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**PROJECT NAME**

**Board Tender Number: 22-7352-RFX**  
**Central Public School – Accessibility, HVAC, Window Upgrades**  
175 Main St, Cambridge, ON N1R 1W5

**PROJECT OWNER**

WATERLOO REGION DISTRICT SCHOOL BOARD  
51 Ardelt Ave  
Kitchener, ON N2C 2R5

**CONSULTANTS**

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Waterloo, ON N2V 1Y8

**END OF SECTION**



**Part 1 General**

**1.1 PRECEDENCE**

- .1 In all cases this Section is intended to be read in conjunction with and to coordinate with all other Sections. In the case of discrepancy between this Section and other Sections to more stringent Articles of any applicable Section shall apply.

**1.2 RELATIONS OF TRADES**

- .1 The Contract Specifications have been generally divided into trade sections for the purpose of ready reference.
- .2 The Contractor is responsible for coordinating all trades. He is solely responsible for determining the lines of demarcation between Contractor and/or trades. Neither the Consultant nor the Owner, assume any responsibility for any such determination or for any dispute arising concerning it. No extras will be considered due to any such dispute concerning either labour or materials.
- .3 Specifications and drawings form an integral part of the Contract Documents. Any subject or item omitted from one, but which is mentioned or reasonably implied in the other, shall be considered as properly and sufficiently specified and will be part of the Work.

**1.3 EXISTING SITE CONDITIONS**

- .1 Ascertaining the specific site and building conditions as they relate to the project is the responsibility of the contractor. Notwithstanding this overriding responsibility the consultant has made every effort to properly represent existing site conditions as they are evident at the time of tender.
- .2 Contractor is to be aware of the severe sloping topography of the site and associated requirements for access to complete the work described. No allowance will be made for additional cost claims due to lack of Bidder awareness of existing site conditions.
- .3 The Contractor shall assume the work site based on the existing conditions as shown on the drawings and visible on the job site at the time of the closing of the tender. All disposal, removal and importing of material is to be included in the work of this Contract.
- .4 Inspection of the site during the tender period is mandatory for all Contractors.

**1.4 WORK WITHIN AN EXISTING OCCUPIED BUILDING**

- .1 The contractor is reminded that work to this project will be performed while occupants are present at the facility. Access restrictions to portions of the work apply. Therefore, precise scheduling and sequencing of the various work areas is required.
- .2 At all times it is the Owner who is the authority responsible for the well-being of the facility occupants. As such, the Contractor's Site Superintendent must establish a working rapport with the Owner or his/her designee, suitable to provide daily notification of proposed construction timing and activities.

- .3 Connection of any services must be made in such a way that it leaves no disturbance to materials or systems, nor any exposed construction conditions within the operating facility area.
- .4 Catering trucks are not permitted on the site whatsoever.
- .5 The Contractor shall minimize nuisances to the facility operation such as loud noise, percussion sounds from power tools, dust, odours. Due to noxious fumes, roofing and asphalt paving shall be done after hours (after 4:00 p.m., or during the weekends). Hot asphalt kettles may not be heated until after 4:00 p.m. on weekdays without prior permission from the School Board Owner and Owner Project Manager.
- .6 *Refer also to Section 01 56 00- 'Temporary Barriers and Enclosures'*

## 1.5 CONSTRUCTION SEQUENCING:

- .1 Basic Scope outline
  - .1 Project award.
  - .2 Shop drawings and ordering of material to commence immediately upon award.
  - .3 March Break 2023 – on site construction commencement in elevator addition area outside building only. Contractor to install hoarding as required for elevator addition.
  - .4 **Phase 1 – Elevator Addition**  
March/April 2023 – January 2024
  - .5 **Phase 2 – Door & Frame Replacement, Washroom renovation, A/V and finish upgrades in areas.** Classroom 13 must to completed sufficiently for school to commence in Sept. (ie: new block wall, new teaching wall, new millwork, new finishes, sanitary connection)  
July 3, 2023 to August 29, 2023
  - .6 **Phase 3 - Unit Ventilator & Window Replacement and related exterior wall work**  
July & August 2023 if possible (ie. if materials are in hand for summer 2023 construction). If materials are not available for summer 2023 construction, contractor to coordinate with Owner and Consultant for possible work in July & August 2024.  
No demolition/work on the exterior walls and unit ventilators may start until the new unit ventilators are on site. This work includes, but is not limited to:
    - Abatements of exterior wall insulation
    - Removal and replacement of siding
    - New structural framing at windows and louvres
    - Removal and installation of windows
    - Removal and installation of unit ventilators
  - .7 Work to be Substantially Performed by the required date for occupancy in the Contract.
  - .8 Following Substantial Performance complete deficiencies to renovations to the existing building such that project Total Completion is achieved by the required date.
- .2 Coordinate sequencing with all trades and advise sub-trades of these sequencing requirements prior to the close of Tenders.

## **1.6 BYLAWS, PERMITS AND APPROVALS**

- .1 Nothing indicated on the Drawings or Specifications is intended to be in conflict with any law, by-law or regulation of Municipal, Provincial, or similar Authority Having Jurisdiction.
- .2 Work of this Contract must conform with such laws, by-laws and/or regulations. Any required variation to, or deviation from, the drawings and specifications, shall be performed in accordance with the Contract contained in these specifications.
- .3 Furnish inspection certificates and/or permits as may be applicable as evidence that the installed Work conforms with laws, by-laws and regulations of Authorities Having Jurisdiction.
- .4 Each subtrade shall obtain and pay for all permits and licenses required by Municipal, Provincial, or other authorities having Jurisdiction, particular to their trade.
- .5 It is the final responsibility of the General Contractor to obtain all the required approvals and permits and include in his Total Stipulated Price, the cost of such approvals, permits and fees. The only exception is the Building Permit, which will be applied for by the Consultant and paid for by the Owner.
- .6 Any revisions or deviations to Contract Documents required by any Authorities Having Jurisdiction must be reviewed by the Consultants before implementation.

## **1.7 ORGANIZATION**

- .1 Organize the Work of each section as required for satisfactory and expeditious completion of the Work. Take field dimensions required for the Work. Fabricate and install work to suit field dimensions and conditions.
- .2 If applicable, take into account existing work to ensure best arrangements of components in available space. Contact the Consultant prior to commencing Work in critical locations and interface with other Contractors' Work.
- .3 Provide all forms, templates, anchors, sleeves, inserts and accessories required to be installed in the Work. Set in place or instruct the applicable subtrade as to their location. Pay costs of extra work, if required, as a result of a failure to comply with these requirements at the proper time.
- .4 Before starting his work and from time to time as the work progresses, each Subcontractor shall examine the work and materials installed by the other Subcontractors insofar as it effects his own work, and the General Contractor shall promptly notify the Consultant IN WRITING, if any condition exists that will prevent any Subcontractor from giving a satisfactory result in his own work.
- .5 Should any Subcontractor start his own work without such notification, it shall be construed as an acceptance by him of all preceding work and as a waiver of all claims or questions as to its suitability for receiving his work.

**1.8 CANADIAN PRODUCTS AND LOCAL LABOUR**

- .1 To the extent that the same are available and consistent with the proper economy and expeditious completion of the Contract, Canadian equipment, materials, products and other such applicable items are preferred by the Owner to be used in the Work, wherever possible and practical.

**1.9 MATERIALS AND WORKMANSHIP**

- .1 All materials shall be new and the best of their respective kinds, where a specific grade or brand is not indicated. Pre-packaged materials shall be delivered and stored in unopened containers.
- .2 All work performed under this Contract shall be done by mechanics skilled in their respective trades. They shall make use of such templates, jigs or special tools as may be required for the operation involved.
- .3 The acceptance of any materials or workmanship shall not be a bar to their subsequent rejection, if found defective.
- .4 Adequate, dry storage facilities shall be provided and all stored materials shall be protected from damage and theft.
- .5 All Contractors will do Work in accordance with the best industry practice of the type of work specified, unless the Contract Documents stipulate more precise requirements, in which case, the more precise requirements shall govern.
- .6 Do Work in a neat, plumb & square manner. Ensure that various work components are properly installed, forming tight joints and appropriately aligned junctions, edges and surfaces, free of warps, twists, waves, or other such irregularities.
- .7 Wherever indicated on the drawings or specifications, or in the manufacturers' / suppliers' written instructions, arrange to have manufacturers' / installer's representatives inspect the Work which incorporates their materials, products or items.
- .8 Do not permit materials to come in contact with other materials such conditions may result in corrosion, staining, discolouration or deterioration of the completed Work. Provide compatible, durable separators where such contact is unavoidable.
- .9 The design of the Work is based on the full interaction of its component parts. No provisions have been made for conditions occurring during construction. Ensure that no part of the Work is subjected to a load which will endanger its safety or which might cause permanent deformation.
- .10 Conceal pipes, ducts, conduit, wiring and other such items requiring concealment preferably in, wall or ceiling construction of all finished areas. If in doubt as to method of concealment, or intent of the Contract Documents in this regard, request clarification from the Consultant before proceeding with the Work.
- .11 Lay out mechanical and electrical work well in advance of concrete placement and furring installation to allow for proper concealment. Test and inspect Work before applying pipe covering and before it is concealed.

- .12 Provide and maintain control lines and levels required for the Work. Lay out the Work in accordance with these lines and levels and dimensions indicated on the drawings.
- .13 Verify lines, levels and dimensions and report any errors or inconsistencies on the drawings to the Consultants.
- .14 Final responsibility of satisfactory completion of all the Work, however, lies with the General Contractor.

