouse Hinds 600 Series equals.
- 1.8.10 Flexible conduit to be used only in areas where vibrations and/or expansion joints are present. The length of any run of flexible conduit not to exceed 2 m.
- 1.8.11 All conduit to be supported at least every 1.525 m, and in accordance with the Ontario Electrical Safety Code. Supports to also be located at all connectors along the length of the conduit.
- 1.8.12 In damp or weather exposed areas, the conduit and related equipment to be suitable for the application.
- 1.8.13 All conductors to be continuous from device to panel.
- 1.8.14 High and low voltage wire to not be run in the same conduit.
- 1.8.15 Sensor, power and control wiring to be run in separate conduit.
- 1.8.16 Where wiring penetrates fire separation, use firestop sealant to maintain fire wall ratings.
- 1.9 **PULL BOXES AND JUNCTION BOXES**
- 1.9.1 All boxes to comply with the Canadian Electrical Code in reference to size, capacity, etc.
- 1.9.2 All boxes to be fabricated of galvanized metal, unless otherwise warranted.
- 1.9.3 A pull box to be located every 30 m. The Contractor is responsible for the location and for obtaining any required approvals from the Consultant.
- 1.9.4 In suspended ceilings, all boxes to be installed on the structure.
- 1.9.5 All boxes to be clearly marked with "BCS" as part of the energy management system.
- 1.10 **WIRING IDENTIFICATION**
- 1.10.1 The two extremities of all wiring to be identified using the same code and cross referenced to the Record Drawings.
- 1.10.2 The terminal strips to be numbered. All Drawings to show wire identification codes and terminal numbers.

1.10.3 The identification to be done using plastic ring or band type. Paper with adhesive backing or Type C plastic labels are not acceptable.

1.10.4 The following colour code to apply to all wiring:

Power

White

Red, Yellow, Blue

Neutral

Phase leads

Black

Switch travellers, for single pole switched circuits, the phase colour shall be carried through the switch to the outlet.

1.10.4.1 All ground wiring to be green.

1.10.4.2 All 24 VAC wiring to be brown - load side; yellow - neutral side of transformer.

## 1.11 NAMEPLATES

1.11.1 Identify each piece of equipment and panel with nameplate identifying equipment and functions in plain English, using the local naming convention.

1.11.2 Use laminated plastic nameplates of at least 75 mm x 25 mm x 3 mm (3" x 1" x 1/8") with black face and white centre and 6 mm (1/4") high engraved lettering. To be securely attached to equipment by screws. Dymo tape name tags are not acceptable. Provide black phenolic nameplates engraved with white letters for all electrical equipment, panels, disconnect switches, etc., as directed.

1.11.3 Identify motorized equipment as follows:

Pumps

Pump 301, etc.

Heat Pump Units

HP-401, etc.

1.11.4 Identify the motor, starter and branch circuit breaker and disconnecting means.

1.11.5 Index terminal strips and tag wires. Label exposed junction boxes including function and nature of service. Tag all wires within the junction boxes including purpose and nature of service.

1.11.6 Use self adhesive strip or clip on style plastic markers for wire tags. Secure tags to each individual wire at both ends.

2 Products

## 2.1 CONTROL ELEMENTS

### 2.1.1 Controllers

2.1.1.1 For each heat pump, etc. as required, provide a unitary controller module complete with mounting enclosure.

2.1.1.2 Provide individual local control panels to control fluid cooler, air handling equipment, boilers, pumps, rooftop unit and all other equipment.

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**2.1.2 Automatic Control Valves and Operators**

- 2.1.2.1 Contractor is responsible for the selection of control valves whose entire characteristics are suitable for the required application, including sizing, pressure rating, flow co-efficient, flow characteristics, close-off rating, fail position and allowable leakage factor.
- 2.1.2.2 Use only Belimo ball style control valves with stainless steel ball and stem and Teflon seals for sizes 12 mm (1/2") through 50 mm (2"). Plug, globe or zone style control valves will not be acceptable. For larger valves, use Belimo globe style control valves. Ensure that straight-through water valves are single seated with equal percentage flow characteristics.
- 2.1.2.3 Use 3-way valves which are linear for each port giving constant total flow. On valves 50 mm (2") and smaller, use screwed 1030 kPa (150 psig) bronze bodies. On valves 65 mm (2-1/2") and larger, use flanged 860 kPa (125 psig) cast iron bodies. Size valves based on maximum 21 kPa (3 psi) pressure drop.
- 2.1.2.4 Use Belimo proportional action actuators. Size actuators to control valves against the maximum pump pressure or dynamic closing pressure, whichever is greater. Provide spring returns so that the valves "fail safe" in normally open or closed position as dictated by freeze, fire, or other temperature protection. Fail in place valves without spring return will be acceptable only for individual radiant ceiling panel control valves only. Spring return valves must be provided for all other services including individual convectors, etc.

**2.1.3 Automatic Control Dampers and Operators**

- 2.1.3.1 Contractor is responsible for the selection of proper control dampers for the project, including sizing, pressure rating, flow co-efficient, flow characteristics, close-off rating and allowable leakage factor.
- 2.1.3.2 Use Tamco Series 1000 dampers. Use Series 9000 for outside air and exhaust air service. Equivalent Ruskin/Alumavent dampers will also be acceptable. Use opposed blade dampers for modulating service and parallel blade dampers for two-position service.
- 2.1.3.3 Blades on multi blade dampers not to exceed 200 mm (8") in width and 1220 mm (48") in length.
- 2.1.3.4 Use Belimo electronic, spring return, low voltage (24 VAC) operators with electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the rotation of the actuator. Mechanical end switches or magnetic clutch to deactivate the actuator at the end of rotation are not acceptable. Provide endswitches where specified.
- 2.1.3.5 Proportional actuators to accept a 0 to 10 VDC or 0 to 20 mA control signal and provide a 2 to 10 VDC or 4 to 20 mA operating range. Actuators to provide a 2 to 10 VDC position feedback signal.
- 2.1.3.6 Size operators to control dampers against the maximum fan pressure or dynamic closing pressure, whichever is greater. Provide spring returns so that the dampers "fail safe" in normally open or closed position as dictated by freeze, fire, or other temperature protection.

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**2.1.4 Temperature Sensors, Thermostats, Freezestats and Firestats**

2.1.4.1 All room temperature sensors to be k OHM thermistors, with a suitable range to match the application. For hot water loop use RTD sensors. The accuracy to be  $\pm 0.2^{\circ}\text{C}$  maximum. All temperature sensors shall be mounted in an enclosure suitable for the application. Room temperature sensors in classrooms, offices and other regularly occupied rooms to be equipped with LCD display, limited setpoint adjustment and pushbutton for occupancy override. In change rooms, washrooms, corridors and regularly unoccupied rooms, use blank stainless steel coverplate style sensors. Sensors to be programmed not to display the room temperature.

2.1.4.2 Space sensors are to be located away from any direct influence from air diffusers or areas affected by drafts.

2.1.4.3 Outdoor temperature sensor is to be mounted in an enclosure complete with sunshield and shall be thermally isolated from all indoor conditions. Conduit entrance to sensor must be sealed with duct seal or equivalent sealant and mounted on a North wall, in a serviceable location, away from any building exhaust/intake vents.

2.1.4.4 All mixed air temperatures to be sensed with averaging sensors having a minimum active length of at least three duct cross sector.

2.1.4.5 Sensor averaging elements are to be mounted in straight sections of duct, in serpentine fashion, equally spaced to provide adequate coverage of duct cross section to prevent stratification. Furthermore, sensor's installation must not present a safety hazard nor impede access to fan compartments.

2.1.4.6 For control of force flow and unit heaters, or convectors in rooms not served by heat pumps, use line voltage, two stage heating thermostat with sub-base and removable setpoint knob. Provide wire guards in all public areas. Where control of both heating and cooling using unit heaters and exhaust fans is specified in operational sequence, use line voltage heating/cooling thermostat with adjustable deadband.

2.1.4.7 All return and supply air temperatures to be sensed with duct-mounted sensors having a minimum probe length sufficient to reach the middle third of the duct space.

2.1.4.8 All liquid temperature sensors to be mounted in wells.

**2.1.5 Relays and Contactors**

2.1.5.1 All interfacing/control relays and contactors to be sized to match the application. Low voltage coils to be used wherever possible, except where it is financially beneficial to use high voltage coils.

2.1.5.2 Mount interfacing relays in control cabinets, where possible. Do not locate relays within electrical starter enclosure. If necessary, use separate enclosure to house interface relays.

2.1.5.3 Contactors to be equipped with auxiliary contacts wherever such status indication is required.

2.1.5.4 All contactors are to be mounted in a NEMA 1 cabinet, enclosing contactor, transformer, protection, etc.



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- 2.1.6 **Current Sensing Relays:** All equipment status monitoring to be accomplished through the use of a current monitoring sensor. This device should output a 4-20 mA or 0 - 10 V signal proportional to measured current. Provide sensors to monitor status of all new electrically driven, mechanical equipment. (Include all new unit ventilators, fans, pumps and rooftop units). Wire to the BCS.
- 2.1.7 **Integral Thermostatic Control Valve:** For all heating units shown on the Drawings with integral thermostat, use Tour and Andersson or Honeywell TRV, self-acting thermostatic valve. Use direct-mounted valves with locking device for high and low limit settings. Use valves with remote adjustment and capillary tube where shown on Drawings.
- 2.1.8 **Differential Pressure Sensors:** Use Rosemount or Veris self-contained strain gauge type sensor with reverse polarity protection, NEMA 4 enclosure, accuracy  $\pm 0.25\%$  of calibrated span.
- 3 Execution
- 3.1 **GENERAL**
- 3.1.1 Use competent tradesmen regularly employed by the manufacturer of the control equipment to install control system.
- 3.1.2 Unless noted otherwise, mount all room sensors and thermostats at 1200 mm (47") above floor or in the classroom control module.
- 3.1.3 DDC controller to be mounted in same room as equipment being controlled. Where this is not practical, provide a communication interface at equipment location for communication to DDC panel. Provide Points List on inside of DDC panels.
- 3.1.4 Nomenclature in DDC programming to match Control Shop Drawing nomenclature. DDC panels to be labelled as per Shop Drawings.
- 3.1.5 Provide a copy of all graphical interfaces to Consultant for review at completion of programming.
- 3.1.6 Remove all redundant controls and return control components to the Owner.
- 3.2 **WIRING**
- 3.2.1 Conceal wiring in all finished areas.
- 3.2.2 Provide an installation which follows horizontal and perpendicular lines to fit into the layout of the area. Properly support and install in a neat and workmanlike manner throughout.
- 3.3 **NAMEPLATES**
- 3.3.1 Install nameplates at all duct mounted devices including transmitters, controllers, gauges, etc. Similarly label manual switches, unless they are delivered with standard nameplates.

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**3.4 CONTROL PANELS**

3.4.1 Mount all equipment inside the cabinet. Mount a plasticized "as-built" control diagram for water system, complete with control piping and wiring layout, on the face of door section. Locate panels in main Mechanical Rooms. Do not locate in ceiling spaces.

**3.5 ELECTRICAL WORK**

3.5.1 Provide all wiring from power supplies to valves, dampers, thermostats, sensors, etc., and all necessary control transformers and relays required for the control system. Provide power from nearest panel.

3.5.2 Coordinate electrical requirements with the electrical trade. Arrange and pay for any modifications necessary to complete the work of this section.

3.5.3 Provide all necessary control wiring for equipment specified under Division 15.

3.5.4 Conceal all wiring. Install wiring in conduit within block walls. In unfinished areas exposed to view, install wiring in conduit. Tie-wrap fire-rated cable elsewhere. Wire in accordance with Division 16 requirements.

**3.6 DDC CONTROL SYSTEM**

3.6.1 Vendor's representatives to install complete control system providing adjustment of all controlled systems.

3.6.2 Vendor's representatives to provide full startup, calibration and commissioning of complete system. Connect all mechanical equipment in accordance with the Specifications.

**3.7 PERFORMANCE VERIFICATION**

3.7.1 Provide verification check sheets for all new control points and all associated control sequences. This work must be done, submitted and approved by the consultant prior to the commissioning agent being engaged and final payment being released. The approved reports are to be included in the maintenance manuals.

3.7.2 Verification check sheets for each piece of equipment must contain list of all control points associated with this piece of equipment. Proper operation of each sensor, actuator, terminal unit, or any other control point must be confirmed in the field by direct observation (if possible) and through the graphical user interface. Each verification sheet must be dated and signed by controls contractor.

3.7.3 Setup and verify trends for all new equipment and all control points. Provide trend verification sheets and sample sheets indicating trended points for consultant's approval

3.7.4 One month after these checks and commissioning are complete, setup a meeting with mechanical contractor, Owner and consultant to confirm the operation of all new equipment. At this meeting all trends will be reviewed and confirmed with the Owner. Prior to the meeting the Controls contractor will be required to provide trend graphs or numerical data in Excel spread sheet form, for all monitored systems for the last month of operation. If numerical data is provided the date/time data must follow

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Excel formatting.

- 3.7.5 Controls contractor will be responsible for correcting of all deficiencies found during this process and will be required to submit trends to verify operation of all equipment after making corrections.

### 3.8 **EXISTING BUILDING CONTROL SYSTEM**

- 3.8.1 A complete new control system is to be provided for the school. Refer to paragraph 1.2.1. All existing equipment currently connected to the BAS which is not replaced as part of this contract, must be reconnected and controlled by the new BCS in identical fashion to existing. Remove all existing redundant controls and components. This includes boilers and associated circulating pumps.

### 3.9 **ROOFTOP MAKEUP AIR UNIT (Drawing Reference RTU-101)**

#### 3.9.1 **System Description**

- 3.9.1.1 This is a constant volume 100% outside air system which includes a rooftop air handling unit with modulating natural gas heating and modulating electric dx cooling. The unit provides tempered ventilation air to heat pumps throughout the Phase 1 area.

- 3.9.1.2 This air system will be enabled for operation during scheduled occupied hours.

- 3.9.1.3 The unit includes variable refrigerant flow DX cooling, for modulating control of cooling capacity and high cooling efficiency. Because of the increased complexity of this system, the units have limited ability to accept external control signals. Most functions will be controlled by the onboard controller, with BCS monitoring through BACnet MSTP.

#### 3.9.2 **Control Devices**

- 3.9.2.1 Provide a dedicated unitary controller for each rooftop air handling unit. Connect to a terminal strip provided within the unit.

- 3.9.2.2 The following terminals will be provided by the unit manufacturer for BCS control:

- unit enable/disable digital input
- outside air damper minimum position analog input
- supply air temperature setpoint analog input

- 3.9.2.3 The following terminals will be provided by the unit manufacturer for BCS monitoring:

- alarm status digital output

- 3.9.2.4 Provide BCS supply air discharge and return air dry bulb temperature sensors and relative humidity sensors. Locate these sensors within the building in the ductwork, with the supply air temperature sensor just upstream of the first branch takeoff. These sensors are in addition to the sensors supplied with the unit and wired back to the unit controller. These points will still be displayed on the graphic in the event of loss of BACnet MSTP communications with the unit.

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- 3.9.2.5 Provide current sensors for supply fan, energy recovery wheel motor and each of the cooling compressors. Monitor status and display on the graphic.
- 3.9.2.6 Each unit will be provided with a BACnet communications module. Coordinate with section 15600. Connect to it and map relevant points to the BCS for BCS monitoring. Allow for mapping of up to 80 BACnet points per unit. Consultant will provide a list of points to be mapped. Approximately 30 of these points indicate temperatures, operating modes, equipment speeds or status and are to be shown on the graphic. The remaining points are for fault indication and are to be annunciated to the BCS on activation.
- 3.9.2.7 A supply air temperature sensor and other sensors will be provided with the rooftop unit. Install the sensors as instructed by the rooftop unit manufacturer and connect them to the unit onboard controller.
- 3.9.2.8 Provide an analog differential pressure sensor for the filter rack.
- 3.9.3 **Schedule and Startup**
- 3.9.3.1 Schedule occupied/unoccupied operation of unit.
- 3.9.3.2 Operate the supply fan continuously during occupied hours for provision of ventilation air.
- 3.9.3.3 At all other times the unit is to be off.
- 3.9.3.4 Provide adaptive optimum start/stop sequence for each unit.
- 3.9.3.5 Through the graphical interface provide an individual Event Mode button to allow the Operator to override the schedule and program in events. During event mode, the system is to enable the "Occupied Day Mode" for the entire scheduled event. Return the room to occupied space temperature setpoints starting one hour (adjustable) prior to the start of the event.
- 3.9.4 **Occupied Mode Air Temperature Control**
- 3.9.4.1 Provide a 2.5°C (5°F) deadband between heating and cooling operation, as required by ASHRAE 90.1. Provide adjustable heating and cooling setpoints.
- 3.9.4.2 The unit will modulate the economizer dampers, VRF cooling and natural gas fired heating in sequence to maintain its supply air discharge temperature setpoint. Operate energy recovery wheel continuously during occupied mode except for during economizer operation. Provide the supply air discharge temperature setpoint to the rooftop unit controller through the terminal. The supply air discharge temperature setpoint minimum is 15°C (59°F).
- 3.9.4.3 Reset the supply air discharge temperature setpoint to satisfy the average space temperature sensor values. Maximum permitted supply air temperature during occupied hours is 29°C (85°F).

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### 3.9.5 Safeties and Miscellaneous Controls

- 3.9.5.1 Use the BCS supply air discharge temperature sensor for low limit protection. Stop the fans, close the dampers and alarm to BAS if supply air temperature falls below 4°C (40°F) (adjustable from graphic).
- 3.9.5.2 Use the BCS return air temperature sensor to stop the supply fan if the return air temperature exceeds 57°C (135°F).
- 3.9.5.3 Monitor differential pressure drop across the filter bank. Display filter pressure drop on graphic and alarm when pressure drop exceeds filter change setpoint. Initial setpoint to be 250 kPa (1.0" w.c.).

### 3.9.6 Graphic Display

- 3.9.6.1 Provide graphic display of air handling unit and equipment internal components such as supply fan, dampers, cooling stages, temperatures, status points, energy recovery wheel, etc. Display must include all monitored and controlled functions, sensors, etc, with all alarms shown and all setpoints easily adjustable.
- 3.9.6.2 Include a button on the graphic which displays a unit specific summary of how the unit is controlled. This summary is to include the description of operation presented at the start of this control sequence. This summary is to be displayed on the screen beside the unit graphic, so that both can be viewed at the same time.

### 3.10 HEAT PUMPS

- 3.10.1 For each heat pump, provide a room temperature sensor and a unitary controller. Locate room temperature sensor in classroom control module or on wall, as shown on Drawings. Connect to occupancy sensor in room. Occupancy sensor will be provided by Division 16.
- 3.10.2 Provide all sensors, relays, transformers and interlocks required for operational sequences described below. Power wiring will be provided by Division 16. "Fan", "Cool" and "Heat" digital inputs and "Alarm Status" digital outputs will be provided by the unit manufacturer on a labelled terminal strip. Provide supply air temperature sensor and supply fan current sensor for each heat pump.
- 3.10.3 In addition to points above, the following are to be visible from the BCS: fan status, supply air temperature, heat or cool command. Certain heat pumps have two stages of heating/cooling. Coordinate with section 15600. Alarm to BCS on high or low space temperature, fan failure, or heat pump general alarm.
- 3.10.4 Provide remote reset from the BCS. Coordinate with the heat pump manufacturer.
- 3.10.5 Program an individual operational schedule for one zoned groups of heat pumps which will enable occupied mode operation. Zones are: Classrooms. Connect each heat pump to classroom occupancy sensors provided by Division 16. Use signal from occupancy sensor to start occupied mode operation when enabled by schedule. Override schedule when temperature sensor pushbutton is activated.
- 3.10.6 **Occupied mode:** Operate fan continuously and cycle stages of heating and cooling to maintain occupied mode space temperature setpoint.

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- 3.10.7 **Unoccupied mode:** For scheduled unoccupied hours or when there is no occupancy sensed, cycle the fan and stages of heating as required to maintain unoccupied mode space temperature setpoint.
- 3.10.8 A two position two way control valve will be provided with each heat pump by Section 15600. Control valve is to open prior to compressor operation. Connect control valve wiring harness to manufacturer's terminal strip.
- 3.10.9 Where supplemental perimeter heating is provided in rooms served by heat pumps, such as radiant panels or wallfin convectors, use perimeter heat as first stage of heat during occupied hours. During unoccupied hours, use heat pump to be first stage of heating.
- 3.11 **FLUID COOLER**
- 3.11.1 Provide local controller and contactors to control the operation of the fluid cooler fan motor and spray pump. Variable frequency drive will be provided by Division 16. Connect to drive and provide analog output signal for fan speed. Connect to pump starter and start and stop pump. Provide fluid cooler intake air dampers and actuators. Connect to fluid cooler exhaust air damper actuator.
- 3.11.2 Provide fluid cooler entering water temperature sensor and leaving water temperature sensor. Locate the leaving water temperature sensor as close to the fluid cooler outlet as practical.
- 3.11.3 On a fluid cooler entering water temperature rise to 32°C, open the fluid cooler inlet and discharge air dampers. On a rise to 34.5°C, start the spray pump. On a rise to 37°C, start the fan at minimum speed. Modulate the fan speed as required to maintain 37°C setpoint (adjustable) entering the cooler. On a fall in loop temperature, reverse the sequence at 2°C differential below the above specified operating points. If the cooler leaving water temperature rises above 37°C, alarm to the BCS. Ensure entering water temperature is used for cooling control, as required by the Owner.
- 3.11.4 When outside air temperature is below 5°C, do not enable fluid cooler spray pump operation, fluid cooler damper operation or fluid cooler fan operation. Water level controls for the sump are provided with the fluid cooler and are to be installed by this Section.
- 3.11.5 Provide all control wiring for chemical feed system.
- 3.11.6 Provide independent enable/disable schedule for fluid cooler operation.
- 3.12 **HEAT PUMP LOOP**
- 3.12.1 Provide three way control valve and actuator. Provide current sensors for pumps. Provide a flow switch for the heat pump water loop, located downstream of CP-302A+B. Provide heat pump supply water temperature sensor, located no farther than 1m from the heating injection tee.

3.12.2 Modulate the three way control valve to maintain 21°C heat pump supply water temperature setpoint (adjustable). Operate one of the heating pumps CP-303A+B whenever the control valve is open. Operate one of the heating pumps CP-304A+B constantly during the heating season, whenever the heating system is enabled. Ensure supply water temperature is used for heating control, as required by the Owner.

3.12.3 If the heat pump loop temperature drops below 13°C, as measured by any of the loop temperature sensors, alarm to the BCS.

### 3.13 **BOILERS**

3.13.1 The existing boiler plant is to remain. Provide all required wiring and controllers to maintain existing operation and to enable full control through building control system.

3.13.2 Provide temperature sensors, flow switches, application controller, relays, etc., for a fully operational system. Provide temperature sensors for system hot water entering and leaving temperatures and leaving water temperature for each boiler. Provide current sensor for each boiler pump and for perimeter heating pump and monitor status. Perimeter heating pump will be started and stopped manually. Boiler pumps will be started and stopped by Boiler controller. Provide supply and return temperature sensors for perimeter heating. Monitor individual boiler alarm status.

3.13.3 The heating system to be switched ON/OFF automatically by BCS or manually by the building's operator. Once enabled, the boilers to operate by direct digital control in parallel with their own operating and limit controls.

3.13.4 Boilers should be switched from lead to lag every other Tuesday at 6:30 am. Should the lead boiler fail, the next boiler in sequence will become the lead boiler. The minimum ON time for the lead boiler should be set to 10 minutes (adjustable). The boilers should be disabled by the BCS when the outside air temperature is above 18°C (adjustable).

3.13.5 When the heating is to be switched OFF, boilers should be stopped. The associated boiler's circulation pumps through a hard wired time delay relay will remain on for five minutes after heating is no longer required.

3.13.6 When lead boiler starts from the outside air temperature setting, lock out the lag boiler for 20 minutes (adjustable). When the hot water supply temperature (HWS) is more than 2.5°C below hot water setpoint, the lead boiler to be enabled at low fire and then cycled on high fire (in accordance with manufacturer's recommended algorithm) to maintain the system HWST setpoint. When the lead boiler is on high fire, after a three minute delay, start lag boiler if the (HWST) is more than 8.5°C (adjustable) below setpoint.

3.13.7 The lag boiler should be stopped when the hot water supply temperature (HWS) is more than 2°C (adjustable) above the setpoint. The lead boiler should be stopped if the hot water supply temperature is more than 5°C (adjustable) above the hot water setpoint.

3.13.8 The outside air temperature shall reset the heating water supply temperature setpoint (HWS-SPT) as per the following schedule:

**O.A. TEMP****HOT WATER SUPPLY SETPOINT**

-20°C  
15°C

71°C  
32°C

3.13.9 During the morning warmup period, should the heat pump loop fall more than 3°C (adjustable) below setpoint with the heat exchanger control valve open, temporarily and gradually raise the hot water supply setpoint, to a maximum of 71°C, until the heat pump loop temperature is achieved. Hold this temperature setpoint for a minimum of 30 minutes (adjustable). If heat pump loop temperature setpoint is achieved at this point and heat exchanger control valve is less than 90% open, return heating loop to normal reset schedule operation.

3.13.10 Wire all flow switches, low limits, boiler control panel, safeties, etc., required with the boilers.

3.14 **PUMPS**

3.14.1 Provide graphical interface indicating Start/Stop and Status points for all circulating duplex pumps. Provide status for single pumps. Schematics indicate how many of parallel pumps operate at the same time. For parallel pumps where only one pump operates, alternate pump operation on a weekly basis. Should one pump fail, alarm to BCS and start other pump.

3.14.2 Provide enable/disable for variable speed pumps CP-302A&B and CP-305A&B. Provide and install differential pressure sensors where shown on the Drawings. Coordinate control settings with Section 15200 - Testing and Balancing. Output pump speed to variable frequency drive in order to maintain differential pressure setpoint. Monitor variable frequency drive status. One pump runs at a time. Periodically alternate lead pump. Should one pump fail, alarm to BCS and start lag pump. Provide graphic display of all monitored and controlled functions, including all alarms, individual pump status, setpoint and speed.

3.15 **HEAT EXCHANGER**

3.15.1 Provide a water temperature sensor on supply and return piping on heated media side. Provide a water temperature sensor on supply and return piping on heating media side. Display heating media supply temperature as measured by hot water heating system supply temperature sensor.

3.16 **FORCE FLOW AND UNIT HEATERS**

3.16.1 Provide wall thermostat and cycle fan to maintain space temperature setpoint.

3.17 **CONVECTORS AND RADIANT PANELS**

3.17.1 Provide thermostatic control valve or space temperature sensor and two way control valve and operator. Modulate to maintain space temperature setpoint. See part 3 heat pump clause for control of units located in rooms served by heat pumps.



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**3.18 DOMESTIC HOT WATER RECIRCULATING PUMP**

3.18.1 Provide start/stop and current sensor for status for recirculating pump. Schedule operating hours of pump, and link operation to the building calendar so that the pump only operates during facility operating hours. Schedule to be adjustable by Owner from graphic.

**3.19 MECHANICAL AND ELECTRICAL ROOMS**

3.19.1 Provide intake and exhaust air dampers and actuators and line voltage thermostats. Activate heater, damper and exhaust fan in sequence to maintain setpoint.

**3.20 EXHAUST FANS**

3.20.1 For all fans, provide exhaust air damper and actuator, current sensor and relay. Provide start/stop and status.

3.20.2 For fans with local wall switches by Division 16, enable fan to operate from switch during occupied hours and disable fan outside of occupied hours.

**3.21 UTILITY PHASE LOSS MONITORING**

3.21.1 Connect and monitor power meter form C output provided by Division 16 and provide "Phase Loss" alarm point monitoring. Meter is located in Electrical Room in new addition.

3.21.2 On activation of phase loss alarm, shut down all BAS controlled three phase equipment and alarm to BAS. Automatically restart equipment in zoned groups once Phase Loss alarm is cleared. Minimum stop to start time is 2 minutes (adjustable).

**3.22 CONTROL SYSTEM ACCEPTANCE**

3.22.1 A complete system check-out is required. Before starting this, provide a detailed step-by-step checkout plan.

3.22.2 Demonstrate to the Owner's satisfaction at job site, the methods, test gear and simulation equipment to be used in check-out of each part of control system. Demonstrate the actual hook-up of test gear, exercise of inputs, trouble isolation and correction technique, and final operation test of a typical remote panel. Owner may check the operation of all sensors, transducers with own equipment to ensure proper operation.

3.22.3 After completion of the check-out, make all necessary corrections and repeat the check. When the system is fully operational, demonstrate in full detail, all functions/indications to the Owner.

3.22.4 Submit a checkout list to the Owner documenting that each point has been checked and is operating satisfactorily. The check should include field wiring, relay operation and HAND/OFF/AUTO checkout.

**3.23 PROGRAM START AND STOP TIMES**

3.23.1 Provide optimal start and stop times programming to compensate for outside temperature. Provide morning warm up routine.

- 3.23.2 For all systems using hot water or heat pump loop for cooling or heating, program an individual, dedicated warm-up or cool-down cycle to bring space temperature from night setback to occupied temperature setpoint. During that cycle all outside air dampers must remain closed. Program each system individually with optimum temperature recovery time. Follow Standard ASHRAE 90.1.
- 3.23.3 Program various system operational times based on the normally occupied periods of the building. Program a yearly calendar to allow for daylight savings time and standard time changes. Provide separate weekly time schedules for heat pumps, exhaust fans, and each air handler.
- 3.23.4 Provide graphical links to fan systems including display of operating schedule, Timed Overrides and Event Mode programming. Timed override shall allow for operation of the fan systems for a 2 hour (adjustable by super user) period, mechanical cooling shall be locked out. Event mode shall allow fans to operate in normal daytime operation for a user adjustable, defined period of operation using a calendar type function. Upon entry of an Event, a report shall be generated and sent to the school board indicating the date, duration, user, and permit number. Event mode shall be linked to associated heat pumps within the building, refer to heat pump sequences above.

3.24 **TREND LOGS**

- 3.24.1 Set up trend logs to continuously monitor critical parameters for each system. Consultant will assist in determining critical parameters.

3.25 **ENVIRONMENTAL ALARMS**

- 3.25.1 Provide sensors and digital outputs to the building security alarm panel for environmental alarms. Provide individual alarms to the security system on: Low space temperature in any room (coordinate setpoint with SCCDSB, active only for ambient below 5°C), no flow in heat pump loop (monitor both flow switch and pump status), high or low heat pump water temperature, low heating system water temperature (active only for ambient below 5°C) loss of AC power to BCS, utility phase loss. Submit proposed setpoints for each alarm for Owner approval. Provide graphic displaying settings so that Owner can easily modify. Alarm outputs to be on native BCS network.

Security System Labels:

- No flow in heat pump loop "Loop Pump"
- High or low heat pump water temperature "Tower Temp"
- Low space temperature in any room "Low Space"
- Low heating system water temperature "Low Header"
- BCS power failure
- Utility phase loss monitoring "Utility Phase Loss"

**END OF SECTION**

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- 1 General
- 1.1 **DESCRIPTION**
- 1.1.1 Conform to the requirements of Section 15001, "Mechanical General Provisions".
- 1.1.2 Perform commissioning of the complete Building Control System (BCS), including every device, input and output. A Commissioning Agent (CA) will be engaged by the General Contractor to verify commissioning has been performed in accordance with the requirements of this Section.
- 1.1.3 Attend all commissioning meetings and perform all commissioning responsibilities assigned by the CA at those meetings.
- 2 Products
- 2.1 **TEST EQUIPMENT**
- 2.1.1 Provide all test equipment necessary to fulfill testing and calibration requirements of this Division. Provide two-way radios for use by CA during commissioning, if required.
- 3 Execution
- 3.1 **SUBMITTALS**
- 3.1.1 Provide two copies of Record Drawings and Shop Drawings for the CA's review and use. Inform CA of any differences between actual systems and systems described in Shop Drawings. On one of the Record Drawing sets, mark the locations of network panels and interconnecting wiring. Indicate wiring types on Drawings.
- 3.2 **TEST PROCEDURES**
- 3.2.1 A test form or checklist will be provided by the CA for each Mechanical and Electrical equipment item controlled or monitored by the BCS. Prior to commissioning, test and calibrate all control devices, inputs and outputs, verify correct operation of devices and controls sequences, and complete test forms. Use a skilled technician who is familiar with the building to perform this work. Submit test forms to the CA for review.
- 3.2.2 Test forms will generally include the following:
- Calibration of all inputs and devices
  - Check of points list stored in each panel
  - Operational check of all valves and dampers
  - Check that all specified sequences are set up, debugged and fully operable
  - Check of battery backup and power-up after power failure restart functions
  - Check of trending and graphing features
  - Check of global commands features
  - Check of schedules and alarms
  - Synchronization of workstation and field panel clock settings
  - Check of field panel functionality using portable workstation
  - Check that all graphic screens and value readouts are completed
  - Check of setpoint changing features and functions

- Check of night setback, morning warmup operation
- Check of communications to remote sites
- Check of fire alarm interlocks
- Check of security system interlocks with environmental alarms
- Check of optimum start/stop and sequential equipment staging/alternating

3.2.3 Prior to testing, ensure all wiring connections for all voltages are properly terminated, ensure all wiring is properly identified, and ensure all wiring requirements of Section 15900, "Controls", are met.

### 3.3 COMMISSIONING

3.3.1 When the CA is satisfied the testing is complete, commissioning will be scheduled. Commissioning will consist of verification of operation of all points, sequences and features, witnessed and directed by the CA and the Owner's representative. Commissioning to be performed by the same technician who performed the testing described in Clause 3.2.

3.3.2 Allow a minimum of five days for assisting CA during commissioning. This does not include time spent in verification and testing described in Clause 3.2 above.

### 3.4 PERFORMANCE VERIFICATION

3.4.1 Provide verification check sheets for all new control points and all associated control sequences. This work must be done, submitted and approved by the consultant prior to the commissioning agent being engaged and final payment being released. The approved reports are to be included in the maintenance manuals.

3.4.2 Verification check sheets for each piece of equipment must contain list of all control points associated with this piece of equipment. Proper operation of each sensor, actuator, terminal unit, or any other control point must be confirmed in the field by direct observation (if possible) and through the graphical user interface. Each verification sheet must be dated and signed by Controls Contractor.

3.4.3 Setup and verify trends for all new equipment and all control points. Provide trend verification sheets and sample sheets indicating trended points for consultant's approval.

3.4.4 One month after these checks and commissioning are complete, set up a meeting with Mechanical Contractor, Owner and Consultant to confirm the operation of all new equipment. At this meeting all trends will be reviewed and confirmed with the Owner. Prior to the meeting the Controls Contractor will be required to provide trend graphs or numerical data in Excel spread sheet form, for all monitored systems for the last month of operation. If numerical data is provided the date/time data must follow Excel formatting.

3.4.5 Controls Contractor will be responsible for correcting of all deficiencies found during this process and will be required to submit trends to verify operation of all equipment after making corrections.

**END OF SECTION**



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- 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.
- 1.2.3 Contractors visiting for site investigation must sign in at the main office. Upon arrival, review and sign the on-site Designated Substances Report prior to site investigation.
- 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.

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**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.

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- 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 \$2,000. 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".

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- 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 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 USB Drive 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 St Clair Catholic District School Board 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.



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- 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.

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- 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 unless specified or shown otherwise. Use red pigmentation when used as mechanical protection for electrical equipment.
- 2.4 **SLEEVES**
- 2.4.1 In general, sleeves are not required through walls or floors except in service room floors and foundation walls.
- 2.4.2 Use Schedule 40 steel pipe sleeves through concrete structural members, walls and floor slabs. Extend sleeves minimum 1" AFF and seal pipe to sleeve.
- 2.4.3 For all conduits passing through foundation walls, use Link-Seal pre-engineered mechanical seals between sleeves and pipes.
- 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 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.
- 2.5.3 The following manufacturers of the above equipment will be considered equal subject to requirements of Clause "Material and Equipment":
- Hilti  
Tremco

2.5.4 Where communications J hooks or cable trays are shown passing through rated walls, provide thru-wall fitting and 103 mm (4") conduit stubs. Provide quantity as required to maintain cross-sectional area of cable tray, or minimum one fitting per communication J hooks. Thru-wall fitting to be suitable for use in plenum spaces and maintain one, two, three or four hour fire rating in drywall, concrete and block penetrations. To be Legrand FlameStopper.

## 2.6 ACCESS DOORS

2.6.1 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.

2.6.2 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,	Acudor UF-5000 (stainless)

2.6.3 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

## 2.7 SPRINKLER PROOF EQUIPMENT

2.7.1 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.

## 2.8 IDENTIFICATION NAME LABELS

2.8.1 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.

2.8.2 Submit a complete list of nameplate wording for review by Consultant prior to installation.

2.8.3 Warning plates are to be red with white letters, minimum 14 pt Arial or Helvetica typeface, as indicated on drawings.

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**2.9 FLASHING**

2.9.1 For locations with roof penetrations serving a piece of equipment, such as for roof mounted split system condensing units, receptacles, etc, 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.

2.9.2 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 minimum 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 EXCAVATION AND BACKFILL**

3.3.1 Be responsible for any excavation and backfill required for work of Division 16. Slope or shore all trenching in accordance with all current regulations and safety standards. Where any conduits pass under building footings, backfill under footings with lean concrete.

3.3.2 Use materials and standards of compaction for backfill in accordance with Division 2 unless specified otherwise.

3.3.3 If changes are required in locations, depth of excavating or related data, advise the Consultant in reasonable time to avoid disruption of work sequence.

### 3.4 CONCRETE WORK

3.4.1 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.

3.4.2 Carry out all concrete work in accordance with requirements of Division 3. Provide wire mesh, rebar and all necessary reinforcing.

### 3.5 SUPPORTS AND BASES

3.5.1 Provide structural work required for installation of equipment provided under this Division.

3.5.2 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.

3.5.3 Extend existing concrete bases as required for replacement or new equipment. Match existing height.

3.5.4 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.

3.5.5 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.

3.5.6 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.

3.5.7 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.

3.5.8 Do not mount starters, VFD's, etc. on building equipment.

3.5.9 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.

3.5.10 Provide lintels for double-width and adjacent tubs and multiple conduits running in parallel, where located in block and poured walls.

### 3.6 CONCRETE INSERTS

#### 3.6.1 General

3.6.1.1 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.

3.6.1.2 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 Inserts in Hardened Concrete:

3.6.2.1 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.

3.6.2.2 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.

3.6.2.3 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.

3.6.2.4 Inserts to be zinc plated female concrete anchors. Nylon or plastic anchors are not acceptable.

3.6.3 Concrete screws without anchors are not acceptable.

### 3.7 SLEEVES

3.7.1 **Sleeves Embedded in Concrete:** Except as approved otherwise by the Consultant, install sleeves embedded in concrete in accordance with the following general guidelines:

3.7.1.1 Centre to centre spacing to be not less than 3 diameters of the maximum size adjacent sleeve.

3.7.1.2 Provide additional reinforcing at points of congestion as directed by the Consultant.

3.7.1.3 Sleeves through beams will be permitted only as directed by the Consultant.

3.7.1.4 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.

3.7.2 Provide sleeves for all conduits which pass through service room floors and foundation walls. Sleeves to extend minimum 1" above finished floor.

### 3.8 FIRESTOPPING

3.8.1 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.

3.8.2 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. For all penetrations through a Service Room floor, provide a minimum W rating - Class 1 in addition to the fire resistance rating.

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 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.

3.8.4 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.

### 3.9 CUTTING AND PATCHING

3.9.1 Flash holes through walls and roof to make weatherproof.

3.9.2 Do not cut or drill holes through floors, roof or structural members before obtaining permission from the Consultant.

3.9.3 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.

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- 3.9.4 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.
- 3.9.5 Where conduits are required to pass through existing walls, floors, and roof, cut and patch the necessary openings.
- 3.9.6 Where recessed electrical equipment is removed or replaced with equipment of a smaller size, patch openings to match existing wall material.
- 3.9.7 Where wiring devices (switches, receptacles, etc) are removed from drywall walls, remove device box and patch opening to match existing wall.
- 3.9.8 Where wiring devices (switches, receptacles, etc) are removed from poured concrete or block walls, remove device and provide blank coverplate.
- 3.9.9 Include the cost of all cutting and patching in the Lump Sum Contract Price for the work of Division 16.
- 3.9.10 Remove and replace ceiling where necessary to complete the work of this Division unless this work is specifically included in another Division.
- 3.9.11 All cutting and patching to be done by the trade specializing in the materials to be cut.
- 3.10 **PAINTING**
- 3.10.1 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.
- 3.10.2 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.
- 3.10.3 Paint disconnect switch or breaker for fire alarm and exit light systems in red enamel. Use one coat of primer and one finish coat.
- 3.10.4 Where walls are cut and patched for electrical work, paint walls to match existing. For walls less than 9.3m<sup>2</sup> (100 sq ft), paint entire wall. For walls larger than 9.3m<sup>2</sup> (100 sq ft), paint area of patch. Painting to be completed by painting contractor.
- 3.10.5 Include the cost of all painting in the Lump Sum Contract Price for the work of Divisions 16.
- 3.11 **ACCESS DOORS**
- 3.11.1 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.



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**3.12 IDENTIFICATION**

- 3.12.1 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.
- 3.12.2 All branch circuits shall be:
- Phase A - red
  - Phase B - black
  - Phase C - blue
- 3.12.3 Identify all disconnects, starters, and other control equipment with lamacoid nameplates indicating the equipment controlled and all panels, transformers, etc identifying equipment name.
- 3.12.4 Lamacoid labels to be mechanically attached with self-tapping screws or rivets. Lamacoid labels attached using adhesive methods are not acceptable.
- 3.12.5 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.
- 3.12.6 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.
- 3.12.7 Where equipment is concealed above accessible ceilings, indicate location using coloured-coded marking devices, approved by Consultant, fastened to the ceiling components.

**3.13 LOCKS AND KEYS**

- 3.13.1 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.

**3.14 TESTING**

- 3.14.1 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. Security and Access Control Systems
  4. PA / Intercom Systems
- 3.14.2 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
  2. Variable Frequency Drives

3.14.3 At the completion of the work, demonstrate operation of all systems to the Owner's representative and the Consultant. Promptly rectify any malfunction found.

3.15 **TEMPORARY ELECTRICAL FACILITIES FOR CONSTRUCTION**

3.15.1 Temporary electrical power is available at the site. Cooperate with owner for use of this power.

3.15.2 Tie in at one location only, as directed. Distribute temporary power from this location.

3.15.3 Arrange and pay for the cost of inspection of the temporary service.

3.15.4 Notify the monitoring company and Owner each and every time a part of the fire alarm system is shut down and reactivated.

3.15.5 Completely remove all temporary facilities when they are no longer required.

3.15.6 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 stairwells use one 100W A21 lamp, or equivalent, at each landing. Lighting to be on dedicated circuits.

3.15.7 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.

3.15.8 Provide minimum two 120V 20A GFCI receptacles, on dedicated circuits, per 150 m<sup>2</sup> construction area.

3.15.9 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.

3.15.10 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.

3.15.11 **Temporary Fire Alarm Devices**

3.15.11.1 Notify the local Fire Department and Owner each and every time a part of the fire alarm system is shut down and reactivated.

3.15.11.2 Provide new temporary hard wired fire alarm detectors, pull stations and notification appliances within the construction area.

3.15.11.2.1 Provide one 135°F rate-of-rise heat detector for every 465 m<sup>2</sup> (5000 ft<sup>2</sup>) of floor area.

3.15.11.2.2 Provide smoke detectors in all temporary corridors spaced maximum 10m (30 ft).

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- 3.15.11.2.3 Provide a manual pull station at every exit/entrance to the construction area.
  - 3.15.11.2.4 Provide one surface mounted bell for every 560 m<sup>2</sup> (6000 ft<sup>2</sup>) of floor area.
  - 3.15.11.3 Use #14 AWG, AC-90 cable for temporary wiring to devices.
  - 3.15.11.4 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.
  - 3.15.11.5 Completely verify temporary fire alarm devices any time temporary devices are added, removed or relocated.
  - 3.15.11.6 Once the permanent fire alarm system is operational completely remove all temporary devices and wiring. Turn devices over to the Owner.

### 3.16 **EQUIPMENT SCHEDULE**

- 3.16.1 Equipment Schedules are as shown on Drawings.
- 3.16.2 In general, the motor or item numbers shown in the Equipment Schedules coincide with those numbers shown for Mechanical Trades.

### 3.17 **GROUNDING**

- 3.17.1 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.
- 3.17.2 Provide a separate green ground conductor in all raceways.
- 3.17.3 Ground secondary neutrals of transformers to building ground conductor.
- 3.17.4 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.
- 3.17.5 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.
- 3.17.6 Clean all surfaces to which bus or cable are to be bolted, of all paint, rust, etc., and work to a bright, flat surface.
- 3.17.7 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.
- 3.17.8 Provide a separate #14 green ground wire for all isolated ground receptacles.

### 3.18 **START-UP SERVICES**

- 3.18.1 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.

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**3.19 MAINTENANCE OF EXISTING SERVICES**

- 3.19.1 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.
- 3.19.2 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.
- 3.19.3 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.

**3.20 PROTECTING AND MAKING GOOD**

- 3.20.1 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.
- 3.20.2 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.
- 3.20.3 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.
- 3.20.4 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.

**3.21 REMOVAL OF EXISTING MATERIAL AND EQUIPMENT**

- 3.21.1 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.

**3.22 LOAD BALANCE**

- 3.22.1 Measure phase current to distribution panels and MCCs with normal loads operating at time of acceptance.

3.22.2 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.

### 3.23 REBATES AND INCENTIVES

3.23.1 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.

### 3.24 CASH ALLOWANCES

3.24.1 Refer to Section 01020 for cash allowances carried by the General Contractor.

3.24.2 Include in the Base Bid price, cash allowances of:

3.24.2.1 \$3,000.00 to cover the cost of unforeseen electrical deficiencies. Submit Electrical Safety Authority Inspection deficiencies to the Consultant.

3.24.2.2 \$15,000.00 to cover the cost of a Metering cabinet and Utility work required for new secondary ductbank.

3.24.3 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.

### 3.25 DEFICIENCY REVIEW

3.25.1 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.

3.25.2 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.

### 3.26 LIST OF ELECTRICAL SUBCONTRACTORS AND MANUFACTURERS

3.26.1 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.

**3.26.2 Subcontractors**

Fire Alarm System  
Data Wiring  
PA System  
Security System

**3.26.3 Manufacturers**

Disconnect Switches  
Emergency Lighting / Exit Signs  
Fire Alarm Devices  
Intercom System  
Luminaires (by Type)  
Motor Control Equipment  
Occupancy Sensors  
Panelboards  
Security System  
Structured Wiring  
Wiring Devices

**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 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.

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**2.5.4 Receptacles**

2.5.4.1 125 volt 15 amp white U-ground Duplex Receptacle (CSA 5-15R)  
Hubbell Catalogue No. HBL-5252-W

2.5.4.2 125 volt 15 amp white self-testing GFCI Duplex Receptacle (CSA 5-15R)  
Hubbell Catalogue No. GFST15W

2.5.4.3 125 volt 20 amp white U-ground Duplex Receptacle (CSA 5-20R)  
Hubbell Catalogue No. HBL-5352-W

2.5.4.4 125 volt 20 amp white self-testing GFCI Duplex Receptacle (CSA 5-20R)  
Hubbell Catalogue No. GFST20W

**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 gasketed 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 Unless specified otherwise, 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 For 120V mechanical equipment, provide Hubbell Cat. #B100 toggle switch complete with lockable cover.

2.6.3 For equipment above ceilings such as fans and heat pumps single phase and three phase 30A and below: Hubbell Cat # HBL1372 disconnect switch with aluminum housing or equivalent to be approved by Consultant.

2.6.4 For exterior roof mounted equipment single phase and three phase 30A and below: Hubbell Cat # HBL13R series NEMA 3R disconnect switch with aluminum housing. Or equivalent to be approved by Consultant.

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 **OVERCURRENT PROTECTIVE DEVICES - FUSES**

2.7.1 Provide fuses for all fusible equipment in this Contract.

2.7.2 Fuse interrupting rating is to be 200,000 amps RMS symmetrical unless otherwise noted.

2.7.3 Rated as noted on the Drawings, 600 volts AC, fuses will be CSA certified HRCI J/Class J Time Delay with dimensions and current limiting performance in accordance with CSA Specification C22.2 No. 106-05 or UL Standard 198C for Class J fuses. HRCI/JY fuses are not acceptable.

2.7.4 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause "Materials and Equipment":

Cooper Bussmann  
General Electric Power Controls  
Littlefuse  
Mersen

## 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.

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- 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**

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- 
- 1 General
- 1.1 **GENERAL REQUIREMENTS**
- 1.1.1 Conform to the requirements of Section 01010, "General Provisions".
- 1.2 **DESCRIPTION**
- 1.2.1 Provide concrete encased ductbanks below grade. Ductbanks to consist of PVC ducts, as called for on the Drawings.
- 2 Products
- 2.1 **MATERIALS**
- 2.1.1 Use materials specified herein or approved equal.
- 2.2 **PVC DUCTS**
- 2.2.1 Use Type II PVC duct (CSA Standard C22.2 NO. 211.1) in concrete encased ductbank. All bends to be long sweep type (minimum 925 mm [36"] radius) of same material as conduit. Use adapters when connecting duct to conduit. Terminate ducts with bell ends flush with end of ductbank at both ends, except where they are to be extended. Seal unused duct ends with plastic plugs.
- 2.2.2 Support the ducts with approved spacers minimum every 5ft (1520mm).
- 2.3 **PULL ROPE**
- Provide and install a 6 mm (1/4") nylon pull rope in each empty duct.
- 2.4 **CONCRETE**
- 2.4.1 Arrange and pay for the supply and pouring of all concrete for the ductbank.
- 2.4.2 In general, use mixed-in-transit ready mixed concrete in accordance with CSA Standard A.23.1-M. Provide red dye in ductbank concrete.
- 2.4.3 Reinforce duct bank with minimum 15M reinforcing bars. Overlap joints by 6" (150mm) and tie. Number of bars should equal number of horizontal ducts plus one. All reinforcing steel to be placed with minimum 3" (76mm) bottom clearance, 1 1/2" (38mm) top and side clearance, with support bars at 4 ft (915mm) oc, lap splices 18" (457mm) minimum.
- 2.4.4 Carry all steel 6" into foundation walls and manholes and tie to the building foundations to prevent the duct bank from shearing away from the building if the ground beneath the duct bank subsides. (For existing foundations - drill and dowel rods in to existing structure at least 4" (100mm.) Care shall be taken to ensure good water seal around the ducts where they enter building or manholes.
- 2.4.5 For general duct bank installation, use 25 MPa concrete, maximum slump 125 mm (5").

---

**2.5 LINK SEALS**

2.5.1 For all pipes passing through foundation walls, use Link-Seal pre-engineered mechanical seals between sleeves and pipes as manufactured by Corrosion Service Company (1-416-630-2600).

3 Execution

**3.1 PVC DUCTS**

3.1.1 Pull mandrel through ducts properly sized for the size of duct, in all new ducts prior to installation of 6 mm (1/4") pull rope and new cable. Consultant to witness mandrel pull.

**3.2 DUCTBANK INSTALLATIONS**

3.2.1 Comply with Construction Safety Act and other regulations of the Ontario Ministry of Labour or local bylaws relating to the work of this Section.

3.2.2 Install ducts at elevations and with slope as indicated.

3.2.3 Install base spacers at maximum intervals of 1.5 m (5') levelled to grades indicated for bottom layer of ducts.

3.2.4 Lay PVC ducts with configuration and reinforcing as indicated with rigid plastic intermediate spacers to maintain spacing between ducts at not less than 40 mm (1-1/2") horizontally and vertically. Stagger joints in adjacent layers at least 150 mm (6") and make joints watertight. Encase ductbank with 75 mm (2-3/4") minimum thick concrete cover.

3.2.5 Make transpositions, offsets and changes in direction using 5° bend sections. Do not exceed a total of 20° with duct offset.

3.2.6 Use bell ends at duct terminations in pull pit.

3.2.7 Clean ducts before laying. Cap ends of ducts during construction and after installation to prevent entrance of foreign materials

3.2.8 Immediately after placing of concrete, pull through each duct a sizing mandrel with compacted cotton cloth ball of a diameter 6 mm (1/4") less than internal diameter of duct, followed by stiff bristle brush to remove sand, earth and other foreign matter. Avoid disturbing or damaging ducts where concrete has not set completely. Pull stiff bristle brush through each duct immediately before pulling in cables.

3.2.9 Place concrete down sides of ductbank filling space under and around ducts. Rod concrete with float bar between vertical rows filling voids.

3.2.10 Consider backfill from the trench bottom to 300 mm (12") above the top of the ductbank as "bedding". Consider all materials above this level to be "backfill". Where trenches are under roadways, parking areas, etc., continue the bedding to the subgrade of the roadways and parking areas.

- 3.2.11 Be responsible for all excavation, bedding and backfill required for the work. Slope or shore all trenching in accordance with the Occupational Health and Safety Act, 1990 and Regulations for Construction Projects (Ontario Regulation 213/91).
- 3.2.12 Do not open trench ahead of duct placement. Backfill within 24 hours of concrete pours.
- 3.2.13 Break rocks and boulders to facilitate removal. Remove these by drilling and wedging. Blasting will not be permitted.
- 3.2.14 Allow bedding and backfill materials to drop freely into trenches. Use ramps, sloping chutes or other approved method. Do not push material into trenches. Moisten or dry bedding and backfill materials as required for maximum density. Use hand tampers and mechanical vibrators to produce required compaction.
- 3.2.15 Remove from site all excess materials.
- 3.2.16 Install clean sharp sand 150 mm (6") below and above ductbanks, as bedding. Damper and rake sand evenly below ductbank installation. Call for inspection by the Consultant.
- 3.2.17 Mix all concrete with materials so graded and proportioned to produce a plastic mass of such consistency that it will flow slowly under its own weight and which can be readily worked into corners. Ensure required encasement size (as noted on Drawings) for full length.
- 3.2.18 All concrete operations during cold weather to be in accordance with Section 16 of C.S.A. Standard A.23-1973.
- 3.2.19 Install T & B or Brady identification tape 300 mm (12") wide, or two 150 mm (6") wide, colour yellow, full length of run. Install 300 mm (12") below grade.
- 3.2.20 Backfill trenches immediately following installation and inspection.
- 3.2.21 Compact to the following densities:
- |          |   |                       |
|----------|---|-----------------------|
| Backfill | - | 95% Standard Proctor  |
| Bedding  | - | 100% Standard Proctor |
- 3.2.21.1 Leave backfill crowned for settlement. Re-finish surfaces to "as was" condition. Backfill in a maximum of 150 mm (6") lifts and compact. Where asphalt is removed, backfill with Granular "A" and top with 100 mm (4") of asphalt. Restore grassed areas with topsoil and sod.
- 3.2.22 Use rebar as shown in the Drawings for areas under vehicular traffic, and where soil has previously been disturbed.
- 3.3 **LINK SEALS**
- 3.3.1 Provide link seals around all conduits 50 mm (2") and larger penetrating outside walls.

**3.4 CONDUIT SEALS**

- 3.4.1 Seal end of conduit around cables at manholes, pulling pits or transformer base to prevent water from entering building via conduits.
- 3.4.1.1 Use Densyl Mastic "Molding & Filler Mastic" products as manufactured by Denso North America Inc. (sales@denso-na.com)

**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 **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 **FULL VOLTAGE MOTOR STARTERS**
- 2.1.1 **Common Requirements**
- 2.1.1.1 Provide starters as specified in Equipment Schedules and as shown on the Drawings.
- 2.1.1.2 Starters to be complete with enclosures suitable for the area in which they are installed and capable of being padlocked in the OFF position.
- 2.1.1.3 Single phase and three phase magnetic starters shall not be smaller than NEMA size 0 and NEMA size 1 respectively.
- 2.1.1.4 Provide 1 normally open and 1 normally closed auxiliary contacts in all starters.
- 2.1.1.5 All starters to be NEMA rated. IEC rated starters are not acceptable.
- 2.1.2 **Manual Starters**
- 2.1.2.1 Manual single-phase starters to have a double-break silver alloy contact mechanism and pilot light. The overload shall have a field adjustment allowing up to +/- 24% variance in ratings of the nominal heater value.
- 2.1.2.2 Manual three-phase starters to have a double-break silver alloy contact mechanism and pilot light. The overload shall be ambient compensated bimetallic-type with interchangeable heaters and automatic reset.
- 2.1.2.3 In service spaces, starters are to be enclosed in a general purpose NEMA 1 enclosure. In finished areas, starters are to be flush-mounted with a stainless steel faceplate.
- 2.1.2.4 The operating toggle or button shall clearly indicate whether the unit is ON, OFF or TRIPPED.
- 2.1.3 **Magnetic Starters**
- 2.1.3.1 Unless noted otherwise, magnetic starters to be full-voltage non-reversing type complete with HAND-OFF-AUTO selector switch and red "motor running" pilot light.
- 2.1.3.2 Provide one set of contacts for remote automatic start.
- 2.1.3.3 Provide one set of contacts for Fire Alarm shutdown, as noted on Mechanical Equipment Schedule. Fire Alarm shutdown operation to override HAND-OFF-AUTO selector switch.
- 2.1.3.4 Magnetic starters to be complete with individual control transformer protected by control fuses. Control voltage 120 volt, 60 hertz unless otherwise noted or required by Controls Contractor. Coordinate with Controls Contractor.



2.1.3.5 Where shown as combination magnetic starters, provide disconnect switch and breaker overcurrent protection integral to enclosure.

2.1.4 The following manufacturers of the above equipment will be considered as equal, subject to the requirements of Clause "Materials and Equipment":

Allen-Bradley  
Eaton  
Siemens  
Square D

## 2.2 PILOT DEVICES, RELAYS AND CONTACTORS

2.2.1 Selector switches are to be standard duty, oil tight type. When separately mounted, they are to be located in their own enclosures.

2.2.2 Unless noted otherwise, pilot lights to be oil tight, long-life LED type, with transformer.

2.2.3 Install double voltage relays and/or CSA approved segregated auxiliary contacts as required to perform interlocking or other functions. Contacts to suit application.

2.2.4 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.

### 3.1.2 Starters

3.1.2.1 Install starters and connect wiring as indicated on Drawings, in accordance with Code requirements, and in accordance with approved wiring diagrams and manufacturer's Drawings.

3.1.2.2 Where multiple devices are located in close proximity, provide 19 mm (3/4") thick plywood panel sized to accommodate group-mounted disconnect switches, starters, splitter box and other required control devices.

- 
- 3.1.2.3 Provide raceways, boxes, cables and wirings from panelboards or switchgear through splitters, starters and field disconnect switches to complete power supply required for motors.
- 3.1.2.4 Provide raceways and wirings for control devices and instruments for installation by Division 16 when specified herein. Other control wiring and conduits for field instruments and devices forming part of automated control system for equipment are to be supplied and installed by Divisions installing such system and equipment.
- 3.1.2.5 Provide raceways and wiring, and terminate in designated power supply connection points of pre-wired equipment or package unit supplied by other Divisions. All other outgoing control wiring and conduits are to be installed by Divisions supplying and installing pre-wired equipment or package unit.
- 3.1.3 Check in field and coordinate motor nameplate full load amperes and service factor to ensure correct fuses and overload relay heater elements are installed. Set adjustable relays.
- 3.1.4 Provide lamacoid nameplates on front cover of starters, separately-mounted control stations, and field-mounted disconnect switches, indicating function or equipment service identification as indicated on Drawings.
- 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 a switchgear, distribution panelboards as shown on the Drawings.
- 1.2.2 Provide 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 **SERVICE ENTRANCE SWITCHBOARD**
- 2.2.1 **Ratings**
- 2.2.1.1 Voltage and amperage ratings to be as indicated on the Drawings.
- 2.2.1.2 The service panel bus to equal to Eaton Pow-R-Line C, 18" deep service entrance switchboard.
- 2.2.1.3 Switchboard is to be complete with copper bus bars and rated to withstand interrupting capacity of circuit breakers contained within.
- 2.2.1.4 Switchboard is to be complete with copper ground bus, with 2-hole NEMA connections for the grounding system.
- 2.2.1.5 All bus bars to run the length of the board.
- 2.2.1.6 Provide metering where indicated on Drawings.
- 2.2.2 **Construction**
- 2.2.2.1 The service entrance switchboard to be fabricated from code gauge formed galvanized steel complete with float sheet covers to form a rigid dead front totally enclosed structure. The service entrance switchboard is to be floor-mounted.
- 2.2.2.2 All compartments are to be designed to make components totally front accessible to enable the panel to be installed against the wall.

2.2.2.3 Isolation barriers to be provided to separate the main disconnect device and the utility current/potential transformer section. The distribution section/cell to be separately barriered and isolated from the main service entrance section. Ventilation to be provided to meet CSA C22.2 #31 temperature rise requirements.

2.2.2.4 All covers are to be painted ASA-61 grey.

### 2.2.3 **Circuit Breakers**

2.2.3.1 The main breaker to be sized as shown on drawings complete with electronic trip unit.

2.2.3.2 Distribution breakers to be moulded case with interrupting ratings as indicated on the Drawings. Breakers are to be moulded case and to have a minimum interrupting capability of 30 kA RMS symmetrical at rated voltage. Series rated breakers are not acceptable unless stated otherwise on the Drawings.

2.2.3.3 All circuit breakers 400A and larger to have adjustable Long-time Short-time Instantaneous (LSI) solid state trip unit.

2.2.3.4 Provide a hasp on the breaker escutcheon that can receive padlocks when the breaker is in the open position, positively preventing unauthorized closing of the breaker.

2.2.4 **Utility Metering Transformer Compartment:** The utility transformer compartment to be designed to meet the local utility requirements. It is to be bussed and pre-drilled to accept standard bar type current transformers. The compartment to have bolt-on cover and access door with concealed hinges, both sealable to prevent tampering. Review locations of PTs and CTs with utility during shop drawing phase.

2.2.5 Provide mechanical interlocks as shown on the drawings. Arrange main-tie-main interlocks such that only two breakers maximum can be closed at the same time.

2.2.6 Provide quantity of spare breakers as called for on the Panel Schedules or Drawings

2.2.7 Provide mechanically fastened lamacoid nameplates engraved with white upper case characters for identification of the main breakers, feeder switches and all the instruments.

### 2.2.8 **Colour Coding**

2.2.8.1 Unless noted otherwise, switchboard to be ASA 61 grey.

2.2.8.2 All exposed filler plates to match switchgear colour.

2.2.9 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause "Material and Equipment":

Eaton  
Schneider  
Siemens

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**2.3 DISTRIBUTION EQUIPMENT****2.3.1 Distribution Panels**

2.3.1.1 Distribution panel consisting of circuit breakers, main breakers and metering as indicated on the drawings.

2.3.1.2 Provide a hasp on the breaker escutcheon that can receive padlocks when the breaker is in the open position, positively preventing unauthorized closing of the breaker.

2.3.1.3 Provide lamacoid nameplates for identification of the main breakers, feeder switches and all instruments.

2.3.1.4 Use panelboards of type noted on the Panel Schedules. All bus bars to be copper and rated to withstand interrupting capacity of circuit breakers contained within.

2.3.1.5 Provide full-rated neutral bus bars for single-phase and 4 wire, 3 phase panelboards.

2.3.1.6 Where space is indicated, bus the space for future breakers. Provide panel fronts with removable fillers in spaces.

**2.3.2 Panelboards**

2.3.2.1 Use panelboards of the circuit breaker type, complying with the requirements contained in the Panel Schedules.

2.3.2.2 Panelboards are to have formed galvanized steel tubs and shop finished enamelled covers.

2.3.2.3 All panelboards to have hinged doors with chrome plated locks and catches. Flush-mounted panelboards to have concealed hinges and trim fasteners, flushlock and large rigid covers. All parts of the panel are to be of welded construction.

2.3.2.4 Provide gutter space and barriers in panelboard where required by Inspection Authorities.

2.3.2.5 Each breaker or switch to be clearly identified with a factory stamped circuit number on silkscreened metal tape or lamacoid. Double section panels must have circuit numbers factory installed, indicating from 1 - 84. Circuit numbers are to be mechanically fastened to panelboard. Two sided tape on accessories will not be accepted.

2.3.2.6 Use panelboards of type noted on the Panel Schedules. Bus to be copper and rated to withstand interrupting capacity of circuit breakers contained within.

2.3.2.7 Where panelboards are indicated with main contactors, contactors shall be enclosed within the same tub as the panelboard and with same interrupting rating as breakers.

2.3.2.8 Where space is indicated, bus the space for future breakers. Provide panel fronts with removable fillers in spaces.

2.3.2.9 Where equipped with main breakers mounted vertically, down position should open breaker.

---

**2.3.3 Distribution and Panelboard Circuit Breakers**

- 2.3.3.1 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).
- 2.3.3.2 Breakers are to be suitable for the panelboards provided. All breakers are to be bolted in place. Plug-in only type are not acceptable.
- 2.3.3.3 For 250V panelboards, main and branch breakers to be rated minimum 22,000 amperes RMS symmetrical at 208 or 240 volt.
- 2.3.3.4 For 600V panelboards, main and branch breakers to be rated minimum 22,000 amperes RMS symmetrical at 600 volt.
- 2.3.3.5 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.
- 2.3.3.6 All circuit breakers 400A and larger to have adjustable Long-time Short-time Instantaneous (LSI) solid state trip unit.
- 2.3.3.7 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).
- 2.3.3.8 Shunt trip breakers to be 120V AC solenoid type. Electrically held shunt trip breakers are not acceptable.
- 2.3.3.9 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.
- 2.3.3.10 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
  - Fire Alarm control panels
  - Security System control panels
  - door hardware
- 2.3.3.11 Provide quantity of spare breakers as called for on the Panel Schedules or Drawings

**2.3.4 Colour Coding**

- 2.3.4.1 Distribution Panelboards, panelboards and filler plates located in Electrical and Mechanical rooms are to be factory painted as follows. Paint inside of doors in finished areas.

Normal power - ASA grey



2.3.5 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause "Material and Equipment":

Eaton  
Schneider  
Siemens

## 2.4 METERING

2.4.1 Where shown on drawings, provide the following:

- one digital multi function meter, Power Measurement Model Number P7650B1C0B6E0N0A integrated display, 10MB logging memory and 1024 samples/cycle complete with one 100BASE-TX and one RS-485 port, eight digital inputs, four 0 to 20mA analog inputs and four 0 to 20 mA analog outputs.

2.4.2 For externally mounted meters, provide NEMA 1 metering cabinet, complete with drip ledge and terminal blocks sized to suit meters. Refer to details on drawings.

2.4.3 For meters mounted in distribution equipment, locate meters such that display and controls are located between 1000mm and 1800mm above finished floor.

2.4.4 Submit wiring details with Shop Drawings.

2.4.5 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause "Material and Equipment":

Eaton  
Power Measurement  
Siemens

## 2.5 SURGE PROTECTIVE DEVICES (SPD)

2.5.1 SPD shall be UL 1449 3rd Edition verified labelled as Type 1 for service entrances or Type 2 and shall contain thermally protected metal-oxide varistors, each of which is internally fused by a thermal element, that safely removes them from the circuit breaker under abnormal conditions under every protection mode, including N-G. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.

2.5.2 SPD shall be UL labelled with 200kA Short Circuit Current Rating (SCCR).

2.5.3 Suppression components shall be heavy duty 'large block' MOVs, each exceeding 30 mm diameter.

2.5.4 All SPDs applied to the distribution system shall have a 20kA  $I_n$  rating regardless of their SPD Type (includes Types 1 and 2) or operating voltage.

2.5.5 Minimum surge current capability (single pulse rated) per phase shall be:

Service Entrance or Transfer Switch	200kA
Distribution panelboard & MCCs	150kA
Branch panelboards	80kA

2.5.6 SPD shall provide surge current paths for all modes of protection: L-N, L-G, L-L and N-G for Wye systems; L-L, L-G in Delta and impedance grounded Wye systems.

2.5.7 Voltage Protection Ratings (VPRs) shall not exceed the following:

<b>Modes</b>	<b>208Y/120</b>	<b>480Y/277</b>	<b>600Y/347</b>
L-N, L-G, N-G	700V	1200V	1500V
L-L	1200V	2000V	3000V

2.5.8 Maximum Continuous Operating Voltage (MCOV) shall not be less than 115% of the nominal system operating voltage:

<b>System Voltage</b>	<b>208Y/120</b>	<b>480Y/277</b>	<b>600Y/347</b>
MCOV	138V	318V	399V

2.5.9 The SPD shall be maintenance free and shall not require any user intervention throughout its life. SPDs containing items such as replaceable modules, replaceable fuses, replaceable batteries, or require periodic tightening of connections shall not be accepted.

2.5.10 The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV.

2.5.11 No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be soldered, hardwired with connections utilizing low impedance conductors.

2.5.12 SPD to have EMI/RFI filtering with minimum attenuation of -50dB from 10kHz to 100MHz using the MIL-STD-200A insertion loss test method.

2.5.13 SPD to have the following visual LED diagnostics, visible from the front of the equipment:

2.5.13.1 For wye configured units, the indicator lights must report the status of all protection elements and circuitry in the L-N and L-G modes. Wye configured units shall also contain an additional green / red solid-state indicator light that reports the status of the protection elements and circuitry in the N-G mode.

2.5.13.2 The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators must indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights must continue to indicate the status of the protection on all other phases and protection modes.

2.5.14 The SPD to include Form C dry contacts (one NO and one NC) for remote annunciation of its status by changing state under any fault condition.

2.5.15 Provide push-to-test button to provide testing of all monitoring points.

- 2.5.16 The SPD shall be equipped with an LCD display that indicates to the user how many surges have occurred at the location. A reset pushbutton shall also be standard, allowing the surge counter to be zeroed. The ongoing surge count shall be stored in internal non-volatile memory not requiring battery backup to maintain counter value.
- 2.5.17 The SPD shall not limit the use of through-feed lugs, sub-feed lugs, and sub-feed breaker options. SPDs shall be installed immediately following the load side of the main breaker or immediately following the incoming main lugs.
- 2.5.18 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause "Materials and Equipment":
- Advanced Protection Technologies
  - Current Technology
  - Eaton
  - Innovative Technology Inc.
  - Schneider
  - Siemens

### 3 Execution

#### 3.1 DISTRIBUTION SWITCHBOARD AND DISTRIBUTION PANELS

- 3.1.1 Install switchboards in electrical rooms. Arrange for all necessary lifting and moving equipment. Coordinate with all trades to provide openings or space to install and assemble switchboards in rooms in compliance with building schedule.
- 3.1.2 Clearly determine access to spaces within existing building. Assemble equipment in location on site if required.
- 3.1.3 Arrange for 100 mm (4") high concrete pad to extend 50 mm (2") on all sides of switchboard.
- 3.1.4 Assemble complete board in accordance with manufacturer's directions.
- 3.1.5 Provide lamacoid labels mechanically fastened to switchboards indicating connected load. Include room number and description of load for each breaker.

#### 3.2 PANELBOARDS

- 3.2.1 Locate panelboards as indicated on the drawings. Confirm with Consultant prior to rough-in if panels cannot be installed in locations shown.
- 3.2.2 Install panelboards level and upright. Remove shipping supports only after securing.
- 3.2.3 Unless otherwise shown on the Drawings, mount panelboards 1830mm (72") above finished floor to top of panel and minimum 125mm (5") above finished floor.
- 3.2.4 Provide two empty 25 mm (1") conduit stubs into the ceiling cavity from all flush-mounted panelboards.
- 3.2.5 Provide a typewritten directory mounted under transparent cover identifying each breaker on the back of each panel door.

- 3.2.6 Provide new typewritten directories for all existing panelboards affected by work.
- 3.2.7 Contractor to provide updated schedules complete with room numbers. Trace out existing circuits as required.
- 3.2.8 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.

### 3.3 **METERING**

- 3.3.1 All power supply and communications wiring connections shall be performed in accordance with the guidelines set out in the product documentation.
- 3.3.2 The installation must be in accordance with the Ontario Electrical Safety Code.
- 3.3.3 All voltage sensing connections to Instrumentation shall be made with proper overcurrent protection.
- 3.3.4 Appropriately sized current transformers must be installed on each phase and must be installed with CT shorting blocks. All CTs with 5A secondary shall have CT shorting blocks.
- 3.3.5 Meters must be powered from an auxiliary power supply, and not powered from the PTs.
- 3.3.6 Locate meters such that display and controls are located between 1000mm and 1800mm above finished floor.
- 3.3.7 Test, adjust and set the digital meter to provide correct output readings. Demonstrate programming steps to Consultant and Owner.
- 3.3.8 Demonstrate conclusively to the Owner that the display correctly indicates the following items:
- amperes
  - volts line to line
  - volts line to neutral
  - kilowatt
  - kilowatt demand (15 mins)
  - kilovolt amperes
  - power factor
  - frequency
  - megawatt hours
- 3.3.9 Label enclosure with multiple meters to clearly identify each meter. Provide warning label stating 'Fed From Multiple Sources' as required. Refer to section 16001 "Electrical General Provisions" for labelling details.
- 3.3.10 Provide laminated simple clear instructions on how to read and operate the meter, attached to the switchboard adjacent to meter.
- 3.3.11 Reset recorded measurements prior to turnover to Owner.

- 3.3.12 Connect flow and temperature meters provided by Division 15. Program meters to display all measured and derived parameters listed below:

Supply Temperature (°C)  
Return Temperature (°C)  
Flow Rate (L/s)  
Chilled Water Power (kW)  
Chilled Water Energy (kWh)  
Chilled Water Power (kW) (Derived)  
Chilled Water Energy (kWh) (Derived)

- 3.3.13 Connect Ion meters to existing Ion Enterprise metering system. Coordinate integration of additional meters with Langford and Associates (888-216-8074).

### 3.4 SURGE PROTECTIVE DEVICES (SPD)

- 3.4.1 SPD shall be installed per manufacturer's installation instructions with lead lengths as short (less than 24") and straight as possible. Gently twist conductors together.
- 3.4.2 Rearrange breaker locations to ensure short & straightest possible leads to SPDs.
- 3.4.3 SPD to be connected to a 30A circuit breaker for disconnecting using short lengths of conductors integral to the SPD. Lead length between the breaker and suppressor shall be kept as short as possible to ensure optimum performance. Any excess conductor length shall be trimmed in order to minimize let-through voltage.
- 3.4.4 Before energizing, installer shall verify service and separately derived system Neutral to Ground bonding jumpers per Ontario Electrical Safety Code.
- 3.4.5 The manufacturer shall provide a full ten (10) year warranty from the date of shipment against any SPD part failure when installed in compliance with manufacturer's written instructions and any applicable codes.
- 3.4.6 If equipped, reset surge counters to zero before building turnover.

### 3.5 COORDINATION STUDY

- 3.5.1 Provide complete coordination study with all trip curves shown on log-log paper. Determine the settings for all overload trip units, fuse sizes and protective device settings. Set all trips to be selective, such that downstream devices trip first, then the main switchboard fuses. Calculate fault levels at all distribution, lighting and power panels and MCCs.
- 3.5.2 **Submit all Drawings and calculations, each stamped by a qualified Engineer to the Consultant for approval at time of submission of main switchboard.** Include proof of professional (E&O) liability insurance with Coordination Study.
- 3.5.3 Company completing the coordination study shall obtain feeder lengths and distribution equipment information from site and information from utility as required to complete Coordination Study.
- 3.5.4 Include all new and existing mechanical equipment and elevators over 10 hp.

- 
- 3.5.5 Each adjustable trip breaker shall be labelled with the proper setting. Labels shall be installed on the breaker behind Plexiglass windows or on lamacoid label next to breaker.
- 3.5.6 For each fusible disconnect, provide labelling showing size, type and current rating of maximum fuse size.
- 3.5.7 Adjust trip settings on adjustable breakers in accordance with Coordination Study only under the supervision of a representative of the company which completed the Coordination Study.
- 3.5.8 Representative of company shall provide letter to the Consultant stating that all trip devices have been set in accordance with the Coordination Study.
- 3.5.9 **Arc Flash Study and Labels**
- 3.5.9.1 Provide "Flash Hazard" report, based on IEEE 1584-2002 and IEEE 1584b-2011.
- 3.5.9.2 Provide "Flash Hazard" warning labels on each switchboard, panelboard, MCC and splitter.
- 3.5.9.3 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.
- 3.5.9.4 Labels to be applied only under the supervision of a representative of the company which completed the Arc Flash Study and Report.
- 3.5.10 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause "Materials and Equipment":
- Cutler Hammer  
Schneider  
Siemens

**END OF SECTION**

**PROJ. NAME:** OUR LADY OF FATIMA PHASE 2 RENEWAL  
**PROJ. NO :** 8391

**PANEL ID:** HPA  
**MAINS:** 225A  
**VOLTAGE:** 208/120V, 3Ø, 4W  
**MOUNTING:** FLUSH  
**NO OF CKT:** 72

**LOCATION:** SEE PLANS  
**FED FROM:** MAIN DISTRIBUTION BOARD 'DP1'  
**COMMENTS:**  
 NEW HEAT PUMP PANEL

CKT	BRKR	DESCRIPTION	WATTS	CKT	BRKR	DESCRIPTION	WATTS
1	15	HP-403 IN CR1-5	2350	2	20	HP-405 IN CR1-5	5155
3	2P			4			
5	20	HP-405 IN CR1-5	5155	6	3P	HP-405 IN CR1-5	5155
7				8	20		
9	3P			10			
11	20	HP-406 IN CR1-5	6323	12	3P	HP-405 IN CR1-5	5155
13				14	20		
15	3P			16			
17	20	HP-405 IN CR1-5	5155	18	3P	HP-405 IN CR1-5	5155
19				20	20		
21	3P	HP-401 IN CR1-7	1048	22		HP-405 IN CR1-5	6323
23	15			24	3P		
25	2P	HP-401 IN CR1-7	1048	26	20	HP-405 IN CR1-3	5155
27	15			28			
29	2P			30	3P		
31	20	HP-406 IN CR1-4	6323	32	20	HP-405 IN CR1-4	5155
33				34			
35	3P			36	3P		
37	20	HP-405 IN CR1-4	5155	38			
39				40			
41	3P			42			
43				44			
45				46			
47				48			
49				50			
51				52			
53				54			
55				56			
57				58			
59				60			
61	15	SPARE		62	15	SPARE	
63				64			
65	3P	SPARE		66	3P	SPARE	
67	20			68	20		
69				70			
71	3P			72	3P		

**PROJ. NAME:** OUR LADY OF FATIMA PHASE 2 RENEWAL  
**PROJ. NO :** 8391

**PANEL ID:** A  
**MAINS:** 225A  
**VOLTAGE:** 208/120V, 3Ø, 4W  
**MOUNTING:** FLUSH  
**NO OF CKT:** 72

**LOCATION:** CORRIDOR  
**FED FROM:** MAIN DISTRIBUTION BOARD 'DP1'  
**COMMENTS:**  
 NEW PANEL TO REPLACE EXISTING

CKT	BRKR	DESCRIPTION	WATTS	CKT	BRKR	DESCRIPTION	WATTS
1	20	RM 134, 136, 138 LTG		2	20	NORTH CORRIDOR LTG	
3	20	NORTH CLASSROOM LTG		4			
5				6			
7	20	EXISTING CIRCUIT		8	20	EXISTING CIRCUIT	
9	20	EXISTING CIRCUIT		10	20	EXISTING CIRCUIT	
11	20	EXISTING CIRCUIT		12	20	EXISTING CIRCUIT	
13	20	EXISTING CIRCUIT		14	20	EXISTING CIRCUIT	
15	20	EXISTING CIRCUIT		16	20	EXISTING CIRCUIT	
17	20	EXISTING CIRCUIT		18	20	EXISTING CIRCUIT	
19	20	EXISTING CIRCUIT		20	20	EXISTING CIRCUIT	
21	15	EXISTING CIRCUIT		22	15	EXISTING CIRCUIT	
23	15	EXISTING CIRCUIT		24	15	EXISTING CIRCUIT	
25	15	EXISTING CIRCUIT		26	15	EXISTING CIRCUIT	
27	15	EXISTING CIRCUIT		28	15	EXISTING CIRCUIT	
29	15	EXISTING CIRCUIT		30	15	EXISTING CIRCUIT	
31	15	EXISTING CIRCUIT		32	15	EXISTING CIRCUIT	
33	15	EXISTING CIRCUIT		34	15	EXISTING CIRCUIT	
35	15	EXISTING CIRCUIT		36	15	EXISTING CIRCUIT	
37	15	RM 146 FLUSH VALVES		38	15	EXISTING CIRCUIT	
39	15	EF-1		40	20	EXISTING CIRCUIT	
41	20 GFCI	RTU-101 REC		42	20	EXISTING CIRCUIT	
43	20	RM 144 REC		44	15	EXISTING CIRCUIT	
45	20	RM 146 HAND DRYER		46			
47	20	RM 146 HAND DRYER		48			
49	20	RM 148 HAND DRYER		50			
51	20	RM 148 HAND DRYER		52			
53				54			
55				56			
57				58			
59				60			
61				62			
63				64			
65	15	SPARE		66	15	SPARE	
67	15	SPARE		68	15	SPARE	
69	20	SPARE		70	20	SPARE	
71	20	SPARE		72	20	SPARE	



**PROJ. NAME:** OUR LADY OF FATIMA PHASE 2 RENEWAL  
**PROJ. NO :** 8391

**PANEL ID:** C  
**MAINS:** 225A  
**VOLTAGE:** 208/120V, 3Ø, 4W  
**MOUNTING:** SURFACE  
**NO OF CKT:** 72

**LOCATION:** MECHANICAL ROOM 150B  
**FED FROM:** MAIN DISTRIBUTION BOARD 'DP1'  
**COMMENTS:**  
 NEW PANEL TO REPLACE PANEL 'C', PANEL 'PL' AND  
 PANEL 'F'

CKT	BRKR	DESCRIPTION	WATTS	CKT	BRKR	DESCRIPTION	WATTS
1	20	ELEC/MECH ROOM LTG		2	20	EXISTING PANEL 'F' LOAD	
3	15	EXISTING PANEL 'F' LOAD		4	20	EXISTING PANEL 'F' LOAD	
5	15	EXISTING PANEL 'F' LOAD		6	15	EXISTING PANEL 'C' LOAD	
7	15	EXISTING PANEL 'F' LOAD		8	15	EXISTING PANEL 'C' LOAD	
9	15	EXISTING PANEL 'F' LOAD		10	15	EXISTING PANEL 'C' LOAD	
11	15	EXISTING PANEL 'F' LOAD		12	15	EXISTING PANEL 'C' LOAD	
13	15	EXISTING PANEL 'F' LOAD		14	15	EXISTING PANEL 'C' LOAD	
15	20	EXISTING PANEL 'C' LOAD		16	15	EXISTING PANEL 'C' LOAD	
17	20	EXISTING PANEL 'C' LOAD		18	15	EXISTING PANEL 'C' LOAD	
19	20	EXISTING PANEL 'C' LOAD		20	15	EXISTING PANEL 'C' LOAD	
21	20	EXISTING PANEL 'C' LOAD		22	15	EXISTING PANEL 'C' LOAD	
23	20	EXISTING PANEL 'C' LOAD		24	15	EXISTING PANEL 'C' LOAD	
25	20	EXISTING PANEL 'C' LOAD		26	15	EXISTING PANEL 'C' LOAD	
27	20	EXISTING PANEL 'C' LOAD		28	15	EXISTING PANEL 'C' LOAD	
29	20	EXISTING PANEL 'C' LOAD		30	15	EXISTING PANEL 'C' LOAD	
31	20	EXISTING PANEL 'C' LOAD		32	15	EXISTING PANEL 'C' LOAD	
33	20	EXISTING PANEL 'C' LOAD		34	15	EXISTING PANEL 'C' LOAD	
35	20	EXISTING PANEL 'C' LOAD		36			
37	20	EXISTING PANEL 'C' LOAD		38	3P		
39	20	EXISTING PANEL 'C' LOAD		40	50	EXISTING PANEL 'C' LOAD	
41	20	EXISTING PANEL 'C' LOAD		42	2P		
43	20	EXISTING PANEL 'C' LOAD		44	20	EXISTING PANEL 'PL' LOAD	
45	15	EXISTING PANEL 'PL' LOAD		46	20	EXISTING PANEL 'PL' LOAD	
47	15	EXISTING PANEL 'PL' LOAD		48	15	RM 152 DOOR OPERATOR	
49	15	VEST V05 FORCE FLOW		50	15	RM 152 HAND DRYER	
51	15	EF-2		52			
53				54			
55				56			
57				58			
59				60			
61				62			
63				64			
65	15	SPARE		66	15	SPARE	
67	15	SPARE		68	15	SPARE	
69	20	SPARE		70	20	SPARE	
71	20	SPARE		72	20	SPARE	

**PROJ. NAME:** OUR LADY OF FATIMA PHASE 2 RENEWAL  
**PROJ. NO :** 8391

**PANEL ID:** MA  
**MAINS:** 225A  
**VOLTAGE:** 208/120V, 3Ø, 4W  
**MOUNTING:** SURFACE  
**NO OF CKT:** 72

**LOCATION:** MECHANICAL ROOM 150  
**FED FROM:** MAIN DISTRIBUTION BOARD 'DP1'  
**COMMENTS:**  
 NEW PANEL

CKT	BRKR	DESCRIPTION	WATTS	CKT	BRKR	DESCRIPTION	WATTS
1	15	EXISTING PANEL 'F' LOAD	600	2	15	EXISTING PANEL 'F' LOAD	1080
3	15	EXISTING PANEL 'F' LOAD	600	4	15	EXISTING PANEL 'F' LOAD	1000
5	15	EXISTING PANEL 'F' LOAD	600	6	15	EXISTING PANEL 'F' LOAD	1000
7	15	EXISTING PANEL 'F' LOAD	1080	8	20 GFCI	METERING CABINET REC	300
9	20	EXISTING PANEL 'F' LOAD	1080	10	20	BAS HEADEND REC	1000
11	20	MECHANICAL ROOM REC	300	12	15	UH-420 RM 150B	600
13	40	CP-302B	10000	14	40	CP-302A	10000
15	16						
17	18			3P			
19	15	CP-304A	1419	20	15	CP-304B	1419
21	22						
23	24			3P			
25	15	CP-303A	1419	26	15	CP-303B	1419
27	28						
29	30			3P			
31	15	CP-305A	2675	32	15	CP-305B	2675
33	34						
35	36			3P			
37	15	CP-306	675	38	15	EF-5	675
39	15	FLUID COOLER REC	1000	40			
41				42			
43				44			
45				46			
47				48			
49				50			
51				52			
53				54			
55				56			
57				58			
59				60			
61				62	15	SPARE	
63				64			
65	15	SPARE		66	3P		
67	15	SPARE		68	20	SPARE	
69	20	SPARE		70			
71	20	SPARE		72	3P		

**PROJ. NAME:** OUR LADY OF FATIMA PHASE 2 RENEWAL  
**PROJ. NO :** 8391

**PANEL ID:** E  
**MAINS:** 225A  
**VOLTAGE:** 208/120V, 3Ø, 4W  
**MOUNTING:** SURFACE  
**NO OF CKT:** 66

**LOCATION:** STORAGE ROOM  
**FED FROM:** MAIN DISTRIBUTION BOARD 'DP1'  
**COMMENTS:**  
 PROVIDE NEW BREAKERS TO SUIT EXISTING  
 SIEMENS PANEL

CKT	BRKR	DESCRIPTION	WATTS	CKT	BRKR	DESCRIPTION	WATTS
1	15	EXISTING CIRCUIT		2	15	EXISTING CIRCUIT	
3	15	EXISTING CIRCUIT		4	15	EXISTING CIRCUIT	
5	15	EXISTING CIRCUIT		6	15	EXISTING CIRCUIT	
7	15	EXISTING CIRCUIT		8	15	EXISTING CIRCUIT	
9	15	EXISTING CIRCUIT		10	15	EXISTING CIRCUIT	
11	15	EXISTING CIRCUIT		12	15	EXISTING CIRCUIT	
13	15	EXISTING CIRCUIT		14	15	EXISTING CIRCUIT	
15	15	EXISTING CIRCUIT		16	15	EXISTING CIRCUIT	
17	15	EXISTING CIRCUIT		18	15	EXISTING CIRCUIT	
19	15	EXISTING CIRCUIT		20	15	EXISTING CIRCUIT	
21	15	EXISTING CIRCUIT		22	15	EXISTING CIRCUIT	
23	20	EXISTING CIRCUIT		24	20	EXISTING CIRCUIT	
25	15	EXISTING CIRCUIT		26	20	EXISTING CIRCUIT	
27	20	EXISTING CIRCUIT		28	15	EXISTING CIRCUIT	
29				30	20	EXISTING CIRCUIT	
31	3P			32	20	EXISTING CIRCUIT	
33	15	EXISTING CIRCUIT		34	15	EXISTING CIRCUIT	
35	15	EXISTING CIRCUIT		36	20	EXISTING CIRCUIT	
37	15	EXISTING CIRCUIT		38	20	EXISTING CIRCUIT	
39	15	EXISTING CIRCUIT		40	15	EXISTING CIRCUIT	
41	15	EXISTING CIRCUIT		42	15	EXISTING CIRCUIT	
43	15	EXISTING CIRCUIT		44	15	EXISTING CIRCUIT	
45	15	EXISTING CIRCUIT		46	15	EXISTING CIRCUIT	
47	15	EXISTING CIRCUIT		48	15	EXISTING CIRCUIT	
49	20	EXISTING CIRCUIT		50	15	EXISTING CIRCUIT	
51	20	EXISTING CIRCUIT		52	20	SOUTH WING LIGHTING	
53	20	RM 124,125 REC		54	15	TF-4	
55				56			
57				58			
59				60			
61				62			
63				64			
65				66			

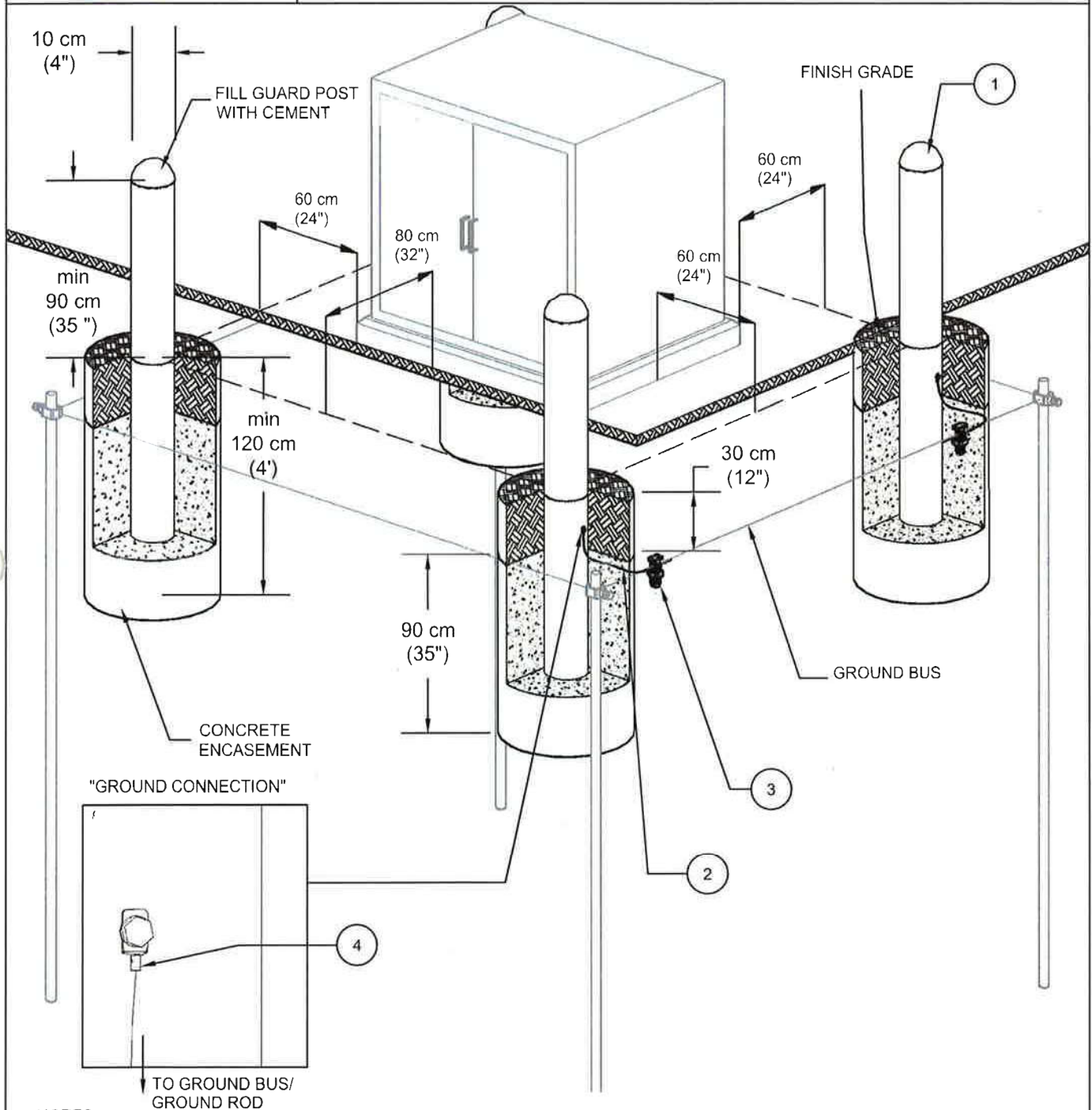
**PROJ. NAME:** OUR LADY OF FATIMA PHASE 2 RENEWAL  
**PROJ. NO :** 8391

**PANEL ID:** H  
**MAINS:** 225A  
**VOLTAGE:** 208/120V, 3Ø, 4W  
**MOUNTING:** SURFACE  
**NO OF CKT:** 66

**LOCATION:** STORAGE (ROOM 156)  
**FED FROM:** MAIN DISTRIBUTION BOARD 'DP1'  
**COMMENTS:**  
 PROVIDE NEW BREAKERS TO SUIT EXISTING  
 SIEMENS PANEL

CKT	BRKR	DESCRIPTION	WATTS	CKT	BRKR	DESCRIPTION	WATTS
1	15	EXISTING CIRCUIT		2	15	EXISTING CIRCUIT	
3	15	EXISTING CIRCUIT		4	15	EXISTING CIRCUIT	
5	15	EXISTING CIRCUIT		6	15	EXISTING CIRCUIT	
7	15	EXISTING CIRCUIT		8	20	EXISTING CIRCUIT	
9	15	EXISTING CIRCUIT		10	15	EXISTING CIRCUIT	
11	15	EXISTING CIRCUIT		12	15	EXISTING CIRCUIT	
13	15	EXISTING CIRCUIT		14	15	EXISTING CIRCUIT	
15	15	EXISTING CIRCUIT		16	15	EXISTING CIRCUIT	
17	15	EXISTING CIRCUIT		18	15	EXISTING CIRCUIT	
19	15	EXISTING CIRCUIT		20	15	EXISTING CIRCUIT	
21	40	EXISTING CIRCUIT		22	15	EXISTING CIRCUIT	
23				24	15	EXISTING CIRCUIT	
25	3P			26	15	EXISTING CIRCUIT	
27	15	EXISTING CIRCUIT		28	2P		
29	15	EXISTING CIRCUIT		30	15	EXISTING CIRCUIT	
31	15	EXISTING CIRCUIT		32	2P		
33	15	EXISTING CIRCUIT		34	15	EXISTING CIRCUIT	
35	15	EXISTING CIRCUIT		36	15	EXISTING CIRCUIT	
37	15	EXISTING CIRCUIT		38	15	EXISTING CIRCUIT	
39	20	SOUTH WEST WING LTG		40			
41				42			
43				44			
45				46			
47				48			
49				50			
51				52			
53				54			
55				56			
57				58			
59				60			
61				62			
63				64			
65				66			

Title: DETAIL FOR GUARD POST INSTALLATION AND GROUNDING



NOTES:

1. GUARD POST SHALL BE GALVANIZED STEEL OR PAINTED WITH RUST-RESISTANT PAINT. PLASTIC COVERS MAY BE INSTALLED.
2. DIMENSIONS EQUIPMENT GIVEN IN THIS FIGURE ARE TYPICAL. ACTUAL DIMENSIONS SHALL BE DETERMINED IN ACCORDANCE WITH THE SPECIFIC EQUIPMENT BEING INSTALLED.
3. EQUIPMENT IN HIGH-TRAFFIC AREA MIGHT REQUIRE ADDITIONAL GUARD POSTS ON THE PERIMETER.
4. GUARD POST LOCATIONS TO BE DETERMINED BASED ON THE DIRECTION OF POTENTIAL THREAT.
5. CARE SHOULD BE TAKEN TO ENSURE THAT THE GUARD POST DOES NOT HINDER THE OPERATION, MAINTENANCE, OR REPLACEMENT OF THE EQUIPMENT.
6. GUARD POST SHALL BE CONNECTED TO GROUND GRID (AS SHOWN) OR TO GROUND ROD AS SHOWN, OR WITH APPROVED CONNECTION.