#### **1.10 QUALITY CONTROL**

- .1 Refer also to Section 01 45 00.
- .2 The Consultants and authorized Owner staff shall have access to all areas of the Work, including any off site construction facilities.
- .3 The General Contractor shall give timely notice requesting inspection if Work is designated for special tests, inspections, or approvals by the Consultants, or any other authorized Owner staff or testing and Inspection Company.
- .4 If the General Contract covers, or permits to be covered Work that has been designated as outlined above, he shall uncover such work, have the inspections and tests satisfactorily completed and make good such work at no additional cost to the Owner.
- .5 The Consultants or the authorized Owner Staff may order any part of the Work to be examined, if such Work is suspected not to be according to the Contract Documents. If, upon examination, such work is found not to be in accordance with the Contract Documents, then the General Contractor shall correct such Work and pay for cost of examinations and correction. If such Work is found to be in full accordance with the Contract Documents, the Owner shall pay for the cost of examination and making good.
- .6 If defects are revealed during inspection and/or testing, the appointed agency may request additional inspection and/or testing to ascertain the full degree of defects. The General Contractor shall correct the defects and irregularities as reported by the inspection and/or testing agency, at no additional cost to the Owner and the General Contractor shall pay all associated costs for retesting and reinspection.
- .7 The General Contractor shall provide any tools, materials or equipment that may be required by the inspection and/or testing agencies in retesting the Work (*e.g.* Video camera rental to reinspect incorrectly installed sewer lines.)
- .8 The employment of inspection and/or testing agencies does not, in any way, affect the General Contractor's responsibility to perform the Work in strict accordance with the Contract Documents.
- .9 The General Contractor shall remove all defective work, whether the result of poor workmanship by him or his subtrades, use of defective or damaged products, whether or not incorporated into the Work and any Work that has been rejected by the Consultants or authorized Owner Staff as failing to conform to the Contract Documents. Replacement and execution of the affected Work shall be done in full accordance with the Contract Documents, making good other trades' work damaged by such removals or replacements at no additional charge to the Owner.

- .10 If, in the opinion of the Consultant and/or the authorized Owner Staff, it is not expeditious to correct the defective Work, or Work not performed in accordance with the Contract Documents, the Owner, may, at its sole discretion, deduct from the Contract Price, the difference in value between the work performed and that required by the Contract Documents, the amounts of which shall be determined by the Consultant.

- .1 The notable exception to the above item is a faulty installation of base and asphalt paving. If, the inspection agency, after performing random test holes to determine compaction and thickness of sub base, base and asphalt, determines that either one or both, are not according to what was specified in the Contract Documents, the Owner will not accept credits for such inconsistencies but rather, demand that any such installation be removed and redone in its entirety, at the pleasure and convenience of the Owner, but within the first year of the warranty period.

#### **1.11 OVERTIME AND OVERTIME SCHEDULING**

- .1 The General Contractor must include in his Total Stipulated Tender Price, all costs for overtime work which may be necessary to complete the various portions of the Work, in accordance with the Completion Dates specified in the contract documents. The Owner shall not entertain requests for any payments in connection with overtime work that may be required by the General Contractor, or any of his subtrades, in order to comply with the above referenced dates.
- .2 Similarly, it is the Contractor's responsibility to ensure, prior to the close of tenders that all subtrades will meet the requirements for overtime, as required, with no additional costs to the owner, in order to meet the Completion Dates specified in the Form of Tender.
- .3 The contractor shall recognize the critical importance that the schedule for full occupancy must be met by the dates stated in the contract documents. Note that local by-laws may be enforced restricting morning and evening and Sunday work hours.
- .4 Note that at no time will the Owner entertain additional charges or claims from the General Contractor or his subcontractors for premium, overtime or after-hours work.
- .5 Only claims for scope changes or conditions beyond the control of the Contractor may be submitted for review by the Consultants and must be submitted and accepted in advance of the work taking place and at the outset of the condition or scope change arising. No claims additional charges or delays will be accepted if not reviewed and formally accepted in advance.

#### **1.12 PROTECTION OF OTHER WORK**

- .1 Each trade shall avoid damage to other trades and shall take all measures necessary and provide all masking and materials necessary, to provide adequate protection.
- .2 Each Subcontractor shall be held responsible for all damage to work installed by others that is caused by this work or by anyone employed by him.
- .3 Patching and repairing of damaged work shall be done by the Contractor who installed the work, as directed by the Consultant, but the cost of same, shall be paid for by the Contractor who is responsible for the damage.

**1.13 FASTENINGS**

- .1 All fastenings must be permanent, of same metal, or compatible with any metals with which they are in contact, of adequate size and spacing, to ensure permanent anchorage against load or shear.
- .2 Exposed fastenings must be evenly spaced, neatly laid out and must not mar surfaces of prefinished materials.
- .3 No ram-setting or similar techniques will be permitted, without prior written approval of the Consultant.

**1.14 SUPPLY AND INSTALL**

- .1 Unless specifically noted, “*supply only*”, any reference to supply intends the supply and installation of material or item so noted.

**1.15 GENERAL REQUIREMENTS**

- .1 All Contractors shall examine carefully all drawings and specifications to inform themselves fully of all conditions and limitations pertaining to the work of the contract.
- .2 All Contractors shall co-operate and co-ordinate their work for the proper completion of the work, including co-ordination of delivery dates and commencement of subtrades work.
- .3 The responsibility and costs for all work, including temporary structures, shoring, shoring design (if applicable) and erection shall at all times rest with the General Contractor and his Subcontractors. The Consultant will review construction methods and shop drawings for general arrangements only. The method of obtaining the results contemplated by the Contract Documents shall be determined by the General Contractor.
- .4 The undertaking of period site review by the Consultant or Owner Representative shall not be construed as supervision of actual construction, nor make them responsible for providing a safe place for work, visit, use, access, travel, or occupancy of the Consultant’s or Owner’s employees or agents.
- .5 The General Contractor shall be fully responsible for coordinating and expediting the work of all Subcontractors and shall employ the necessary and qualified personnel to provide the required quality of labour and materials and to prevent delays in the progress of the project. Each trade shall be afforded all reasonable opportunities for the installation of its work and for the storage and handling of its materials.

**1.16 COORDINATION**

- .1 The General Contractor shall coordinate all work and preparation on which subsequent work depends to facilitate mutual progress, and to prevent any conflict.
- .2 The General Contractor shall ensure that each trade makes known, for the information of the General Contractor and other trades, the environmental and surface conditions required for the execution of its work; and that each trade makes known the sequence of others’ work required for installation of its work.

- .3 The General Contractor shall ensure that each trade, before commencing work, knows the requirements for subsequent work and that each trade is assisted in the execution of its preparatory work by trades whose work depends upon it.
- .4 The General Contractor shall ensure that shop and layout drawings, templates, and all information necessary for the location and installation of materials, openings, inserts, anchors, accessories, fastenings, connections and access panels are provided by each trade whose work requires cooperative location and installation by other trades and that such information is communicated to the applicable installer.
- .5 The General Contractor shall ensure that delivery of materials supplied by one trade to be installed by another is well before the installation begins.
- .6 The General Contractor shall inform all trades that giving installation information in error, or too late to incorporate in the work, shall be responsible for any extra work caused thereby, unless impractical and where required, cutting shall be done by each respective trade, and patching shall be done by the general contractor.

#### **1.17 ACCESS TO THE PROJECT**

- .1 The General Contractor for this Work shall, at all times allow the Consultants, the Owner, or any other Owner commissioned contractor or their employees, access into the building or around the premises, undisturbed, whether union or non-union, as may be required in the execution of other portions of the building work and installation of equipment, etc.
- .2 The General Contractor shall cooperate fully with any and all Owner commissioned Contractors.

#### **1.18 SUBTRADE AWARDS**

- .1 The Contractor shall, on notice of award of the contract, obtain the Consultants approval of a complete list of all persons or firms to which he proposes to sublet any part of the work, the trades or divisions of work which are to be sublet to each, and the amount of each trade. The General Contractor shall provide to the Consultant a financial breakdown showing all divisions of the work amounting to the full sum of the contract. Mechanical and Electrical trades shall be further broken down as specified in Divisions 26 and 33.

#### **1.19 SAFETY DATA SHEETS**

- .1 The General Contractor shall ensure that the following material and safety data sheets are submitted prior to commencing installation and application of at least the following:
  - .1 Lead-free solder
  - .2 Resilient flooring
  - .3 Painting and finishing
  - .4 Fertilizers
  - .5 Glues and adhesives
  - .6 Pesticides
  - .7 Herbicides



- .8 Any other product which may give off air borne particles after installation.
- .9 Sealants and caulking
- .2 The General Contractor and all of his Subcontractors must note that specifically, Asbestos and Asbestos containing materials solder for piping containing lead, and Painting & Coatings containing lead and/or mercury must be excluded from any part of the Work.
- .3 The General Contractor must submit Certificates of Compliance, prior to the application for Substantial performance, for each of the following items:
  - .1 An affidavit relative to the use of Lead-free solder for all domestic water lines, regardless of location.
  - .2 Products for which Material Safety Data Sheets have been submitted and accepted.
  - .3 Other Work/Products identified in the Contract Documents as requiring a Certificate of Compliance.
- .4 Each Certificate of Compliance must indicate names and addresses of the project, the Owner, the date of Issue, produce description including name, number, manufacturer, with a statement verifying that the Work/Product installed meets specified requirements and, if applicable, complies with the submitted and accepted Material Safety Data Sheets.
- .5 Each Certificate of Compliance must be issued on the trade's letterhead, properly executed, under whose work the respective Work/Product has been provided.
- .6 Each Certificate of Compliance must be endorsed by the General Contractor with his authorized stamp/signature.
- .7 The Completion Security Account will not be paid to the Contractor without submission of all required affidavits and requested material and safety data sheets.

## **1.20 REGULATING DOCUMENTS**

- .1 The General Contractor and all of his Subcontractors, Suppliers/Installers etc., must conform to the latest editions in force at the time of tender of each and all of the following: Ontario Building Code, Canadian Electrical Code (CEC), The Occupational Health and Safety Act, Ontario, the National Fire Code, the local Municipal Fire Code, and all other applicable Codes and Building By-Laws. All must also conform to the requirements of the Authorities Having Jurisdiction, such as Public Utilities. Where required under the Occupational Health and Safety Act, engage a Professional Engineer to design hoarding, scaffolding and shoring, formwork and falsework for concrete.
- .2 Contract forms, codes, standards and manuals referred to in these specifications are the latest published editions at the date of close of tenders. The General Contractor and all of his Subcontractors, Suppliers/Installers must meet or exceed the requirements of specified standards.
- .3 Provide, on site, copies of documents referred to in the Specification for joint use of Contractor and Consultant.

## 1.21 SITE SUPERINTENDENTS AND PROJECT MANAGERS

- .1 It is the requirement under the work to this Contract that the Contractor provide an on-site, full-time, *Site Superintendent* while work is being performed, for the entire project duration through to the end of Deficiency completion. Superintendent shall have qualifications of previous experience with similar projects. Superintendent shall remain assigned full time to the project until completion of all deficiencies. This is a base bid requirement and the Contractor shall include this cost in the Tender Amount.

## 1.22 GENERAL CONTRACTOR'S RESPONSIBILITIES

- .1 The list of General Contractor's responsibilities identified below is by no means comprehensive, nor is it in any priority or critical order. It is here, merely to identify the most often forgotten or ignored responsibilities of the General Contractor and is reproduced only as a reminder. The Consultants and the Owner advise the General Contractor that it is he who is responsible for all aspects and facets of the Project, from start to completion, from compliance with Occupational Health and Safety regulations to compliance with all codes and statutes.
  - .1 The General 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 equipment shall be in safe operating condition and appropriate to the task.
  - .3 Only competent personnel will be permitted on site. During the site introduction, *only the Consultant* will determine who is competent. The General Contractor will cause to remove from the site any persons not observing or complying with safety requirements.
  - .4 The General Contractor shall comply with, and shall ensure that all of his Subcontractors, Suppliers, Installers etc., comply with all Federal, Provincial and Municipal Safety Codes and Regulations and the Occupational Health and Safety Act.
  - .5 The General Contractor shall supply competent personnel to implement his safety program and ensure that all Subcontractors comply with the Owner's standards, and those of the Occupational Health and Safety Act.
  - .6 The Owner will provide periodic monitoring to ensure that safety requirements are met, and that safety records are properly kept and maintained. Continued disregard for safety standards can cause the Contract to be canceled and the General Contractor removed from the site.
  - .7 The Owner may hire Commissioners to perform inspections of building systems at the closing stages of the work of this contract. If so contracted and identified in the *Instructions to Bidders*, the General Contractor shall cooperate with and coordinate the work of the Owner's Commissioners on site.
  - .8 The General Contractor will report to the Owner and Jurisdictional Authorities any accident or incident involving personnel and/or property of the Contractor, Owner, or Public, arising from the General Contractor's or any of his Subcontractors' execution of the work.
  - .9 The General Contractor will include all provisions of this contract in any agreement with Subcontractors, and hold them equally responsible for safe work performance.

- .10 If the General Contractor is responsible for a delay in the progress of the work due to an infraction of legislation or Owner Health and Safety requirements, the Contractor will, without additional cost to the Owner, work such overtime, and acquire and use for the execution of the work such additional labour and equipment as to be necessary in the sole opinion of the Owner's Representative and Consultant, to avoid delay in the final completion of the work or any operations thereof.

### **1.23 MANUFACTURERS' INSTRUCTIONS**

- .1 Unless otherwise specified, the General Contractor and all his Subcontractors shall comply with manufacturer's latest printed instructions for materials and installation methods.
- .2 The General Contractor shall notify the Consultant in writing of any conflict between the Specifications and Manufacturer's Instructions and have same clarified.

### **1.24 FIRE SAFETY**

- .1 The General Contractor and all of his Subcontractors must comply with requirements of standard for Building Construction Operations FC No. 301-1982, issued by the Fire Commissioner of Canada.
- .2 The appropriate clauses of the Ontario Building Code relating to fire protection shall be strictly followed.
- .3 The General Contractor shall provide and maintain free access to temporary or permanent fire hydrants acceptable to local fire department.

### **1.25 CONSTRUCTION SAFETY**

- .1 The General Contractor and all his trades must observe and enforce construction safety measures required by Canadian Construction Safety Code, Workplace Safety & Insurance Board, and Municipal statutes. In particular, the Ontario Construction Safety Act, the regulations of the Ontario Department of Labour and Ontario Hydro Safety Requirements shall be strictly enforced. In event of conflict between any provisions of above authorities the most stringent provisions will apply.
- .2 The General Contractor is reminded that it is he who is responsible for Occupational Health and Safety on this Project. The items listed below are only guidelines of the Owner's expectations in this regard and not to be construed to be comprehensive or total in nature.
- .3 The Owner will take every reasonable precaution to prevent injury or illness to students, employees and the public, participating in Owner activities, or performing their duties. This shall be accomplished by providing and maintaining a safe, health working environment by providing the education necessary to perform these activities or duties safely.
- .4 The Owner is vitally interested in the health and safety of all Contractors and their workers performing work for the Owner. Cooperation and support of the General Contractor in the protection of workers from injury or occupational disease is a major,

- continuing object of the Owner. To achieve these goals, the Owner, in concert with the Contractors, will endeavor to make every effort to ensure that the Contractors provide a work site which is a safe and healthy work environment. The Owner insists that all Contractors and their workers are dedicated to the continuing objective of reducing risk and injury.
- .5 The General Contractor covenants and agrees to comply with all statutory and other obligations, including, without limitation, the provisions of the Occupational Health and Safety Act (Ontario) and all Regulations thereto, and all amending and successor legislation, including without limitation, Bill 208 (the “Act”) in connection with all work performed by either the Contractor, Subcontractors, or any Other Contractor on, or in connection with, the Project.
  - .6 Without limiting the foregoing, for the purposes of this Contract, the General Contractor agrees that he shall be the “constructor” of the Project within the meaning of the Act, and as such, shall assume all the obligations and responsibilities, and observe all construction safety requirements and procedures, and duties of inspection imposed by the Act on the “constructor”, as therein defined, for all work and services performed by the General Contractor, Subcontractors and Other Contractors on or in connection with the Project.
  - .7 The General Contractor further covenants and agrees that the Owner and its existing and former officers, trustees, employees and agents, and their respective heirs, executors, administrators, successors and assigns (hereinafter collectively referred to as the “Owner”) shall be released from any obligations or liabilities otherwise imposed on the Owner, or on any of them, pursuant to the Act in connection with the Project, and that the General Contractor shall assume all liability and responsibility in connection with same.
  - .8 The General Contractor agrees to save harmless and indemnify the Owner from any losses, damages, costs and expenses of any kind, or nature whatsoever, including all legal expenses, and all defense costs and related expert or consulting fees, incurred by the Owner, or any of them, arising in connection with the failure, default, or inability of the General Contractor of the Owner, or any of them, to comply with any of the aforementioned statutory, or other legal requirements, or arising in connection with any breach by the General Contractor of any of its covenants, agreements and obligations under this Contract.
  - .9 The General Contractor shall inform and instruct Other Contractors that they, while performing work on this project, are under the authority of the Contractor. Other Contractors are to discuss and co-ordinate with, and follow instructions from, the General Contractor on all matters of site access, vehicles, deliveries, storage, temporary facilities, coordination with the work of other subcontractors, work methods, scheduling, labour conditions, construction safety, environmental protection, security and all other matters which relate to the safe and proper execution of construction work.
  - .10 The General Contractor shall ensure that all supervisory personnel on job site are fully aware of the procedures and requirements outlined above and comply with all requirements specified.
  - .11 All Contractors are responsible to ensure that all machinery and/or equipment are/is safe and that the workers perform their tasks in compliance with established safe work practices or procedures. Workers must receive adequate training in their specific work tasks to protect their health and safety.

- .12 The General Contractor shall be responsible for all persons and companies performing work, including Other Contractors, on this project, at all times, up to and including, the date of Substantial Performance of the Work. Authority for coordination and instructions relating to all matters which relate to the safe and proper execution of construction work shall rest with the General Contractor. The Contract Price must include the General Contractor's fees for the coordination and supervision of the work of all Other Contractors.
- .13 In addition to the responsibility of all contractors as outlined above, Subcontractors will be held accountable for the health and safety of workers under their supervision.
- .14 Every worker must protect his/her own health and safety by working in compliance with the law and with safe work practices and procedures established by the authorities having jurisdiction.
- .15 All sections of the Occupational Health and Safety Act for Industrial Establishments, latest edition, and the Occupational Health and Safety Act for Construction projects, latest edition, shall be enforced, by the General Contractor, in their entirety, throughout the duration of the construction project.
- .16 The General Contractor shall provide the Consultant with the telephone number where the General Contractor or his representative can be reached at any time, day or night, for the duration of the contract.
- .17 Where an accident, explosion, or fire causes a person injury at the work place, and the worker is disabled from performing the usual task, the General Contractor shall prepare a written notice and shall forward same to the Ministry of Labour within four days of the occurrence with a copy to the Owner's Representative, who shall copy and inform the Owner's Supervisor of Health and Safety and/or the Owner's Joint Health and Safety Committee, containing such information and particulars as may be described.
- .18 Where a person is killed or critically injured from any cause at the work place, the General Contractor shall immediately call the Ministry of Labour. A written notice from the General Contractor shall be given to the Ministry of Labour within forty-eight hours after the occurrence, containing such information and particulars as may be prescribed, with copies to the Architect and the Owner's Representative.
- .19 The General Contractor is advised that the accident scene is under the jurisdiction of the Ministry of Labour and no wreckage, articles, etc., shall be interfered with, disturbed, destroyed, altered or carried away at the scene, or connected with the occurrence, until the Ministry of Labour has given permission.

## **1.26 INDEPENDENT TESTS AND INSPECTIONS**

- .1 The Contractor shall appoint inspection firms as directed by the Consultant and make payments from the cash allowances specified in Division noted, except for the following, which shall be included in the contract:
  - .1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
  - .2 Inspection and testing performed exclusively for Contractor's convenience.

- .3 Testing, adjustment and balancing of mechanical and electrical equipment and systems.
- .4 Mill tests and certificates of compliance.
- .5 Re-testing as already described in *Quality Control* of this Section.
- .2 The Consultant will authorize payment of inspection services from specified cash allowances.
- .3 The General Contractor shall furnish labour and facilities to:
  - .1 Provide access to work to be inspected and tested.
  - .2 Facilitate inspections and tests.
  - .3 Make good work disturbed by inspection and test.
  - .4 Pour concrete test cylinders and store as directed by Inspection Firm.
- .4 The General Contractor shall notify Inspection Firms sufficiently in advance of operations to allow for assignment of laboratory personnel and scheduling of test.
- .5 Where materials are specified to be tested, the General Contractor shall deliver representative samples in required quantity to testing laboratory.