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PART 3 - EXECUTION

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Appendix 'A' - C+B - Emergency Lighting Test Form

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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 **LED LUMINAIRES**
- 2.2.1 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.
- 2.2.2 **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.
- 2.2.3 **Luminaires designed with integrated custom LED's.** shall be as specified on drawings or approved equal meeting the following requirements:
- 2.2.3.1 Only products from manufacturers that have been in the lighting manufacturing business for minimum of 10 years will be considered.
- 2.2.3.2 Modularity, shall be designed to allow for replacement of; driver, LED's, without specialised tools and without removing luminaire from the ceiling.
- 2.2.3.3 Performance - LED luminaire with custom lamps must exceed LED lamp parameters specified below for efficacy and lumen maintenance by minimum 15%.
- 2.2.3.4 Lumen Maintenance - at least 70% of initial lumens for at least 50,000 hours.
- 2.2.3.5 Minimum luminous efficacy 50 lumens per watt (lm/W)



- 2.2.3.6 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.

### 2.3 EXIT SIGNS

- 2.3.1 Signs to be suitable for wall and/or ceiling mounting and be provided with diffusers on the underside for down lighting and directional arrows in the face as indicated on the Drawings.
- 2.3.2 Signs to be green pictograms, Meeting CSA22.2 No. 141-10 with directional pictograms and faces as shown on the drawings.
- 2.3.3 Provide an LED (light emitting diode) type light source, maximum 3 watts, 120/347 volt power supply.
- 2.3.4 Signs to meet CSA-C860-01 "Performance of Internally Lighted Exit Signs".
- 2.3.5 Provide suitable clear acrylic guards as indicated on the Drawings.
- 2.3.6 Signs to be self-powered for 2 hours constructed from extruded, one-piece aluminum painted white, suitable for wall and/or ceiling mounting. To be Lumacell LA-3-W-S.
- 2.3.7 Combination exit/emergency lighting units to have die cast or extruded aluminum housing suitable for wall and/or ceiling mounting. Provide integral and remote 4W MR16 LED lamps as shown on the drawings. Unit to be 12 volt, capable of producing 50 watts for 1/2 hour at 120 volt, rated in accordance with CSA Standard C22-2-141. To be Lumacell LAC-2-W-1250-2-LD7.
- 2.3.8 The following manufacturers will be considered as equal subject to the requirements of Clause "Material and Equipment":

AimLite  
Beghelli Luxnet  
Emergi-lite  
Hubbell  
Lithonia  
Lumacell  
Lumaid  
Stanpro  
Uniglo

### 2.4 EMERGENCY LIGHTING

- 2.4.1 Emergency lighting units are to be Lumacell RG12S-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 RG12S-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":

AimLite  
Beghelli Luxnet  
Emergi-lite  
Hubbell  
Lithonia  
Lumacell  
Lumaid  
Stanpro  
Uniglo

## 2.5 LUMINAIRE NOISE

2.5.1 All ballasted luminaires are to be manufactured to reduce noise below room ambient noise level.

2.5.2 Any luminaire or group of luminaires which can be heard above ambient noise are to be quietened or replaced at no additional cost to the Contract.

## 2.6 SPARE LUMINAIRES

2.6.1 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 an 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.

### 3.6 EXIT SIGNS

- 3.6.1 Locate exit signs as required to prevent obstruction from view. Mount on walls where possible.
- 3.6.2 Mount exit signs as required to prevent plumbing, structural supports, etc from obstructing view of exit sign. Provide pendant mounts as required for ceiling mounted signs.

**END OF SECTION**

# **A P P E N D I X “A”**

## **Emergency Lighting Test Form**



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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 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 **DT-200 Dual Technology Sensor**
- 40 kHz frequency ultrasonic transmission
  - Time delays: SmartSet (automatic), fixed (5, 10, 15, 20, or 30 minutes), walk-through, test-mode
  - Sensitivity adjustment: SmartSet (automatic) or reduced sensitivity (for PIR sensitivity); ultrasonic sensitivity is variable with trimpot
  - Built-in light level sensor (DT-200) – works from 2 to 200 foot candles
  - Low voltage, momentary switch input for manual operation
  - DT-I relay with N/O and N/C outputs; rated for 1 Amp at 24 VDC/VAC
  - 2000 sq ft of walking motion mounted at 10 ft; 1000 sq ft of desktop motion



**2.2.2.2 DT-300 Dual Technology Ceiling Sensor**

- 40 kHz frequency ultrasonic transmission
- Advanced Signal Processing automatically adjusts detection threshold
- User-adjustable DIP switch time delay and sensitivity settings
- Isolated relay allows sensor to interface with building control systems
- Omni-directional transmission (360° coverage)
- Temperature and humidity resistant receivers
- Digital DIP switch time delay (15 seconds to 30 minutes)




**2.2.2.3 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

**2.2.2.4 DSW-200 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
- 50% auto on, dual relay type

2.2.3 Unless otherwise indicated, provide the following models according to the symbol type:

Type	Symbol	Wattstopper Cat. No.	Mounting
1		DT-200	wall at ceiling
2		DT-300	ceiling
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.

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**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

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**2.3 ADDITIONAL SYSTEM COMPONENTS**

2.3.1 Provide auxiliary relays and other items as shown on the drawings:

**2.4 DIGITAL LIGHTING MANAGEMENT**

2.4.1 Provide a 100% digital lighting control system as shown on the drawings to meet space control requirements of MMA Supplementary Standard SB-10 and AHSRAE/IESNA 90.1-2013. 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.

2.4.2 Provide automatic shut-off of receptacles as shown on the drawings. Receptacles to be powered whenever spaces are occupied, regardless of overhead lighting.

2.4.3 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.

2.4.4 All components to be self-configuring, digitally addressable, capable of ladderless configuration and will not have dip switches or potentiometers.

2.4.5 Provide contact closure to BAS for occupancy status.

**2.4.6 Digital Room Controllers**

2.4.6.1 Housing to be plenum rated and complete with nipple to mount to standard junction box.

2.4.6.2 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.

2.4.6.3 Provide receptacle controllers for circuits as shown on the drawings.

2.4.6.4 WattStopper LMRC-210 (dimming).

**2.4.7 Digital Switches**

2.4.7.1 Low voltage momentary pushbutton switches to be in 2 or 5 button (with paddle) configuration, white and compatible with standard decorator wall plates. Buttons to be field replaceable without removing switch from wall.

2.4.7.2 Buttons to be field replaceable without removing switch from wall.

2.4.7.3 Switches to have two connection ports for digital network through-wiring.

2.4.7.4 WattStopper LMSW series. Refer to drawings for button configurations.

**2.4.8 Digital Occupancy Sensors**

2.4.8.1 Digital occupancy sensors to provide automatic switching for specified load connected to a room controller. Sensors shall be interchangeable without the need for rewiring.




2.4.8.2 Sensors to have two connection ports for digital lighting network.

2.4.8.3 Sensors to use dual technology (passive infrared and ultrasonic or microphonic) for occupancy detection. Sensors must be initially triggered by both detection technologies.

2.4.8.4 Digital occupancy sensors shall provide digital calibration for sensitivity (0-100%), time delay (1-30 minutes) and test mode.

2.4.8.5 Multiple occupancy sensors shall be able to be added to the digital lighting network without additional configuration.

2.4.8.6 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	 LV	LMDW-102-W	wall at switch height

**2.4.9 Digital Photosensors**

2.4.9.1 Digital photosensors to provide automatic switching or dimming daylight harvesting capabilities for specified load connected to a room controller. Photosensors shall be interchangeable without the need for rewiring.

2.4.9.2 Sensors to have one connection port for digital lighting network.

2.4.9.3 Sensors to have a operational range for wavelengths between 400nm and 700nm and less than 5% sensitivity for wavelengths outside of this range. Light level range shall be from 1-10,000 footcandles complete with a deadband between the ON and OFF setpoints that will prevent the lights from cycling after they turn off.

2.4.9.4 Adjustable head and a mounting bracket shall accommodate multiple mounting positions and building materials. The photosensor may be mounted on a ceiling tile, skylight light well or backbox.

2.4.9.5 Open loop digital photosensors to have an internal photodiode to measure light with a 60 degree cutoff to avoid unwanted light from the interior of the room.

2.4.9.6 WattStopper LMLS-500.

- 
- 2.4.10 **Isolated Relay Interface**
- 2.4.10.1 Provide Wattstopper LMRL-100 isolated relay interface to provide contact closure.
- 2.4.11 **Input Interface**
- 2.4.11.1 Provide Wattstopper LMIN-104 Input/Output interface to provide integration between third party devices.
- 2.4.12 **Handheld Configuration Tool**
- 2.4.12.1 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.
- 2.4.13 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.
- 2.4.14 The following manufacturers will be considered as equal, subject to the requirements of Clause "Material and Equipment":
- Acuity Brands Control  
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.

<b>Space</b>	<b>Work Plane Height</b>	<b>Illuminance</b>
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.
- 1.3.3 **Audio and Video Systems:** 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 16713 for cabling details.
- 2 Products
- 2.1 **MATERIALS**
- 2.1.1 Use materials specified herein or approved equal.
- 2.2 **COMMUNICATION WIRING HANGERS**
- 2.2.1 Provide communications system wiring hangers as indicated on the Drawings.
- 2.2.2 Hangers are to be suitable for supporting up to 80 4-pair UTP low voltage cables with 50 mm (2") diameter loop. Provide multiple hangers on single support bracket as shown on details. Erico No. CAT32.
- 2.2.3 Provide all required 10 mm (3/8") threaded hanger rods, bolts, wall anchors, beam clamps and fittings as indicated on the Drawings and as required.
- 2.2.4 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause "Materials and Equipment".
- Caddy  
B-Line

### 2.3 COMMUNICATION/SECURITY/ACCESS CONTROL SYSTEM CONDUIT

2.3.1 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".

2.3.2 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
<b>Max UTP</b>	2	3	6	7	14	17	20
<b>Max Coax</b>	2	4	6	9	17	26	38

2.3.3 Cables shall NOT be attached to pipe or conduit or ductwork, etc.

2.3.4 Conduit ends shall be provided with non-metallic bushings to provide a round edge, which will not abrade the cable jacket.

2.3.5 **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') of conduit, and more than two 90° bends or equivalent.

2.3.5.1 Stainless Steel faceplates specified in Section 16710 do not fit in all device boxes. Confirm compatibility with Data contractor prior to rough-in.

2.3.6 **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') of conduit, and more than two 90° bends or equivalent. All conduits to have pull strings from device wall boxes to cable tray.

2.3.7 PVC conduit is not allowed inside and will be removed at the contractor's expense.

## 3 Execution

### 3.1 COMMUNICATION WIRING HANGERS

3.1.1 Refer to floor plans and details and install communication system wiring hangers as indicated.

3.1.2 Coordinate location of all hangers with Division 15 and building structure to ensure no conflicts. Hangers are to be mounted within 400 mm (16") of a 45° or 90° change in cable routing and on 910 mm (36") spacing.

3.1.3 Provide minimum three hangers on each support rod or as shown on the Drawings.

### 3.2 COMMUNICATION/SECURITY/ACCESS CONTROL SYSTEM CONDUIT

3.2.1 Provide 20 mm (3/4") conduit except as noted, from each wall outlet to accessible ceiling space. **Ensure end of conduit is fully accessible for cabling installers.**

- 
- 3.2.2 Provide all conduits, outlet boxes and wiring for a complete system. Minimum size conduit to be 21 mm (3/4"), except where noted.
- 3.2.3 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.
- 3.2.4 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.
- 3.2.5 The inside radius of bends not to be less than: Six times the internal diameter of conduits 50mm (2") and smaller.
- 3.2.6 Install conduits and boxes as per TIA/EIA-569-A.
- 3.2.7 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.
- 3.2.8 Conduits shall be grounded minimum at one end.
- 3.2.9 Conduit fill capacity shall not exceed 35%.
- 3.2.10 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.
- 3.2.11 Pull wires must be provided in all conduits.

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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 Horizontal cabling for phones located in the school will be terminated on a dedicated patch panel in each LAN room.
- 2.1.4 Provide horizontal cabling for analog phone outlets as shown on the drawings. Terminate on 110 punch down 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 VOIP 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.

## 2.4 TELECOMMUNICATIONS GROUND BUSBAR

2.4.1 Provide telecommunications ground busbar in each equipment room as shown on the Drawings. Busbar to be predrilled 1/4" thick copper with fiberglass-reinforced unsaturated polyester stand-off insulators.

2.4.2 For equipment rooms with 1 - 4 racks, provide 2" x 12" busbar with 9 predrilled holes. Erico EGBA series, pattern CC or equal.

2.4.3 For equipment rooms with 4 - 10 racks or rooms with raised access flooring, provide 2" x 24" busbar with 38 predrilled holes. Erico TGBA series or equal.

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 cable 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 SCCDSB specifications.
- 3.2.1.2 **Horizontal 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 SCCDSB 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.
- 3.4.6 All test results will be verified by SCCDSB IT staff prior to invoicing.
- 3.4.7 The completed installation will be inspected by SCCDSB IT staff prior to invoicing.

#### 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).
- 3.5.4 All documentation will be verified by SCCDSB IT staff prior to invoicing.

**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 Provisions as hereinbefore written will form a part of the following Specifications and the Contractor will consult them in detail for instructions governing the work.
- 1.2 **DESCRIPTION OF SYSTEMS**
- 1.2.1 **Intercom System**
- 1.2.1.1 Provide new wiring, speakers and intercom stations as indicated on the drawings.
- 1.2.1.2 Extend existing intercom as indicated on the drawings.
- 1.2.1.3 **A copy of the PA/Intercom software must be turned over to the Owner complete with all passwords, etc., required to make programming modifications to the system. Proprietary programming software will not be acceptable.**
- 2 Products
- 2.1 **MATERIALS**
- 2.1.1 Use materials specified herein or approved equal.
- 2.1.2 Conceal all wiring above finished suspended ceilings, except where otherwise noted.
- 2.1.3 **Speaker Assemblies**
- 2.1.3.1 **Ceilings:** Provide AEG 86-7025L-11 speaker assembly, complete with white round baffle, 25/70 volt transformer and speaker. Unit to be installed in AEG E10 backbox in ceiling tiles.
- 2.1.3.2 **Mechanical Rooms:** Provide Fourjay Industries 205 Series 5 watt re-entrance horn with McBride MCSW-1 call switch assembly with rocker selection of Call or Privacy, on MCWP13SW stainless steel single gang wall plate with telephone handset.
- 2.1.4 The following manufacturers will be considered equal :
- Dukane MCS 350 TR Series  
Carehawk CH-1000 Series  
Telecor SL
- 3 Execution
- 3.1 **INTERCOM SYSTEM**
- 3.1.1 Provide a complete functioning intercom system as specified and as indicated on the Drawings.
- 3.1.2 Provide all conduits, outlet and wiring for a complete system. All cable to be CMP rated. CMR cable will not be permitted.

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- 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 complete, test each station and provide a comprehensive room-by-room report to the Consultant.
- 3.1.4.3 Allow for a minimum of two hour's instruction of operation on two different occasions. (Total of four hours). First training session to be completed during the week before School starts, at a time suitable to the Users.
- 3.1.4.4 In addition to the above, provide a qualified person familiar with the operation of the system to assist the School Administration in the operation of the system between 0800 hours and 1000 hours on the first day of school.

**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 electrically supervised, coded, zoned fire alarm system by Edwards as described herein and as shown on plans. Fire alarm devices are to be in accordance with the Ontario Building Code and associated standards.
- 1.2.2 **Valve Supervisory System**
- 1.2.2.1 In conjunction with the fire alarm system, supply and install all equipment and accessories for an electrically supervised valve system.
- 1.2.2.2 The system is to provide individual supervision of sprinkler and fire standpipe supervised valves and flow switches indicated.
- 2 Products
- 2.1 **FIRE ALARM CONTROL PANEL**
- 2.1.1 Existing Fire Alarm Control Panel is Edwards QuickStart.
- 2.1.2 Consult with fire alarm manufacturer to determine accessories and wiring diagrams required to extend the existing fire alarm system. Extras will not be granted for failure to consult with fire alarm manufacturer.
- 2.2 **ADDRESSABLE DEVICES**
- 2.2.1 Provide suitable wire guards for all devices where indicated on the drawings.
- 2.2.2 **Manual Pull Stations:** Manual single action break-glass addressable pull stations to be Edwards SIGA-270. Provide flush box for all new installations. Provide auxiliary contacts as required for release of magnetic locks where noted on the drawings.
- 2.2.2.1 Provide STI Series Stopper II UL/ULC pull station cover with integral local alarm where indicated on the drawings. To be Edwards STI-1100.
- 2.2.3 **Photoelectric Smoke Detectors:** Addressable photoelectric smoke detectors to be Edwards SIGA-PS. Provide SIGA-SB standard sensor base, SIGA-RB sensor base with addressable supervised relay driver, or SIGA-AB4G audible base as indicated on the drawings.
- 2.2.4 **Automatic Heat Detectors:** Addressable fixed temperature/rate-of-rise sensing automatic heat detectors to be Edwards SIGA-HRD or SIGA-HFS with standard sensor base.

- 2.2.5 **Multi-Sensor Detectors:** Addressable combination photoelectric smoke detector and fixed temperature/rate-of-rise sensing automatic heat detector in one housing. To be Edwards SIGA-PHS. Provide SIGA-SB standard sensor base, SIGA-RB sensor base with addressable supervised relay driver, or SIGA-AB4G audible base as indicated on the drawings.
- 2.2.6 **Addressable Monitor Module:** For monitoring valves, flow switches, and conventional devices, Edwards SIGA-UM. Monitor modules shall be capable of powering 2-wire smoke detectors.
- 2.2.7 **Addressable Control Module:** Provide control relays to allow for various addressable control functions, Edwards SIGA-CR. Relays shall be rated for 0.5A at 120VAC. Relay to change to open state upon loss of communication.
- 2.2.8 **Duct Detectors:** Duct detectors are to be Edwards SIGA addressable smoke detectors. Provide NEMA 4X weatherproof duct housing enclosure with heaters where exposed to the weather.
- 2.2.8.1 For ducts with air velocity range of 30 to 1220 m/min (100 to 4000 ft/min), provide a Edwards SIGA-SD duct detector with sampling tube. Size of tube to be coordinated on site.
- 2.2.8.2 Provide ceiling-mounted remote indicators for each detector located within a ceiling space.
- 2.2.9 **Zone Isolation Modules:** Provide isolator at zone separations, fire separations and where required by the manufacturer. Alternately provide SIGA-IB isolator bases.
- 2.2.10 **Power Isolation Modules:** Provide 24VDC power isolator at zone separations, fire separations and where required by the manufacturer.
- 2.3 **NOTIFICATION APPLIANCES**
- 2.3.1 Provide suitable wire guards for all devices where indicated on the drawings.
- 2.3.2 **Horn:** Wall mounted horn devices are to have red housing with white "FIRE" lettering. Edwards G1RF-HD.
- 2.3.3 **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.
- 2.3.4 **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.
- 2.3.5 **Strobes (Wall Mounted):** Wall mounted 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 GRF-VM.
- 2.3.6 **Strobes (Ceiling Mounted):** Ceiling mounted 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-VM.

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- 2.3.7 Provide red adapter skirt for surface mounted devices on walls.
- 2.3.8 Provide tile bridge for all devices mounted in acoustic ceiling tile ceilings.
- 2.3.9 Provide wire guard with mounting plate where indicated on the drawings.
- 2.4 **PASSIVE GRAPHIC ANNUNCIATOR**
- 2.4.1 Provide 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.
- 2.4.2 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.
- 2.4.3 In partially sprinklered buildings, identify areas that are sprinklered utilizing hatching.
- 2.4.4 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.
- 2.4.5 Floor plans to be shown in 'track up' orientation based upon location of passive graphic.
- 2.5 **ANCILLARY DEVICES**
- 2.5.1 **Electromagnetic Door Holders:** Provide electromagnetic door holders, flush mounted, Edwards 1504-AQN5 or 1505-AQN5 as required. Confirm voltage prior to installation.
- 2.6 **WIRING**
- 2.6.1 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.
- 2.6.2 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%.
- 2.6.3 Conductors in multi-conductor cables to have allowable temperature rating of at least 105°C (200°F).
- 2.6.4 All conductors to be as per Ontario Electrical Safety Code and installed in metallic raceway.
- 2.6.5 Install conductors entirely independent of all other wiring and do not enter fixture, raceway, box or enclosure occupied by other wiring.

2.6.6 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.

2.6.7 All wiring must be clear of shorts, open and grounds on completion of work.

## 2.7 MANUFACTURER

2.7.1 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 on 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 Provide addressable loops as indicated. All addressable wiring to be Data Communications Link Style A (DCLA). Provide line isolation devices at every circuit/zone change and every fire separation crossing, per CAN/ULC-S524 which automatically opens circuit when line voltage drops to protect the rest of the loops on either side.

3.1.2.6 Addressable loops must have at least 30% spare capacity for addition of future devices. Do not exceed 140 devices total on any addressable loop.

3.1.2.7 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.

3.1.2.8 The extended circuit wiring to each alarm receiving circuit or signal circuit is to be individually supervised with no common wiring.

3.1.2.9 Install all wiring in EMT metal conduit above ceilings, and surface in mechanical spaces, and in maintenance/storage spaces with exposed ceilings.

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- 3.1.3      **Control Panels, Transponders and Annunciators**
- 3.1.3.1    Install the main control panel and annunciators as shown on the Drawings.
- 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.
- 3.1.11     **Ancillary Devices**
- 3.1.11.1   Provide independent addressable control modules for each ancillary device shutdown.

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- 3.1.11.2 Verify operating voltage of door hold open devices and magnetic locks supplied by door hardware contractor for tie into new system. Provide necessary transformation or relays.
  - 3.1.11.3 Unless specified otherwise, power door hold-open devices from nearest unswitched lighting circuit.
  - 3.1.11.4 Shutdown of fans to occur at starter separate from building automation controls. Where single point connections are provided to mechanical equipment, connect to fire alarm shutdown contact on mechanical equipment control panel.
  - 3.1.11.5 Door hold open devices and latch retraction hardware to be installed in accordance with Ontario Building Code clause 3.1.8.12.
  - 3.1.11.6 Magnetic locks to be installed in accordance with Ontario Building Code clause 3.4.6.15(4).

## 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.

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- 3.2.7 Test all voice communication systems throughout building. Adjust speaker taps as required to provide a minimum common intelligibility scale (CIS) score of 0.70. Evaluate each acoustically isolated space separately. Provide appropriate reports for review by Consultant. Reports to include room name and number, speaker tap wattage, SPL and CIS at no less than 2 locations per room.
- 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 **ANCILLARY DEVICE OPERATION**

3.4.1.1 All door hardware connected to fire alarm are to release upon general alarm.

3.4.1.2 Outputs to building automation system and lighting control systems to activate upon general alarm.

3.4.1.3 Connect fire alarm panel to ULC remote monitoring station. Coordinate with Owner.

3.4.1.4 Outputs to shutdown air handling equipment to activate only upon activation of any duct detector. General alarm is not to shut down air handling equipment.

#### 3.5 **INSPECTION COSTS**

3.5.1 Include all costs involved with this inspection in the total Bid Price.

#### 3.6 **TESTING**

3.6.1 Tests of the complete system in the presence of the Owner and the Consultant are to include:

3.6.1.1 Spot check of devices to ensure proper connections and supervision.

3.6.1.2 Operation of an alarm initiating device on each detection circuit is to verify the required operation of alarm devices, annunciators, etc.

3.6.1.3 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.

3.6.1.4 Live smoke or open flame are not to be used for testing.



- 3.6.1.5 Test each area in stages to match the Work Schedule.
- 3.6.1.6 Demonstrate to Consultant and Owner the operation of ancillary functions (ie maglock and door hardware release, elevator recall, etc).
- 3.6.2 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.
- 3.6.3 **Integrated Systems Testing**
- 3.6.3.1 Provide Integrated Systems Testing as indicated in CAN/ULC-S1001-11 "Integrated Systems Testing of Fire Protection And Life Safety Systems.
- 3.6.3.2 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.
- 3.6.3.3 Contractor to provide to consultant for approval, all proposed testing procedures and proposed reports prior to commencing test.
- 3.6.3.4 Provide completed reports upon completion of fire alarm verification and submission of verification reports and certificate.
- 3.7 **TRAINING**
- 3.7.1 The Contractor shall provide 2 hours training for the complete operation of fire alarm system.
- 3.8 **SPARE PARTS**
- 3.8.1 Provide spare fire alarm system parts, including programming and verification, as follows (minimum of 2):
- |                              |   |                            |
|------------------------------|---|----------------------------|
| Automatic Initiation Devices | : | 10% of each type installed |
| Manual Pull Stations         | : | 5% of units installed      |
| Signal Appliances            | : | 5% of each type installed  |
| Monitor Modules              | : | 10                         |
| Control Modules              | : | 10                         |
| Duct Detector Housing        | : | 2                          |
- 3.8.2 Turn spare parts 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**

INDEX - SECTION 16820

PART 1 - GENERAL

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General Provisions .....	1.1

PART 2 - PRODUCTS

Electric Hand Dryers .....	2.2
Materials .....	2.1

PART 3 - EXECUTION

Electric Hand Dryers .....	3.1
Testing and Cleaning .....	3.2

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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. 1/8 hp, 4800 RPM adjustable. Air velocity: 7300 LFM.
- 2.2.4 Heater: NiChrome resistance coil to provide an air temperature of 49°C (120°F) measured at average hand position of 102 mm (4") below air outlet.
- 2.2.5 Sound level not to exceed 67 dB.
- 2.2.6 The following manufacturers will be considered as equal subject to the requirements of Clause "Material and Equipment":
- American Dryer Advantage AD Series
- 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):
- |                       |               |
|-----------------------|---------------|
| Men's Washroom        | 1090 mm (43") |
| Women's Washroom      | 1041 mm (41") |
| Kindergarten Washroom | 838 mm (33")  |
| Barrier Free Washroom | 889 mm (35")  |
- 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**

INDEX - SECTION 16920PART 1 - GENERAL

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PART 2 - PRODUCTS

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Protective Functions .....	2.6
Variable Frequency Drives .....	2.1
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PART 3 - EXECUTION

Installation .....	3.1
Owner's Staff Training .....	3.3
Startup .....	3.2

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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 SYSTEM**
- 1.2.1 Provide and install new variable frequency drives in separately mounted enclosures as shown on the Drawings.
- 1.2.2 Variable Frequency Drives (VFD) shall be suitable for use on variable torque pump and fan applications to control the speed of standard NEMA Design B induction motors.
- 1.2.3 The VFD is to be highly reliable and designed to provide at least 250,000 hours mean time before failure (MTBF) when the specified preventative maintenance is performed.
- 1.2.4 **Extended Warranty**
- 1.2.4.1 Each variable frequency drive is to be covered by a one year extended warranty by the manufacturer direct to the Owner. The extended warranty terms and conditions are to be identical to the one year Contract warranty, and the extended warranty period is to commence the day the Contract warranty expires.
- 1.2.4.2 Include a copy of the extended VFD warranty in each Operation and Maintenance Manual, and, prior to completion of the work, submit a copy of the warranty to the Owner.
- 2 Products
- 2.1 **VARIABLE FREQUENCY DRIVES**
- 2.1.1 The VFD to be a pulse width modulated (PWM) AC to AC converter utilizing the latest isolated gate bipolar transistor (IGBT) technology.
- 2.1.2 All VFDs regardless of hp rating are to have the same keypads, and be interchangeable regardless of hp rating.
- 2.2 **VFD RATINGS**
- 2.2.1 Each VFD is to be rated to operate from single phase 120V, 3 phase power at 208V  $\pm 10\%$  or 600V  $\pm 10\%$  as indicated on the Drawings. The VFD is to be of a robust construction utilizing premium rated power devices and shall operate continuously without failure when connected to utilization voltage. The VFD is to employ a full wave rectifier to prevent input line notching and operate at a fundamental input power factor of 0.95 at all speeds and loads. The VFD efficiency is to be 97% or better at full speed and load.
- 2.2.2 For drives serving 5hp and smaller motors, DC link choke may be provided to reduce input current harmonic content.



- 
- 2.2.3 Output voltage and current ratings to match the adjustable frequency operating requirements of standard 3 ph, 60 Hz, NEMA design B motors. The overload current capacity for variable torque overload capacity is to be 110% of rated current for one minute out of 10 minutes and 150% for two seconds out of 15 seconds with an instantaneous overcurrent trip at 350% or higher. Output frequency to be adjustable between 0 and 60 Hz.
- 2.2.4 The VFD is to provide full torque at any frequency from 10 Hz to base speed.
- 2.2.5 VFDs that resort to higher switching frequencies to reduce motor noise are to be sized to provide 100% motor output power at the highest available output switching frequency.
- 2.2.6 VFDs with switching frequencies that produce singing and whining motor noises are not acceptable.
- 2.2.7 The VFD is to be furnished in a NEMA 1 enclosure with sprinkler shield rated for operation at ambient temperatures between 0° and 40°C to suit site conditions. The VFD is to be protected from vibration per IEC 68-2-6.

## 2.3 FEATURES

- 2.3.1 The drive is to be designed to operate on an AC line which may contain line notching and up to 10% harmonic distortion.
- 2.3.2 The drive is to be designed to shut down with no component failure in the event of an output phase to phase to ground short circuit and provide annunciation of the fault condition.
- 2.3.3 The drive is to be capable of determining the speed and direction of a spinning motor and adjusting its output to “pick-up” the motor at the rotating speed. The flying start feature is to be operable with, or without, encoder feedback.
- 2.3.4 The drive is to be capable of control logic ride through in the event of power outages up to two seconds in duration.
- 2.3.5 In the event of loss of the 4 mA to 20 mA reference signal, the drive is to be User programmable to the following:
- Fault and stop.
  - Alarm and maintain last reference (within 10%).
  - Alarm and go to preset speed.
  - Alarm and go to minimum speed.
  - Alarm and go to maximum speed.

## 2.4 CONTROL FUNCTIONS AND ADJUSTMENTS

- 2.4.1 Startup data entries to include motor nameplate power, speed, voltage, frequency and current.

- 2.4.2 Provide a selection of two preprogrammed application macro parameter sets, PFC and HAND/AUTO, with preprogrammed parameters to minimize setup time during commissioning. Additionally two User macros are to be available, User 1 and User 2, for saving custom application parameters. The Pump and Fan Control (PFC) macro, when selected, is to control one pump or fan with the VFD and automatically turn ON or OFF, as demanded by the process.
- 2.4.3 START/STOP control functions are to include 2 or 3 wire START/STOP, COAST/RAMP STOP selections, optional dynamic braking. An automatic reset function is to execute up to five attempts to restart after individually selected overcurrent, overvoltage, undervoltage and signal loss fault conditions. The automatic reset trial and delay times are to be individually adjustable.
- 2.4.4 Accel/Decel control functions is to include two sets of ramp time adjustments with linear and S-curve ramp selections.
- 2.4.5 Speed control functions to include:
- 2.4.5.1 Adjustable min/max speed (frequency limits in scalar mode).
- 2.4.5.2 Selection of up to three preset speed settings for external speed control.
- 2.4.5.3 Two sets of critical speed lockout adjustments (skip frequencies).
- 2.4.5.4 A built-in PID controller to control a process variable such as pressure, flow or fluid level.
- 2.4.5.5 Two analog inputs shall be programmable to form a reference by addition, subtraction, multiplication, minimum selection or maximum selection.
- 2.4.6 The following safety inputs shall be pre-programmed into all drives serving air handling equipment. Provide jumpers where safety interlocks are not used. Upon opening of any contacts, drive to immediately stop load regardless of building automation control or keypad operations. Drive to automatically restart upon contact closure without manual reset.
- 2.4.6.1 Equipment driven shutdown: shutdown on freezestat and firestat.
- 2.4.6.2 Fire alarm shutdown: shutdown on fire alarm.
- 2.5 **OPERATOR CONTROL PANEL**
- 2.5.1 Each VFD is to be equipped with a front-mounted plug-in operator control panel consisting of a minimum two lines by 16 character backlit alphanumeric display and a keypad with keys for Run/Stop, Local/Remote, Increase/Decrease, menu navigation and parameter select/save. All parameter names, fault messages, warnings and other information are to be displayed in complete words or standard abbreviations to allow the user to understand what is being displayed without the use of a manual or cross reference table. In the "Local" mode all control is to be from the keypad. In the "Remote" mode all speed and Run/Stop control is to be from either of two remote locations (EXT1/EXT2) as selected by the position of the external HAND/AUTO switch or contact:

- 2.5.1.1 “HAND” position (EXT1) is to select speed reference from an external speed potentiometer.
- 2.5.1.2 “AUTO” position (EXT2) is to select speed reference from an external location.
- 2.5.2 During normal operation, one line of the control panel is to display the speed reference, and run/stop forward/reverse and local/remote status. The remaining line of the display is to be programmable to display the values of other operating parameters. The parameter is to include the following:
- Speed in percent, or Hz
  - Output frequency, voltage current and torque
  - Input voltage, power and kilowatt hours
  - Status of discrete inputs and outputs
  - Values of analog input and output signals
  - Error signals
- 2.5.3 Control interface inputs and outputs are to include:
- 2.5.3.1 Three analog inputs, one 0 - 10 V and two are 4 - 20 mA, all independently programmable with at least 10 input function selections. Analog input signal processing functions shall include scaling adjustments, adjustable filtering and signal inversion. Upon loss of input signal, the drive shall be programmable to stop and display a fault message, run at a preset speed and display a warning message or display a warning message and run according to the last reference received.
- 2.5.3.2 Three discrete inputs, all independently programmable with at least 10 input function selections. Inputs shall be designed for “dry contact” inputs used with either an internal or external 24 VDC source.
- 2.5.3.3 Two analog outputs providing 4 to 20 mA signals. Outputs shall be independently programmable to provide signals proportional to at least 12 output function selections including output speed, frequency, voltage, current and power.
- 2.5.3.4 Three form C relay contact outputs, all independently programmable with at least 15 output function selections. Relay contacts to be rated to switch 5 A at 24 VDC or 120 VAC. Function selections to include indications that the drive is ready, running, reversed and at set speed. General, specific warning and fault indications are to be available. Adjustable supervision limit indications are to be available to indicate programmed values of operating speed, speed reference current.
- 2.5.3.5 Provide BacNet card to suit VFD. At a minimum, the following control / monitor points shall be available:
- |                      |                          |
|----------------------|--------------------------|
| Speed and Direction  | External Reference 2     |
| Speed                | Control Location         |
| Output Frequency     | Run Time (hours)         |
| Current              | kWh Counter (kWh)        |
| Torque               | Appl Blk Output          |
| Power                | DI 1-3 Status            |
| DC Bus Voltage       | DI 4-6 Status            |
| Output Voltage       | AI 1                     |
| Drive Temperature    | External Safety Override |
| External Reference 1 |                          |

---

**2.6 PROTECTIVE FUNCTIONS**

- 2.6.1 For each programmed warning and fault protection function, the keypad is to display a message in complete words or standard abbreviations. The five most recent fault messages and times is to be stored in the drive's fault history.
- 2.6.2 The VFD is to include MOVs for phase to phase and phase to ground line voltage transient protection.
- 2.6.3 Output short circuit and ground fault protection rated for 22,000 amps are to be provided per UL508C without relying on line fuses. Motor phase loss protection is to be provided.
- 2.6.4 The VFD is to provide electronic motor overload protection qualified per UL508C.
- 2.6.5 Protection is to be provided for AC line or DC bus overvoltage at 130% of max rated or undervoltage at 65% of min rated and input phase loss.
- 2.6.6 A power loss ride through feature will allow the drive to remain fully operational after losing power as long as kinetic energy can be recovered from the rotating mass of the motor and load.
- 2.6.7 Stall protection is to be programmable to provide a warning or stop the VFD after the motor has operated above a programmable torque level for a programmed time limit.
- 2.6.8 Underload protection shall be programmable to provide a warning or stop the VFD after the motor has operated below a selected underload curve for a programmed time limit.
- 2.6.9 Overtemperature protection shall provide a warning if the power module temperature is less than 5°C below the overtemperature trip level.
- 2.6.10 Input terminal shall be provided for connecting a motor thermister (PTC type) to the drive's protective monitoring circuitry. An input shall also be programmable to monitor an external relay or switch contact.
- 2.6.11 The drive protection functions to monitor and annunciate the following conditions as a minimum:
- Overcurrent protection.
  - Short circuit protection.
  - Undervoltage protection.
  - Overvoltage protection.
  - Overtemperature protection.
  - Ground fault protection.
- 2.6.12 The drive will execute, on initial power-up, a self-diagnostic check. The integral programming to provide first fault indication of drive protection functions. Fault indication to be retained if input power is lost. The following faults to be displayed on the local programming panel:

- 
- Overcurrent.
  - Short Circuit/Ground Fault.
  - Undervoltage.
  - Overvoltage.
  - Overtemperature.
  - Power Supply Fault.
  - Motor stalled.
  - Fault codes to provide direction as to board level and input/output level to aid in troubleshooting.

2.6.13 Provide Human Interface Module (HIM) complete with start, stop, speed adjuster and display.

2.6.14 The following manufacturers and service/startup and commissioning companies of the above equipment will be considered as equal subject to requirements of Clause "Material and Equipment":

ABB  
Allen-Bradley  
DanFos

3 Execution

### 3.1 **INSTALLATION**

3.1.1 The VFD manufacturer is to provide adequate drawings and instruction material to facilitate installation of the VFD. Contractor to follow manufacturer's installation instructions.

3.1.2 All feeders between VFDs and motors are to be rated 1000V. See Section 16100.

### 3.2 **STARTUP**

3.2.1 Certified factory startup is to be provided for each drive by a factory authorized service centre. A certified startup form is to be filled out for each VFD with a copy provided to the Owner, a copy kept on file at the manufacturers and copies inserted in Maintenance and Operating Manuals.

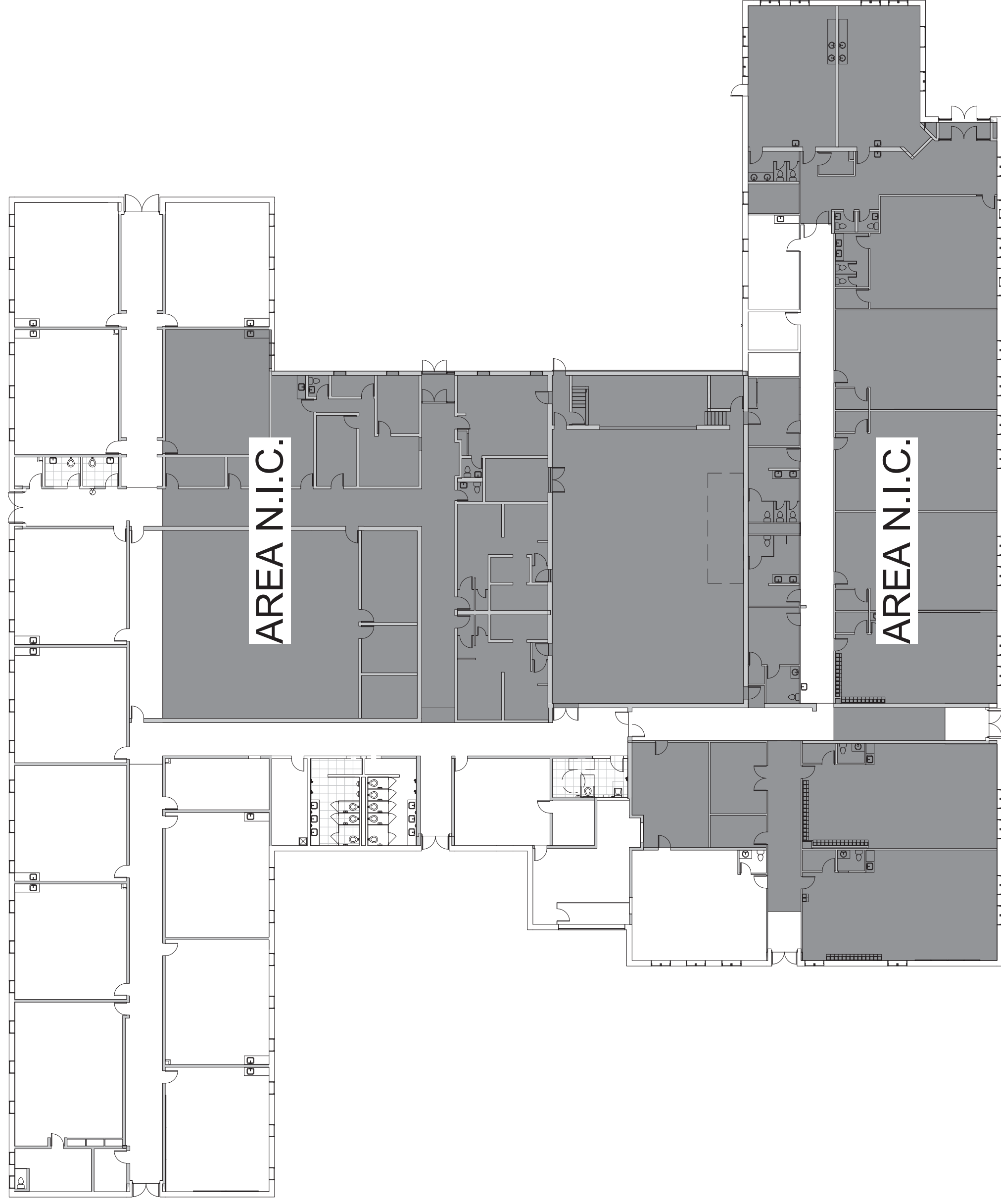
### 3.3 **OWNER'S STAFF TRAINING**

3.3.1 Include in Base Bid for manufacturer's factory trained representative to spend four hours on site for training Owner's staff on the operation, maintenance and startup of the units. Notify Consultant seven days in advance of scheduled training.