#### **1.27 TEMPORARY PROTECTION**

- .1 Refer also to Articles 1.8, in this Section.
- .2 The General Contractor to provide temporary dustproof and fire resistant barricades, screens or barriers to separate all work areas from other parts of the building and/or as directed by the Consultant and/or authorized Owner Representative, for the safety of persons, or for dividing the Work from portion or portions of the building or site that may be required for use by the public.
- .3 Properly protect the Work from any damage by the elements. In cold weather cover all exterior openings in the work areas likely to cause water damage.
- .4 During off hours and/or stages of suspended operations for whatever reasons, the General Contractor must assume all responsibility for protection against the elements, theft and/or vandalism. This applies to all work in progress and to any materials, products, tools, equipment, or other such items left at the work site.
- .5 Properly protect floors and roofs from any damage. Take special precautions when moving heavy loads or equipment over floors and roofs.
- .6 The General Contractor must keep floors free of oils, grease or other such materials likely to discolour them and/or affect bonding of applied surfaces.
- .7 The General Contractor must ensure that no part of the Work is loaded greater than it was designed for, when completed. Make any temporary support as strong as the permanent support. Place no load on concrete structure until it has sufficient strength to safely bear such load.
- .8 Protect glass and other finishes against heat, slab and weld splatters, using appropriate protective shields and covers.

- .9 The General Contractor must provide and maintain, in good working order, appropriately labeled ULC fire extinguishers, to the approval of Authorities Having Jurisdiction.
- .10 The General Contractor must provide a minimum of two safety helmets on site at all times for the use of the Consultant and any other Owner authorized visitors to the site. It is the General Contractor's responsibility to make certain that any such visitors wear the protective headgear and any other safety gear which may be necessary at that particular time of construction.

## **1.28 COMPLETION**

- .1 Upon completion of the Work, all protection erected shall be removed, all damage to the Work and adjoining Work due to the lack or failure of such protection shall be made good and all debris, surplus materials tools equipment shall be removed from the work areas and the site, and the Project shall be left clean and tidy to the full and complete satisfaction of the Consultant and Owner Staff. The General Contractor shall give written notice to the Consultant, requesting final inspection of the completed Project.

## **1.29 CONTINGENCY ALLOWANCE**

- .1 No specified Contingency Allowance amount is to be included in this contract price.

## **1.30 CASH ALLOWANCES**

- .1 Include in the Bid Price, a Cash Allowance in the amount noted in the front-end specifications.
- .2 Cash Allowance, unless otherwise specified, cover the net cost to the General Contractor of services, products, construction, machinery and equipment, freight, handling, unloading, storage installation and other authorized expenses incurred in performing the Work.
- .3 The Contract Price, *and not the Cash Allowance*, includes the General Contractor's profit and coordination costs in connection with all Cash Allowance expenditures.
- .4 The Contract Price will be adjusted by written order by the Consultant to provide for an excess or deficit to each Cash Allowance. Any unused portions of these allowances shall be returned to the Board on the conclusion of the Contract.
- .5 A schedule shall be prepared jointly by the Consultant and the General Contractor to show when items called for under Cash Allowance, so that the progress of the Work is not delayed.
- .6 Exclusive of Deposits, which are the contractor's sole responsibility to provide as required of Authorities Having Jurisdiction, the following is a summary of the scope Cash Allowances to be included in the contract:
- .7 Expend the Cash Allowance as directed by the Consultant in writing. Allowance will be adjusted to actual cost with no adjustment to Contractor's charges. Cash expenditure must identify the H.S.T. separately.
- .8 **Cash Allowance – breakdown of items provided in the front-end specifications.**

**1.31 ALLOWANCES CARRIED IN DIVISIONS 15 AND 16**

- .1 No Additional Cash Allowances are included in the work of Divisions 15 and 16.

**1.32 SCHEDULE OF ALLOWANCES**

- .1 Material Allowances shall include the following:
  - .1 Net cost of Material
  - .2 Applicable taxes and duties
  - .3 Delivery to site
- .2 For Material Allowance, the contract shall include:
  - .1 Handling at site, including unloading, uncrating, storage and hoisting
  - .2 Protection from elements, from damage
  - .3 Labour, installation and finishing
  - .4 Other expenses required to do cash allowance work (i.e. contract co-ordination)
  - .5 Overhead and profit
- .3 Material and Installation Allowances shall include the following:
  - .1 Net cost of material
  - .2 Applicable taxes and duties
  - .3 Deliver to site
  - .4 Handling at site, including unloading, uncrating, storage and hoisting
  - .5 Labour, installation and finishing

**1.33 POLYCHLORINATED BIPHENYL (PCB)**

- .1 Conform to the Environmental Protection Act and Regulations, Ontario Regulation 11/82 as amended.

**1.34 USE OF CONSULTANTS'S DIGITAL DRAWINGS**

- .1 Where a contractor wishes to obtain a digital copy of consultant drawings for shop drawings or survey purposes, the consultant may elect to provide this drawing for a nominal fee. As this is the consultants' option, the contractor shall not anticipate provision of these digital drawings to meet the contract schedule.

**1.35 DIMENSIONS**

- .1 Ensure that all necessary job dimensions are taken and all trades are co-coordinated for the proper execution of the work. Assume complete responsibility for the accuracy and completeness of such dimensions, and for co-ordination.
- .2 Verify that all work, as it proceeds, is executed in accordance with dimensions and positions indicated which maintain levels and clearances to adjacent work, as set out by requirements of the drawings, and ensure that work installed in error is rectified before construction resumes.
- .3 Check and verify all dimensions referring to the work and the interfacing of all services. Verify all dimensions, with the trade concerned when pertaining to the work of other



trades. Be responsible to see that Subcontractors for various trades co-operate for the proper performance of the Work.

- .4 Avoid scaling directly from the drawings. If there is ambiguity or lack of information, immediately inform the Consultant. Be responsible for any change through the disregarding of this clause.
- .5 All details and measurements of any work which is to fit or to conform with work installed shall be taken at the building.
- .6 Advise Consultant of discrepancies and if there are omissions on drawings, including layout of items which affect aesthetics, or which interfere with services, equipment or surfaces. DO NOT PROCEED without direction from the Consultant.
- .7 Prepare interference drawings AND SUBMIT AS SHOP DRAWINGS IN ADVANCE OF PRODUCTION to properly co-ordinate the work in all ceiling spaces and where necessary. Coordinate these drawings with all Divisions. Refer also to Section 013300.

### **1.36 SETTING OF WORK AND REQUIRED SURVEYS**

- .1 If required by the work, as part of the base tender amount, provide and pay for the services of a Land Surveyor acceptable to the Consultant, registered in the Province of Ontario to establish the property boundaries and the location of the building addition.
- .2 Lay out building lines for the work and provide substantial stakes, batter Owners or monuments to preserve lines and levels.
- .3 Verify on the site all grades, lines, levels, dimensions and location of hydrants, existing structures, manholes, overhead and buried utilities, existing trees, roadways, sidewalks and the like, shown on the drawings, and report omissions, errors, or inconsistencies, before commencing work.
- .4 Upon completion of layout work and before commencement of any excavation, give ample notification to allow for inspection of lines and levels. Such inspection does not in any way mitigate the Contractor's responsibility for accuracy of layout.
- .5 Provide the consultant with a Surveyor's Certificate describing the location of all perimeter foundation walls relative to property lines before construction proceeds on those walls.

### **1.37 LAYOUT OF WORK**

- .1 Layout work with respect to the work of all trades. Arrange mechanical and electrical work such as piping, ducts, conduits, panels, equipment and the like to suit the architectural and structural details.
- .2 Alterations necessary due to conflict and interference between trades, to be executed at no cost to the Owner unless notification is given in writing before Tender Closing Date.

### **1.38 DOCUMENTS REQUIRED AT START, DURING & CLOSE-OUT OF CONSTRUCTION**

- .1 At Commencement of Contract

- .1 Supply Performance Bond and Labour and Material Bond, in accordance with contract Terms and Conditions.
  - .2 Supply Public Liability and Property Damage Insurance Certificates, also Builder's Risk and Boiler Insurance as required of the Contract.
  - .3 Supply Certificates of good standing from WSIB for the General Contractor and all Subcontractors.
  - .4 Supply a complete Contract Sum Breakdown of all subtrades or parts of work and general expense items for approval by all consultants. Include Mechanical and Electrical Breakdowns for review and acceptance by Consultants.
  - .5 Supply a competent detailed Construction Schedule that has been reviewed and approved by major subtrades. Identify critical milestone dates for Renovations.
  - .6 Supply Schedule of Shop Drawing Submissions and identify list of long-lead items.
  - .7 Apply for and post and supply a copy of Notice of Project, if applicable.
  - .8 Supply a copy of Health & Safety policy as well as post at the job site.
  - .9 Supply Shoring Designs of all load bearing areas if any required of the construction sequence or if required by the Structural Engineer.
  - .10 Supply interference drawings for all areas requested by the Architect, Mechanical Engineer or Electrical Engineer.
- .2 During Construction
- .1 Maintain as-built record drawings in clean condition.
  - .2 Organize regular Trade Coordination meetings.
  - .3 Organize separate, regular Owner and Consultant Job Meetings in accordance with Section 012200.
  - .4 Maintain a copy of up to date records on site including, but not limited to Permit Sets, Contract Documents updated with all addenda, all Changes and Supplementary Instructions issued by Consultants.
- .3 Monthly with Each Progress Payment Application
- .1 Supply Monthly Progress Reports and Construction Schedule in accordance with Section 012200.
  - .2 Adjust Allowances, as required.
  - .3 Current WSIB Form
  - .4 Confirm that payments are being made to subcontractors and suppliers by submission of original copies of the current versions of Statutory Declarations with the second and subsequent Progress Payment Application. Include both Statutory Declarations Form CCDC-9A for the General Contractor and CCDC-9B from subcontractors with each monthly Progress Payment Application. No payment will be made for unincorporated material on the site, unless Bill of Sale in proper format is provided.
- .4 Prior to Substantial Completion
- .1 Provide detailed Completion Schedule a minimum of 90 days prior to Substantial Completion. Schedule to illustrate all trades and sequences required for completion and legal occupancy. Issue to Consultants and upon acceptance, to all trades.