**END OF SECTION**

# OUR LADY OF FATIMA SCHOOL RENEWAL - PHASE II

545 BALDOON ROAD, CHATHAM ON N7L 4T8



1  
A000  
KEY PLAN  
1 : 250

Item	Ontario's 2006 Building Code Data Matrix Part 3 or 9	OBC Reference
1	Project Description: <input type="checkbox"/> New <input type="checkbox"/> Alteration <input type="checkbox"/> Change of Use Part 11: 1.1.1 to 1.1.4 Part 9: 1.1.2 [A]	1.1.2 [A] & 9.10.1.3 9.10.2
2	Major Occupancy: 3.1.2.1(D)	3.1.2.1(D)
3	Building Area (m <sup>2</sup> ): Existing 387 m <sup>2</sup> New 53 m <sup>2</sup> Total 3924 m <sup>2</sup> 1.4.1.2 [A]	1.4.1.2 [A]
4	Gross Area: Existing 387 m <sup>2</sup> New 53 m <sup>2</sup> Total 3924 m <sup>2</sup> 1.4.1.2 [A]	1.4.1.2 [A]
5	Number of Storeys: Above grade 1 Below grade 0 1.4.1.2 [A] & 9.10.4	1.4.1.2 [A] & 9.10.4
6	Number of Streets/Fire Fighter Access: 1 STREET (EXISTING) 3.2.2.10.4 & 3.2.5	3.2.2.10.4 & 3.2.5
7	Building Classification: 3.2.2.26. Group A, Division 2, up to 2 Storeys, Increased Area, Sprinklered 3.2.2.20-43	3.2.2.20-43
8	Sprinkler System Proposed: <input type="checkbox"/> entire building <input type="checkbox"/> selected compartments <input type="checkbox"/> selected floor areas <input type="checkbox"/> basement <input type="checkbox"/> in lieu of roof rating <input type="checkbox"/> not required 3.2.2.20-43	3.2.2.20-43
9	Staircase required: <input type="checkbox"/> Yes <input type="checkbox"/> No 3.2.9	N/A
10	Fire Alarm required: <input type="checkbox"/> Yes <input type="checkbox"/> No 3.2.4	9.10.18
11	Water Service/Supply is Adequate: <input type="checkbox"/> Yes <input type="checkbox"/> No 3.2.5.7	N/A
12	High Building: <input type="checkbox"/> Yes <input type="checkbox"/> No 3.2.6	N/A
13	Construction Restrictions: <input type="checkbox"/> Combustible permitted <input type="checkbox"/> Combustible required <input type="checkbox"/> Non-combustible 3.2.2.20-43	3.2.2.20-43
14	Annual Construction: 3.2.1.1(E)(4)(3) 9.10.4.1	9.10.4.1
15	Occupant load based on: <input type="checkbox"/> in-person <input type="checkbox"/> design of building 420 Persons 3.1.17	9.9.1.3
16	Barriers-Free Design: <input type="checkbox"/> Yes <input type="checkbox"/> No (Explain) 9.5.2	9.5.2
17	Hazardous Substances: <input type="checkbox"/> Yes <input type="checkbox"/> No 3.3.1.2 & 3.3.1.19	3.3.1.2 & 3.3.1.19

**Firm Name:** Wilson Diaz Architects Inc.  
**Certificate of Practice Number:** 3803  
280 Queens Ave, Suite 10  
London, ON N6H 1X3  
416-439-3362  
www.wilsondiaz.ca

**Name of Project:** Our Lady of Fatima - Chatham, ON  
SCDSB

**Location:** 545 Baldoon Rd, Chatham, ON N7M 5J7

The architect noted above has exercised control with respect to design services. The architect's seal number is the architect's BCDN.

Ontario Building Code Data Matrix - Part 11 - Renovation of Existing Building	OBC Reference
11.1 Existing Building classification: Describe Existing Use: Group A-2 Construction Index: 4 Hazard Index: 6 <input type="checkbox"/> Not Applicable (no change of major occupancy)	11.2.1 11.2.1.A 11.2.1.B 10 N
11.2 Alteration to Existing Building is: Basic Renovation <input type="checkbox"/> Extensive Renovation <input type="checkbox"/>	11.3.3.1 11.3.3.2
11.3 Reduction in Performance Level: Structural: By increase in occupant load: <input type="checkbox"/> No <input type="checkbox"/> Yes (explain) By change of major occupancy: <input type="checkbox"/> No <input type="checkbox"/> Yes (explain) Swaps system: <input type="checkbox"/> No <input type="checkbox"/> Yes (explain)	11.4.2 11.4.2.1 11.4.2.2 11.4.2.3 11.4.2.4 11.4.2.5
11.4 Compensating Construction: Structural: Increase in occupant load: <input type="checkbox"/> No <input type="checkbox"/> Yes (explain) Change of major occupancy: <input type="checkbox"/> No <input type="checkbox"/> Yes (explain) Rumblings: <input type="checkbox"/> No <input type="checkbox"/> Yes (explain) Swaps System: <input type="checkbox"/> No <input type="checkbox"/> Yes (explain)	11.4.3 11.4.3.2 11.4.3.3 11.4.3.4 11.4.3.5 11.4.3.6
11.5 Compliance Alternative Proposed: <input type="checkbox"/> No <input type="checkbox"/> Yes (give number(s))	11.5.1
11.6 Alternative Measures Proposed: <input type="checkbox"/> No <input type="checkbox"/> Yes (explain)	11.5.2

**WASHROOM COUNT**  
TOTAL NUMBER OF EXIST. W.C.: 40  
MEN: 26  
WOMEN: 14  
TOTAL: 40

**NUMBER OF REQUIRED W.C.:**  
MEN: 26  
WOMEN: 10  
TOTAL: 36

**ARCHITECT**  
WILSON DIAZ ARCHITECT INCORPORATED  
280 QUEENS AVE, SUITE 10  
LONDON ONTARIO N6B 1X3  
T: (519) 439-0611  
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**MECHANICAL & ELECTRICAL**  
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LONDON ONTARIO N6B 3P4  
T: (519) 672-8310

Sheet Number	Sheet Name
ARCHITECTURAL	
A000	COVER PAGE
A010	LIFE SAFETY PLAN
A050	GENERAL NOTES
AD100	DEMOLITION PLAN
AD200	REFLECTED CEIL DEMO PLAN
AD400	DEMOLITION SECTIONS
A100	CONSTRUCTION FLOOR PLAN
A150	ENLARGED FLOOR PLANS
A200	REFLECTED CEILING PLAN
A175	ROOF PLAN
A300	EXTERIOR ELEVATIONS
A301	EXTERIOR ELEVATIONS
A400	BUILDING SECTIONS
A500	WALL SECTIONS
A501	MECH. ADDITION WALL SECTIONS
A600	PLAN DETAILS
A625	WINDOW DETAILS
A650	SECTION DETAILS
A675	SECTION DETAILS
A800	FINISHING PLAN
A850	INTERIOR ELEVATIONS
A1000	SCHEDULES
CIVIL	
SE1	SITE SERVICING PLAN
ELECTRICAL	
E100	ELEC. LEGEND, DWGS LIST, SCHEDULES, SITE PLAN
E200	GROUND FLOOR PLAN LIGHTING AND FIRE ALARM
E300	GROUND FLOOR PLAN POWER AND SYSTEMS
E400	GROUND FLOOR PLAN LIGHTING AND FIRE ALARM DEMOLITION
E401	GROUND FLOOR PLAN POWER & SYSTEMS DEMOLITION
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M401	GROUND FLOOR PLAN HEATING
M402	MECHANICAL ROOM PLANS & DETAILS
M501	GROUND FLOOR PLAN AIR DISTRIBUTION
M701	MECHANICAL ROOM PLANS & SYSTEM SCHEMATIC
M702	GROUND FLOOR PLAN PLUMBING DEMOLITION
M703	GROUND FLOOR PLAN HEATING DEMOLITION
STRUCTURAL	
S101	STRUCTURAL

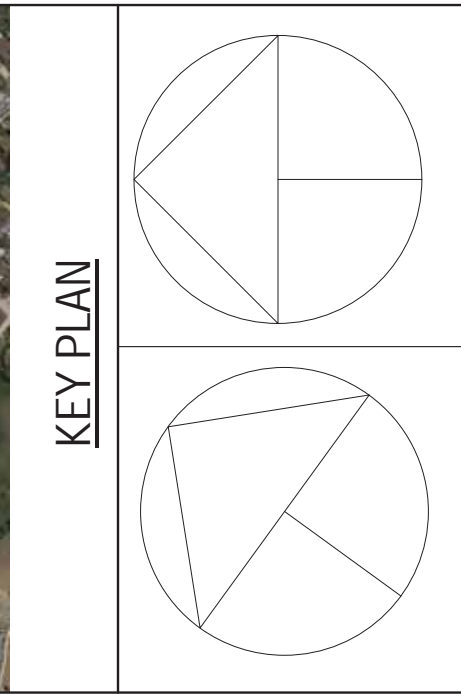
**DATE** 4/12/2018 **ISSUED FOR TENDER** 1

**PROJECT TITLE** OUR LADY OF FATIMA PHASE 2 RENEWAL

**DRAWING TITLE** COVER PAGE

**DATE** 4/9/2018 **SCALE** As Indicated **PROJECT NO.** 1724

**DRAWING NO.** A000



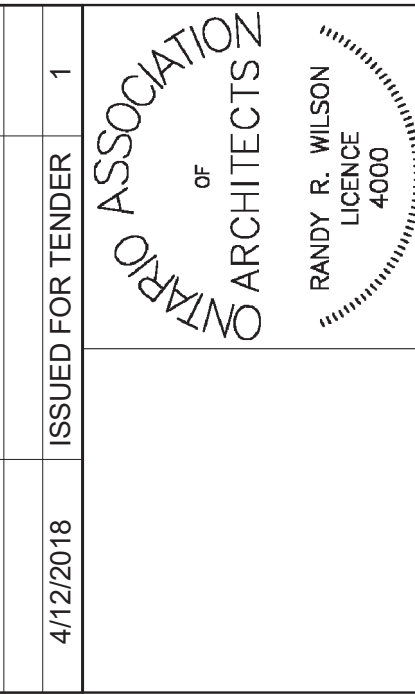
**TRUE NORTH**

**CONSTRUCTION NORTH**

**NOTES**

**LEGEND**

Date	Description	No.
4/12/2018	ISSUED FOR TENDER	1



**PROJECT TITLE** OUR LADY OF FATIMA PHASE 2 RENEWAL

**DRAWING TITLE** COVER PAGE

**DATE** 4/9/2018 **SCALE** As Indicated **PROJECT NO.** 1724

**DRAWING NO.** A000



## GENERAL NOTES:

- REMOVE ALL WIRING FROM ELECTRICAL DEVICES 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.
- MAKE GOOD ALL AREAS AFFECTED BY REMOVALS - FLUSH TO ADJACENT SURFACE AND MATCH TO EXISTING FINISH.
- DISPOSE OF ALL DESIGNATED SUBSTANCES TO THE REQUIREMENTS OF AUTHORITIES HAVING JURISDICTION
- 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.
- 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. CONTACT ARCHITECT PRIOR TO BID CLOSE TO CONFIRM.
- 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.
- PROVIDE PROTECTION FOR ALL FINISHES OR SERVICES TO REMAIN.
- ALL WINDOWS FALLING WITHIN THE DEMOLITION AREA ARE TO HAVE THEIR COVERINGS, FITTINGS, AND MOUNTING HARDWARE REMOVED & RETURNED TO THE OWNER.
- DEMOLITION NOTE REFERENCE NUMBERS, WHERE LOCATED ADJACENT TO A ROOM NAME NUMBER, APPLY TO THE ENTIRETY OF THE ROOM.
- 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 OR SCHEDULE.
- GENERAL CONTRACTOR IS REQUIRED TO REMOVE ALL REMAINING ADHESIVES ON WALLS WHERE MOUNTING HARDWARE IS TO BE REMOVED UNLESS BEING COVERED WITH NEW BOARDS. TYPICAL FOR ALL ROOMS AFFECTED BY WORK.

## DEMOLITION NOTES:

- 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. REMOVE MECHANICAL AND ELECTRICAL COMPONENTS / DEVICES BACK TO SOURCE, UNLESS INDICATED TO BE CONCEALED WITHIN WALLS. PROVIDE ALL SIDING BACK TO SOURCE, UNLESS INDICATED TO BE REMOVED. VERIFY FINISHING STRUCTURE SAFE. REFER TO DRAWINGS & SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.
- EXISTING DOOR, AND FRAME IF INDICATED, TO BE REMOVED. BOX, LABEL AND TURN OVER HARDWARE TO OWNER FOR FUTURE USE. WHERE FRAME IS REMOVED PREPARE OPENING TO RECEIVE NEW IN/FILL OR DOOR AND FRAME. REFER TO NEW CONSTRUCTION PLANS AND ELEVATIONS.
- EXISTING PLUMBING FIXTURES TO BE REMOVED. REMOVE ALL EQUIPMENT, CAP & REMOVE SINKS, DRAINS AND HARDWARE. REFER TO MECHANICAL AND ELECTRICAL FOR ADDITIONAL REQUIREMENTS. ONLY RETAIN FIXTURES FOR OWNERS USE OR REUSE IN NEW CONSTRUCTION WHERE SPECIFICALLY NOTED. REPAIR AND MAKE GOOD ALL EXPOSED SURFACES.
- CAREFULLY REMOVE ALL CEILING TREATMENTS SO AS TO NOT DAMAGE LAY-IN ACOUSTIC TILE. SAFELY STORE TILE FOR LATER REUSE IN NEW LAY GRID. REMOVE & DISCARD ALL OTHER CEILING TREATMENTS SUCH AS GYPSUM BOARD, METAL FRAMING, SUPPORT HANGERS AND OTHER FIXTURES UNLESS NOTED OTHERWISE.
- REMOVE & STORE EXISTING L.E.D. LIGHT FIXTURES IN SAFE LOCATION. CLEAN & REUSE FIXTURES WHEN ABOVE CEILING WORK IS COMPLETED. REFER TO M&E DWGS.
- REMOVE & DISPOSE OF EXISTING WATER FOUNTAINS. REFER TO M&E DRAWINGS.
- REMOVE & DISPOSE OF EXISTING WASHROOM PARTITIONS
- EXISTING FLOOR FINISHES AND WALL BASE TO BE REMOVED INCLUDING ALL ADHESIVES AND MORTAR DOWN TO EXISTING CONCRETE SLAB AND WALL BACKING BY MEANS OF GRINDING. PREPARE FLOOR SURFACE LEVEL TO WITHIN SPECIFIED TOLERANCES 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.
- REMOVE & DISPOSE OF EXISTING EXTERIOR BRICK AND RIGID INSULATION BACK TO EXISTING CONC. BLOCK. WALL CONC. BLOCK STRUCTURE TO REMAIN. MAKE READY FOR NEW MASONRY.
- REMOVE AND DISPOSE OF EXISTING WINDOW AND FRAME.
- AREA OF EXISTING CONCRETE FLOOR SLAB TO BE BROKEN UP FOR INSTALL OF NEW PLUMBING LINES.
- REMOVE & DISPOSE OF EXISTING CANOPY SIDING, SOFFIT, AND PARAPET. CANOPY STRUCTURE TO REMAIN. REFER TO DWGS.
- CUT BACK, BREAKUP AND REMOVE AREA OF EXISTING SIDEWALK AND/OR ASPHALT @ EXIST. CONTROL JOINTS/SAW CUTS. PROVIDE NEW CONCRETE PAD TO OPSB STANDARDS FOR SIDEWALKS.
- CUT OPENING IN EXIST. CMU WALL FOR NEW WINDOW INSTALLATION.

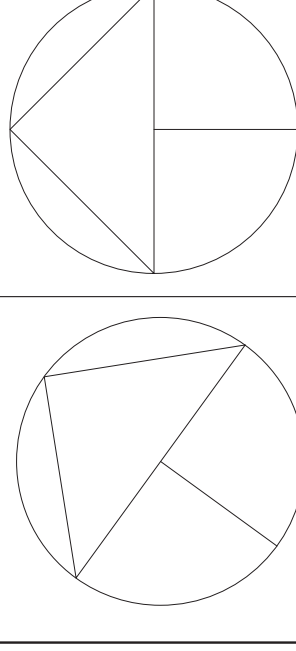
## ASSEMBLY TYPES:

EXTERIOR WALL TYPES		INTERIOR WALL TYPES	
TYPE	DETAIL	TYPE	DETAIL
EW1		IW2.1	
EW1.1		IW2.2	
EW1.2		IW2.3	
EW1.3		IW2.4	
FW1		IW3.1	
		IW3.2	
		IW3.3	

ROOF TYPES		CEILING TYPES	
TYPE	DETAIL	TYPE	DETAIL
EXIST.		ACT HT A.F.F.	
RT.1		GYP HT A.F.F.	
FLOOR TYPES			
FL.1			

SYMBOL	DESCRIPTION	DEMOLITION NOTE REFERENCE NUMBER
1	AREA OF WORK N.I.C.	
	ACT CEILING TILE TO BE REMOVED	
	PORTION OF EXISTING WALLS TO BE REMOVED	
	EXTERIOR MASONRY & INSULATION TO BE REMOVED	
	EXISTING CONC. BLOCK TO REMAIN	
	AREA OF CONCRETE FLOOR TO BE REMOVED FOR PLUMBING	
	EXISTING DOOR & FRAME TO REMAIN	
	EXISTING DOOR & FRAME TO BE REMOVED	
	EXISTING WINDOW & FRAME TO BE REMOVED	
	EXISTING WINDOW & FRAME TO REMAIN	

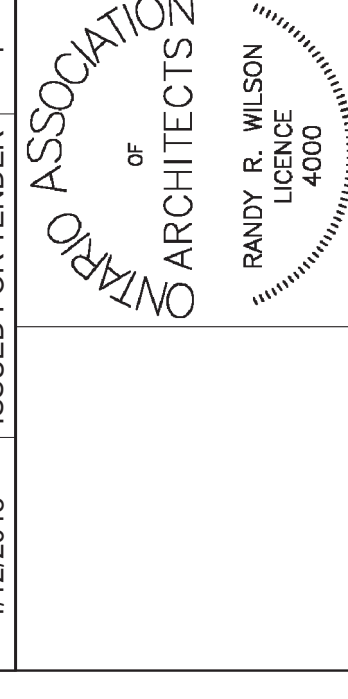
## KEY PLAN



## NOTES

## LEGEND

Date	Description	No.
4/12/2018	ISSUED FOR TENDER	1

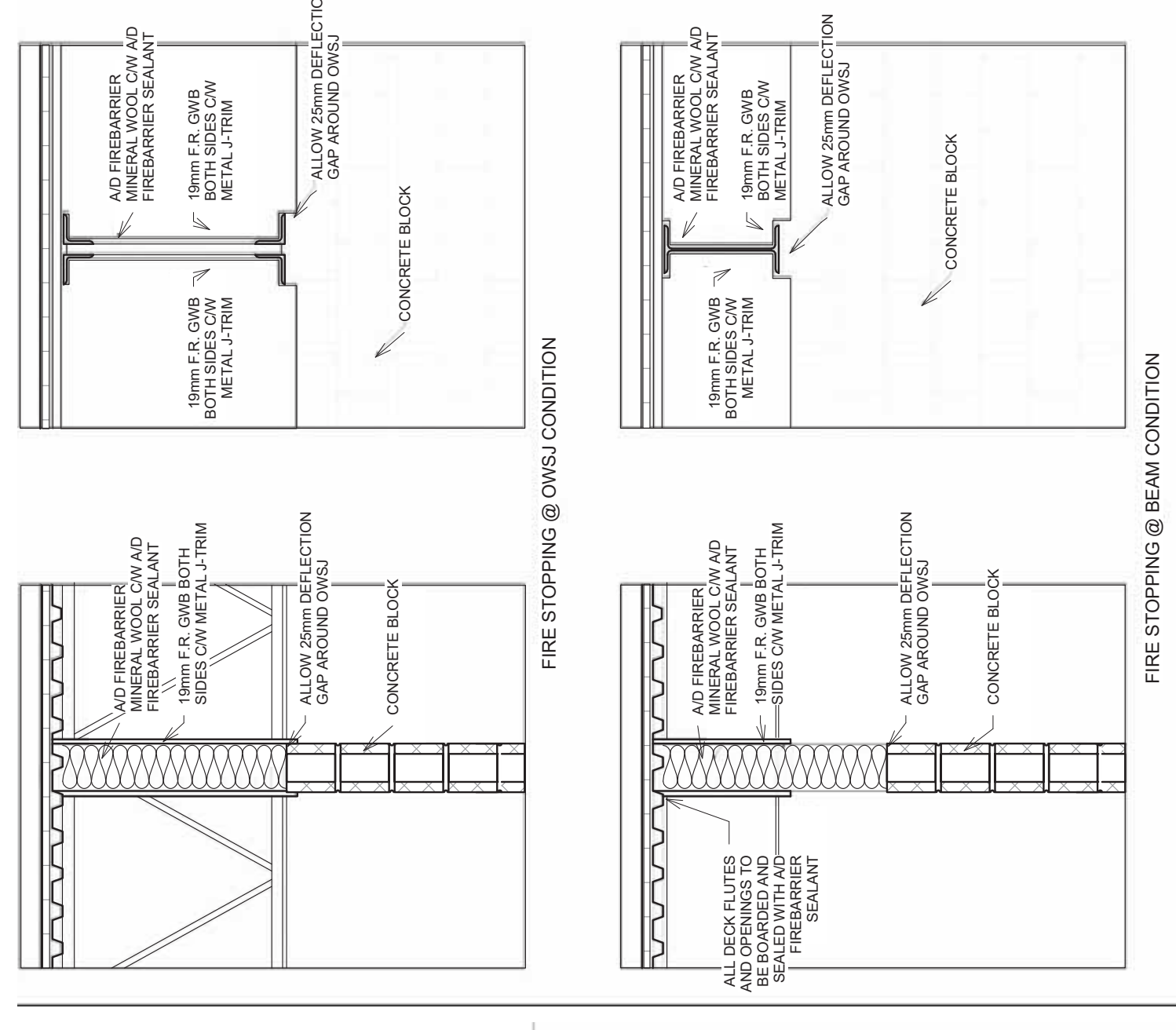


PROJECT TITLE:  
**OUR LADY OF FATIMA PHASE 2  
RENEWAL**

DRAWING TITLE:

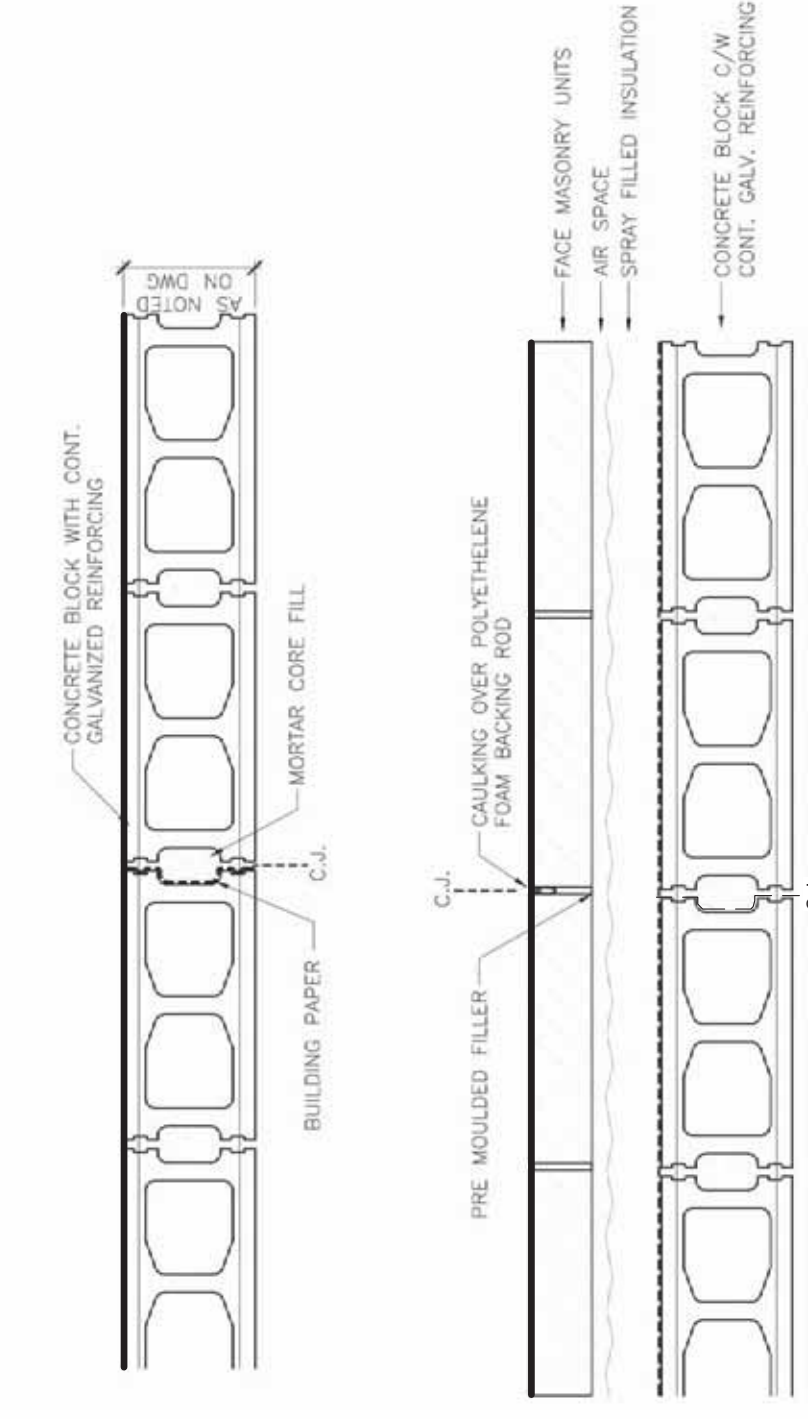
## GENERAL NOTES

DATE: 4/9/2018	DRAWN BY: SH	DRAWING NO.:
SCALE: As Indicated	CHECKED BY: RW	A050
	PROJECT NO.:	1724

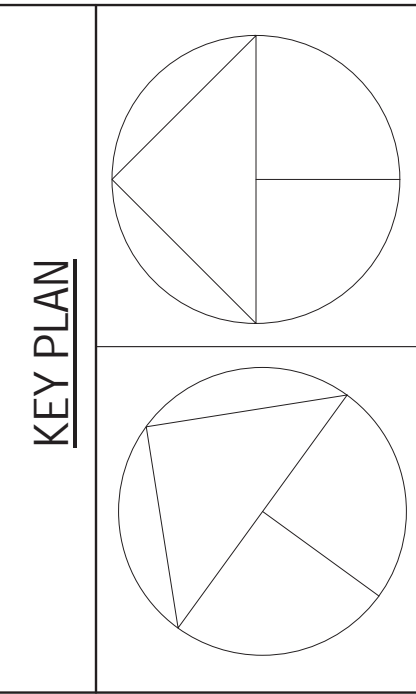


## FIRE STOPPING @ OWSJ & BEAM 1:10

## CONTROL JOINT DETAILS 1:10







**NOTES**

**LEGEND**

SYMBOL	DESCRIPTION
1	DEMOLITION NOTE REFERENCE NUMBER
2	AREA OF WORK N.I.C.
3	ACT CEILING TILE TO BE REMOVED
4	PORTION OF EXISTING WALLS TO BE REMOVED
5	EXTERIOR MASONRY & INSULATION TO BE REMOVED
6	EXISTING CONC. BLOCK TO REMAIN
7	AREA OF CONCRETE FLOOR TO BE REMOVED FOR PLUMBING
8	EXISTING DOOR & FRAME TO REMAIN
9	EXISTING DOOR & FRAME TO BE REMOVED

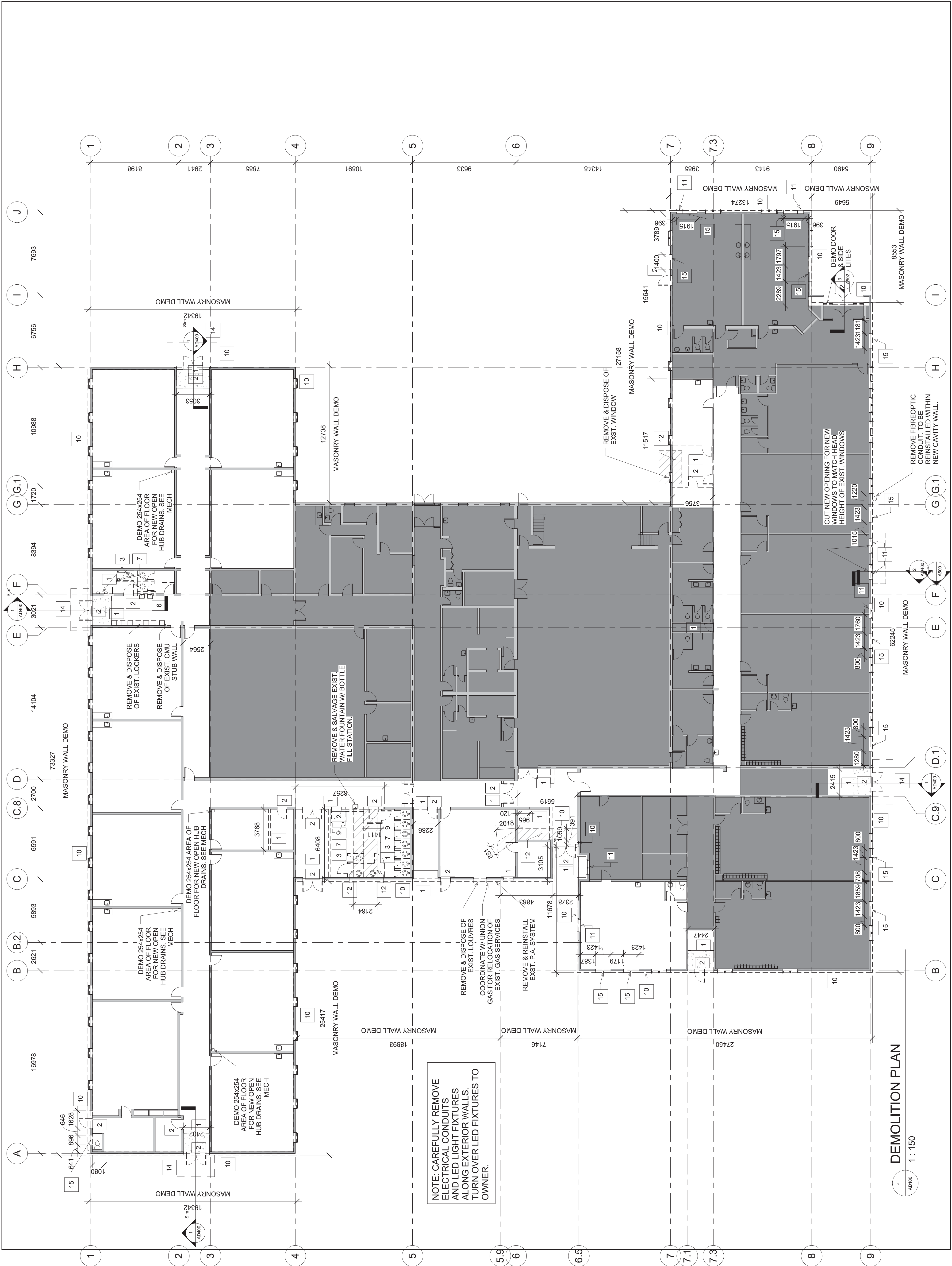
Date	Description	No.
4/12/2018	ISSUED FOR TENDER	1



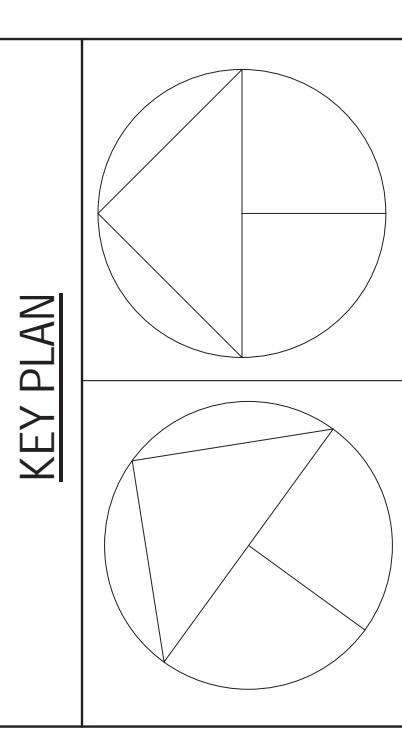
PROJECT TITLE  
**OUR LADY OF FATIMA PHASE 2 RENEWAL**

DRAWING TITLE  
**DEMOLITION PLAN**

DATE 4/9/2018	DRAWN BY Author
SCALE As Indicated	CHECKED BY Checker
PROJECT NO. 1724	DRAWING NO. <b>AD100</b>



**DEMOLITION PLAN**  
1 : 150



TRUE NORTH  
CONSTRUCTION NORTH

NOTES

SYMBOL	DESCRIPTION
1	DEMOLITION NOTE REFERENCE NUMBER
[Hatched Box]	AREA OF WORK N.I.C.
[Dashed Box]	ACT CEILING TILE TO BE REMOVED
[Dotted Box]	PORTION OF EXISTING WALLS TO BE REMOVED
[Diagonal Lines]	EXTERIOR MASONRY & INSULATION TO BE REMOVED
[Stippled Box]	EXISTING CONC. BLOCK TO REMAIN
[Cross-hatched Box]	AREA OF CONCRETE FLOOR TO BE REMOVED FOR PLUMBING
[Solid Box]	EXISTING DOOR & FRAME TO REMAIN
[Dashed Box]	EXISTING DOOR & FRAME TO BE REMOVED

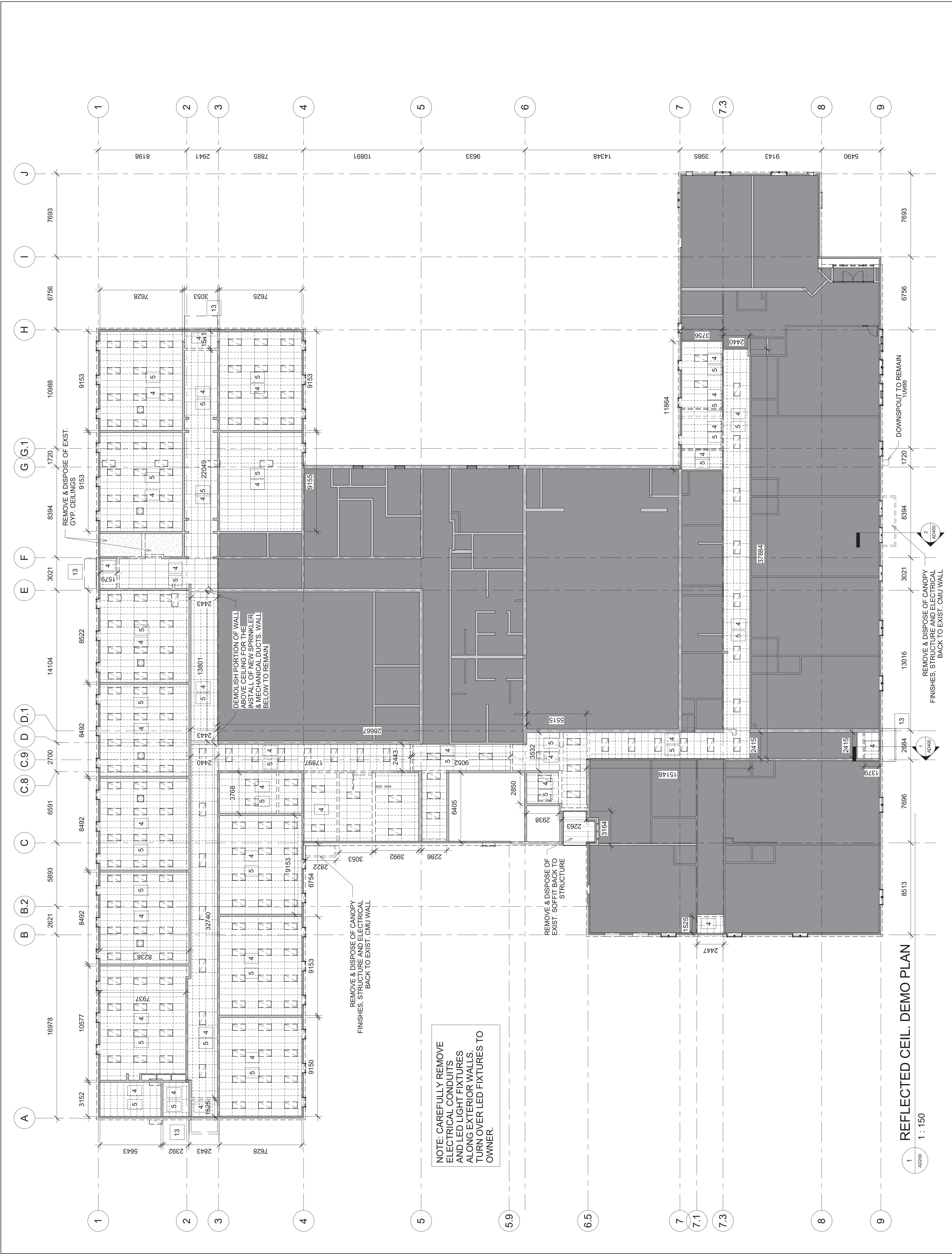
Date	Description	No.
4/12/2018	ISSUED FOR TENDER	1

PROJECT TITLE: OUR LADY OF FATIMA PHASE 2 RENEWAL

DRAWING TITLE: REFLECTED CEIL. DEMO PLAN

DATE: 4/9/2018  
 DRAWN BY: Author  
 SCALE: As Indicated  
 CHECKED BY: Checker  
 PROJECT NO.: 1724

AD200



NOTE: CAREFULLY REMOVE ELECTRICAL CONDUITS AND LED LIGHT FIXTURES ALONG EXTERIOR WALLS. TURN OVER LED FIXTURES TO OWNER.

REFLECTED CEIL. DEMO PLAN  
1 : 150







TRUE NORTH  
 CONSTRUCTION NORTH

**NOTES**

**LEGEND**

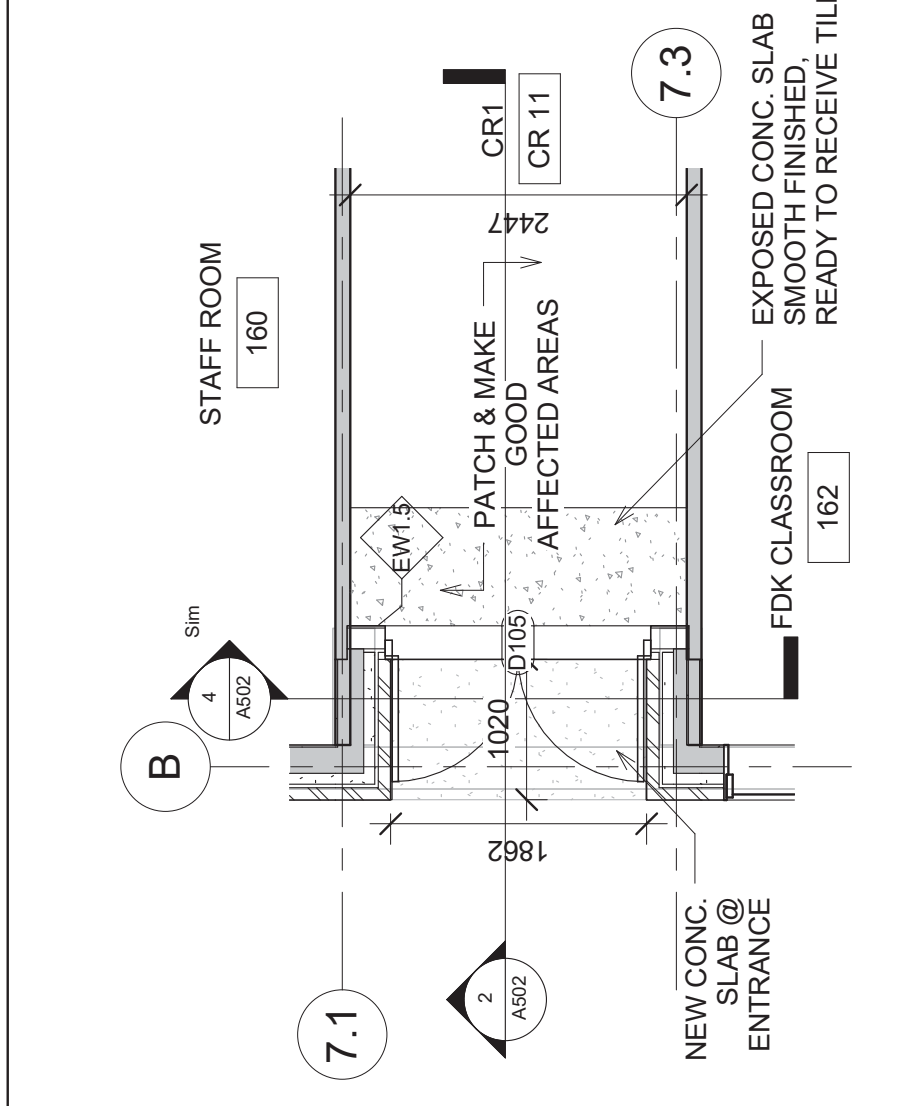
Date	Description	No.
4/12/2018	ISSUED FOR TENDER	1

PROJECT TITLE  
**OUR LADY OF FATIMA PHASE 2  
 RENEWAL**

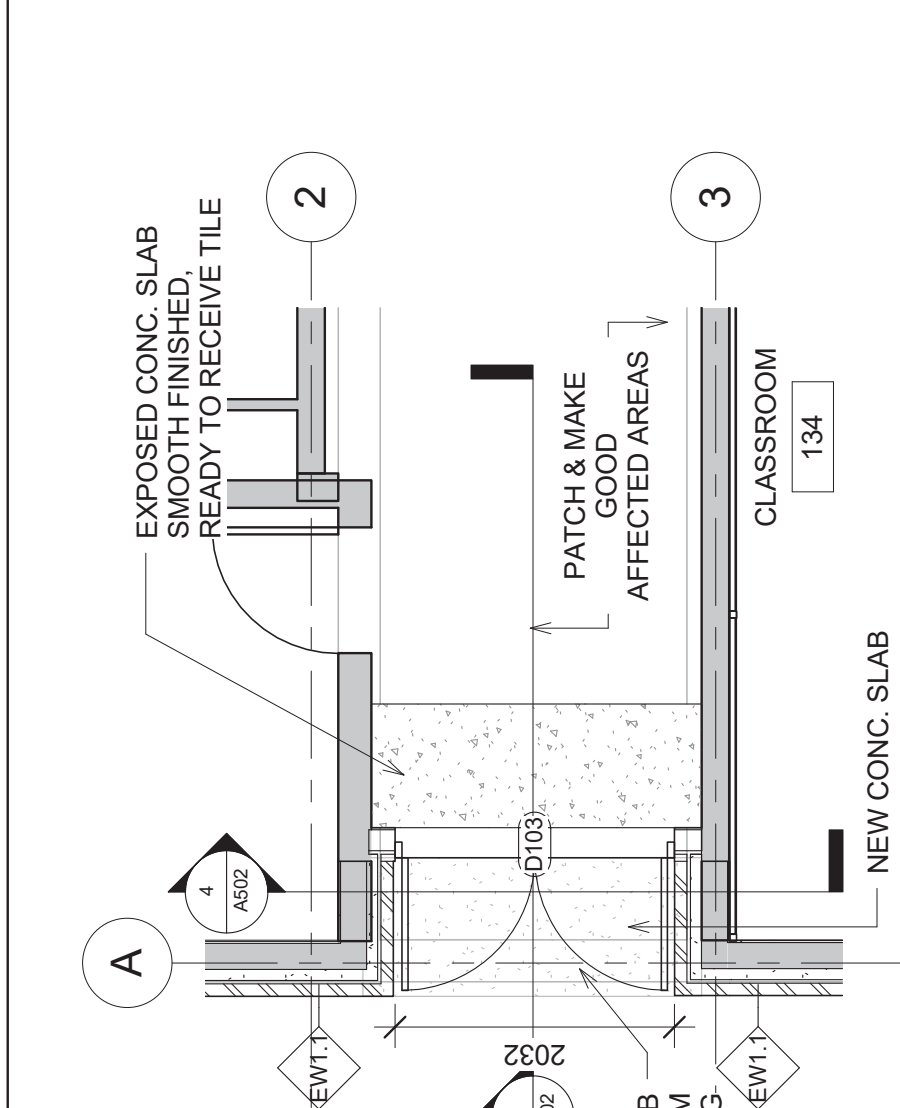
ARCHITECT  
**WILSON DIAZ ARCHITECTS**  
 RANDY R. WILSON  
 LICENCE  
 4000

DRAWING TITLE  
**ENLARGED FLOOR PLANS**

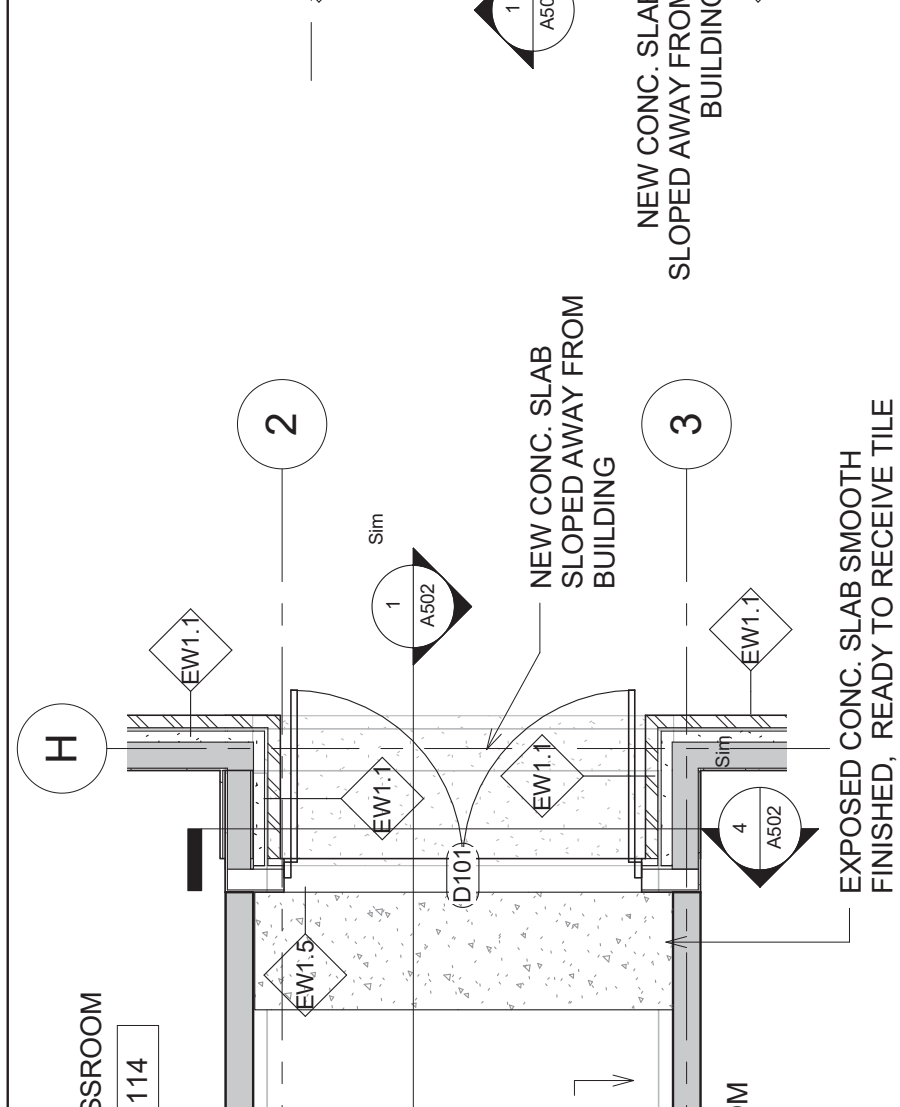
DATE: 4/9/2018  
 DRAWN BY: Author  
 SCALE: 1:50  
 CHECKED BY: Checker  
 PROJECT NO.: 1724  
**A150**



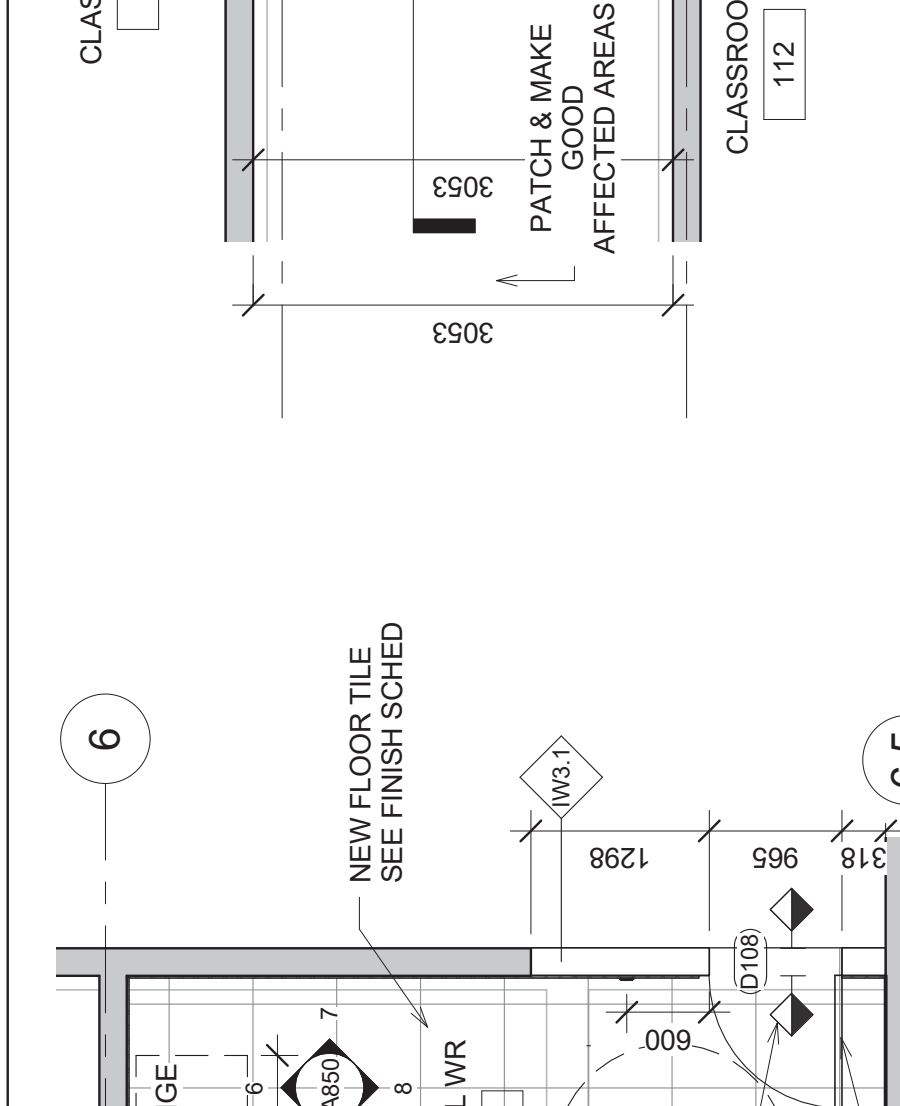
**PLAN DETAIL @ VESTIBULE V6**  
 1:50



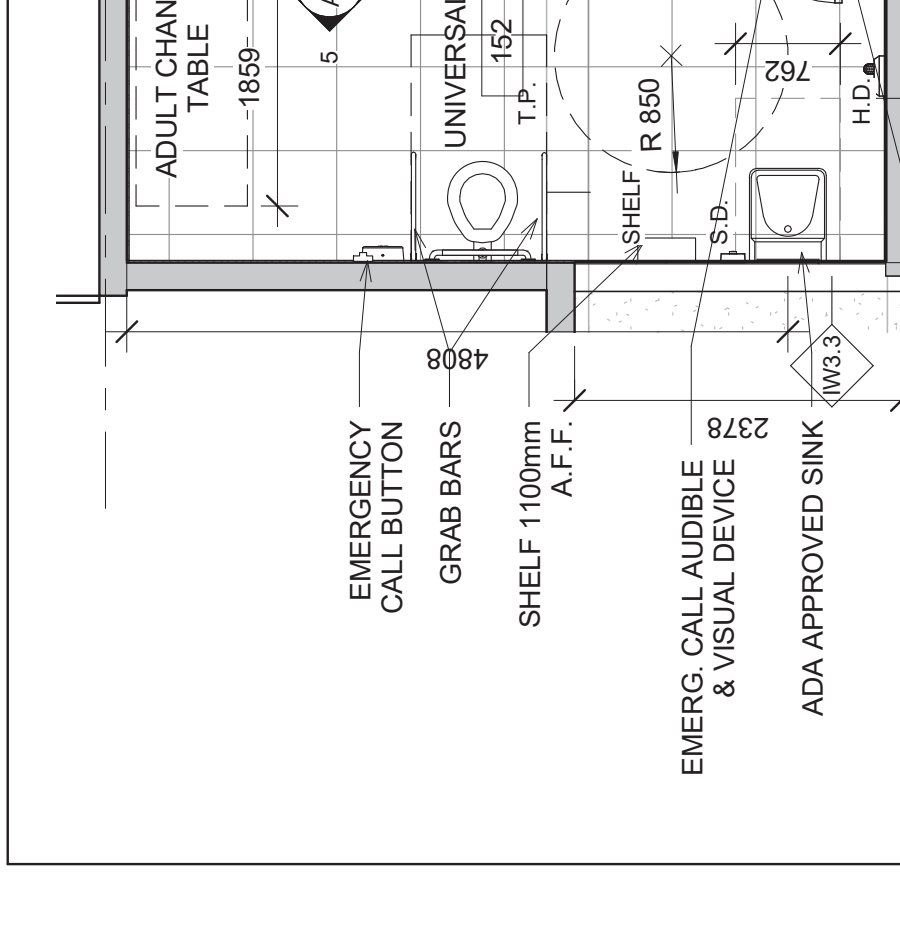
**PLAN DETAIL @ VESTIBULE V4**  
 1:50



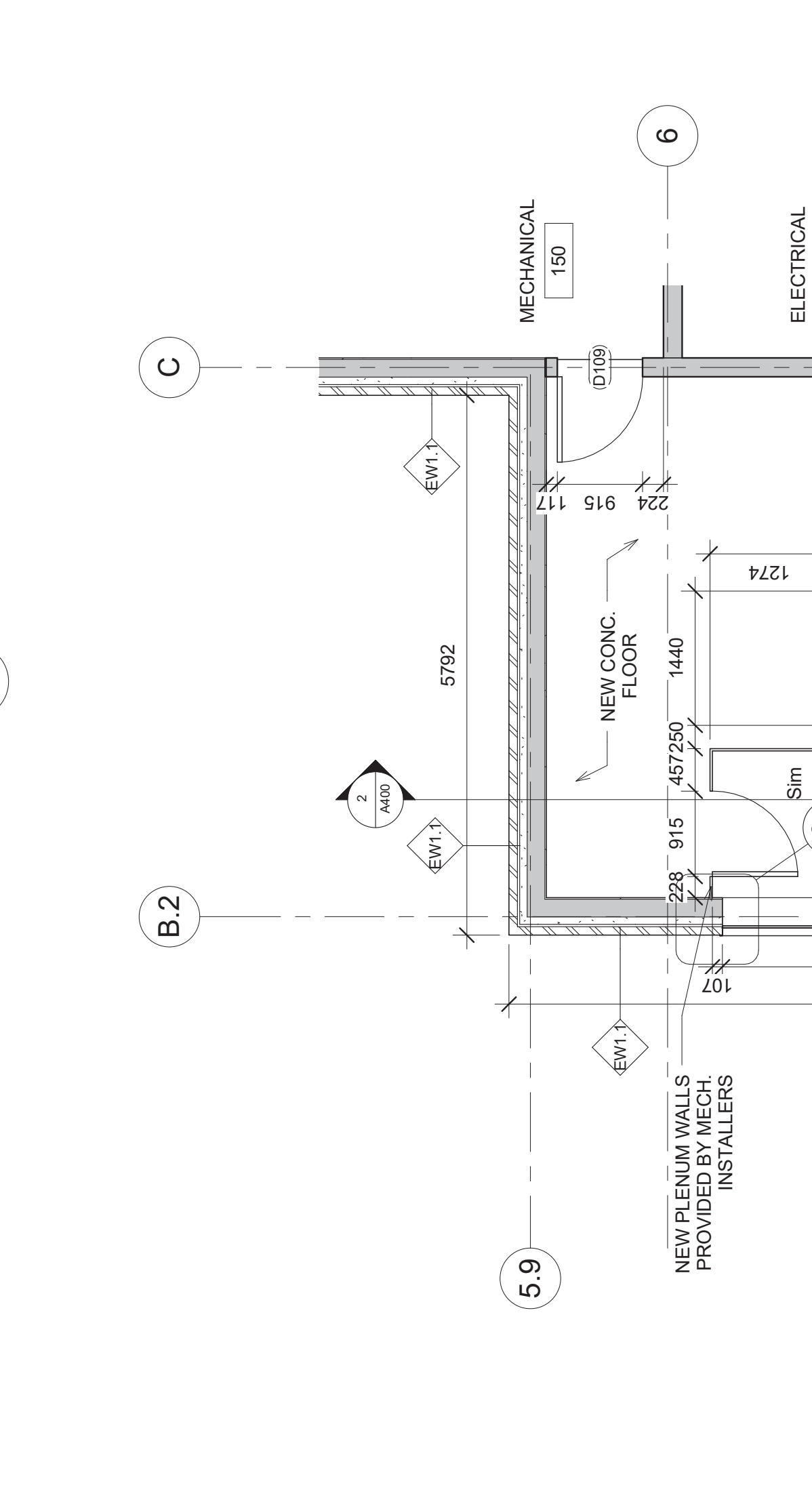
**PLAN DETAIL @ VESTIBULE V2**  
 1:50



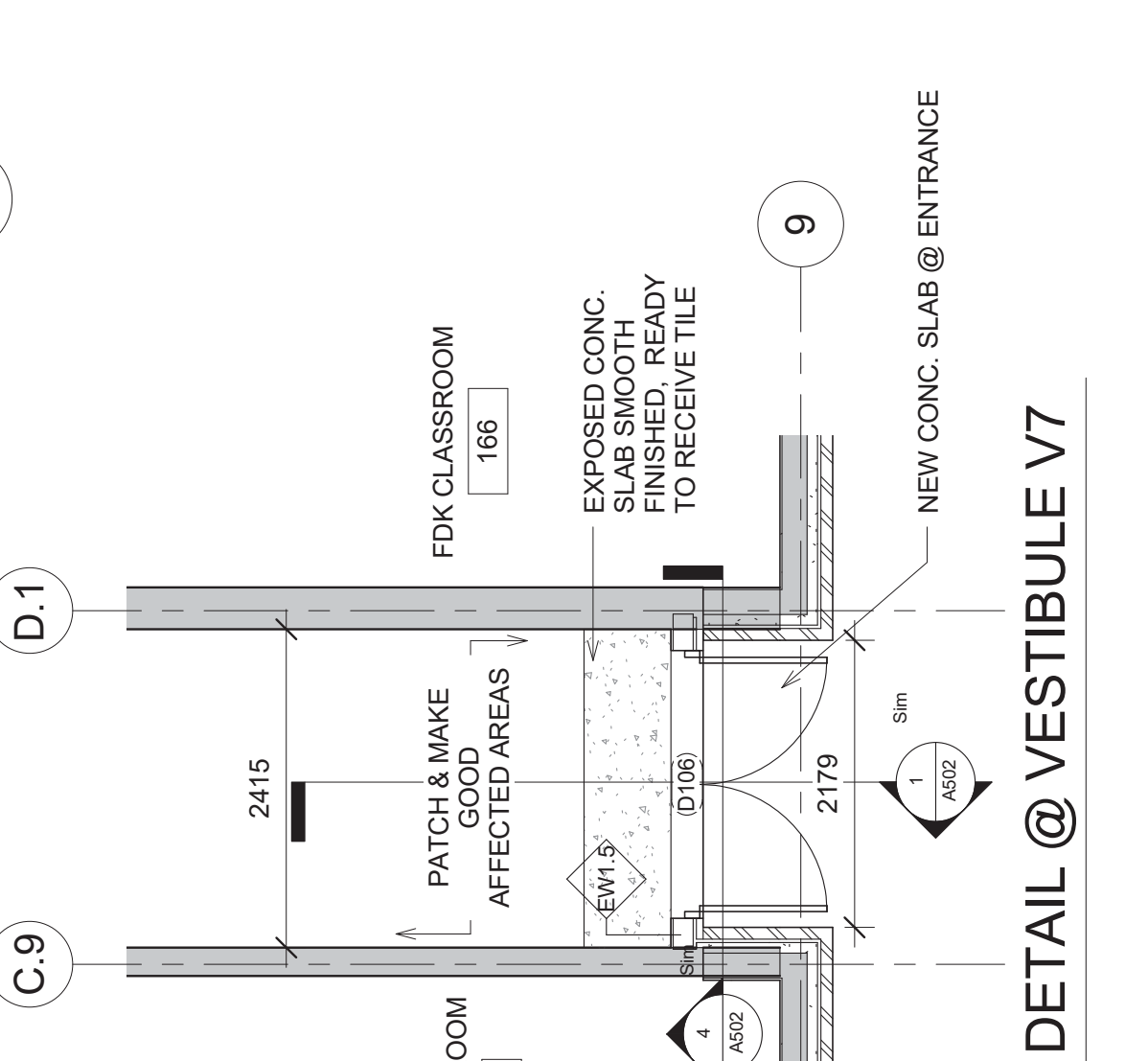
**PLAN DETAIL @ VESTIBULE V7**  
 1:50



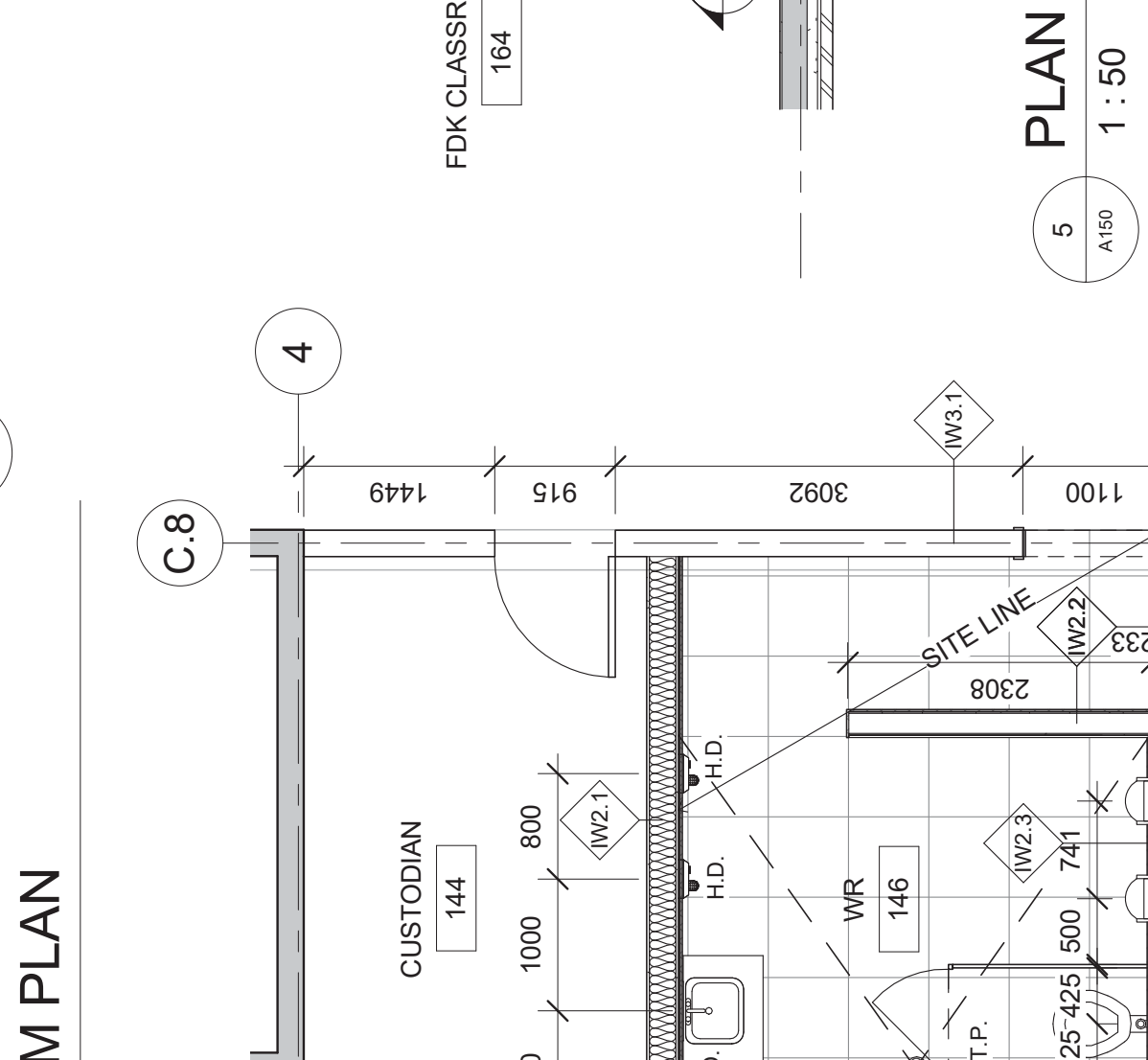
**UNIVERSAL WASHROOM PLAN**  
 1:50



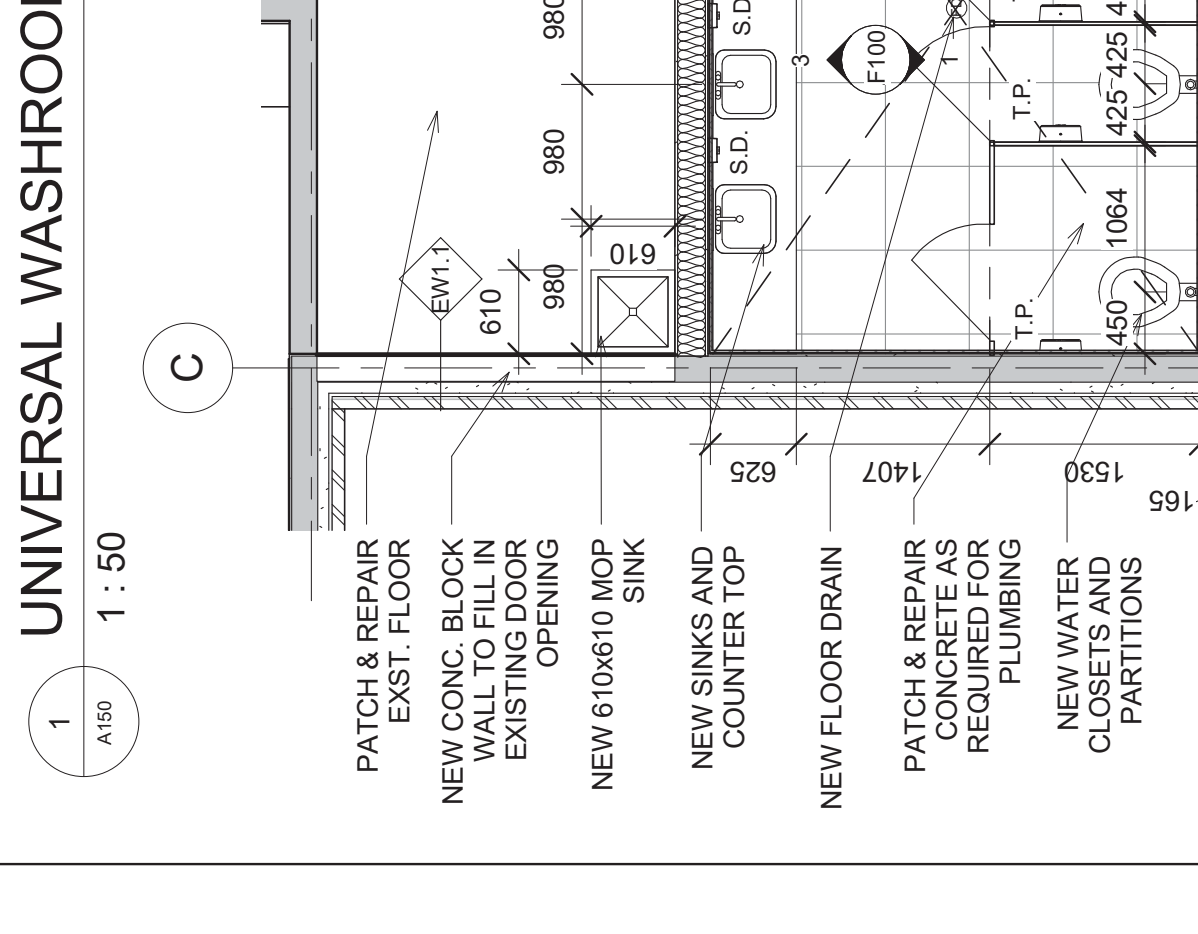
**ENLARGED MECH. ROOM PLAN**  
 1:50



**ENLARGED PLAN @ NORTH ENTRY**  
 1:50



**ENLARGED FLOOR PLAN - WASHROOM GROUP 1**  
 1:50



**PLAN DETAIL @ VESTIBULE V5**  
 1:50

**NOTE:  
 PATCH, REPAIR AND PAINT ALL  
 WALLS AFFECTED BY WORK.**

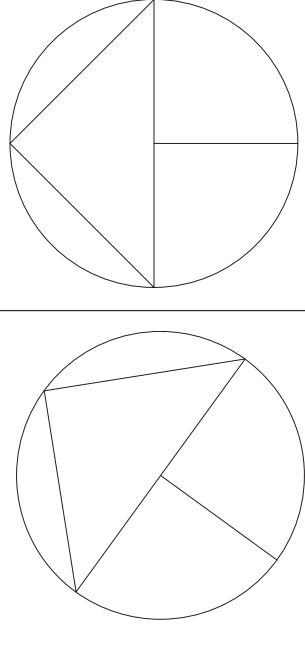
**ENLARGED PLAN @ NORTH ENTRY**  
 1:50

**PLAN DETAIL @ VESTIBULE V5**  
 1:50





KEY PLAN

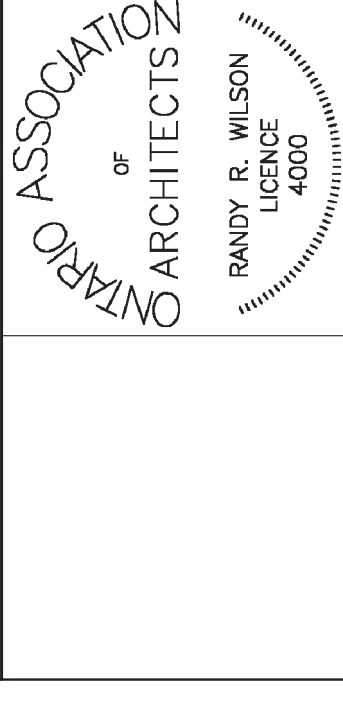


TRUE NORTH CONSTRUCTION NORTH

NOTES

LEGEND

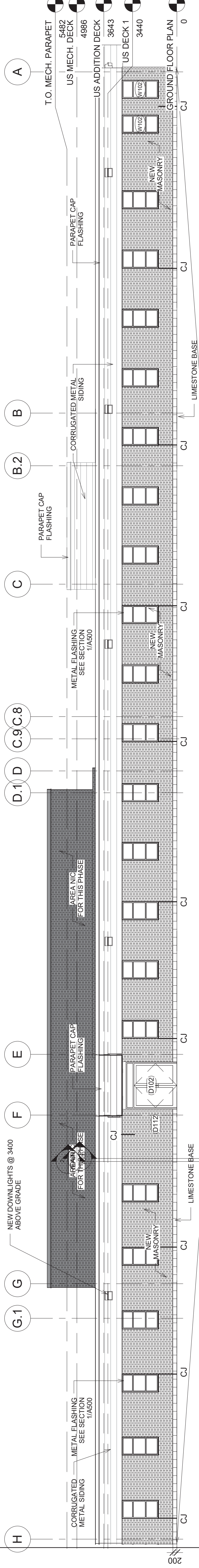
Date	Description	No.
4/12/2018	ISSUED FOR TENDER	1



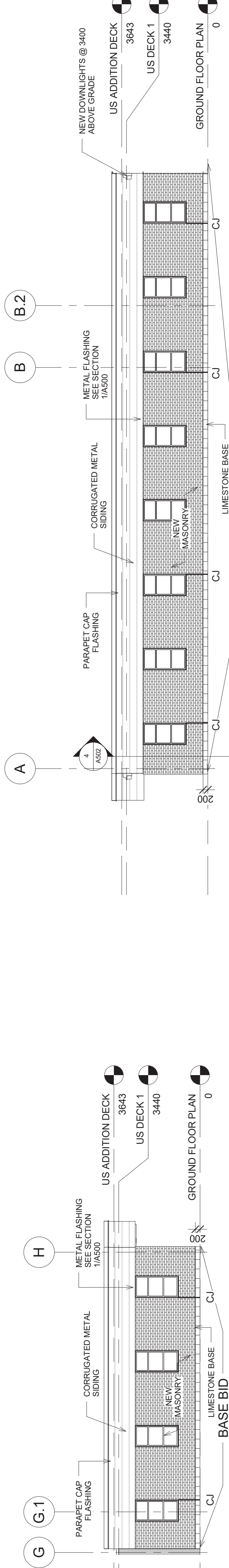
PROJECT TITLE  
**OUR LADY OF FATIMA PHASE 2  
RENEWAL**

DRAWING TITLE  
**EXTERIOR ELEVATIONS**

DATE 4/9/2018	DRAWN BY Author
SCALE 1:100	CHECKED BY Checker
PROJECT NO. 1724	DRAWING NO. <b>A300</b>

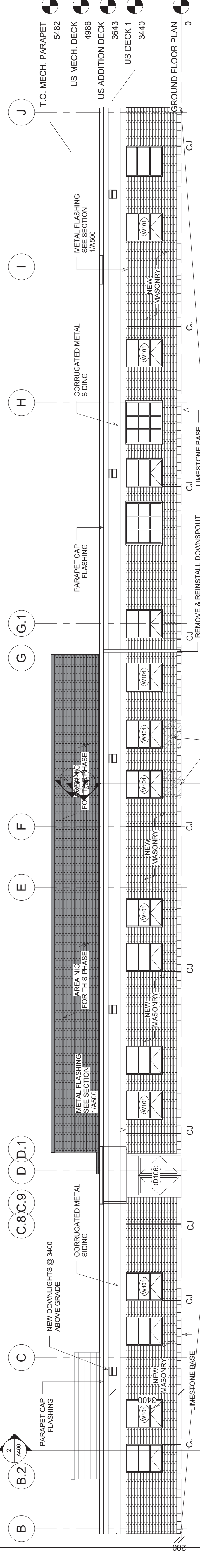


2  
A300  
North Elevation  
1:100

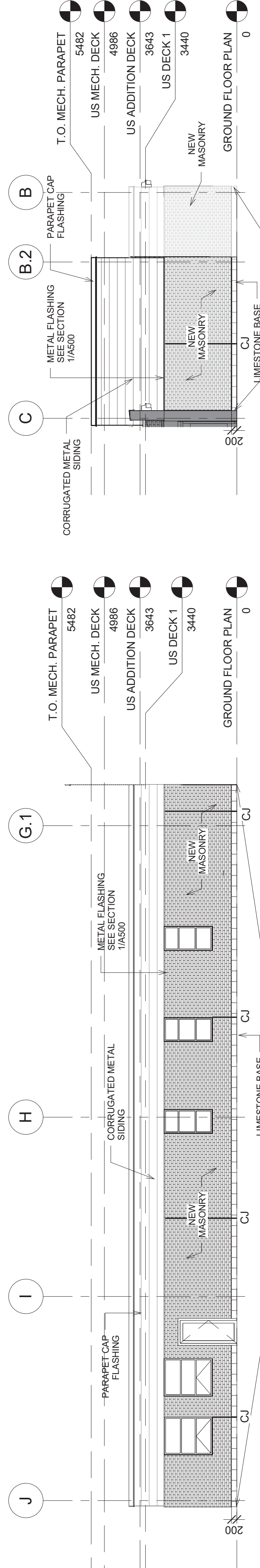


6  
A300  
North West Elevation  
1:100

5  
A300  
North East Elevation  
1:100



3  
A300  
South  
1:100



7  
A300  
South East Elevation  
1:100

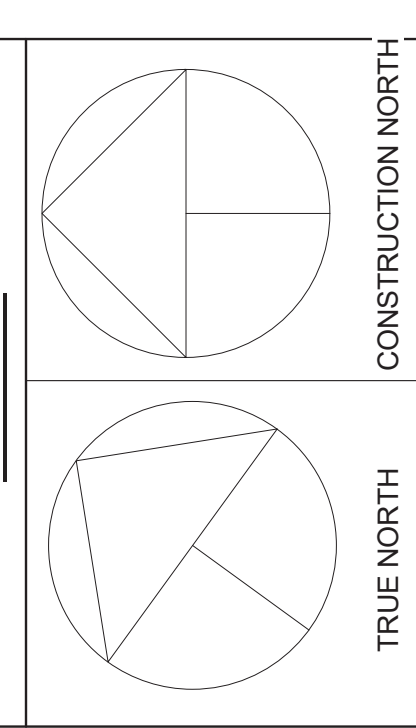
8  
A300  
South West Elevation  
1:100

NOTE:  
CONTROL JOINTS TO ALIGN WHEREVER POSSIBLE WITH EXISTING CONTROL JOINTS IN CONCRETE BLOCK STRUCTURAL WALL BEHIND BRICK MASONRY.