- .2 Coordinate Completion Schedule with Building Commissioner at least 60 days prior to substantial completion or as directed by Consultant.
- .3 Prior and as a requirement of owner acceptance of Substantial Completion of the work the following to be observed, executed and submitted:
  - .1 DEFICIENCIES ARE LISTED: prior to Substantial Completion, the contractor shall prepare a room by room deficiency list in electronic format on an MS Excel spreadsheet provided by the Consultant. Contractor shall print and review on site with consultants at a site meeting and post on each room or area. Contractor shall reissue back to Consultant, when updated, in Excel electronic format. This list will be acted upon by all trades and coordinated and updated weekly as a minimum by the General Contractor to ensure all deficiencies are addressed by the date required for Total Performance. Confirm in writing to the Architect when and on what dates each deficiency has been completed in a satisfactory manner. The Consultant's site review will be final approval.
  - .2 Acceptable preliminary submissions of all Mechanical and Electrical Operations and Maintenance Manuals have been reviewed by Consultants.
  - .3 Acceptable preliminary submissions of all Warranty and Shop Drawing Records have been reviewed by Consultants.
  - .4 All final clean-up to have been executed, as specified in Section 01 74 11.
  - .5 Complete preliminary balancing and provide preliminary Balancing Reports.
- .4 Failure to comply with these requirements shall have amounts withheld on Progress Payments and delay issuance of Certificate of Substantial Completion.
- .5 Note that Prior to the Release of Holdback, a similar Progress Claim is required, and must include current Statutory Declaration Forms CCDC-9A for the General Contractor and CCDC-9B from subcontractors updated to refer to the Previous Certificate of Payment.
- .5 Upon Completion (Refer also to 01 78 00 Close-Out Submittals)
  - .1 Upon completion of work before the Final Certificate of Payment is issued, the following to be observed, executed and submitted:
  - .2 DEFICIENCIES ARE COMPLETE. Confirm in writing to the Architect when and on what dates each deficiency has been completed in a satisfactory manner. The Consultant's site review will be final approval.
  - .3 Organize a Final Inspection tour at which to be present: the Owner's authorized representative; the Architectural, Structural, Mechanical and Electrical Consultants, and their supervisory personnel, if any; the Contractor and his superintendent.
  - .4 Where the above procedure is impossible or where any deficiencies remain outstanding, the Owner's representative and the Consultant concerned, to inspect and accept the affected work and/or material upon notification by the Contractor, that all deficiencies involving this Consultant have been made good.
  - .5 A complete release of all liens arising out of this Contract, other than his own. If a subcontractor or supplier refuses to furnish a release of such a lien, furnish a bond satisfactory to the Owner to indemnify him against any claim under such a lien.
  - .6 Certificates of good standing from the WSIB, for the General Contractor and all Subcontractors.

- .7 All reference records, as specified, under Section 01 78 00.
- .8 Certificate of Inspection from Mechanical and Electrical Engineers.
- .9 Copies of all Lists of Deficiencies with each Deficiency verified when complete by only this project's job Superintendent. The Final List of Deficiencies to be signed, completed by all concerned, if accepted.
- .10 Statement of Completion from General Contractor.
- .11 Final adjustment of all Allowances.
- .12 Certificates required by Provincial, Municipal and other authorities having jurisdiction. Including signed Building Permit (if applicable).
- .13 2 sets of marked up prints of complete Architectural, Structural, Mechanical and Electrical drawings in addition to the digital copies required below.
- .14 Digital copy of Site Services, Architectural, Structural, Mechanical and Electrical and 2 sets As-Built Drawings
- .15 Final copies of all Maintenance Manuals.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not used.

**END OF SECTION**

## **Part 1 General**

### **1.1 DESCRIPTION**

- .1 This Section outlines the mandatory minimum Health and Safety protocols for all renovation, addition and new school board construction Projects where all or a portion of the existing school building remains occupied and in use.
- .2 These Health and Safety protocols are mandatory minimum requirements, procedures and standards that the School Board insists are fully complied with by all parties involved with renovation projects.

### **1.2 RELATED SECTIONS**

- .1 These specifications apply to all Divisions of this Project specification. It is the responsibility of the Contractor to apply these provisions wherever practical within specification limits to all products and services used on this Project.
- .2 The requirements of this Section supersede those of all other specification Sections and Drawings. Where conflicts exist in procedures, methods or materials, they shall immediately be brought to the attention of the Consultant and Board Project Manager. Where clarification is not immediately available, the Contractor shall assume the specifications contained in this Section are a minimum standard and the more stringent specification shall apply.
- .3 The Contractor must receive approval from Board Project Manager for any deviations from this specification Section.
- .4 The General Contractor shall recognize that it is *he* who is the Constructor of the Project. The General Contractor shall also recognize that he is solely responsible for site safety at the Place of the Work and compliance with the requirements of this Section does not limit or remove his total responsibility for site safety as Constructor of the Project.

### **1.3 REFERENCES**

- .1 Applicable related regulations, standards and laws related to safety include but are not limited to:
  - .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations.
  - .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
    - .1 Material Safety Data Sheets (MSDS).
  - .3 Province of Ontario
    1. Occupational Health and Safety Act and Regulations for Construction Projects, R.S.O. 1990 June 2002.

### **1.4 COMPLIANCE SPECIFICATION**

- .1 Notwithstanding the requirements of this Section, the Contractor must comply with all applicable health, safety and environmental regulations and statutes.

## **1.5 BEYOND COMPLIANCE SPECIFICATION**

- .1 These specifications apply in addition to all applicable health, safety and environmental compliance regulations. They are incorporated here to reflect the Board's intention to develop a specification which provides the safest practical procedures and policies for construction project sites that are occupied and in use by staff, students and visitors during the execution of the Construction Contract.
- .2 Beyond compliance specifications recognize that performance well beyond the minimum regulatory standard is often desirable, possible and affordable, often with no cost or low cost options. It also recognizes that application methods or protocols may be as important as the material specified. Therefore, these specifications cover both material and methods.
- .3 These provisions apply to both indoor and outdoor applications equally.

## **Part 2 Products**

### **2.1 NOT USED**

## **Part 3 Execution and Compliance Requirements**

### **3.1 APPLICATION OF COMPLIANCE REQUIREMENTS**

- .1 The articles set out herein are to be applied together as a set of related policies and procedures to achieve a comprehensive Health and Safety working protocol.
- .2 The Contractor shall execute all of the procedures and meet all of the requirements set out herein and apply these protocols from the outset of the Construction Phase.
- .3 These procedures or requirements are to be maintained for the duration of the Construction Phase. The Contractor shall not discontinue any of the individual procedures or requirements without the prior approval of the Board Project Manager.

### **3.2 SITE SUPERVISOR (SITE SUPERINTENDENT)**

- .1 A full-time Site Supervisor (Site Superintendent) is required on site, regardless of the number of active workers on site.
- .2 Site Superintendent shall have as a minimum:
  - .1 Recent, previous experience with renovation or addition projects involving occupied buildings including (but not limited to) school construction, sites with students, tenants, employees, retail customers, pedestrian and vehicular traffic.

- .2 Successful completion of a multi-session Supervisor’s training course conducted by a recognised Construction Association in Ontario.
- .3 Site Superintendent must carry a cell phone at all times during construction with the ability to be reached directly during all work hours and the ability to have voicemail recorded and accessed during all non-work hours including weekends and holidays.
- .4 Site Superintendent must have means of live phone or walkie-talkie communication with the site Flagman during all work hours.
- .5 Site Superintendent shall not be changed throughout project unless confirmed and approved by the Board Project Manager.

### 3.3 ONTARIO OCCUPATIONAL HEALTH & SAFETY ACT AND REGULATIONS FOR CONSTRUCTION PROJECTS

- .1 General Contractor to comply with the Ontario Occupational Health & Safety Act and Regulations for Construction Projects, latest edition– including all amendments.
- .2 Beyond compliance in item .1 above, regardless of the number of labourers active on the Project, the General Contractor shall form a contractors’ Health & Safety Committee at the outset of construction. This Committee shall then follow the standard requirements for such a Committee as set out in the *Occupational Health & Safety Act and Regulations for Construction Projects*.

### 3.4 ON-SITE COMMUNICATIONS

- .1 At the outset of the project the General Contractor shall provide to the Board Project Manager all relevant contact information for the Site Superintendent, GC Project Manager and key sub-contractors including names and cell phone numbers.
- .2 The General Contractor shall provide at least one “emergency contact” telephone number at which the Contractor’s representative can be reached directly during all work hours and have the ability to have voicemail recorded during all non-work hours including weekends and holidays. As outlined below, this may be designated to the Site Superintendent’s cell phone number.
- .3 Regardless of compliance method for the emergency contact telephone number stated above, the Site Superintendent must carry a cell phone at all times during construction with the ability to be reached directly during all work hours and the ability to have voicemail recorded during all non-work hours including weekends and holidays.
- .4 Site Superintendent must have means of live phone or walkie-talkie communication with the site Flagman during all work hours.
- .5 The Contractor is to ensure that the Board Project Manager is immediately apprised of any safety issues as each arises and the related request and/or resolution. The Board Project Manager is responsible for any decisions that have an effect on the contract execution.

- .6 Notwithstanding the reporting to the Project Manager noted above the Site Superintendent shall liaise with school principal or designate on all safety related matters as required on a daily basis.
- .7 In the event of a safety issue requiring contractual clarification or action (i.e. Change Notice, etc.), the contractor shall ensure that, where applicable, the action is followed up with appropriate documentation.