**NOTES**

**LEGEND**

Date	Description	No.
4/12/2018	ISSUED FOR TENDER	1

PROJECT TITLE  
**OUR LADY OF FATIMA PHASE 2 RENEWAL**

DATE  
 4/9/2018

SCALE  
 1:15

PROJECT NO.  
 1724

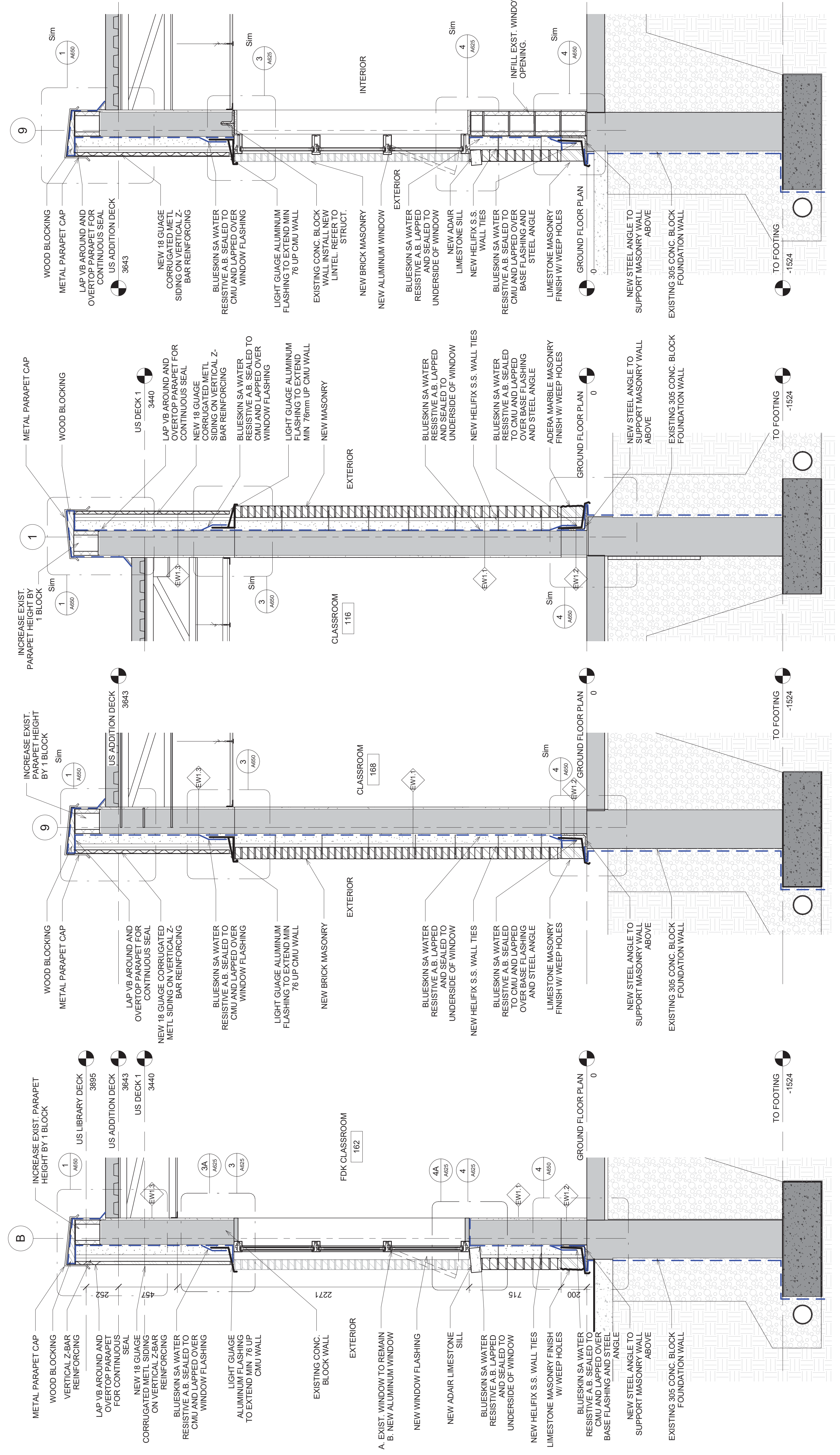
DRAWING NO.  
**A500**

DESIGNED BY  
 Author

CHECKED BY  
 Checker

WILSON DIAZ ARCHITECTS  
 RANDY R. WILSON  
 LICENCE  
 4000

DRAWING TITLE  
**WALL SECTIONS**



**SECTION 1 @ 2002 ADDITION**  
 1:15

**SECTION 2 TYP. WALL SECTION**  
 1:15

**SECTION 3 TYP. WALL SECTION @ 2002 ADDITION**  
 1:15

**SECTION 4 SECTION @ NEW WINDOW**  
 1:15



**KEY PLAN**

TRUE NORTH

CONSTRUCTION NORTH

**NOTES**

**LEGEND**

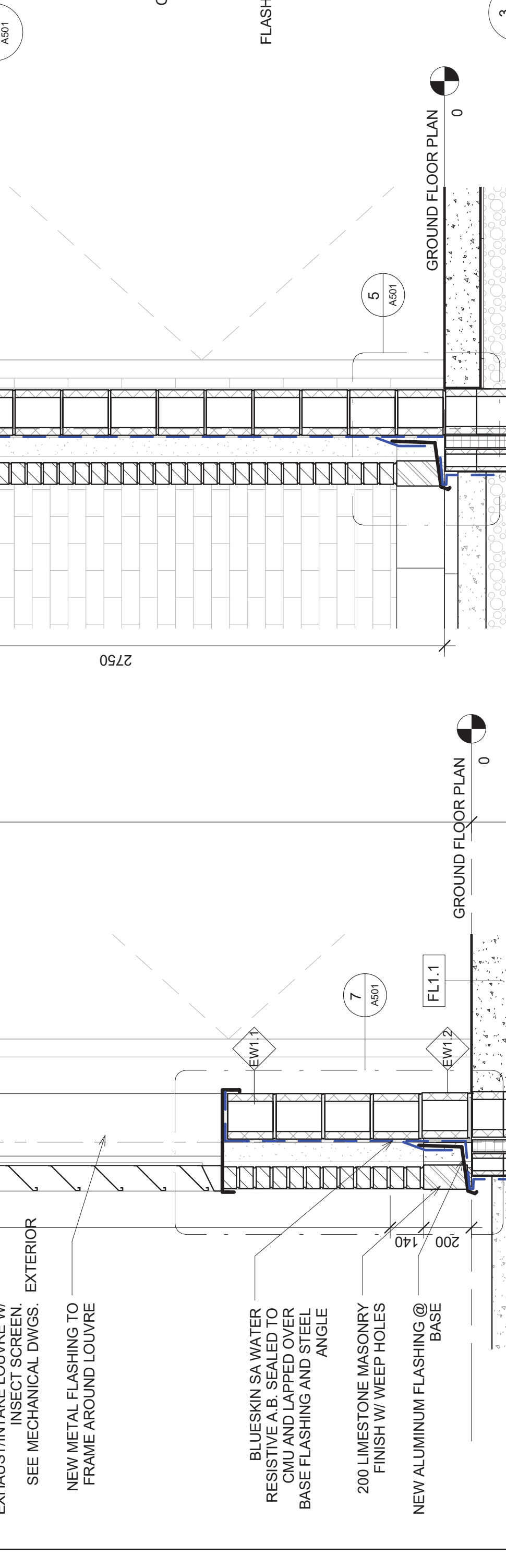
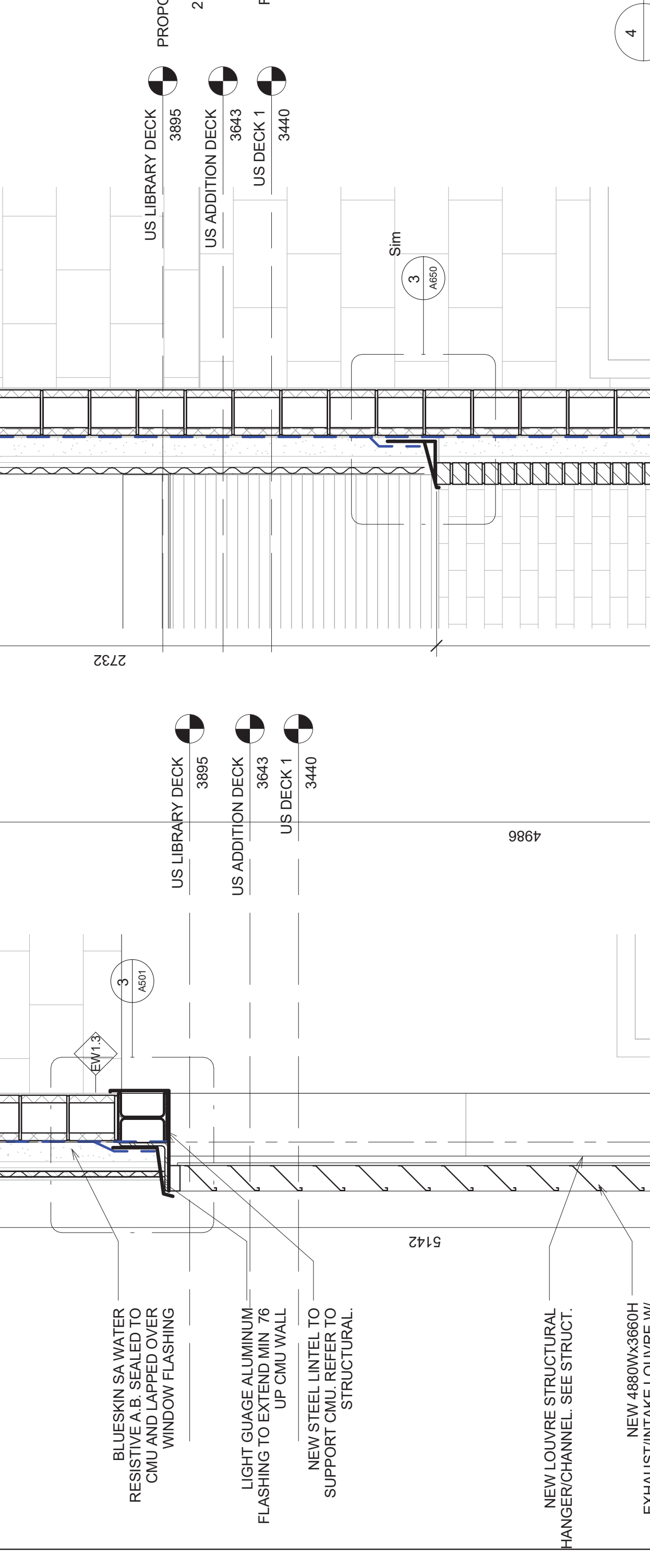
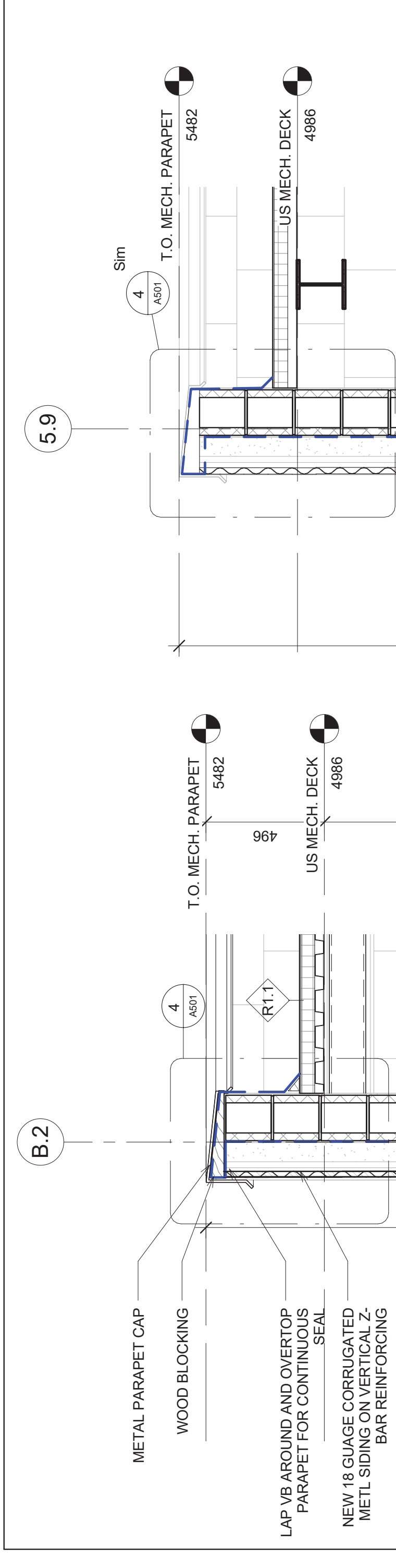
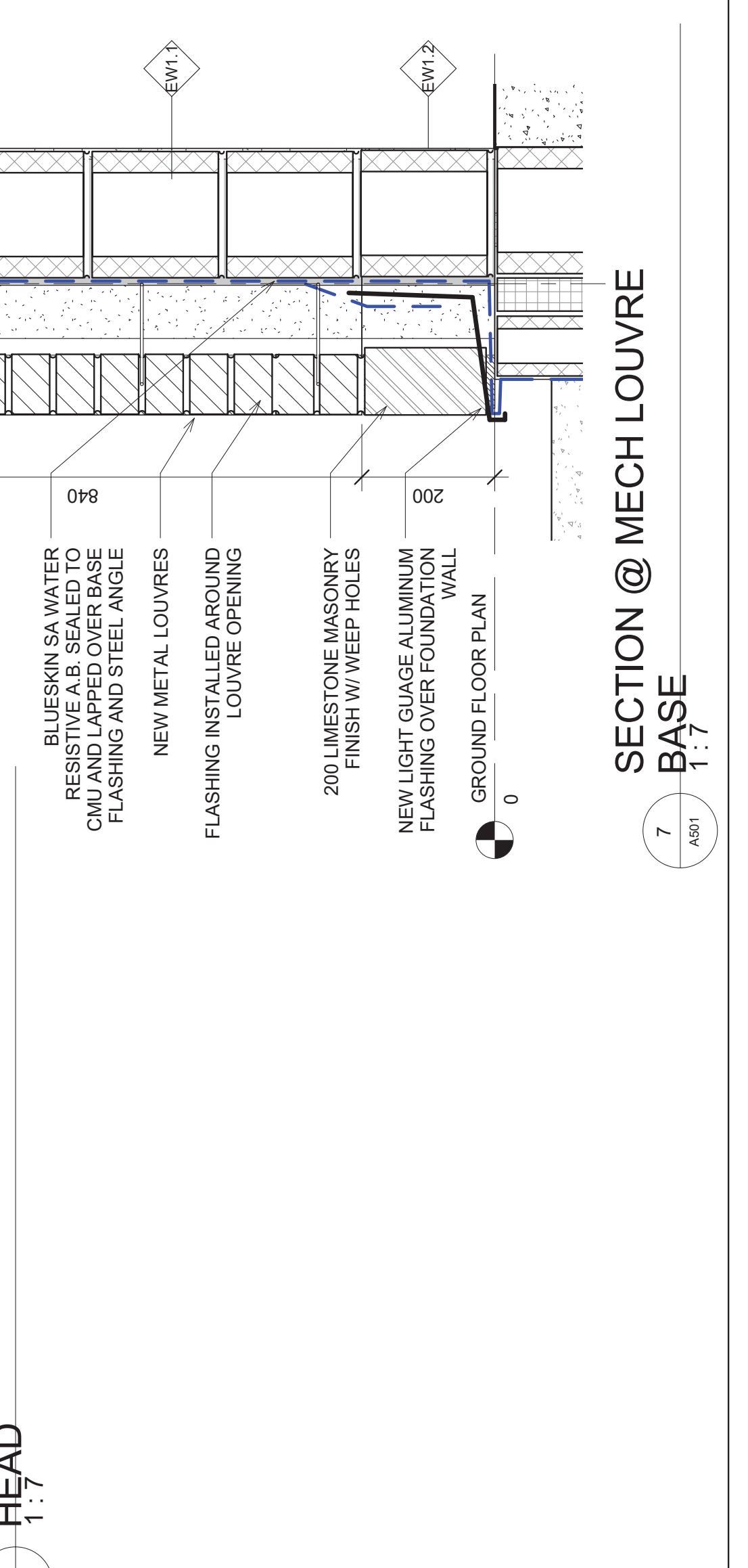
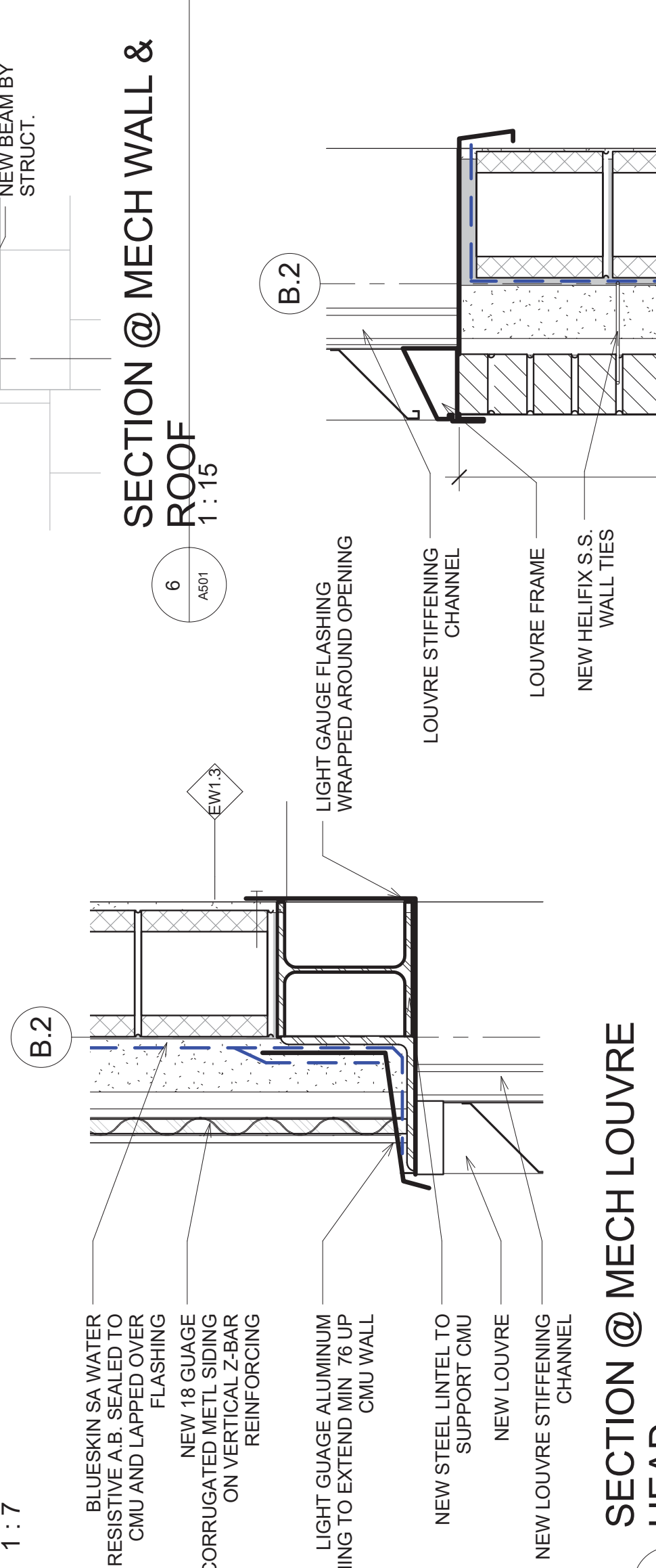
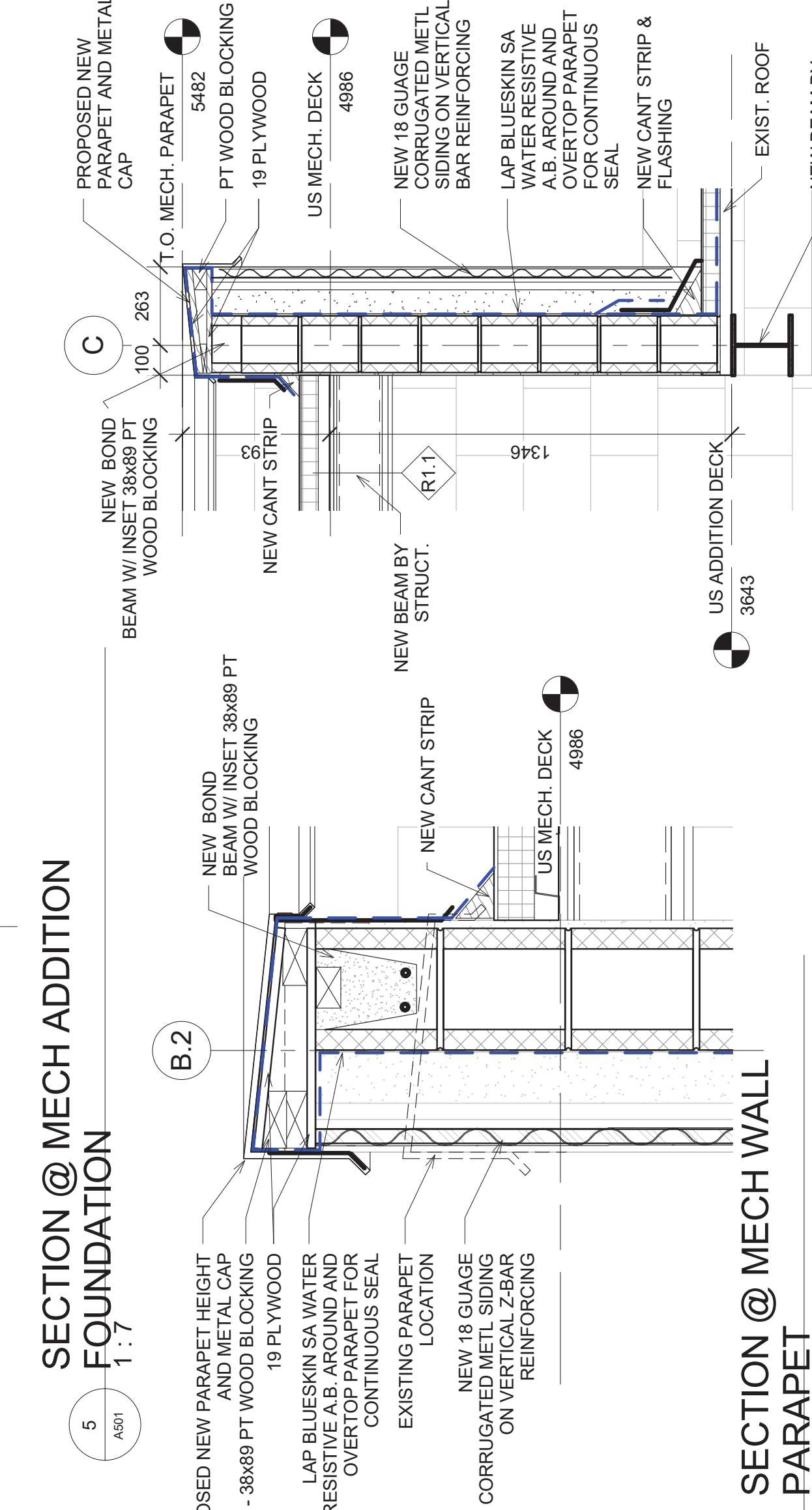
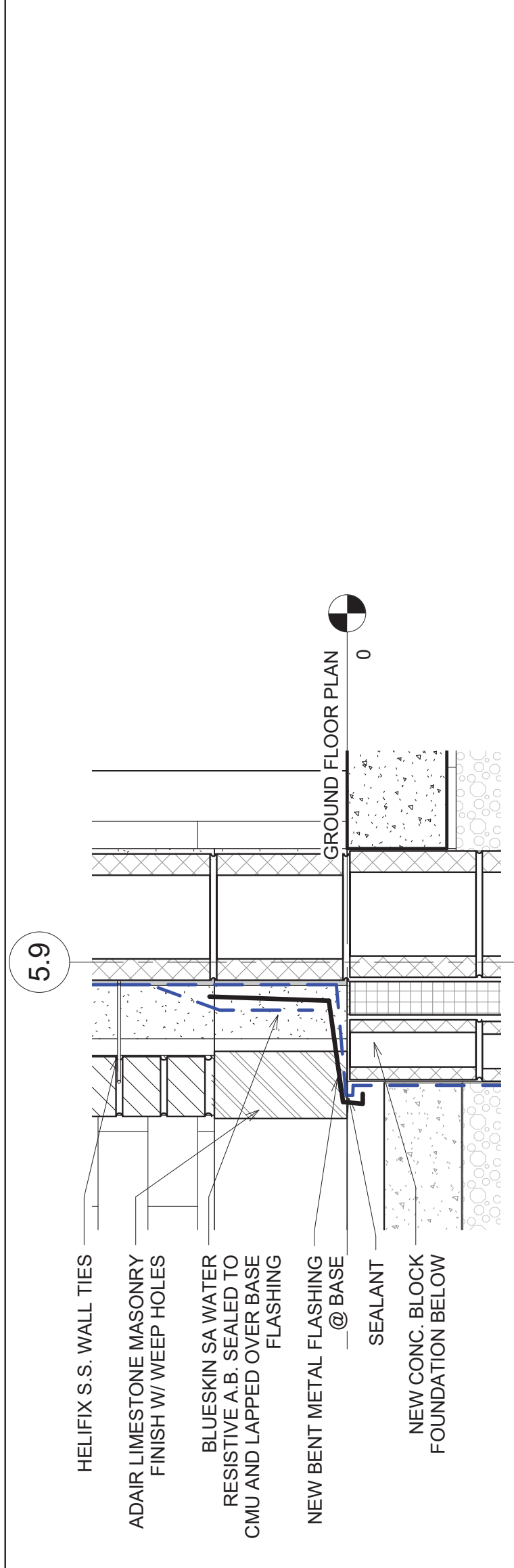
Date	Description	No.
4/12/2018	ISSUED FOR TENDER	1

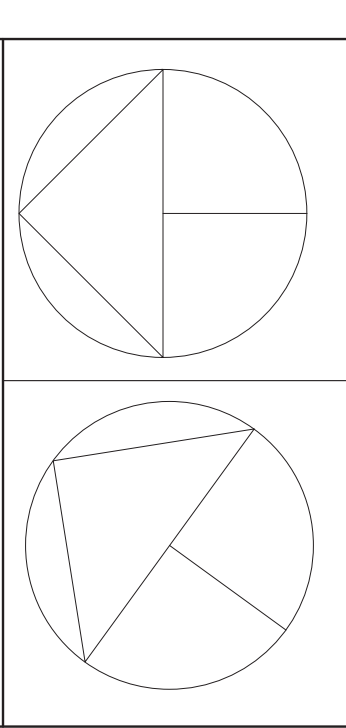


PROJECT TITLE  
**OUR LADY OF FATIMA PHASE 2  
RENEWAL**

DRAWING TITLE  
**MECH. ADDITION WALL SECTIONS**

DATE: 4/9/2018  
DRAWN BY: Author  
SCALE: As Indicated  
CHECKED BY: Checker  
PROJECT NO.: 1724  
DRAWING NO.: **A501**





TRUE NORTH  
 CONSTRUCTION NORTH

**NOTES**

**LEGEND**

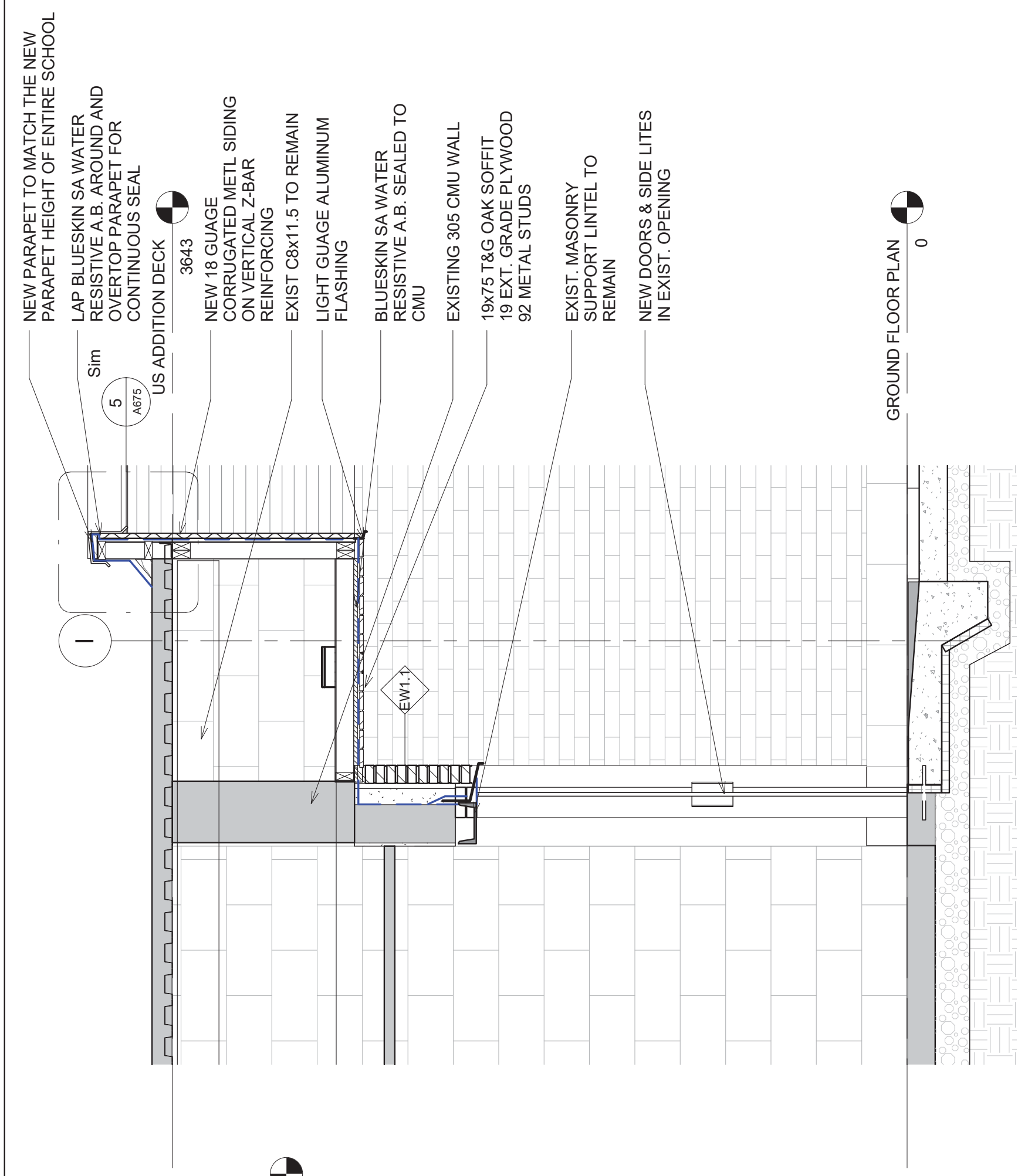
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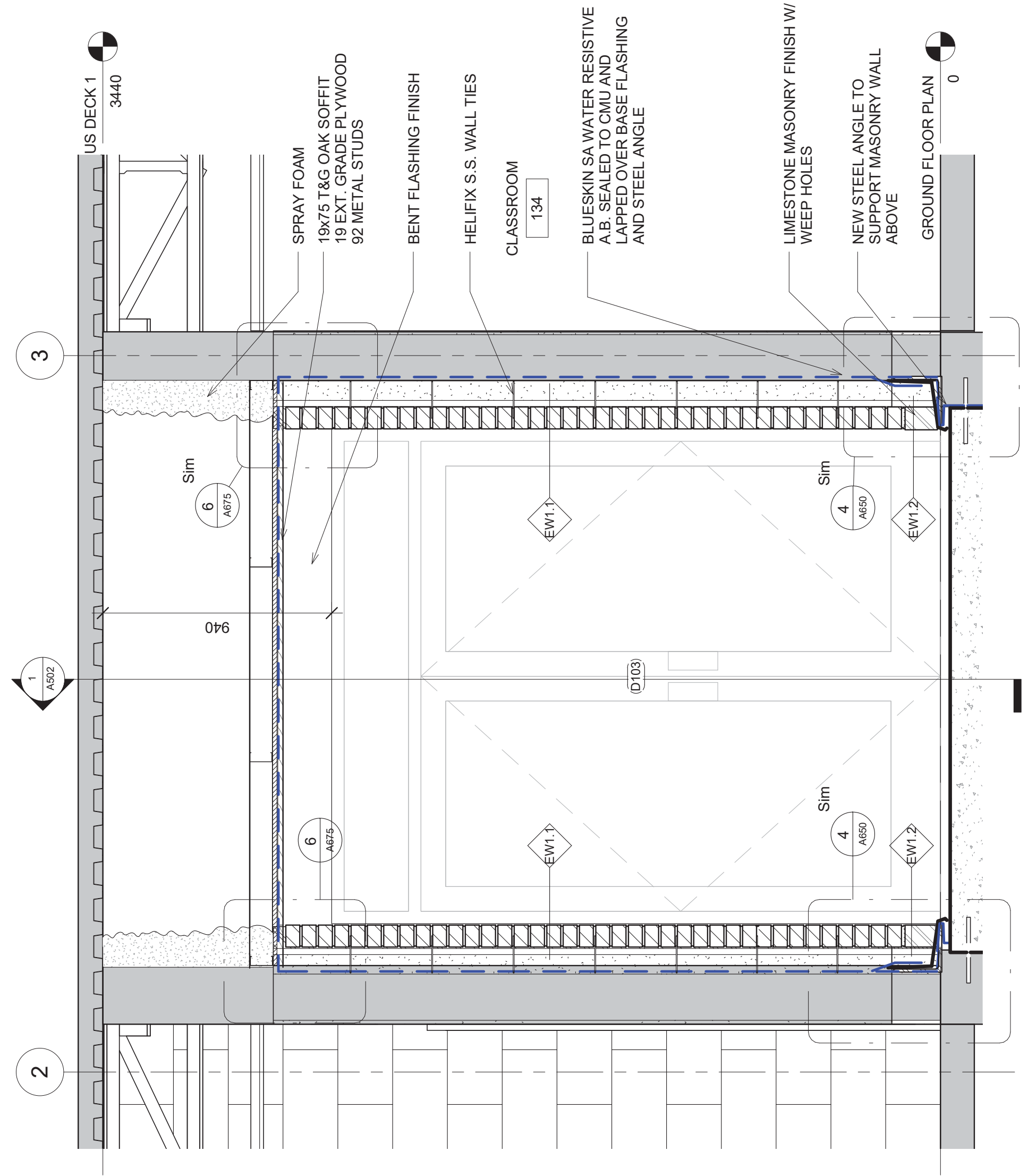
PROJECT TITLE  
**OUR LADY OF FATIMA PHASE 2  
 RENEWAL**

DRAWING TITLE  
**WALL SECTIONS**

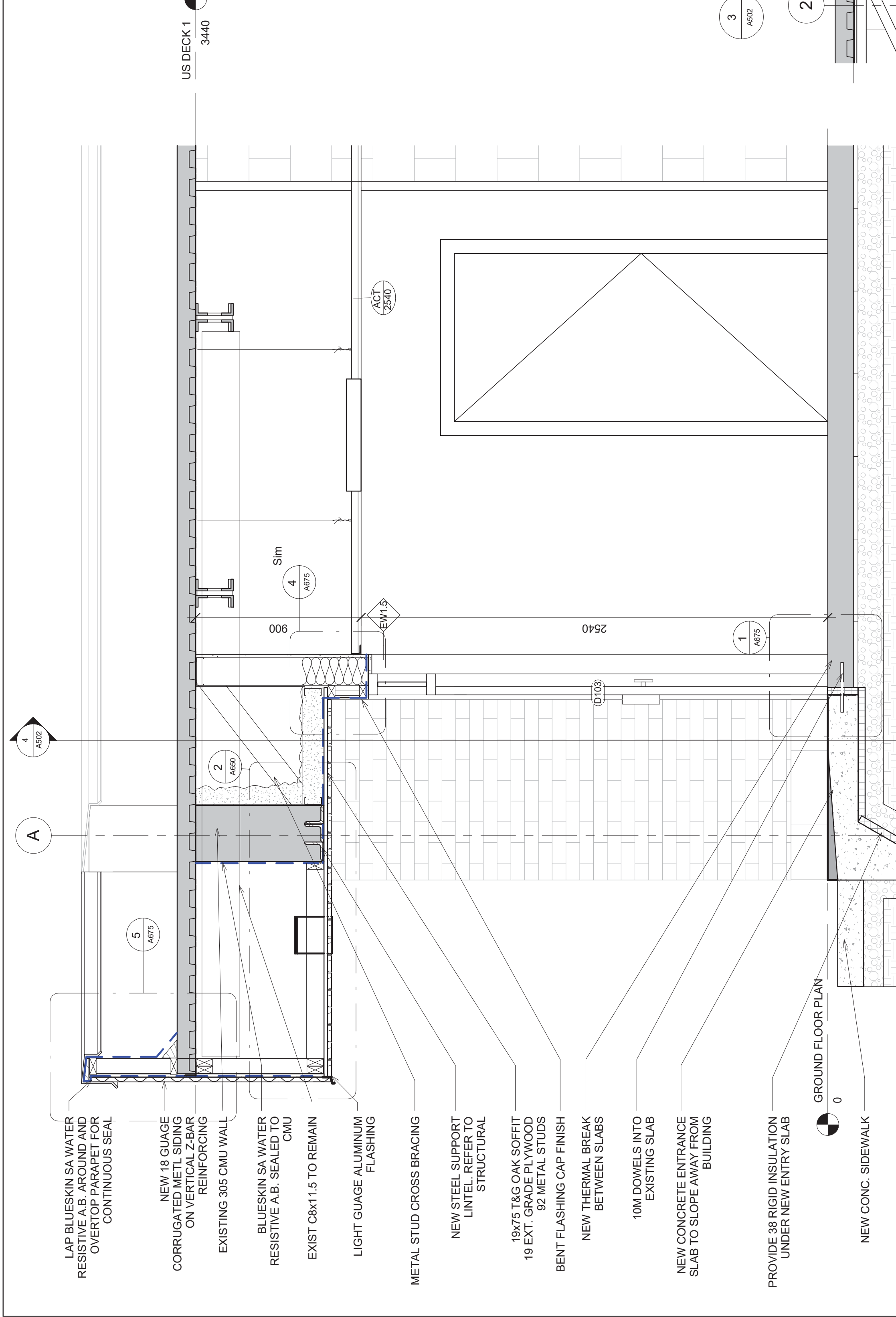
DATE 4/9/2018	DRAWN BY Author	PROJECT NO. 1724
SCALE As Indicated	CHECKED BY Checker	
DRAWING NO. <b>A502</b>		



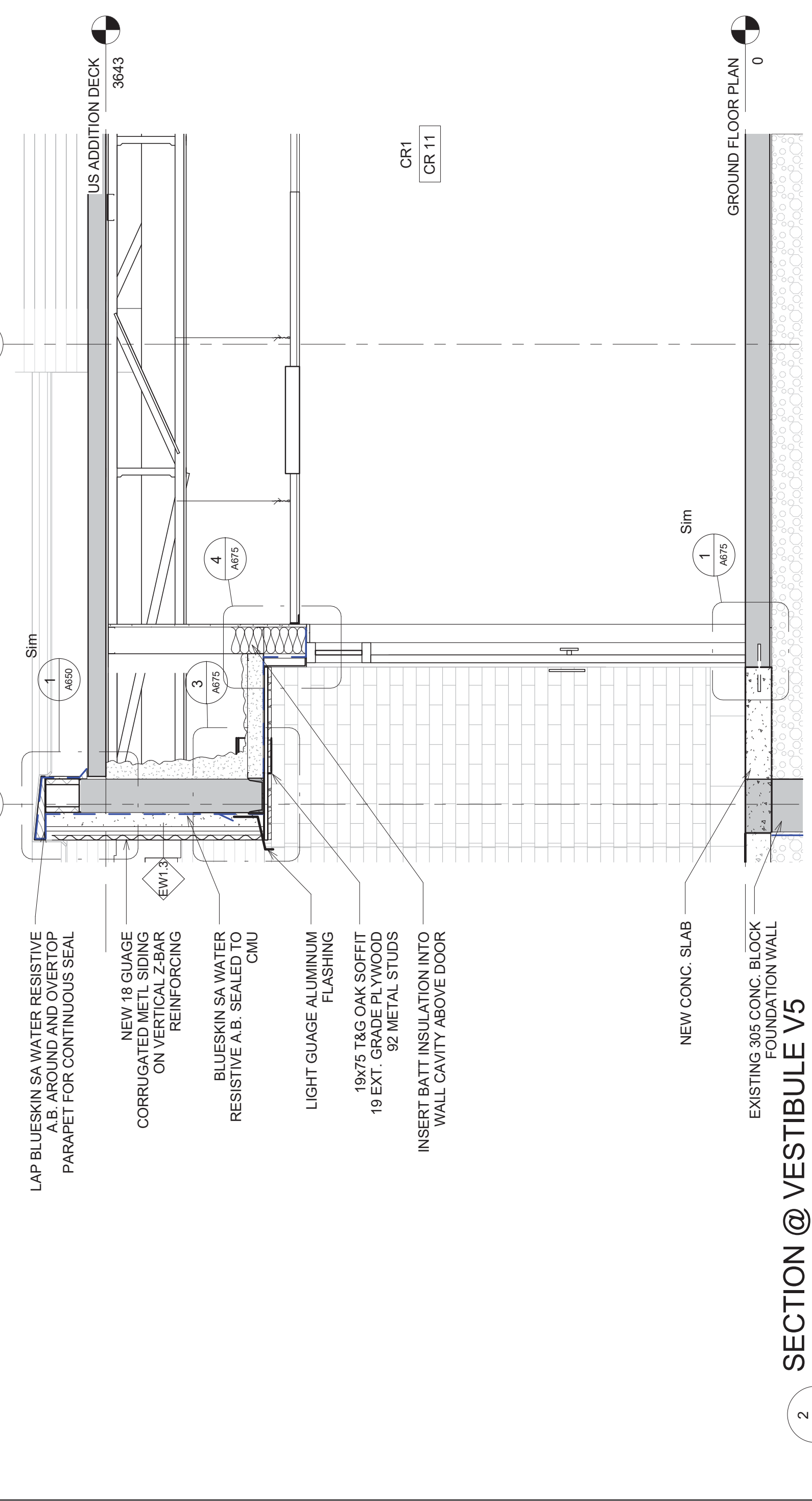
**SECTION @ CHILDCARE  
 ENTRANCE VESTIBULE**  
 1 : 20



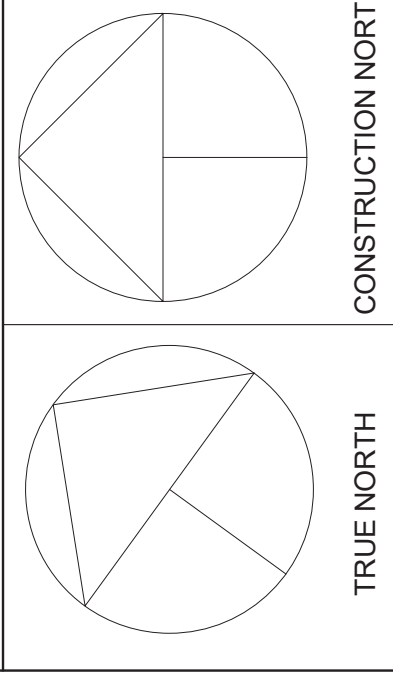
**SECTION @ ENTRY VESTIBULE**  
 1 : 15



**SECTION @ VESTIBULE**  
 1 : 15



**SECTION @ VESTIBULE V5**  
 1 : 20



**NOTES**

**LEGEND**

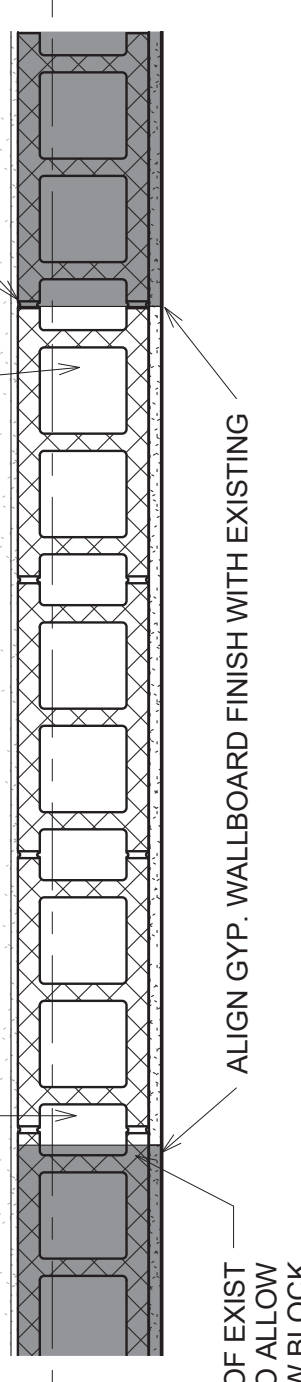
Date	Description	No.
4/12/2018	ISSUED FOR TENDER	1

PROJECT TITLE  
**OUR LADY OF FATIMA PHASE 2 RENEWAL**

PROJECT NO.  
**1724**

DRAWING NO.  
**A600**

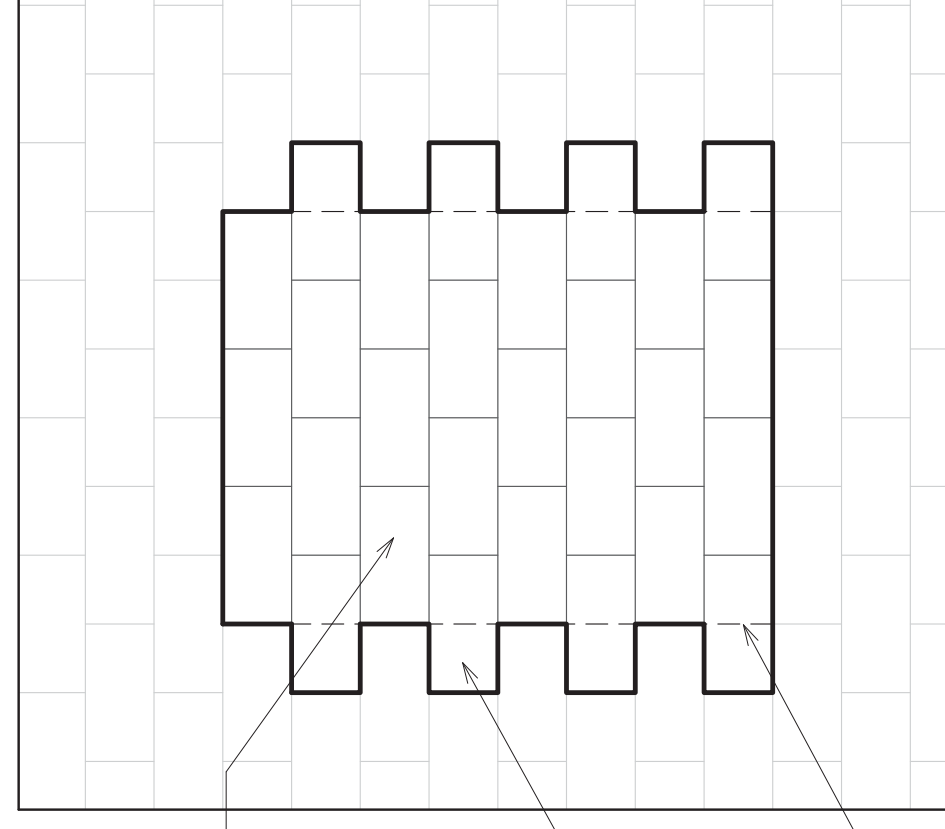
WHERE EXIST. BRICK & INSULATION IS REMOVED AND EXPOSED IN MECHANICAL ROOM, CUT PROTRUDING REINFORCEMENT TIES & PATCH SMOOTH WITH MORTAR ALL SURFACES. PRIME & PAINT.



REMOVE PARTS OF EXIST. CONC. BLOCK TO ALLOW FOR TOOTHING OF NEW BLOCK

STAFF ROOM  
160

**1** **DETAIL @ WALL INFILL**  
1 : 10

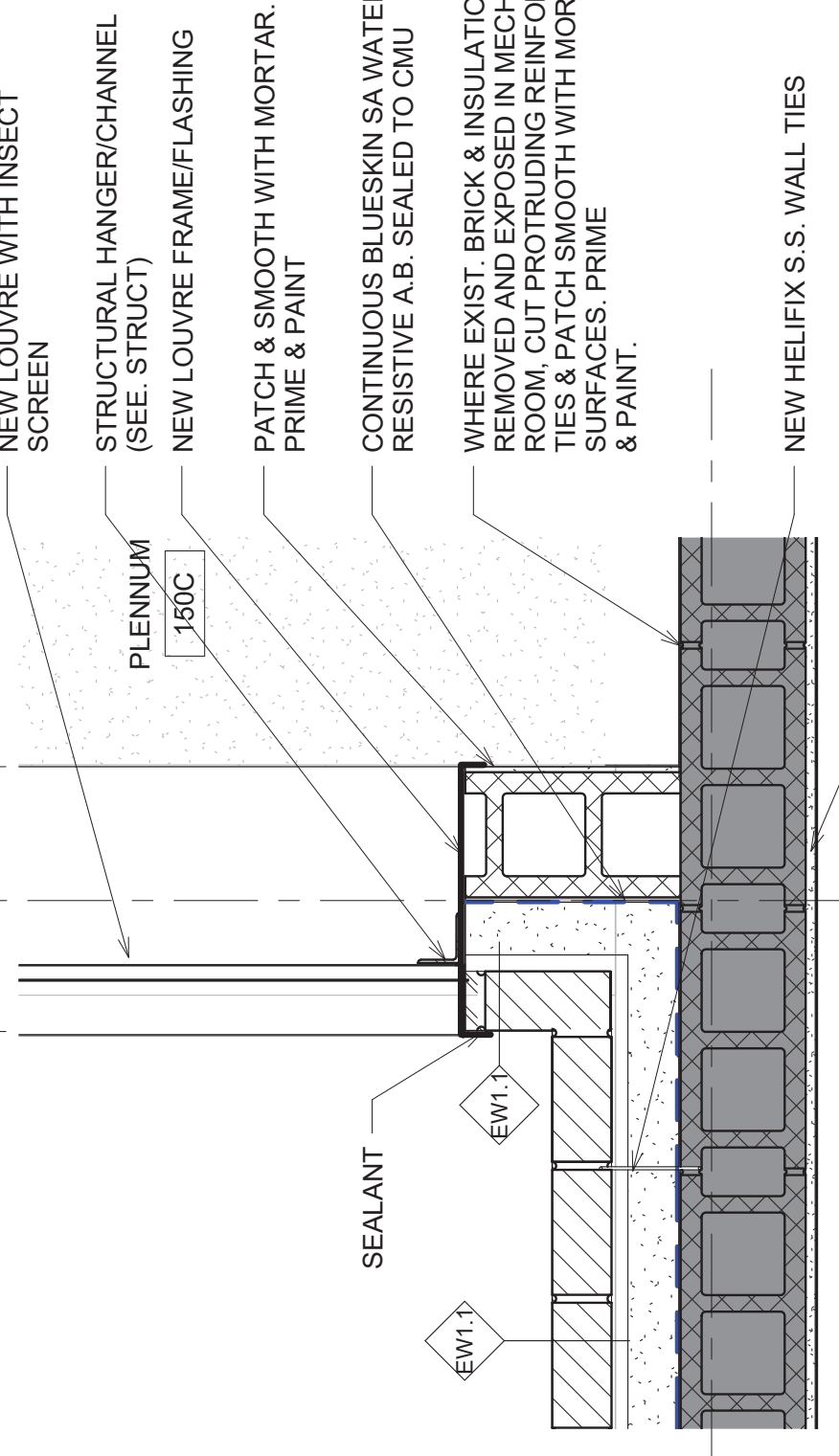


**8** **WALL INFILL ELEVATION**  
1 : 20

NEW CMU TOOTHED IN AT EXISTING WALL OPENINGS

EXISTING CMU TO BE REMOVED TO ALLOW NEW CMU TO BE TOOTHED IN

LINE OF EXIST. OPENING



STAFF ROOM  
160

**2** **PLAN DETAIL @ LOUVRE CORNER**  
1 : 10

NEW LOUVRE WITH INSECT SCREEN

STRUCTURAL HANGER/CHANNEL (SEE STRUCT)

NEW LOUVRE FRAME/FLASHING

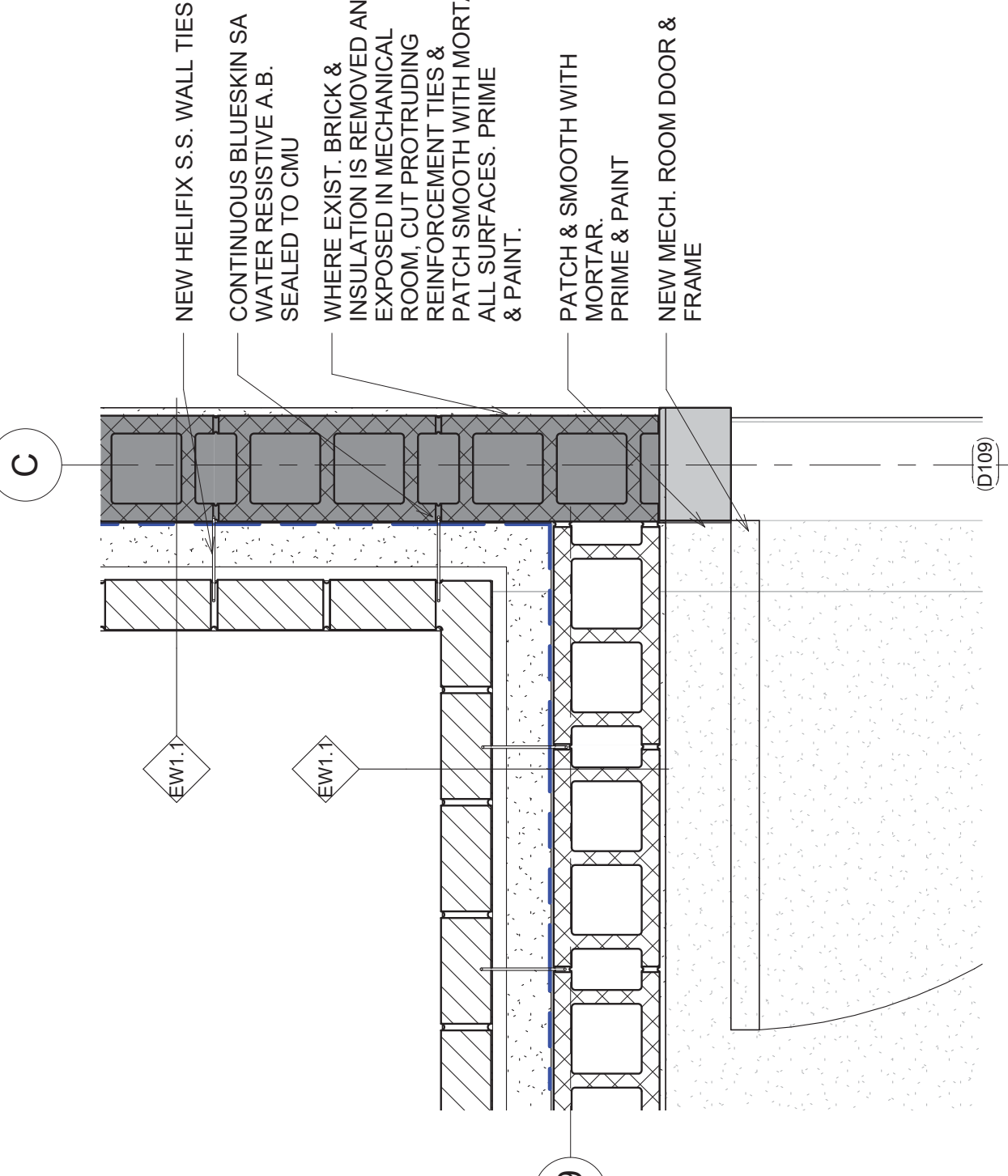
PATCH & SMOOTH WITH MORTAR. PRIME & PAINT

CONTINUOUS BLUESKIN SA WATER RESISTIVE A.B. SEALED TO CMU

WHERE EXIST. BRICK & INSULATION IS REMOVED AND EXPOSED IN MECHANICAL ROOM, CUT PROTRUDING REINFORCEMENT TIES & PATCH SMOOTH WITH MORTAR ALL SURFACES. PRIME & PAINT.

NEW HELIFIX S.S. WALL TIES

MAKE GYP. FINISH SMOOTH AND ALIGN WITH EXIST. WALL



**6** **PLAN DETAIL @ MASONRY WALL CORNER**  
1 : 10

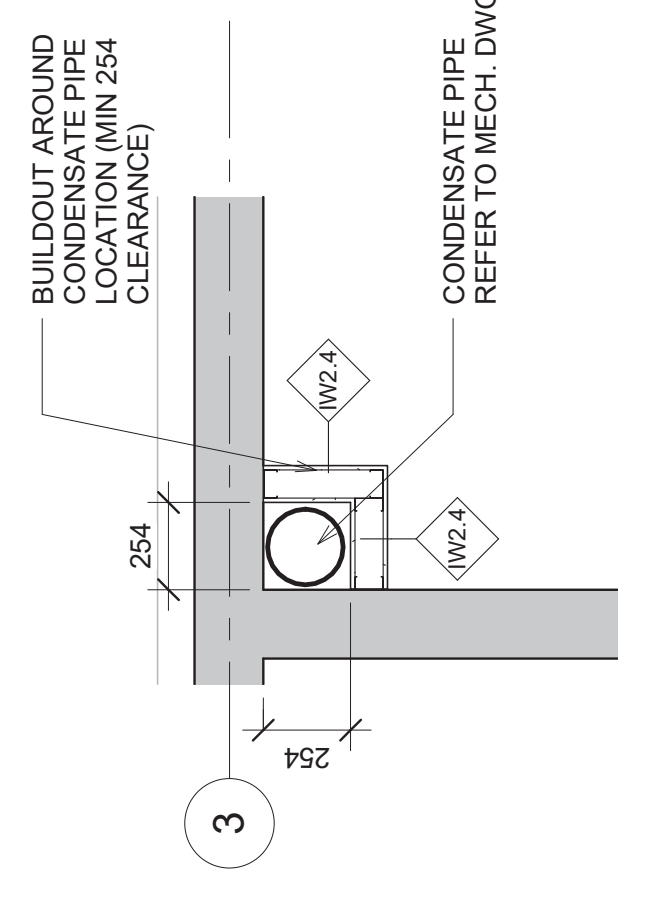
NEW HELIFIX S.S. WALL TIES

CONTINUOUS BLUESKIN SA WATER RESISTIVE A.B. SEALED TO CMU

WHERE EXIST. BRICK & INSULATION IS REMOVED AND EXPOSED IN MECHANICAL ROOM, CUT PROTRUDING REINFORCEMENT TIES & PATCH SMOOTH WITH MORTAR ALL SURFACES. PRIME & PAINT.