### 3.5 FULL-TIME ON-SITE FLAGMEN

- .1 A full-time, designated Flagman is required at all vehicular construction entrances. Refer to drawings for the scope and locations.
- .2 In the event there is more than one entrance to the hoarded/fenced construction area, there must be a separate Flagman for each entrance.
- .3 Flagman may not be same person as Site Superintendent or other construction worker.
- .4 Flagman shall not be changed throughout the Project unless confirmed and approved by the Board Project Manager.
- .5 Flagman must have means of phone communication with Site Superintendent (phone or walkie-talkie).
- .6 The Flagman shall not be designated for any other duties than to act as a Flagman for safety purposes as described herein.
- .7 The Flagman shall meet and escort any construction traffic from the site **entrance** into and out of the hoarded/fenced construction area (including through open site areas until entrances to hoarding).
- .8 The Flagman shall only open hoarded areas when construction traffic moves through and immediately re-close gates.
- .9 The Flagman shall control construction parking at the school site (including vehicles parking or traveling in unauthorized areas).
- .10 The location of the Flagman shall be set to ensure the safe guarding of staff, student, and pedestrian traffic.
- .11 If not designated on the Contract Documents, the location of the Flagman shall be confirmed with the Board Project Manager and Consultant at the outset of the project and before the placement of hoarding and fencing.
- .12 Where the Contractor deems it necessary, in order for the Flagman to carry out the required full-time duties, the cost of a temporary shelter shall be included in the Tender Price.



- .13 The Flagman shall be properly attired to carry out his duties, including the use of safety equipment (e.g. wear reflective vest, have appropriate traffic hand-held “Stop” sign and have a visible identification tag).

### **3.6 SITE SAFETY SIGNAGE**

- .1 Standardised Safety Signage is required at all construction entrances.
- .2 If not designated on the Contract Documents, the location of the Safety Signage shall be confirmed with the Board Project Manager and Consultant at the outset of the Project and before the placement of hoarding and fencing.
- .3 Safety Signage is to be posted at all street entrances to school site and at each entrance to hoarded/fenced construction area.
- .4 Total surface area of signage is to avoid exceeding municipal standards that would require a separate signage permit.
- .5 Access signage text shall include cell phone contact number for Site Superintendent.
- .6 Signage posted at gates shall state restrictions on hours of entry and egress as described in the Contract Documents and under no circumstances shall construction traffic be allowed within 30 minutes prior to school start, during recess, lunch break, and 30 minutes after dismissal periods.

### **3.7 ACCESS/EGRESS CONTROLS**

- .1 At the outset of the Contract, the General Contractor shall advise all suppliers and subcontractors of the protocols listed herein and of the requirement to contact the Site Superintendent by Cell phone prior to entering the site.
- .2 The drivers of all construction vehicles entering the site, including delivery vehicle drivers, are to contact site Superintendent by cell phone prior to entering site; the Site Superintendent shall, in turn, give notice to the Flagman to be aware of the traffic and authorize the Flagman to allow entry of that vehicle.
- .3 Vehicular Gates are only for entry and exit of for construction purposes such as construction personnel, Authorities performing inspections, Board representative, delivery personnel, and disposal pickup and ONLY under escort by the Flagman. As such vehicular gates must remain closed and locked at all times and only opened for access/egress under escort by the Flagman, then closed and locked again.
- .4 Gates are to be lockable swing gates for vehicles and man gates at all access points to the hoarded/fenced construction area.

### **3.8 CONTRACTOR PARKING**

- .1 Contractor parking shall be restricted to hoarded areas or designated parking areas only where pre-approved by Board Project Manager and Principal.
- .2 Contractor parking is restricted from all off-site street areas that interfere with site specific parent drop-off and parking areas.

### **3.9 REQUIRED PRE-CONSTRUCTION MEETINGS**

- .1 Meeting 1: Contractor shall receive approval from the Architect and the Board Project Manager for parking, vehicular movement, access/egress strategies at a Pre-construction meeting taking place in advance of mobilizing on site.
- .2 Meeting 2: Once hoarding and fencing is erected BEFORE site construction is fully active and vehicles or equipment is mobilized on site, an initial site meeting shall take place at which time the layout of trailers and staging, deliveries, storage of materials, parking areas and vehicular movement to be reviewed and approved by the Board Project Manager.
- .3 See article 3.12- 'Site Meetings' following.

### **3.10 CONSTRUCTION FENCING AND HOARDING**

- .1 Construction hoarding requirements shall be a site based decision to be determined by the Architect and the Board Project Manager at the design stage and shown on Contract Documents.
- .2 No fencing or hoarding shall be less than a continuous 1800 mm high.
- .3 In portions of the site where chain link is approved, it shall be continuous 1800 mm high chain link fencing, wire-tied to staked iron 'tees' at 1800 mm on centre - OR - leased, modular 'quick fencing' if staked down and wire tied together.
- .4 All fenced and hoarded areas to be gated with lockable vehicular and man gates-minimum construction to be steel rail and chain link construction.
- .5 Plastic snow fencing is NOT permitted.
- .6 All hoarding and fencing shall be maintained in a stable condition, for duration of construction period as part of the base contract price and to include Superintendent's inspection at the beginning and end of each work day.
- .7 All Fire Routes to be outside all fenced and hoarded areas and maintained clear at all times.
- .8 'Covered way' protection shall be provided when accesses or pathways are in proximity to construction, in accordance with Ministry of Labour *Occupational Health & Safety Act* Regulations.

### **3.11 HEALTH, WELLNESS & SAFETY DEPARTMENT REPRESENTATIVE**

- .1 A representative of the Board’s Health, Wellness & Safety Dept. (‘Environment, Health and Safety Officer’) may visit site at any anytime throughout the duration of the Contract to review the site, as it relates to the safety of the occupied areas of the site. Such site review shall neither constitute an inspection or approval for the Contractor.
- .2 Concerns or issues identified by the representative from the Board’s Health, Wellness & Safety Dept. shall be communicated through the Board Project Manager and the school Principal for corrective action.
- .3 Contractor shall ensure full access to all site areas, at all times, for the Board’s Health, Wellness & Safety Department Representative.

### **3.12 SITE MEETINGS**

- .1 Coordinate the requirements of this Section with *Section 01 22 00 – ‘Meetings and Progress Reports’*.
- .2 Initial site meeting to take place after erecting fencing and hoarding but prior to the mobilisation of any vehicles, equipment or start of Work.
- .3 Contractor shall ensure that the Board Project Manager, School Principal and a representative of the Board’s Health, Wellness & Safety Department and the School Principal attend the initial site meeting.
- .4 The initial meeting shall review and approve a standardised agenda for all site meetings and a thorough review of the Site Safety Protocol.
- .5 The standardised agenda shall include a Checklist and Report of Health and Safety items at the beginning of the agenda. This Checklist shall be included and each item reviewed at all site meetings for the duration of the project.
- .6 The Checklist of Site Safety items shall include but not be limited to:
  - .1 Contractor’s report of site safety record and report of recent site activities, precautions or actions.
  - .2 Review any visits to the site and actions required by Ministry of Labour or Board Health, Wellness & Safety representatives or other Authorities Having Jurisdiction.
  - .3 Contractor’s Health & Safety policy manual posted in site trailer.
  - .4 Copy of Ministry of Labour *Occupational Health & Safety Act and Regulations for Construction Projects* in site trailer.
  - .5 Name of General Contractor H&S representative.
  - .6 Continuing compliance with Safety Signage.
  - .7 Hoarding & fencing layout and condition.
  - .8 Access and egress measures and any breaches of requirements.
  - .9 Confirmation of communications link between Site Superintendent & Flagman.

- .10 Work that may produce any noxious odours and the containment measures, (*i.e.*: schedule, type, approvals required therefore).
- .11 Copies of Material Safety Data sheets in site trailer.
- .12 Complete meeting minutes including details of Safety Checklist shall be copied to Architect, Board Project Manager and Principal.
- .7 Contractor to produce record of written Memorandum to all subtrades and suppliers detailing but not limited to: hours of delivery; site access procedures and restrictions; use of existing facilities.
- .8 Contractor to prepare detailed and accurate written record of all meetings to be kept and issued to all parties.

**3.13 CONTRACTOR’S HEALTH AND SAFETY COMMITTEE MEETINGS**

- .1 As required in item 3.1.2, the Contractor shall form a Health and Safety Committee, hold meetings and record minutes of meetings for the duration of the Contract.
- .2 Contractor to maintain a copy of Health & Safety Committee minutes on site for review by Ministry of Labour or Board representative(s).

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 Related Sections**

These photographs are provided for convenience only. Bidders are strongly encouraged to attend the non-mandatory Site Meeting during tender.

Bidders remain responsible to inspect the site and assume existing site conditions.

Bidder is to be aware of the severe sloping topography of the site and associated requirements for access to complete the work described. No allowance will be made for additional cost claims due to lack of Bidder awareness of existing site conditions.

The following photos were taken in 2022.

Exterior photos

Exterior



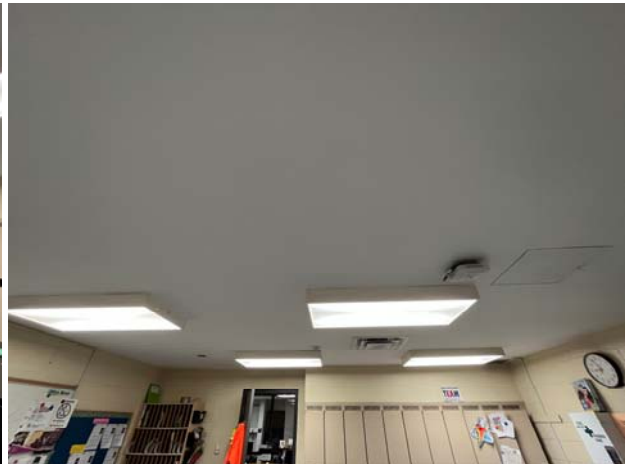




General Office



Staff Room



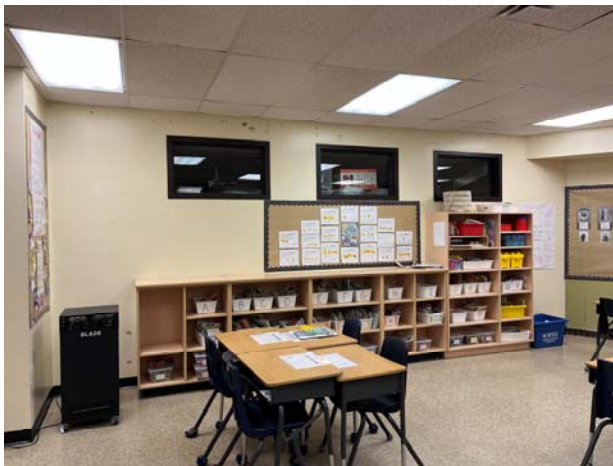
Classroom 4







Classroom 5



Classroom 4 & 5 Alcove

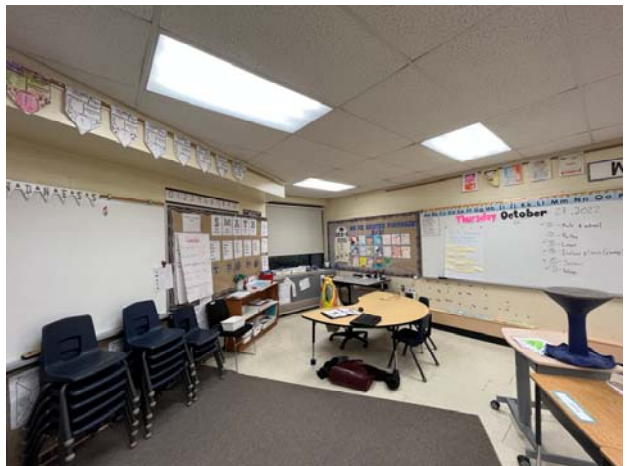


Classroom 6





Classroom 7



Classroom 6&7 Alcove



Classroom 8



Classroom 9



Classroom 8 & 9 Alcove



Classroom 10



Classroom 11



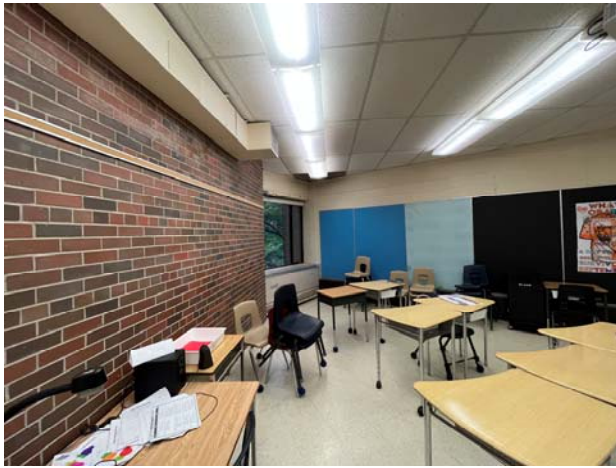


Classroom 10 & 11 Alcove



Classroom 12





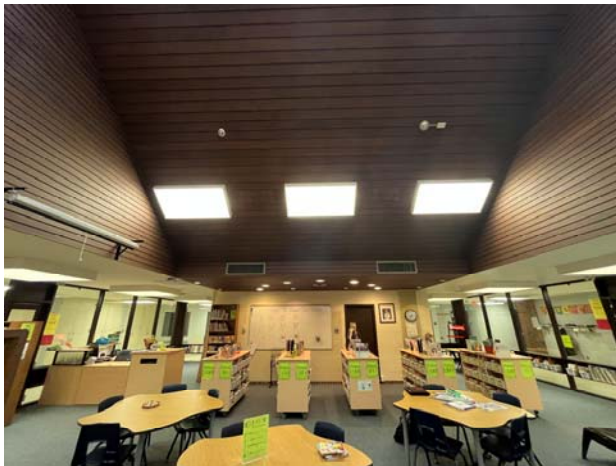
Classroom 13

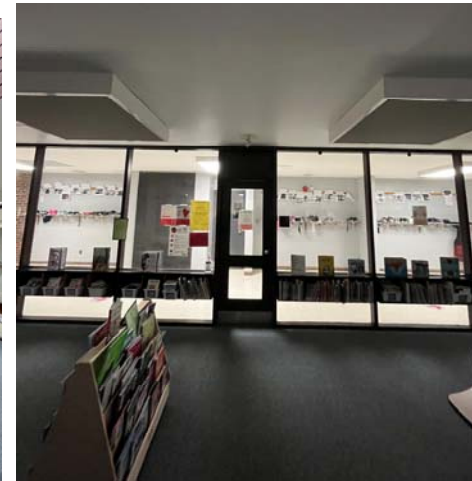






Library





Gym



A/V Storage / BF Washroom



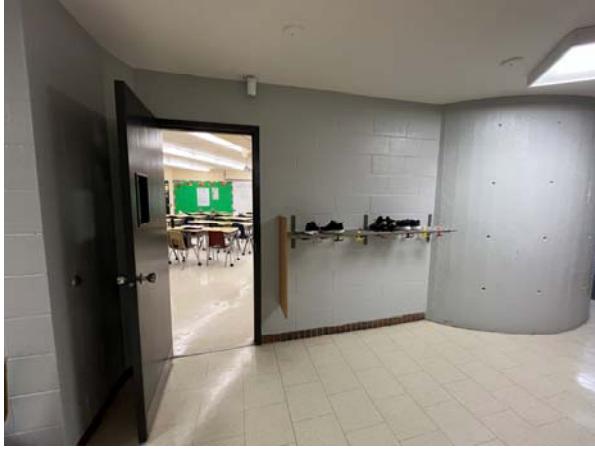
BF Washroom 221



Corridor 801



Corridor 803



Corridor 815



## **PART 1 GENERAL**

### **1.1 Related Sections**

1. Section 01 11 00 - Summary of Work
2. Section 01 56 00 – Temporary Barriers and Enclosures
3. Section 01 73 03 – Execution Requirements (Cutting and Patching)
4. Section 04 21 13- Brick and Block Masonry
5. Section 01 33 00 - Submittal Procedures
6. Section 08 11 14- Metal Doors and Frames
7. Section 08 71 15 – Finish Hardware
8. Section 09 91 22- Painting
9. Section 09 21 16- Gypsum Board Assemblies
10. Section 09 51 13- Acoustic Panel Ceilings
11. Section 10 11 25- Manufactured Specialties
12. Mechanical and Electrical Sections

### **1.2 Scope**

1. Scope includes but is not limited to:
  - .1 Demolition or alteration of all structural, architectural, mechanical, electrical or site components, equipment, fitments and finishes as required to execute the work.
  - .2 The removal, repair and reinstallation as required to make good of existing acoustic unit ceilings gypsum board bulkheads, windows, doors, hollow metal screens and partition walls where required to be removed for routing new services, general alterations or revising demising walls.
  - .3 Removal and reinstallation as indicated of any existing fixed in place millwork, chalkboards or tackboards or similar fitments or devices identified to remain and be reinstalled.
  - .4 Grinding and patching of walls where chalkboards or fitments have been removed and surface adhesives or similar surface deficiencies remain.
  - .5 Cutting and removal of slabs on grade to remove or replace existing drains, clean outs, oil interceptors, trenches and sub slab services contained within them, not previously removed by Abatement work.
  - .6 Making good of all walls and floors remaining where sections of walls or floors have been removed and surfaces require repair.
  - .7 Making good of all finishes to remain as result of selective demolition.

### **1.3 Existing Conditions**

1. Existing Ground Floor structure contains in-floor heating system materials that are no longer in use but may remain abandoned in place. These may be encountered during construction.
2. Take over structures to be demolished or altered based on their condition on date that tender is accepted, at time of examination prior to tendering.
2. Contractor may confirm the prior removal of all asbestos containing materials in documentation left on site following prior abatement work contract. Should areas of

asbestos be found which are not documented as removed or included in the scope of this work for removal, it shall be reported to the Consultant and Owner’s representative for review and instructions for removal.

3. Prior to beginning alteration or demolition, confirm with Owner that no items to be salvaged or turned over to the owner remain in the work areas.

#### **1.4 Protection**

- .1 Prevent movement, settlement or damage of adjacent structures, services, walks, paving, trees, landscaping, adjacent grades parts of existing building to remain. Provide bracing, shoring and underpinning required. Make good damage and be liable for injury caused by demolition.
- .2 Take precautions to support structures and, if safety of building being demolished or adjacent structures or services appears to be endangered, cease operations and notify Consultant.
- .3 Refer to structural drawings for Shoring Designs and Method Statements.
- .4 Prevent debris from blocking surface drainage system, elevators, mechanical and electrical systems which must remain in operation.

#### **Part 2 Products** NOT USED

#### **Part 3 Execution**

##### **3.1 Work**

- .1 Dispose of demolished materials except where noted otherwise and in accordance with authorities having jurisdiction. Confirm in Divisions 15 and 16 for removal and re-use of mechanical and electrical materials and equipment.
- .2 Refer to drawings for furniture, materials or equipment to be removed and turned over to the owner. Carefully remove such items and store in location designated by Owner.
3. For a scope of work refer to all Drawings and also coordinate items to be altered, re-built, cleaned or otherwise “made good” as a result of the cutting and patching scope of work described in Section 01 73 03 Execution Requirements or other Sections.

##### **3.2 Preparation**

- .1 Disconnect electrical, telephone/PA and data service lines in work areas without disrupting main service to building and in accordance with regulations of authorities having jurisdiction. Post warning signs on electrical lines and equipment which must remain energized to serve other properties during period of demolition.
- .2 Disconnect and cap designated mechanical services in accordance with requirements of local authority having jurisdiction.
  - .1 Natural gas supply lines, if applicable to be removed by gas company by qualified tradesman in accordance with gas company instructions.
  - .2 Remove, cap or dispose of other underground services as indicated in drawings.
  - .3 Do not disrupt active or energized utilities traversing premises designated to remain undisturbed.



- .3 Floor scans to locate hidden or buried services in the work area have NOT previously been done. Prior to cutting, demolition or removal of any slabs on grade or areas where services may be concealed, engage a **private locate firm to provide magnetic and X-ray scans** of all areas involved. This is the responsibility of the General Contract and costs for such scans are to be included in the base contract price.