PATCH & SMOOTH WITH MORTAR. PRIME & PAINT

NEW MECH. ROOM DOOR & FRAME



**3** **PIPE BUILDOUT OF CONDENSATE**  
1 : 20

BUILDOUT AROUND CONDENSATE PIPE LOCATION (MIN 254 CLEARANCE)

CONDENSATE PIPE REFER TO MECH. DWGS



TRUE NORTH  
 CONSTRUCTION NORTH

**NOTES**

**LEGEND**

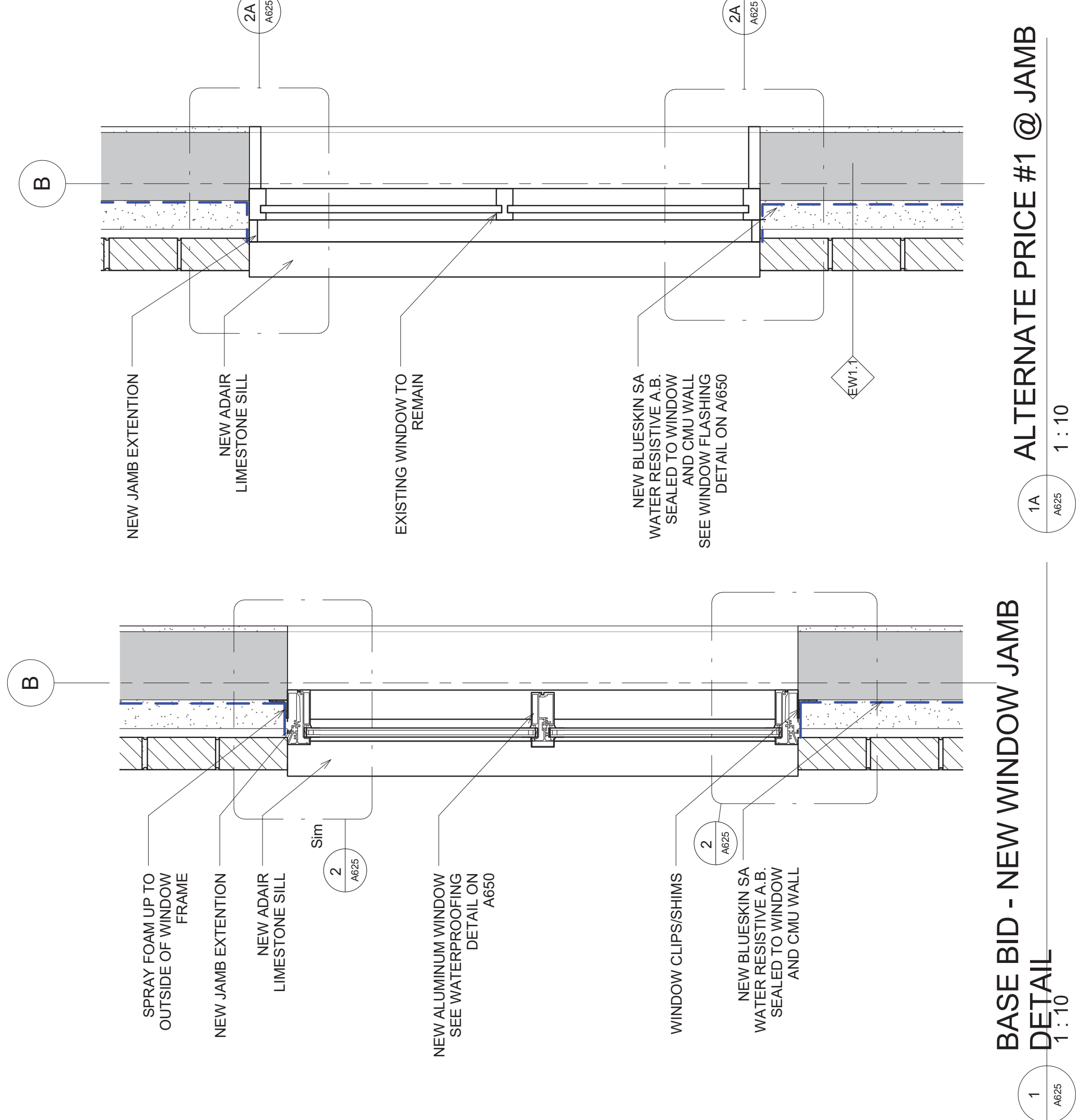
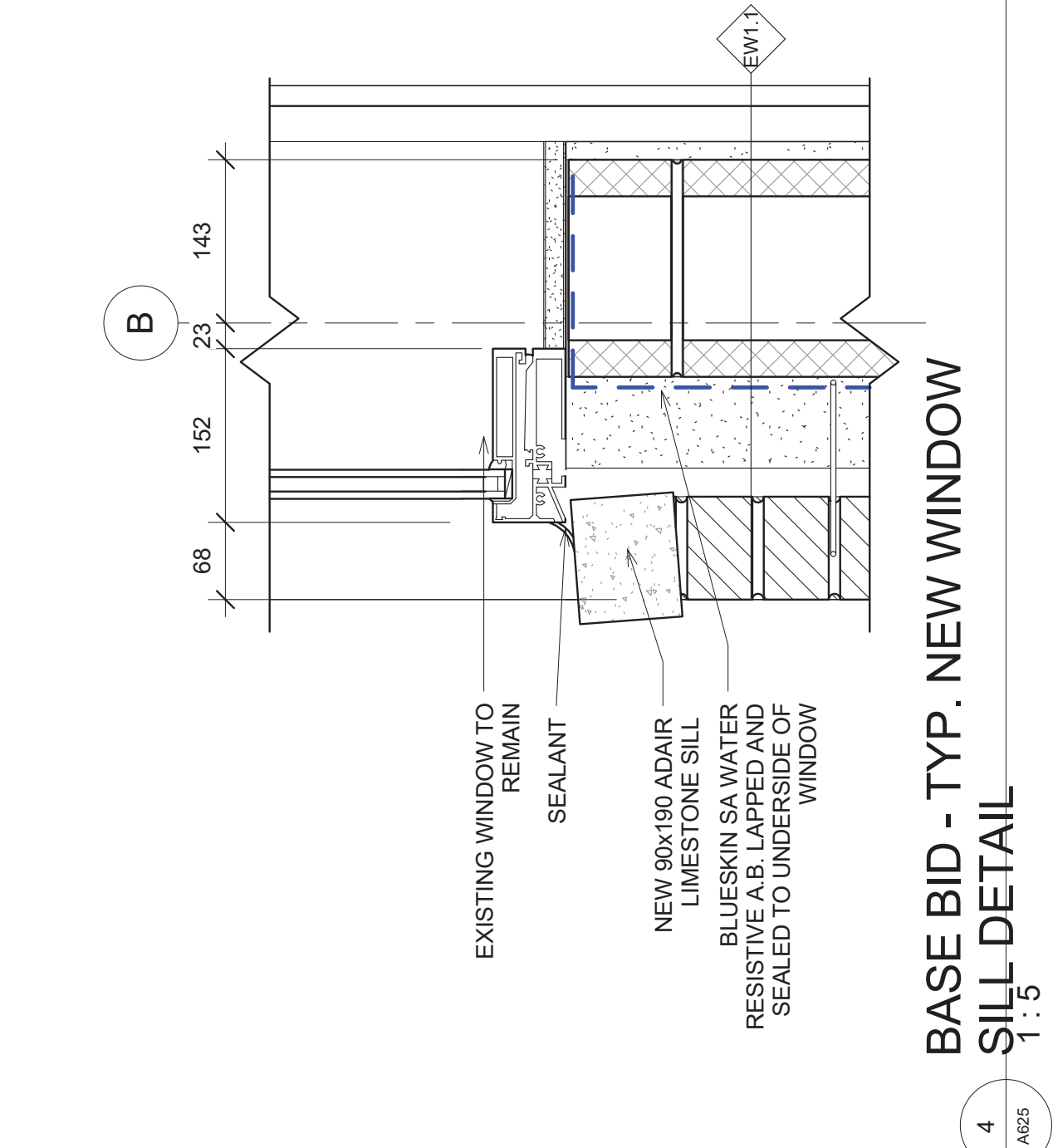
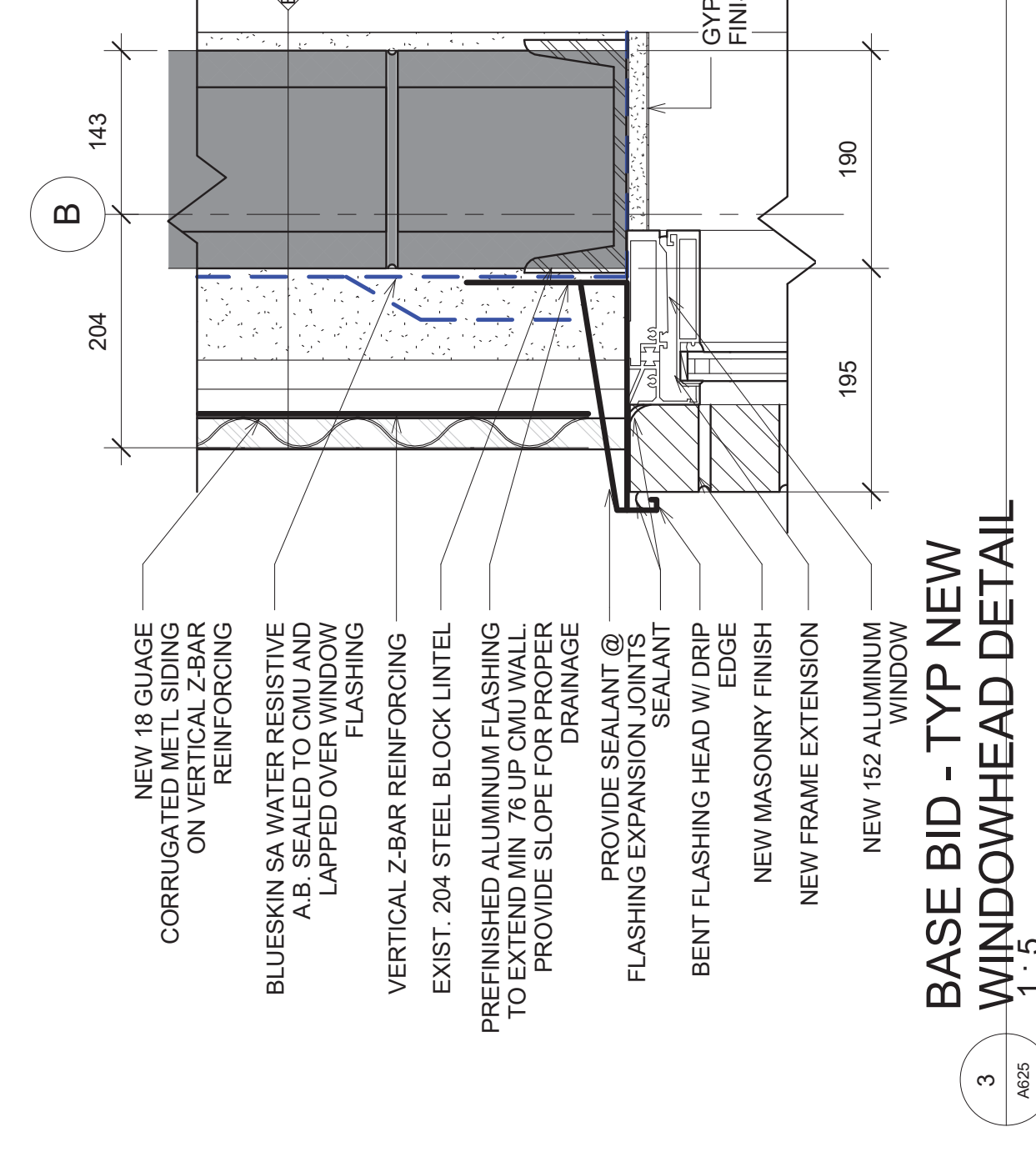
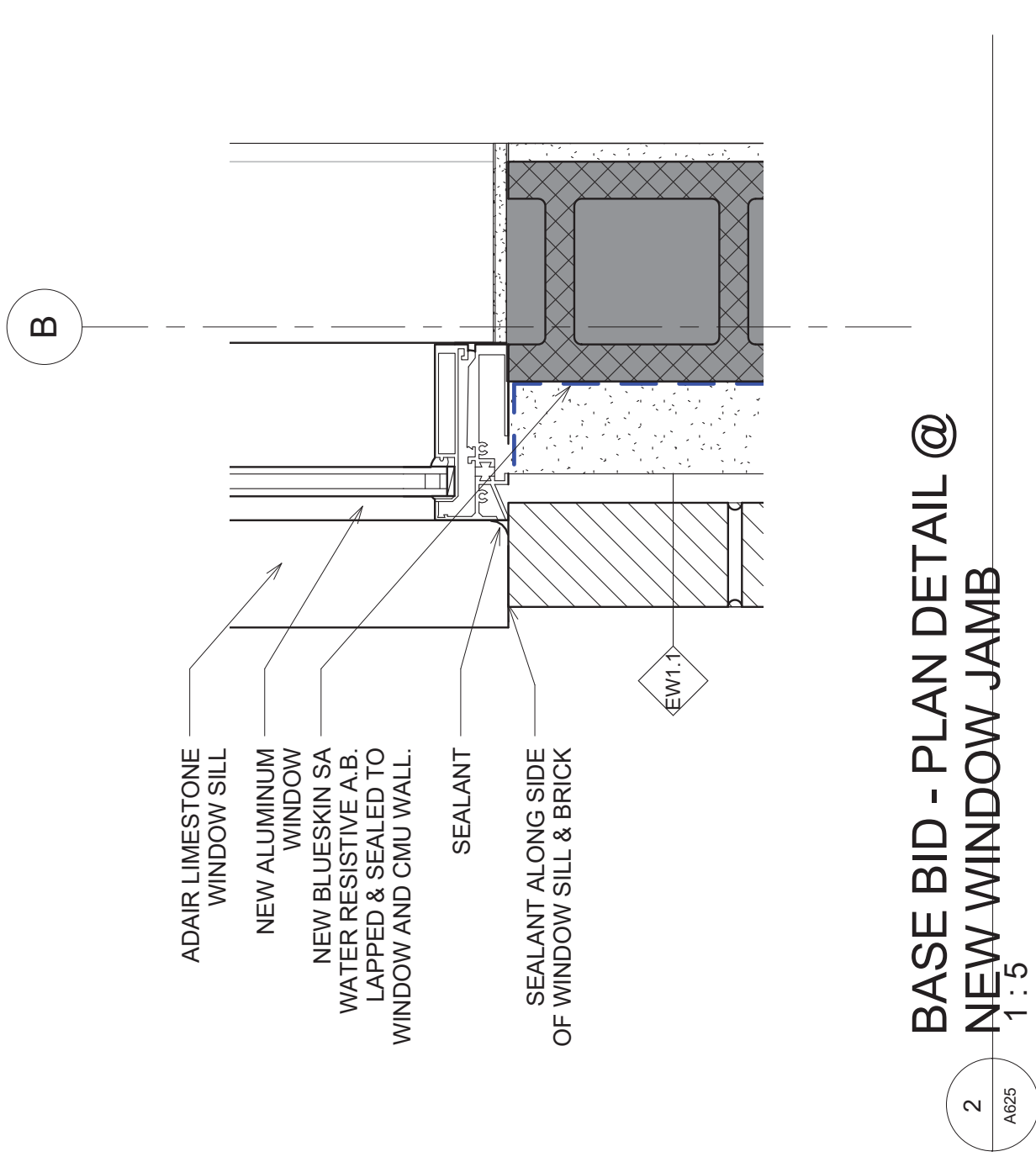
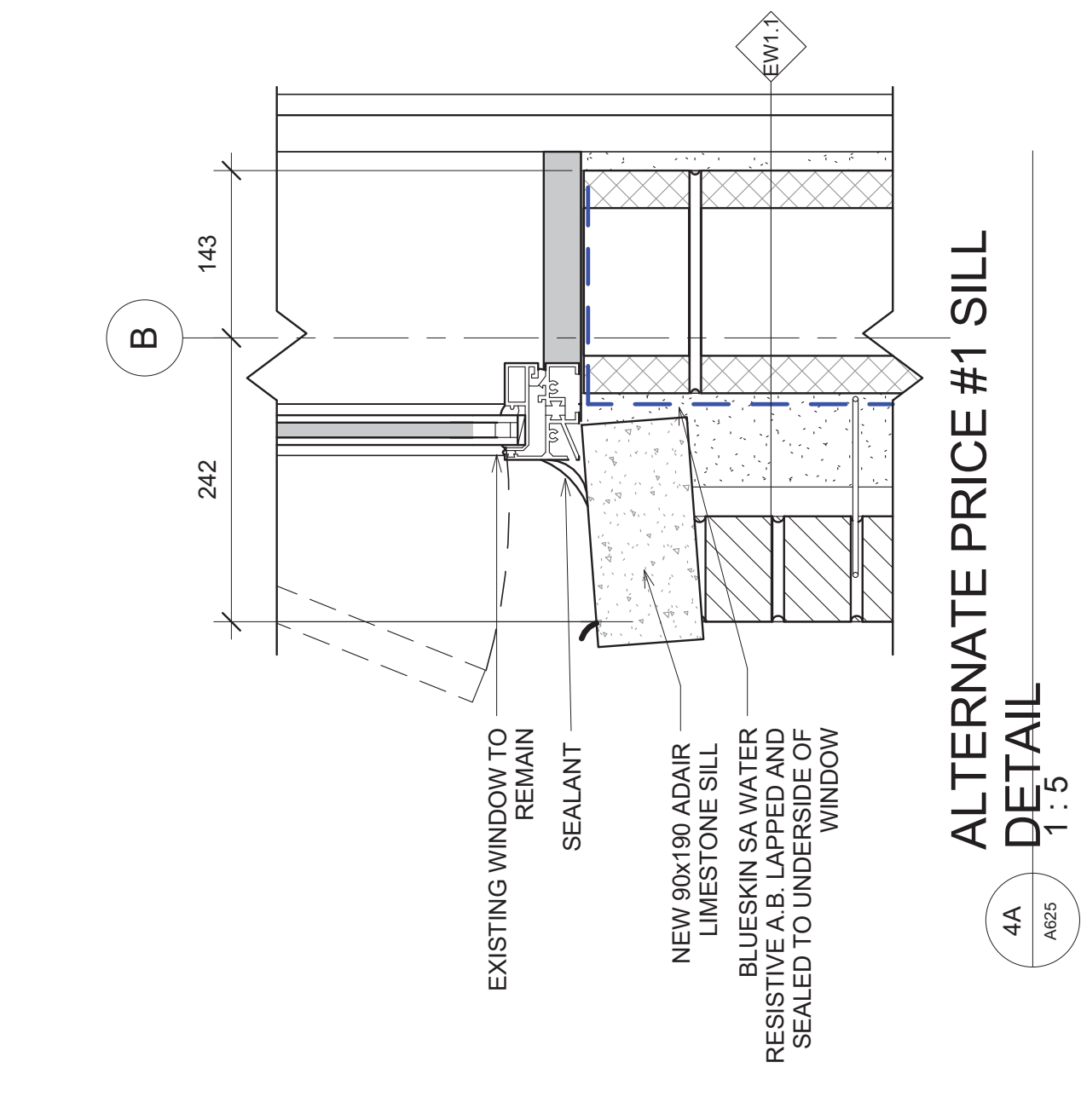
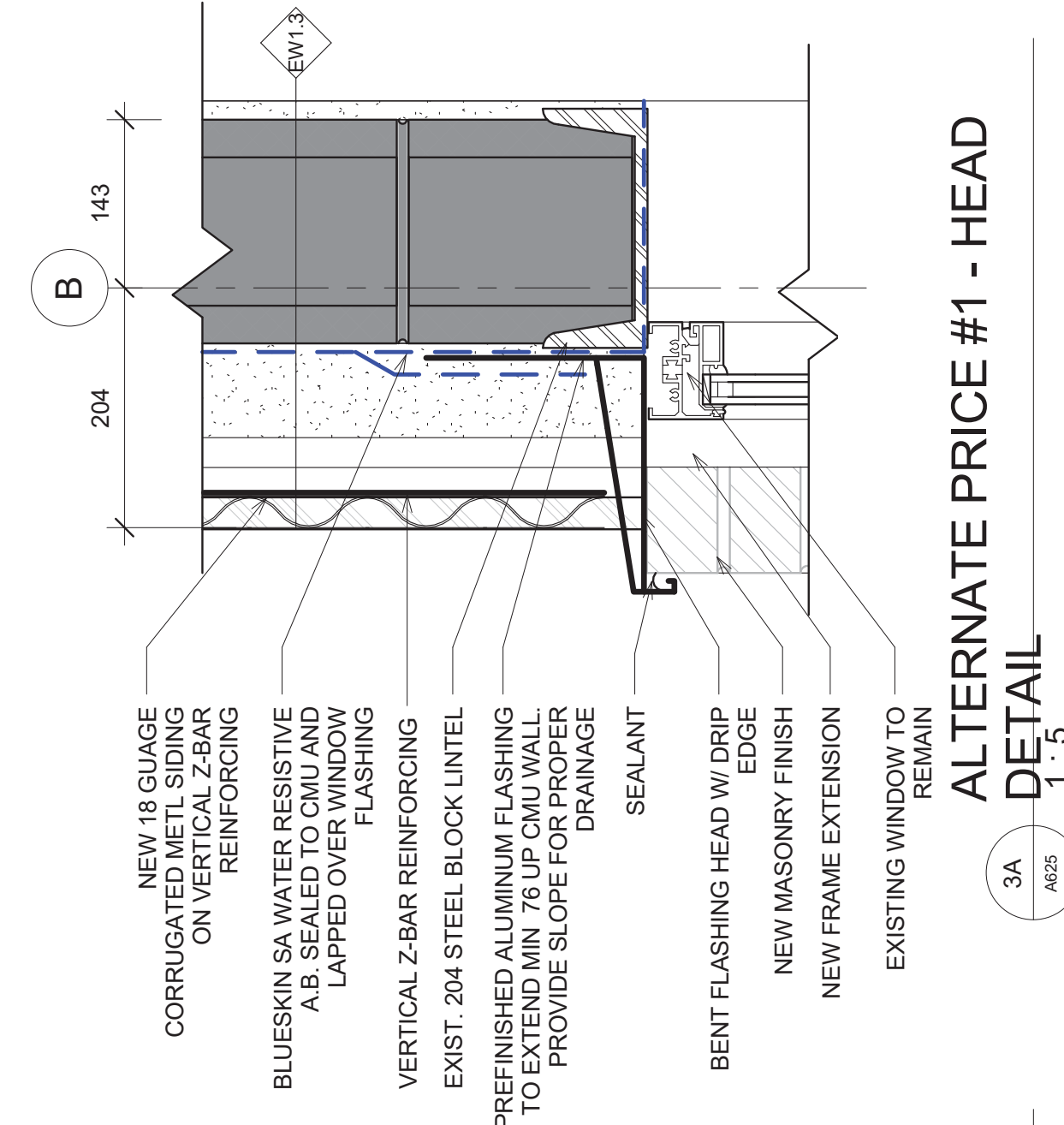
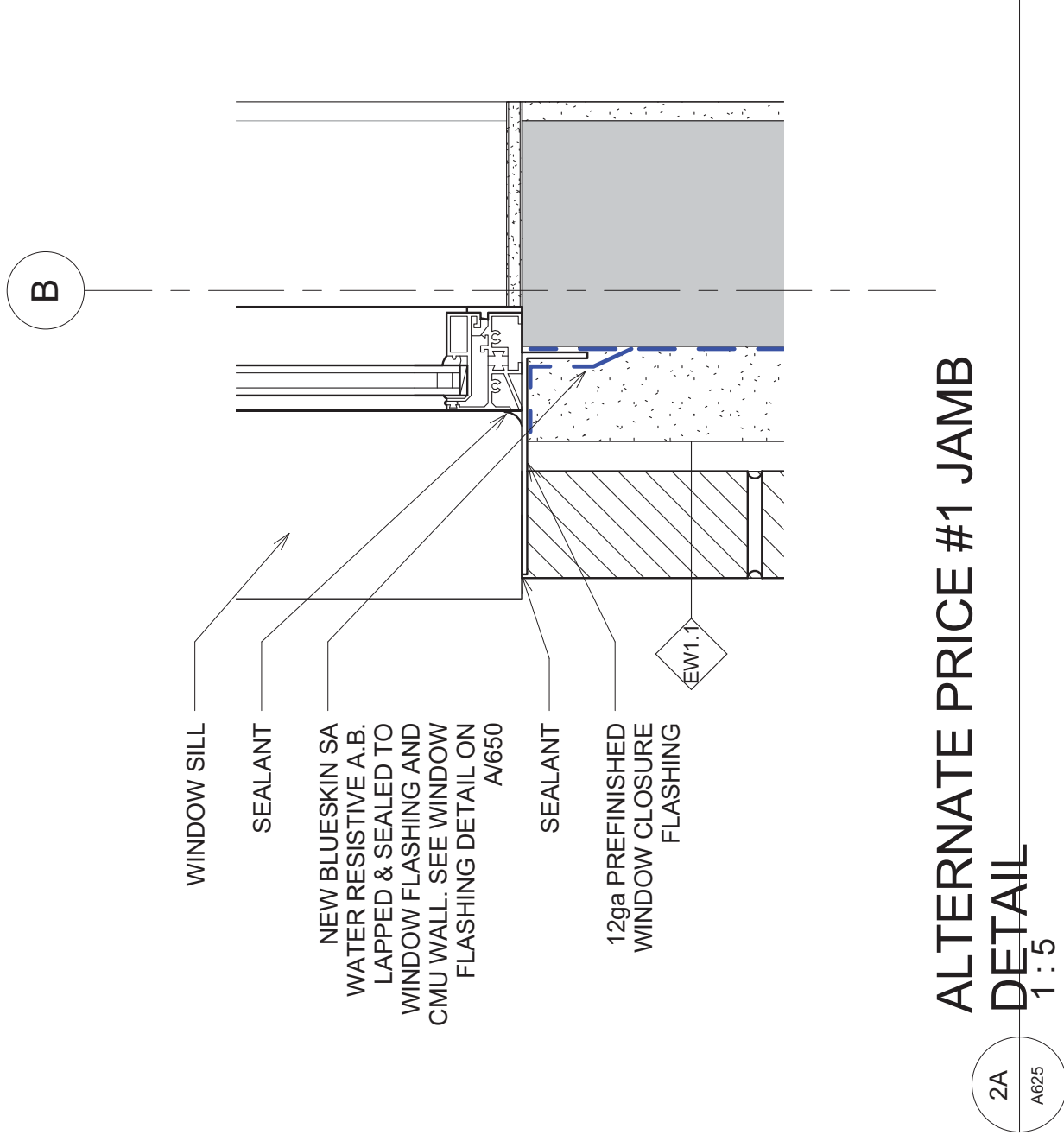
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4/12/2018	ISSUED FOR TENDER	1



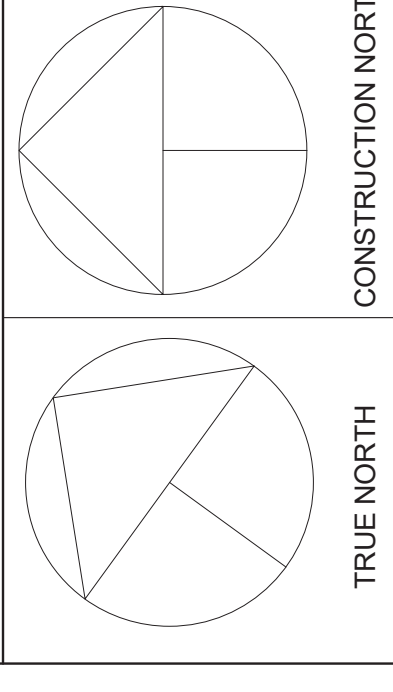
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**OUR LADY OF FATIMA PHASE 2  
 RENEWAL**

DRAWING TITLE  
**WINDOW DETAILS**

DATE: 4/9/2018  
 DRAWN BY: Author  
 SCALE: As Indicated  
 CHECKED BY: Checker  
 PROJECT NO.: 1724  
 DRAWING NO.: **A625**



**WINDOW DETAILS**



**NOTES**

**LEGEND**

Date	Description	No.
4/12/2018	ISSUED FOR TENDER	1

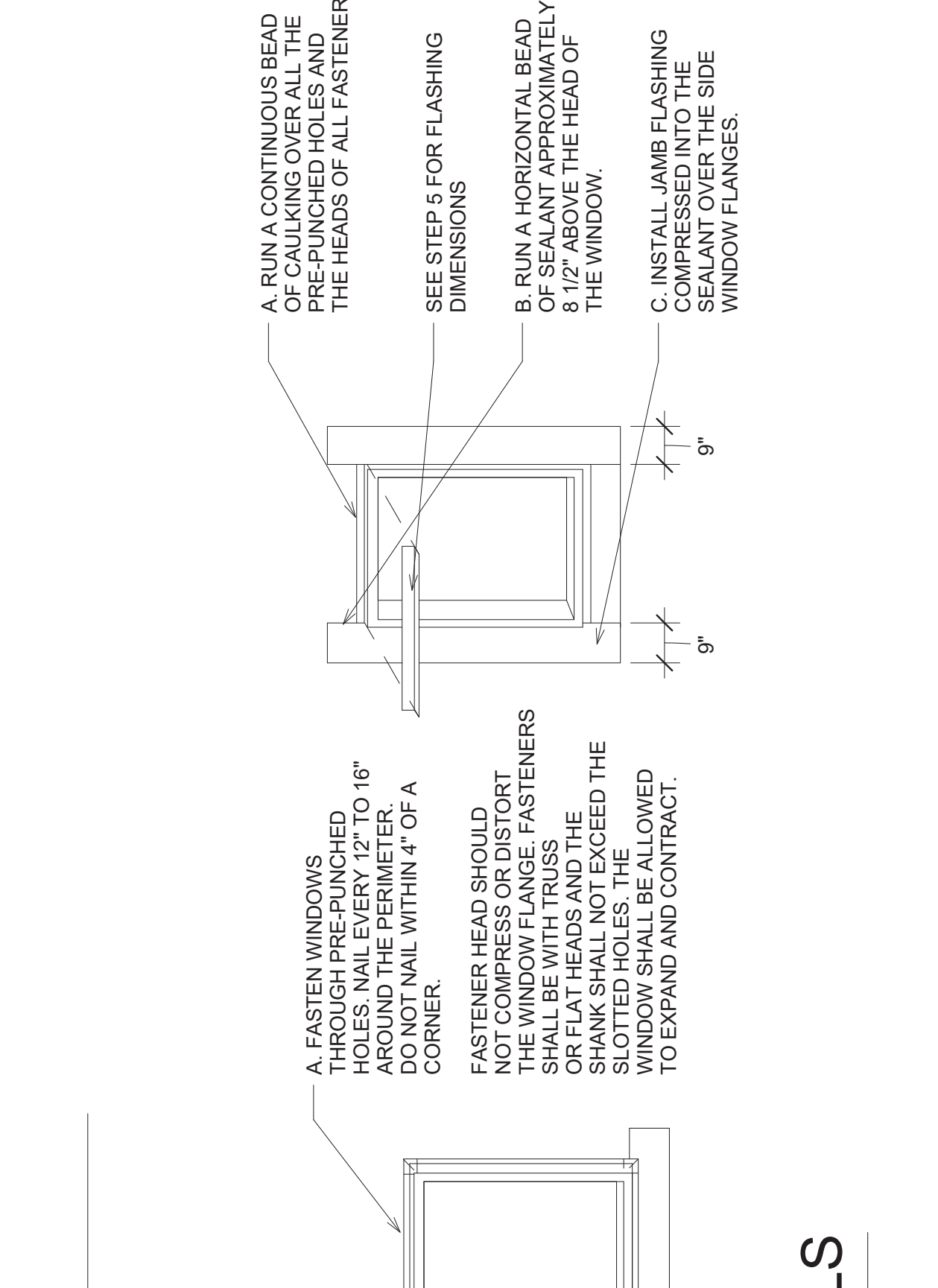
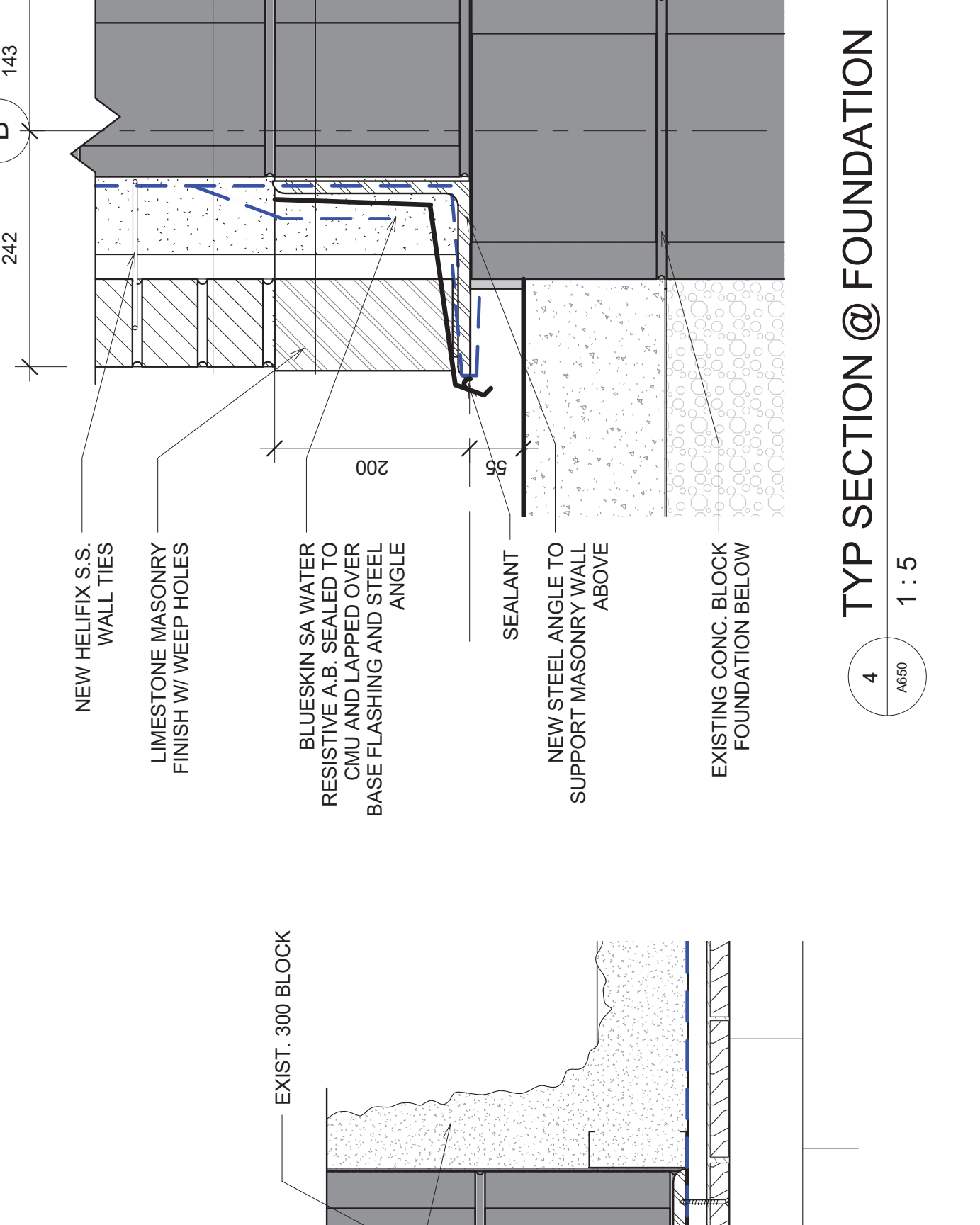
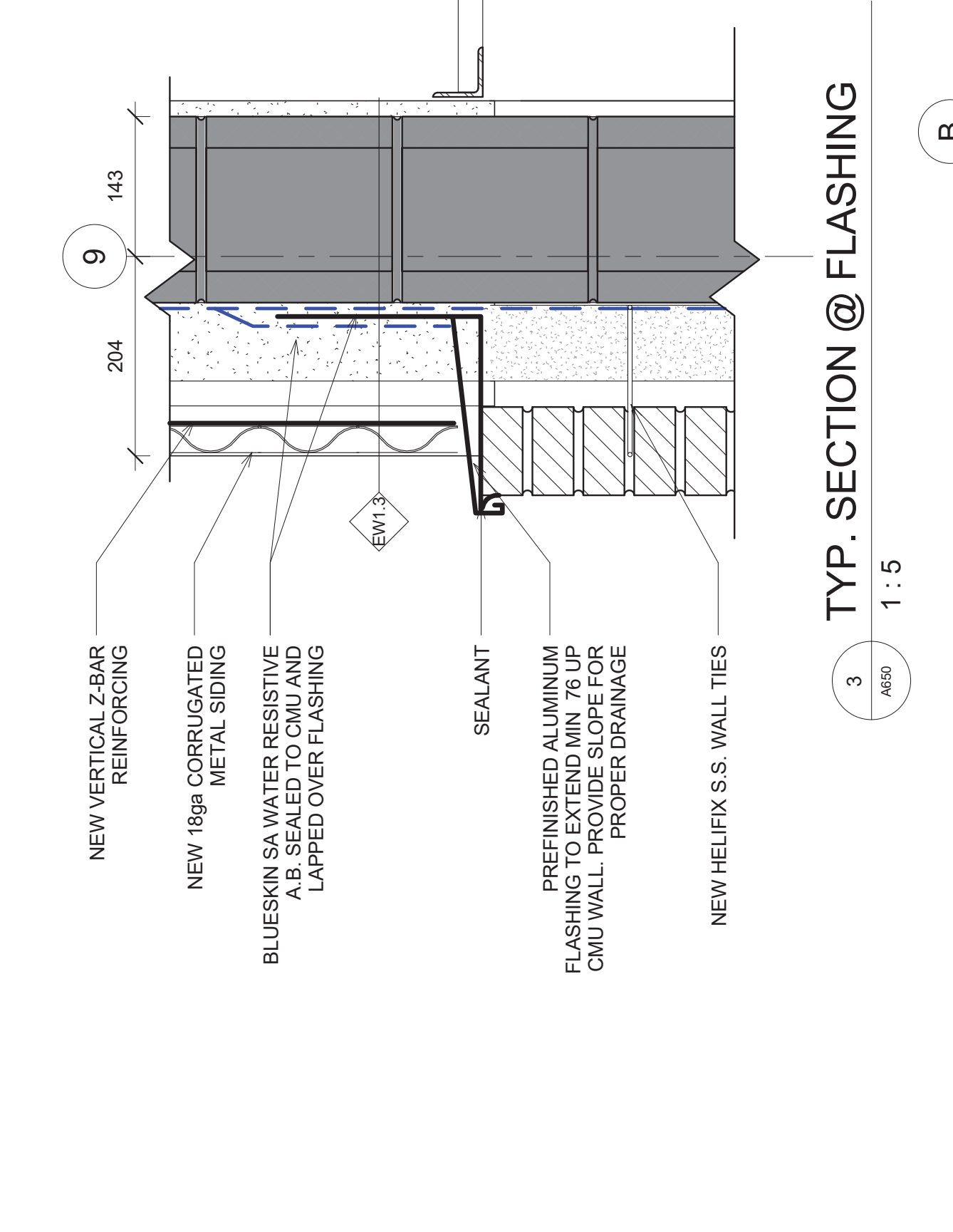
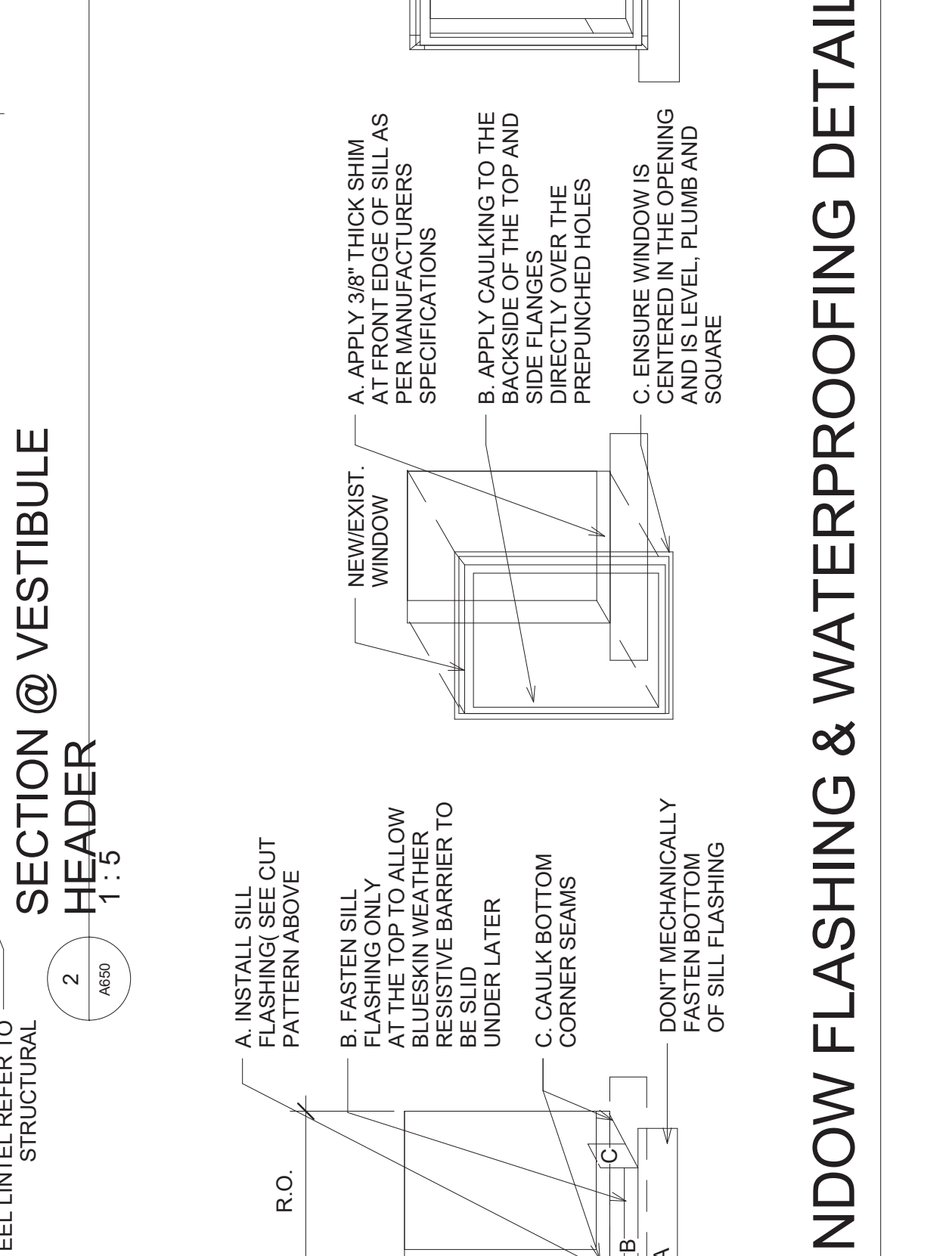
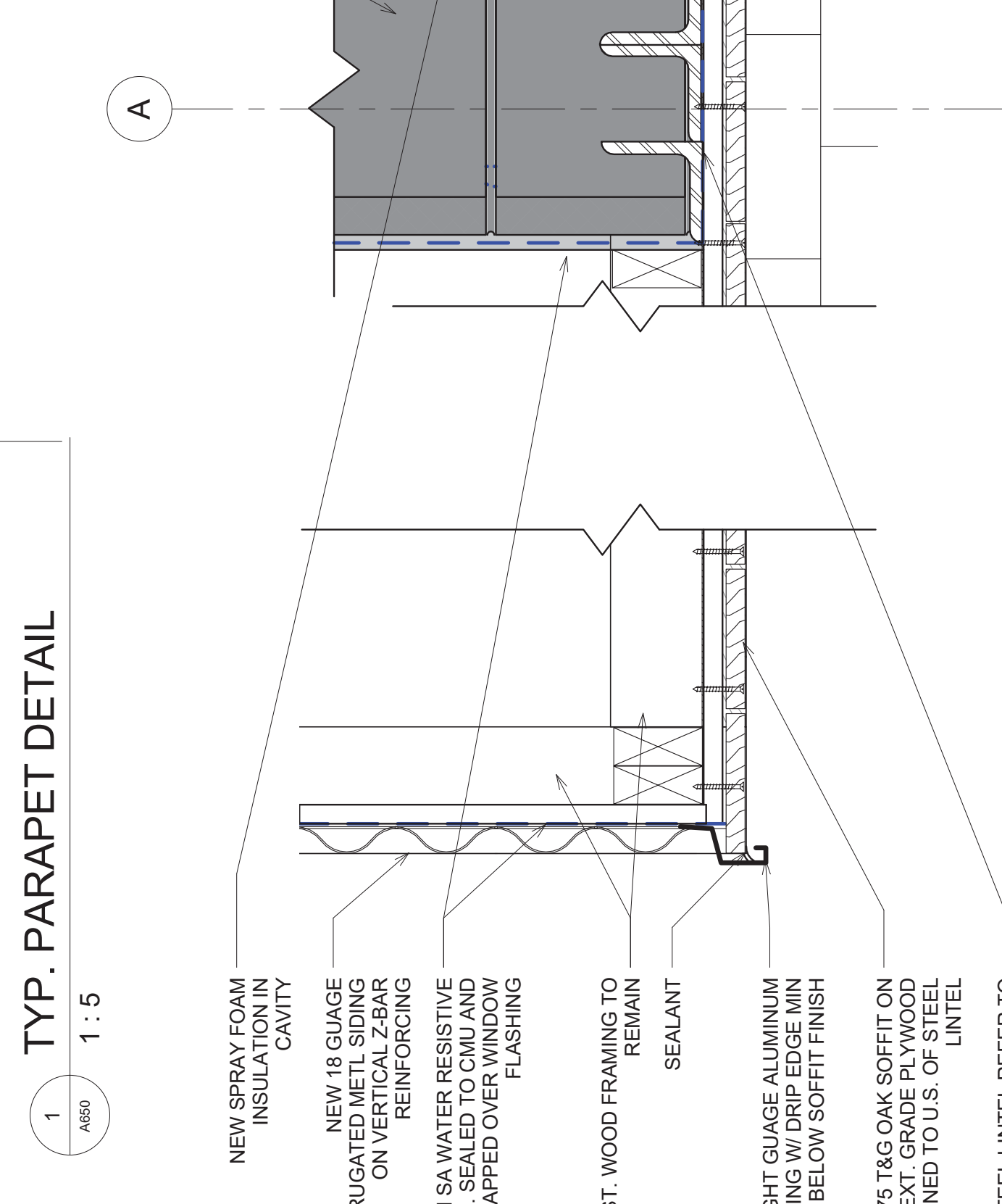
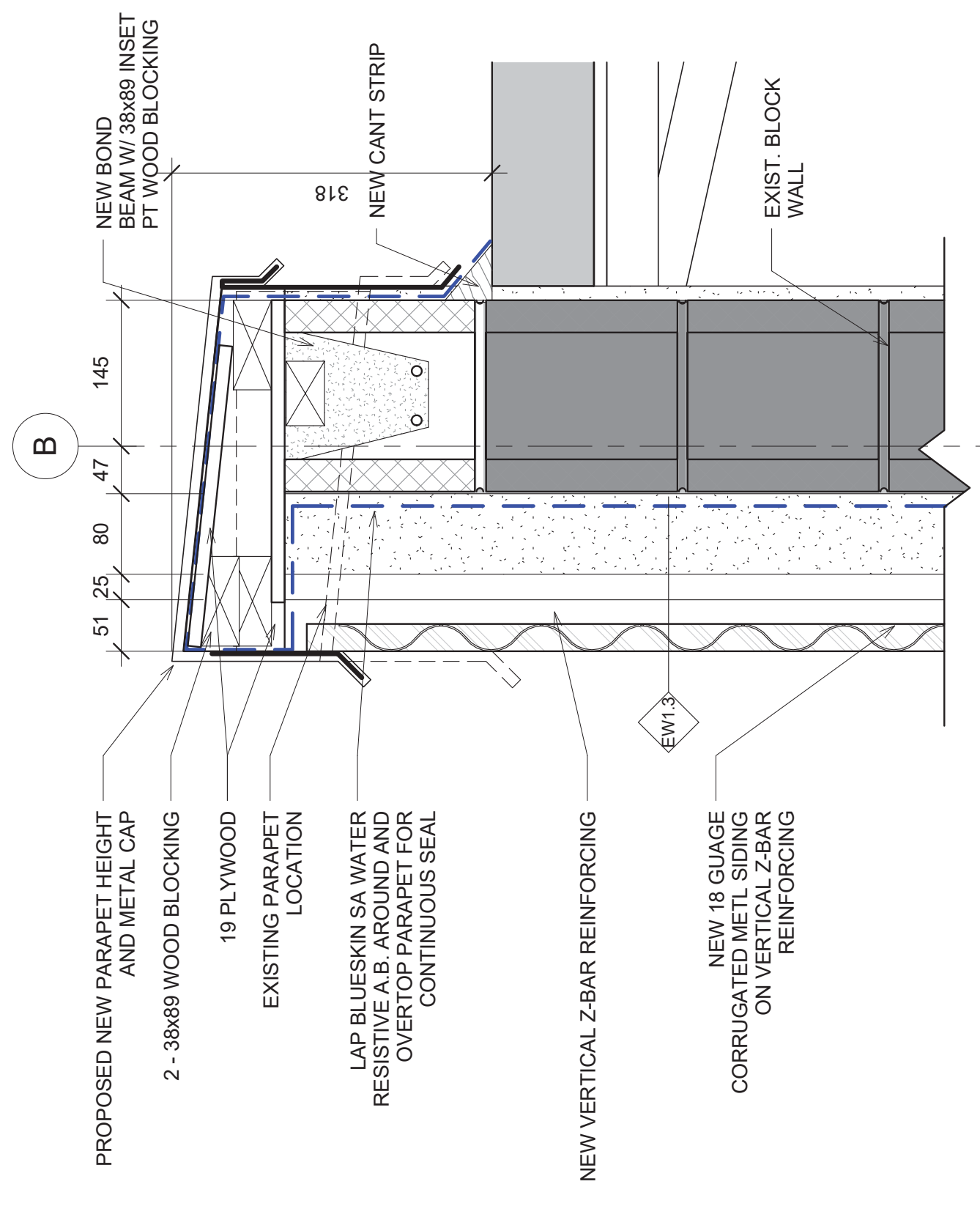
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 DRAWING TITLE: **SECTION DETAILS**

DRAWN BY: Author  
 CHECKED BY: Checker  
 PROJECT NO: 1724

DATE: 4/9/2018  
 SCALE: As Indicated

ASSOCIATION OF ARCHITECTS OF ONTARIO  
 RANDY R. WILSON  
 LICENCE 4000

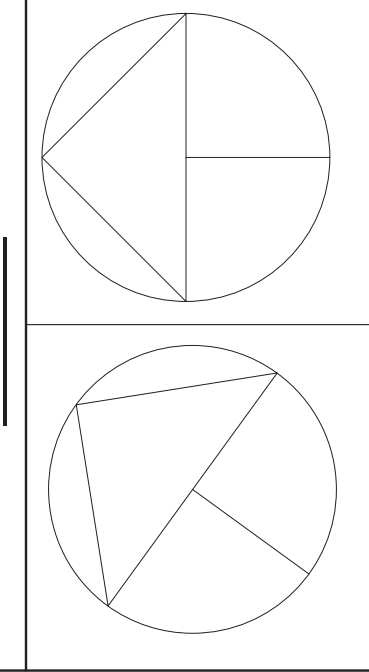
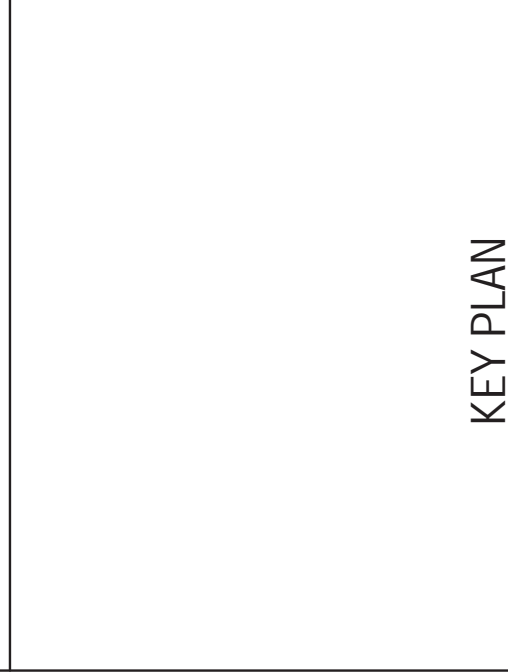
**SECTION DETAILS**



**WINDOW FLASHING & WATERPROOFING DETAILS**







**NOTES**

**LEGEND**

	PATCH & REPAIR CONCRETE FLOOR WHERE AFFECTED BY PLUMBING WORK OR WALL REMOVAL.
	PCT - PORCELAIN TILE W/ PCT BASE - FIELD PATTERN
	PCT - PORCELAIN TILE W/ PCT BASE - HIGHLIGHT PATTERN
	QT - NEW QUARTZ TILE

Date	Description	No.
4/12/2018	ISSUED FOR TENDER	1



PROJECT TITLE:  
**OUR LADY OF FATIMA PHASE 2 RENEWAL**

DRAWING TITLE: **FINISHING PLAN**

DATE: 4/9/2018	DRAWN BY: Author
SCALE: As Indicated	CHECKED BY: Checker
PROJECT NO: 1724	DRAWING NO: A800

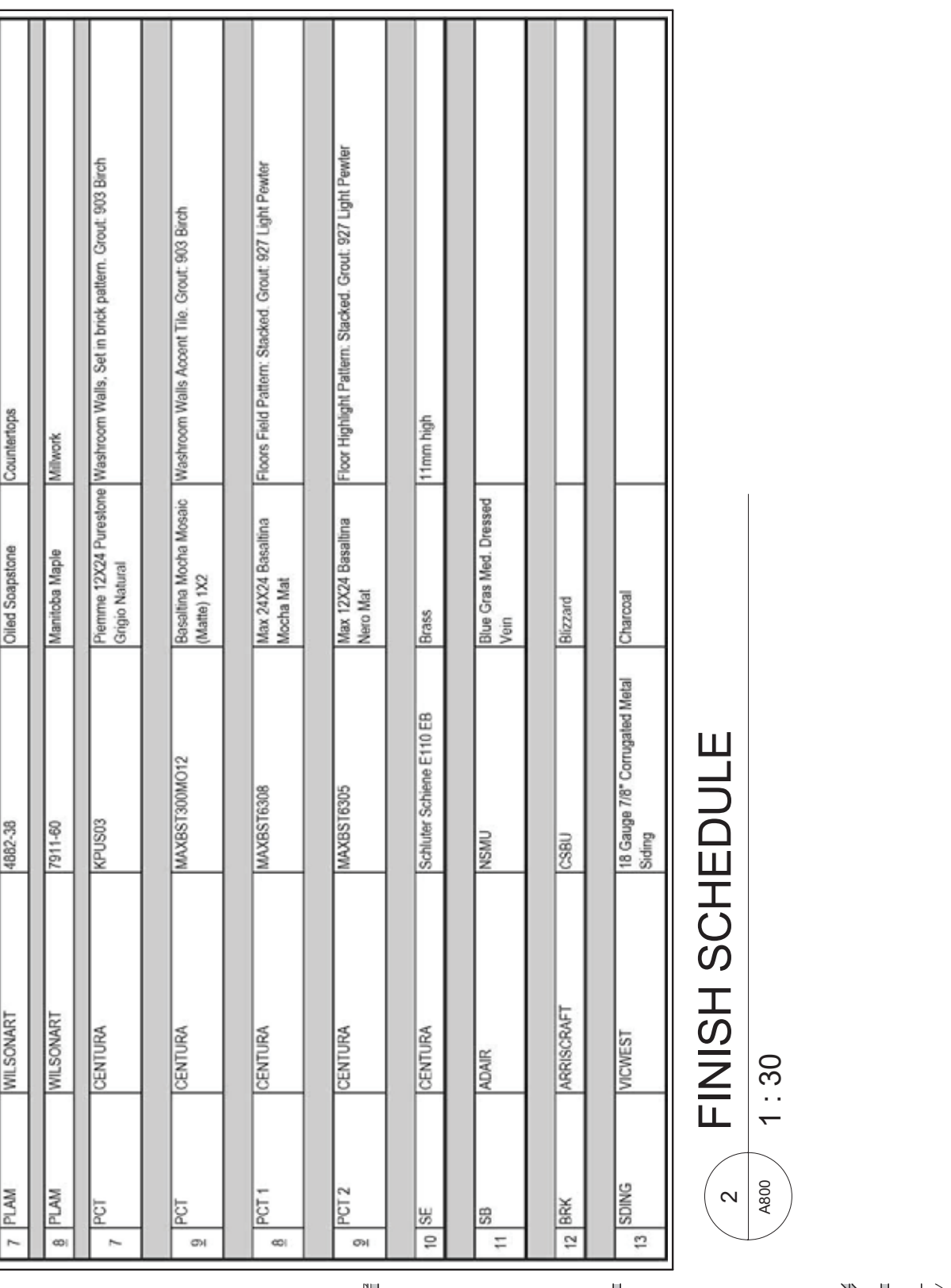
**ROOM FINISH SCHEDULE**  
 Our Lady of Fatima - Chatham - Phase II  
 Wilson Diaz Architects Incorporated

CHANGES ARE HIGHLIGHTED, BOLD & ITALICIZED

Room	Room No.	Room Name	Finish	Material	Colour	Remarks
102	102	MECHANICAL	EX	EX	ACT	Refer to elevations in A800 for ceramic tile finish.
103	103	MECHANICAL	EX	EX	ACT	Refer to elevations in A800 for ceramic tile finish.
104	104	MECHANICAL	EX	EX	ACT	Refer to elevations in A800 for ceramic tile finish.
105	105	MECHANICAL	EX	EX	ACT	Refer to elevations in A800 for ceramic tile finish.
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200	200	MECHANICAL	EX	EX	ACT	Refer to elevations in A800 for ceramic tile finish.

**FINISH SCHEDULE**  
 St. Clair Catholic District School Board  
 Our Lady of Fatima  
 Wilson Diaz Architects Incorporated

TAG	MANUFACTURER	MATERIAL CODE	COLOUR	REMARKS
1	VERSA TILE	PAIN SPRING		
2	BULLX	5057 EB10	White Wavy 4018	Field color, includes bullwork, Espallat finish
3	BULLX	5058 EB10	Charcoal Grey 4018	Door and window frame, Espallat finish
4	ROUPE	PINKALE	123-Charcoal	100mm high
5	ROLLETS SINGLES	SOLARFACTIVE PRODUCTS LTD	Skalar Shade Mat. 300 Series, 3%	3% Opacity / weave
6	ACT TYPE 1	PRIMSTRONGS	White	2x4x8
7	FLAM	WILSONART	Onyx Soapstone	Countertops
8	FLAM	WILSONART	Manitoba Maple	Milwork
9	PC1	CENTURA	60-503	Fluoresc. 1552 / Function: Waterroom Walls, set to brick pattern. Count: 603 Bath
10	PC1	CENTURA	MAUS51030672	Southern Maple Mosaic: Waterroom Walls, set to brick pattern. Count: 603 Bath
11	PC1	CENTURA	MAUS510308	Mocha Mah
12	PC1	CENTURA	MAUS510305	Mocha Mah
13	PC1	CENTURA	MAUS510305	Mocha Mah
14	PC1	CENTURA	MAUS510305	Mocha Mah
15	PC1	CENTURA	MAUS510305	Mocha Mah
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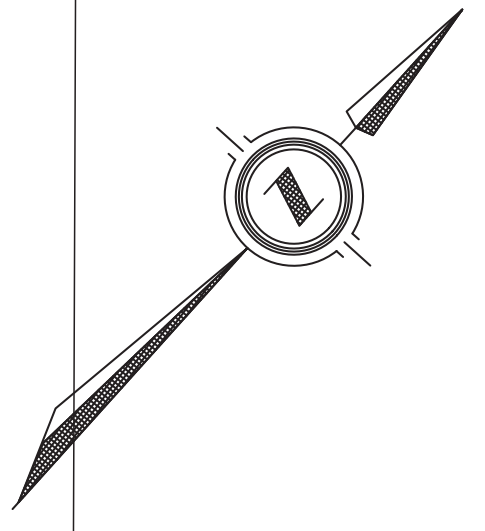




OUR LADY OF  
FATIMA CATHOLIC  
SCHOOL  
FFF = 180.32

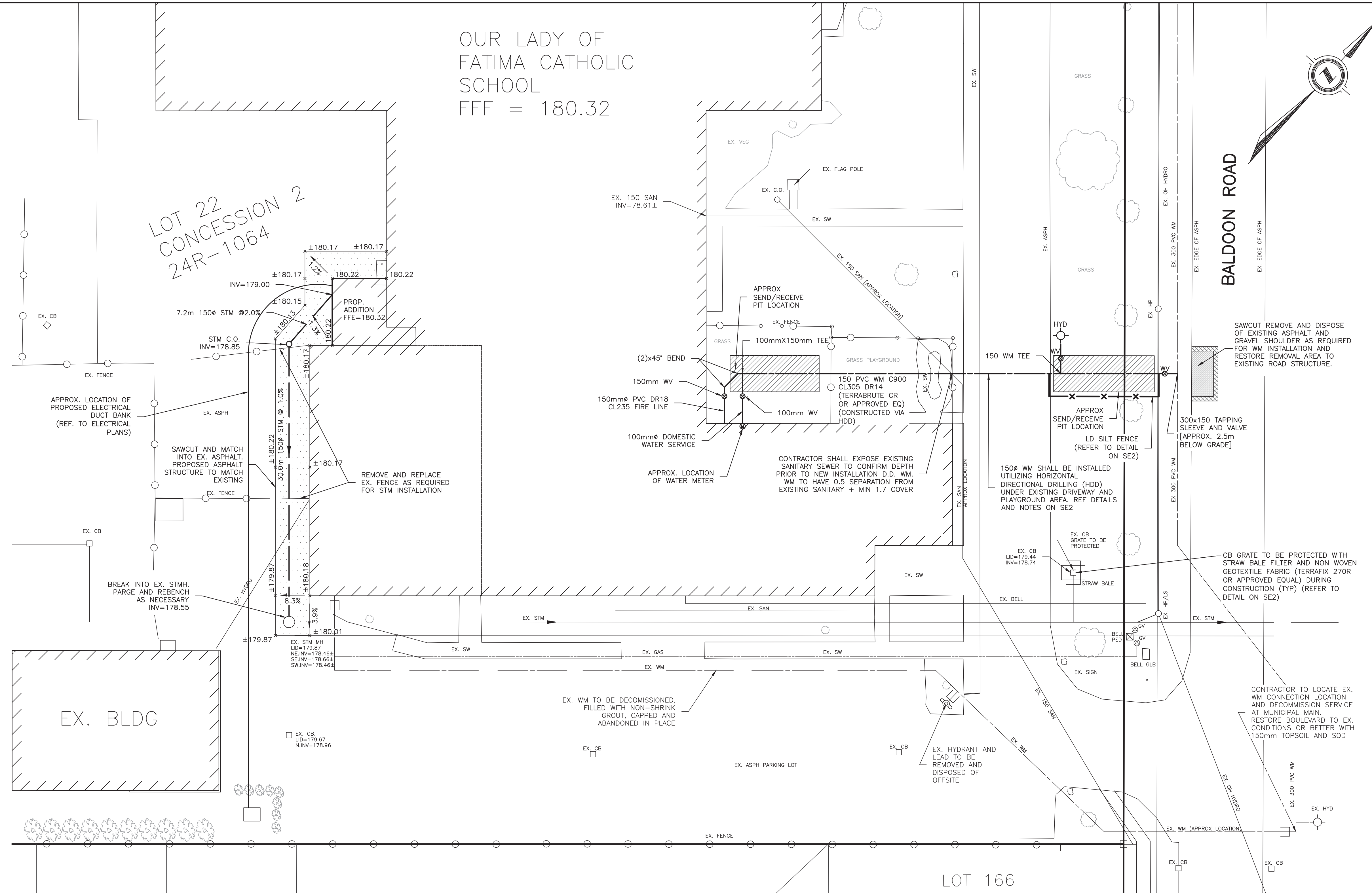
LOT 22  
CONCESSION 2  
24R-1064

BALDOON ROAD



**LEGEND**

- EX. FH ○ EXISTING HYDRANT
- EX. WV ⊗ EXISTING VALVE
- EX. 300mm WM EXISTING WATERMAIN
- EX. GM ○ EXISTING FENCE
- EX. GM ⊕ EXISTING GAS METER
- EX. GV ⊕ EXISTING GAS VALVE
- EX. GM EXISTING GAS MAIN
- EX. BP @HP EXISTING BELL POLE
- EX. B.PED ⊕ EXISTING BELL PEDESTAL
- EX. BMH ○ EXISTING BELL MANHOLE
- EX. BM EXISTING BELL CABLE
- EX. HP/LS @HP EXISTING ELECTRICAL CABLE
- EX. HP @HP EXISTING HYDRO POLE/LIGHT STANDARD
- EX. HP @HP EXISTING HYDRO POLE
- EX. HP/LS EXISTING SANITARY SEWER
- EX. HP EXISTING STORM SEWER
- EX. STMH EXISTING STORM MANHOLE
- EX. CB EXISTING CATCHBASIN
- C.O. EXISTING CLEANOUT
- EXISTING TREE
- ▨ EXISTING ASPHALT OR CONCRETE SIDEWALK TO BE REMOVED
- ▨ ASPHALT MILLING (REFER TO DETAIL ON SE2)
- X—X— SILT FENCING (REFER TO DETAIL ON SE2)
- 150mm PVC DR18 CL235 WM PROPOSED WATERMAIN
- WV ⊗ PROPOSED WATER VALVE
- ⊕ PROPOSED WATER METER
- ⊕ PROPOSED HYDRANT
- 37.2-150 ST-1.0% PROPOSED STORM SEWER
- C.O. PROPOSED CLEANOUT

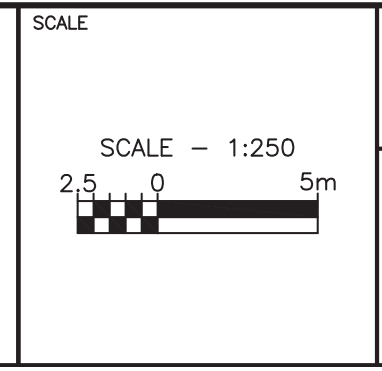
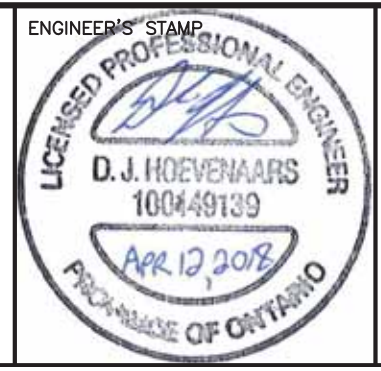


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EXISTING SERVICES	DRAWING #, SOURCE	DATE	AS CONSTRUCTED SERVICES	COMPLETION	DETAILS	No.	REVISIONS	DATE	CONSULTANT
					DESIGN BY JSC/DH	1	ISSUED FOR TENDER/APPROVAL	03/21/18	DEVENG
					DRAWN BY JSC	2	ADDED BUILDING ADDITION STM DRAIN	04/12/18	DEVENG
					CHECKED BY DH				

CONSULTANT OR DIVISION
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Paris Office 31 Mechanic St., Unit 301 (519) 442-1441

development  
engineering  
(London) Limited  
CONSULTING CIVIL ENGINEERS



OUR LADY OF FATIMA CATHOLIC SCHOOL  
515 BALDOON ROAD  
CHATHAM, ONTARIO

**SITE SERVICING AND GRADING PLAN**

PROJECT No. DEL18-011  
SHEET No. SE1  
PLAN FILE No.





















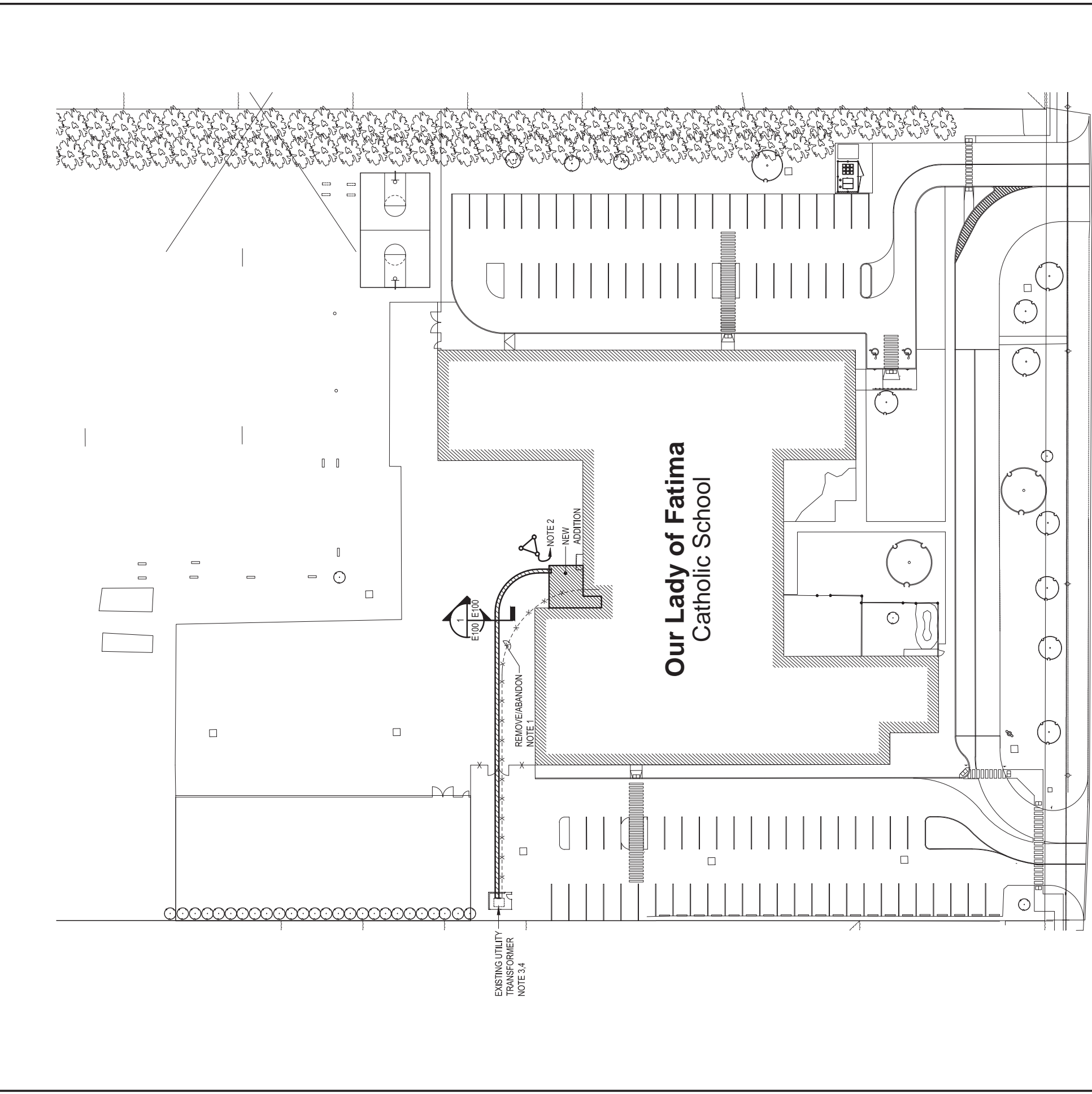










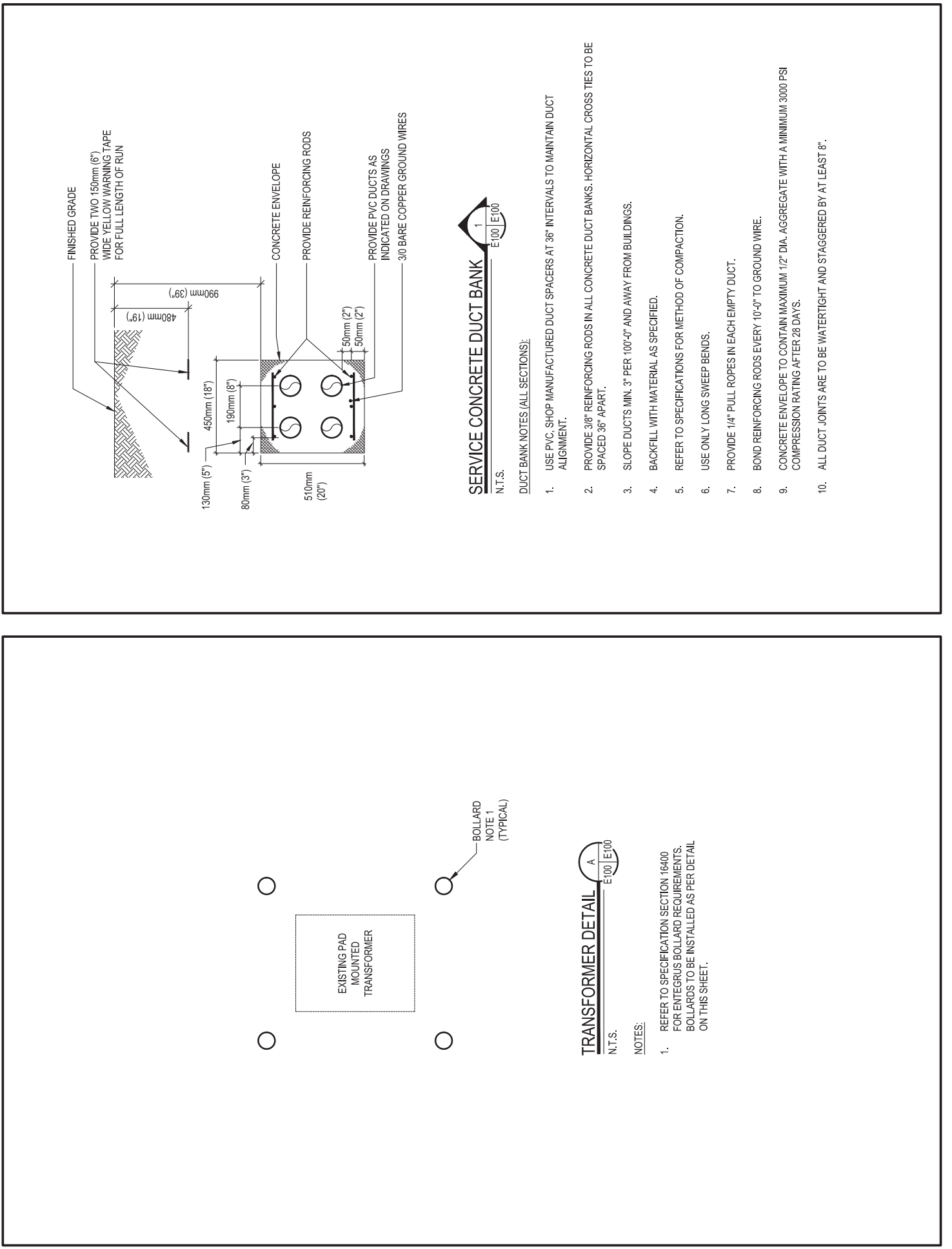


### Balloon Road

#### ELECTRICAL SITE PLAN

SCALE: 1:500

- EXISTING UNDERGROUND CABLES AS INDICATED.
- PROVIDE THREE (3) 40mm (1.5") COPPER CLAD BUILDING GROUND RODS (300mm x 100mm x 100mm) IN CONTACT WITH THE ELECTRICAL ROOM GROUND BUS.
- ENTRANCE POWERMEN WORK TO INCLUDE SUPPLY AND INSTALLATION OF THE FOLLOWING:
  - 3.1. SUPPLY OF PFC AND ITS TRANSFORMER.
  - 3.2. SECONDARY CONDUCTORS AND DUCT BANK.
  - 3.3. SECONDARY TRANSFORMER TERMINATIONS.
  - 3.4. RETURN.
- THESE TRIMMING WORKS INCLUDING ENCLOSURE, REMOVAL OF EXISTING WALL AND BOLLARDS.
- SECONDARY CONDUCTORS AND DUCT BANK.
- SECONDARY TRANSFORMER SECONDARY CONDUCTORS.
- TRANSFORMER DETAIL ON THIS SHEET.



#### TRANSFORMER DETAIL

- N.T.S.
- NOTES:
- REFER TO SPECIFICATION SECTION 4.0.0.0 FOR TRANSFORMER AND DUCT BANK DETAIL ON THIS SHEET.

#### SERVICE CONCRETE DUCT BANK

DUCT BANK (NOTEL SECTION)

- USE PVC SHOP MANUFACTURED DUCT SPACERS AT 50mm INTERVALS TO MAINTAIN DUCT ALIGNMENT.
- PROVIDE 30mm REINFORCING BARS IN ALL CONCRETE DUCT BANKS HORIZONTAL CROSS-TIE TO BE SPACED AT 50mm.
- DUCTS SHALL BE 100mm DIA AND 100mm DIA FROM BUILDING.
- PROTECT WITH MATERIAL AS SPECIFIED.
- REFER TO SPECIFICATIONS FOR METHOD OF COMPACTION.
- USE ONLY LONG SWEEP BENDS.
- PROVIDE 10mm PULL RODS IN EACH EMPTY DUCT.
- END BENDS SHOULD BE SPACED 100mm FROM END.
- CONCRETE ENVELOPE TO CONTAIN MAXIMUM 12% COAGULATE WITH A MINIMUM 500 PSI COMPRESSION RATING AFTER 28 DAYS.
- ALL DUCT JOINTS ARE TO BE WATER-TIGHT AND STAGGERED BY AT LEAST 100mm.

#### LUMINAIRE SCHEDULE

TYPE	MANUFACTURER	AMPS	VOLTS	WATTAGE	NOTES
A1	LITPROM CAT 100 (40W) PFC/40W/3000K	0.90	230V	40W	SEE LUMINAIRE SCHEDULE
A2	LITPROM CAT 100 (40W) PFC/40W/3000K	0.90	230V	40W	SEE LUMINAIRE SCHEDULE
A3	LITPROM CAT 100 (40W) PFC/40W/3000K	0.90	230V	40W	SEE LUMINAIRE SCHEDULE
B1	LITPROM CAT 100 (40W) PFC/40W/3000K	0.90	230V	40W	SEE LUMINAIRE SCHEDULE
D1	LITPROM CAT 100 (40W) PFC/40W/3000K	0.90	230V	40W	SEE LUMINAIRE SCHEDULE
E1	LITPROM CAT 100 (40W) PFC/40W/3000K	0.90	230V	40W	SEE LUMINAIRE SCHEDULE
F1	LITPROM CAT 100 (40W) PFC/40W/3000K	0.90	230V	40W	SEE LUMINAIRE SCHEDULE

#### MECHANICAL EQUIPMENT SCHEDULE

ITEM	DESCRIPTION	LOCATION	NO.	UNIT	VOLTS	PHASE	NOTES
CP-001	CIRCULATING PUMP	ELECTRICAL 10A	72	3	208	3	270mm
CP-002	CIRCULATING PUMP	ELECTRICAL 10A	73	3	208	3	270mm
CP-003	CIRCULATING PUMP	ELECTRICAL 10A	74	3	208	3	270mm
CP-004	CIRCULATING PUMP	ELECTRICAL 10A	75	3	208	3	270mm
CP-005	CIRCULATING PUMP	ELECTRICAL 10A	76	3	208	3	270mm
CP-006	CIRCULATING PUMP	ELECTRICAL 10A	77	3	208	3	270mm
CP-007	CIRCULATING PUMP	ELECTRICAL 10A	78	3	208	3	270mm
CP-008	CIRCULATING PUMP	ELECTRICAL 10A	79	3	208	3	270mm
CP-009	CIRCULATING PUMP	ELECTRICAL 10A	80	3	208	3	270mm
CP-010	CIRCULATING PUMP	ELECTRICAL 10A	81	3	208	3	270mm
CP-011	CIRCULATING PUMP	ELECTRICAL 10A	82	3	208	3	270mm
CP-012	CIRCULATING PUMP	ELECTRICAL 10A	83	3	208	3	270mm
CP-013	CIRCULATING PUMP	ELECTRICAL 10A	84	3	208	3	270mm
CP-014	CIRCULATING PUMP	ELECTRICAL 10A	85	3	208	3	270mm
CP-015	CIRCULATING PUMP	ELECTRICAL 10A	86	3	208	3	270mm
CP-016	CIRCULATING PUMP	ELECTRICAL 10A	87	3	208	3	270mm
CP-017	CIRCULATING PUMP	ELECTRICAL 10A	88	3	208	3	270mm
CP-018	CIRCULATING PUMP	ELECTRICAL 10A	89	3	208	3	270mm
CP-019	CIRCULATING PUMP	ELECTRICAL 10A	90	3	208	3	270mm
CP-020	CIRCULATING PUMP	ELECTRICAL 10A	91	3	208	3	270mm
CP-021	CIRCULATING PUMP	ELECTRICAL 10A	92	3	208	3	270mm
CP-022	CIRCULATING PUMP	ELECTRICAL 10A	93	3	208	3	270mm
CP-023	CIRCULATING PUMP	ELECTRICAL 10A	94	3	208	3	270mm
CP-024	CIRCULATING PUMP	ELECTRICAL 10A	95	3	208	3	270mm
CP-025	CIRCULATING PUMP	ELECTRICAL 10A	96	3	208	3	270mm
CP-026	CIRCULATING PUMP	ELECTRICAL 10A	97	3	208	3	270mm
CP-027	CIRCULATING PUMP	ELECTRICAL 10A	98	3	208	3	270mm
CP-028	CIRCULATING PUMP	ELECTRICAL 10A	99	3	208	3	270mm
CP-029	CIRCULATING PUMP	ELECTRICAL 10A	100	3	208	3	270mm
CP-030	CIRCULATING PUMP	ELECTRICAL 10A	101	3	208	3	270mm
CP-031	CIRCULATING PUMP	ELECTRICAL 10A	102	3	208	3	270mm
CP-032	CIRCULATING PUMP	ELECTRICAL 10A	103	3	208	3	270mm
CP-033	CIRCULATING PUMP	ELECTRICAL 10A	104	3	208	3	270mm
CP-034	CIRCULATING PUMP	ELECTRICAL 10A	105	3	208	3	270mm
CP-035	CIRCULATING PUMP	ELECTRICAL 10A	106	3	208	3	270mm
CP-036	CIRCULATING PUMP	ELECTRICAL 10A	107	3	208	3	270mm
CP-037	CIRCULATING PUMP	ELECTRICAL 10A	108	3	208	3	270mm
CP-038	CIRCULATING PUMP	ELECTRICAL 10A	109	3	208	3	270mm
CP-039	CIRCULATING PUMP	ELECTRICAL 10A	110	3	208	3	270mm
CP-040	CIRCULATING PUMP	ELECTRICAL 10A	111	3	208	3	270mm
CP-041	CIRCULATING PUMP	ELECTRICAL 10A	112	3	208	3	270mm
CP-042	CIRCULATING PUMP	ELECTRICAL 10A	113	3	208	3	270mm
CP-043	CIRCULATING PUMP	ELECTRICAL 10A	114	3	208	3	270mm
CP-044	CIRCULATING PUMP	ELECTRICAL 10A	115	3	208	3	270mm
CP-045	CIRCULATING PUMP	ELECTRICAL 10A	116	3	208	3	270mm
CP-046	CIRCULATING PUMP	ELECTRICAL 10A	117	3	208	3	270mm
CP-047	CIRCULATING PUMP	ELECTRICAL 10A	118	3	208	3	270mm
CP-048	CIRCULATING PUMP	ELECTRICAL 10A	119	3	208	3	270mm
CP-049	CIRCULATING PUMP	ELECTRICAL 10A	120	3	208	3	270mm
CP-050	CIRCULATING PUMP	ELECTRICAL 10A	121	3	208	3	270mm
CP-051	CIRCULATING PUMP	ELECTRICAL 10A	122	3	208	3	270mm
CP-052	CIRCULATING PUMP	ELECTRICAL 10A	123	3	208	3	270mm
CP-053	CIRCULATING PUMP	ELECTRICAL 10A	124	3	208	3	270mm
CP-054	CIRCULATING PUMP	ELECTRICAL 10A	125	3	208	3	270mm
CP-055	CIRCULATING PUMP	ELECTRICAL 10A	126	3	208	3	270mm
CP-056	CIRCULATING PUMP	ELECTRICAL 10A	127	3	208	3	270mm
CP-057	CIRCULATING PUMP	ELECTRICAL 10A	128	3	208	3	270mm
CP-058	CIRCULATING PUMP	ELECTRICAL 10A	129	3	208	3	270mm
CP-059	CIRCULATING PUMP	ELECTRICAL 10A	130	3	208	3	270mm
CP-060	CIRCULATING PUMP	ELECTRICAL 10A	131	3	208	3	270mm
CP-061	CIRCULATING PUMP	ELECTRICAL 10A	132	3	208	3	270mm
CP-062	CIRCULATING PUMP	ELECTRICAL 10A	133	3	208	3	270mm
CP-063	CIRCULATING PUMP	ELECTRICAL 10A	134	3	208	3	270mm
CP-064	CIRCULATING PUMP	ELECTRICAL 10A	135	3	208	3	270mm
CP-065	CIRCULATING PUMP	ELECTRICAL 10A	136	3	208	3	270mm
CP-066	CIRCULATING PUMP	ELECTRICAL 10A	137	3	208	3	270mm
CP-067	CIRCULATING PUMP	ELECTRICAL 10A	138	3	208	3	270mm
CP-068	CIRCULATING PUMP	ELECTRICAL 10A	139	3	208	3	270mm
CP-069	CIRCULATING PUMP	ELECTRICAL 10A	140	3	208	3	270mm
CP-070	CIRCULATING PUMP	ELECTRICAL 10A	141	3	208	3	270mm
CP-071	CIRCULATING PUMP	ELECTRICAL 10A	142	3	208	3	270mm
CP-072	CIRCULATING PUMP	ELECTRICAL 10A	143	3	208	3	270mm
CP-073	CIRCULATING PUMP	ELECTRICAL 10A	144	3	208	3	270mm
CP-074	CIRCULATING PUMP	ELECTRICAL 10A	145	3	208	3	270mm
CP-075	CIRCULATING PUMP	ELECTRICAL 10A	146	3	208	3	270mm
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CP-078	CIRCULATING PUMP	ELECTRICAL 10A	149	3	208	3	270mm
CP-079	CIRCULATING PUMP	ELECTRICAL 10A	150	3	208	3	270mm
CP-080	CIRCULATING PUMP	ELECTRICAL 10A	151	3	208	3	270mm
CP-081	CIRCULATING PUMP	ELECTRICAL 10A	152	3	208	3	270mm
CP-082	CIRCULATING PUMP	ELECTRICAL 10A	153	3	208	3	270mm
CP-083	CIRCULATING PUMP	ELECTRICAL 10A	154	3	208	3	270mm
CP-084	CIRCULATING PUMP	ELECTRICAL 10A	155	3	208	3	270mm
CP-085	CIRCULATING PUMP	ELECTRICAL 10A	156	3	208	3	270mm
CP-086	CIRCULATING PUMP	ELECTRICAL 10A	157	3	208	3	270mm
CP-087	CIRCULATING PUMP	ELECTRICAL 10A	158	3	208	3	270mm
CP-088	CIRCULATING PUMP	ELECTRICAL 10A	159	3	208	3	270mm
CP-089	CIRCULATING PUMP	ELECTRICAL 10A	160	3	208	3	270mm
CP-090	CIRCULATING PUMP	ELECTRICAL 10A	161	3	208	3	270mm
CP-091	CIRCULATING PUMP	ELECTRICAL 10A	162	3	208	3	270mm
CP-092	CIRCULATING PUMP	ELECTRICAL 10A	163	3	208	3	270mm
CP-093	CIRCULATING PUMP	ELECTRICAL 10A	164	3	208	3	270mm
CP-094	CIRCULATING PUMP	ELECTRICAL 10A	165	3	208	3	270mm
CP-095	CIRCULATING PUMP	ELECTRICAL 10A	166	3	208	3	270mm
CP-096	CIRCULATING PUMP	ELECTRICAL 10A	167	3	208	3	270mm
CP-097	CIRCULATING PUMP	ELECTRICAL 10A	168	3	208	3	270mm
CP-098	CIRCULATING PUMP	ELECTRICAL 10A	169	3	208	3	270mm
CP-099	CIRCULATING PUMP	ELECTRICAL 10A	170	3	208	3	270mm
CP-100	CIRCULATING PUMP	ELECTRICAL 10A	171	3	208	3	270mm
CP-101	CIRCULATING PUMP	ELECTRICAL 10A	172	3	208	3	270mm
CP-102	CIRCULATING PUMP	ELECTRICAL 10A	173	3	208	3	270mm
CP-103	CIRCULATING PUMP	ELECTRICAL 10A	174	3	208	3	270mm
CP-104	CIRCULATING PUMP	ELECTRICAL 10A	175	3	208	3	270mm
CP-105	CIRCULATING PUMP	ELECTRICAL 10A	176	3	208	3	270mm
CP-106	CIRCULATING PUMP	ELECTRICAL 10A	177	3	208	3	270mm
CP-107	CIRCULATING PUMP	ELECTRICAL 10A	178	3	208	3	270mm
CP-108	CIRCULATING PUMP	ELECTRICAL 10A	179	3	208	3	270mm
CP-109	CIRCULATING PUMP	ELECTRICAL 10A	180	3	208	3	270mm
CP-110	CIRCULATING PUMP	ELECTRICAL 10A	181	3	208	3	270mm
CP-111	CIRCULATING PUMP	ELECTRICAL 10A	182	3	208	3	270mm
CP-112	CIRCULATING PUMP	ELECTRICAL 10A	183	3	208	3	270mm
CP-113	CIRCULATING PUMP	ELECTRICAL 10A	184	3	208	3	270mm
CP-114	CIRCULATING PUMP	ELECTRICAL 10A	185	3	208	3	270mm
CP-115	CIRCULATING PUMP	ELECTRICAL 10A	186	3	208	3	270mm
CP-116	CIRCULATING PUMP	ELECTRICAL 10A	187	3	208	3	270mm
CP-117	CIRCULATING PUMP	ELECTRICAL 10A	188	3	208	3	270mm
CP-118	CIRCULATING PUMP	ELECTRICAL 10A	189	3	208	3	270mm
CP-119	CIRCULATING PUMP	ELECTRICAL 10A	190	3	208	3	270mm
CP-120	CIRCULATING PUMP	ELECTRICAL 10A	191	3	208	3	270mm
CP-121	CIRCULATING PUMP	ELECTRICAL 10A	192	3	208	3	270mm
CP-122	CIRCULATING PUMP	ELECTRICAL 10A	193	3	208	3	270mm
CP-123	CIRCULATING PUMP	ELECTRICAL 10A	194	3	208	3	270mm
CP-124	CIRCULATING PUMP	ELECTRICAL 10A	195	3	208	3	270mm
CP-125	CIRCULATING PUMP	ELECTRICAL 10A	196	3	208	3	