### **3.3 Disconnection and Removal of Materials and Equipment**

- .1 Contractor shall cooperate with the Owner to determine which materials are to be removed and retained by Owner. The Owner will decide which items or equipment they wish to retain as their property and all other materials shall be removed from the premises by this Contractor. The equipment which is to be retained by the Owner shall be stored on site where directed by the Owner.
- .2 Refer to mechanical and electrical drawings and for disconnection and removal and/or relocated existing electrical, ductwork, piping and/or equipment.

### **3.4 Temporary Removals and Replacement**

- .1 All items to be removed and installed shall be completed so that replaced materials are left in a clean undamaged state. If required to be replaced due to damage, the contractor shall include in his price for the component to be replaced and installed at no additional cost to the Contract.

### **3.5 Oil Tank Investigation and Possible Removal**

- .1 A Subsurface Investigation report by MTE Engineers dated Dec. 7, 2018, has been provided in the specifications for sampling taken in the location of a possible oil tank within the work area. No concerns were reported with regards to contaminated soil. Should the tank be encountered during construction, the Contractor is to remove the underground abandoned oil tank and infill the area with compacted subbase and reinforced concrete slab as per proposed drawings. Refer to mechanical drawings. Oil Tank Removal, environmental engineering fees and associated testing is to be expended from the Cash Allowance. Licensed Petroleum Mechanic is required to remove the existing oil tank (with the fill pipe). The oil & gas interceptor is to be removed as part of the base bid (by the General Contractor).

### **3.6 Selective Demolition**

- .1 Follow best trade practices for all demolition and alteration work. This includes but is not limited to the following items.
  - .1 The school will be mostly vacant during the construction, with the exception of some spaces being utilized intermittently. Despite this, ensure demolition work does not disrupt any ongoing aspect of the operation of the building.
  - .2 Confirm all demolition work (including potential noise, vibration, tools or equipment noise, etc.) in advance with the principal of the school on a daily basis. Similarly, notify all building occupants in advance at each possible interruption in services or utilities.
  - .3 Protect all areas from damage and intrusion by means of locking rooms under construction when not in use, use of dust tight screens and temporary partitions and

- hoarding. Demolish to minimize dusting. Refer to drawings for locations and other Specification Sections for requirements.
- .4 Signage to be posted at all times. Take precautions to demolish only areas as necessary to complete the work, and avoid damage to adjacent areas. Make good all areas affected by demolition or renovation activities, whether specifically included in the contract documents or not.
  - .5 The Contractor shall be responsible for damage to all areas affected by renovation or alteration activities.
  - .6 Prior to demolition, the Contractor shall carefully examine the drawings in relation to the site conditions, to ensure that all intended work can be carried out without ambiguity. Incorrect demolition of any work by the Contractor, will be back-charged to him. Any discrepancies between the drawings and the site conditions, must be reported to the Consultants immediately.
  - .7 Demolish or remove interior and exterior elements as indicated.
  - .8 Remove existing equipment, services, and obstacles where required for refinishing or making good of existing surfaces, and replace as work progresses.
  - .9 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.
  - .10 Demolish masonry and concrete walls in small sections. **Salvage existing imperial block units in coordination with Section 04 21 13 to re-use as patching in existing imperial unit masonry.**
  - .11 Carefully remove and lower structural framing and other heavy or large objects as required. Where partial walls of exposed concrete block masonry is to remain, grind all exposed edges to a bullnose and patch as required suitable for final painting.
  - .12 Do not sell or burn materials on site.
  - .13 Remove contaminated or dangerous materials from site and dispose of in safe manner to minimize danger at site or during disposal, in accordance with all governing legislation.
  - .14 Where applicable, saw cut existing terrazzo floor and base as required and remove to nearest metal 'panel' joint to enable replacement at a full panel. **Replace with terrazzo flooring to match existing as closely as possible. Provide sample to consultant for approval.**
  - .15 Following demolition and removals of floor trenches, walls and fitments, coordinate with Section 01 73 03. As part of the work of this section, scarify or otherwise grind existing or new slabs in preparation for slab in-fills and a self leveler skim slab by Section 01 73 03. That Section is responsible for the provision of a backfill, slab on grade patching and self leveling skim coat where required in advance of new VCT finishes by Section 09 65 19.
  - .16 Patch and make good existing wall, ceiling and floor finish with identical original materials if affected by temporary protection or by previous Abatement contract.

### 3.7 Repair to all Finishes and Colours

- .1 Repaint all walls in rooms or areas modified as indicated in the Finish Schedule, or as directed by the Consultant.

- .2 Repair and make good all fixtures, finishes, trims and surfaces to all floor, wall and ceiling areas in rooms or areas whether or not they have been modified or affected by the work or by previous Abatement Contract.
- .3 Existing paint colours are to be matched exactly using computer colour matching.

**END OF SECTION**

**Part 1 General**

**1.1 HAZARDOUS BUILDING MATERIALS REPORT & ABATEMENT SPECIFICATIONS REFERENCE**

- .1 Asbestos Abatement forms part of this contract. The **Asbestos Audit Report** prepared for this project is bound within this document. These reports outline the areas of hazardous materials discovered at this site.
- .2 It is the responsibility of the contractor to engage a qualified abatement contractor for required removal.
- .3 Removal and air quality testing is to be performed outside of operating school hours and done in a manner to not interfere with operating school hours.
- .4 The referenced asbestos reports were not prepared by or under the supervision of the Architect. The Architect claims no responsibility or liability for the accuracy of the information contained in the report.
- .6 Refer also to Division 1 and Section 01 35 30 and coordinate with this Section.

**Part 2 Products**

**2.1**

1. Refer to documents noted above.

**Part 3 Execution**

**3.1**

- .1 Inspection and Testing will be paid for under Cash Allowances.

**END OF SECTION**

**Part 1 General**

- .1 A Designated Substance Audit Report has been provided the Owner by their consultant, MTE Consultants, and provided for convenience in these specifications.
- .2 Abatement as outlined in the following specifications is to be included in the base bid contract. Additional designated substance abatement that may be required, beyond that identified within the contract documents, is to be paid for by the Cash Allowance amount identified in the front end documents.

**Part 2 Products**

1. Refer to above.

**Part 3 Execution**

- .1 Inspection and Testing will be paid for under Cash Allowances.

**END OF SECTION**



# Central Public School

## Designated Substance Audit Report

**Project Location:**

175 Main Street, Cambridge, ON

**Prepared for:**

Waterloo Region District School Board  
51 Ardelt Avenue, Kitchener, ON

**Prepared by:**

MTE Consultants  
520 Bingemans Centre Drive  
Kitchener, ON N2B 3X9

February 9, 2022

**Revised:** November 14, 2022

**MTE File No.:** 34532-935





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## 1.0 Introduction

MTE Consultants Inc. (MTE) was retained by the Waterloo Region District School Board (WRDSB) to conduct a Designated Substance Audit for Central Public School located at 175 Main Street in Cambridge, Ontario.

The purpose of the audit was to identify the presence of Designated Substances within the building(s) in accordance with Section 30 of the Occupational Health & Safety Act (OHSA), in advance of building renovation. This report meets the requirements of Section 30 of the OHSA and the requirements of Ontario Regulation (O. Reg.) 278/05.

## 2.0 Scope of Work

As requested by the Client, this assessment was limited to work areas outlined in Demolition Floor Plans provided by WRDSB and completed by Hossack and Associates Architects. The scope of work has expanded from the original work area. These areas are referred to in the following sections as the “Subject Areas”.

The Scope of Work for this assessment was completed by MTE and included the following activities:

- Review of existing or historical reports and documentation pertaining to Designated Substances within the building;
- Visual inspection of all accessible areas within the buildings and all accessible exterior finishes and elements to identify the following suspect Designated:
  - Asbestos;
  - Lead;
  - Mercury; and,
  - Silica.
- The following Designated Substances are not expected to be present due to the building use or in a form that is hazardous: Acrylonitrile, Arsenic, Benzene, Coke Oven Emissions, Ethylene Oxide, Isocyanates, and Vinyl Chloride;
- Collection of bulk building material samples suspected to contain asbestos;
- Collection of paint scrape samples suspected to contain lead;
- Submission of samples to an accredited and/or qualified laboratory;
- Interpretation of laboratory results; and
- Preparation of this report of findings and recommendations.

## 3.0 Methodology and Assessment Criteria

This audit was conducted using visual and laboratory identification methods for the assessment of materials outlined in Section 2.0 and their corresponding location and use. Materials that are determined to be asbestos-containing materials (ACM) are further classified by their friability and condition. The areas outlined in Section 2.0 were inspected and limited to building



components, materials and service connections. Notwithstanding that reasonable attempts were made to identify all Designated Substances, the possibility of concealed substances and material exists and may not become visible until substantial demolition has occurred and therefore are currently undocumented. All work was conducted in accordance with industry accepted methods and MTE Standard Operating Procedures and did not include the following:

- Materials indicated in this report as “Potentially Concealed”;
- Locations that may be hazardous to the surveyor (located at heights, electrical equipment, confined spaces);
- Locations concealed by building finishes that require substantial demolition or removal for access or determination of quantities (plumbing or electrical lines);
- Non-permanent items or personal contents, furnishings; and
- Settled dust or airborne agents unless otherwise stated.

## 4.0 Assessment and Results

An inspection of the building was conducted by MTE on January 31, 2022. An additional inspection of the expanded scope of work was conducted by MTE on November 1, 2022.

The proposed renovation project is expected to disturb interior and exterior windows, interior and exterior walls, flooring, ceilings, interior doors frames and glazing, electrical and mechanical components, and associated hardware and sealants. Specific mechanical system upgrades are also included

It should be noted that the WRDSB identified the potential of asbestos cement sheeting on exterior wall portions with metal panel siding of the renovation work area, based on original building plans. Attempts to identify backing material from within louvers associated with the metal exteriors were inconclusive, but identified a metal pane interior assembly at a location with a corresponding interior heating unit. Due to the access and demolition required to access all of the these locations and likelihood of the presence of the ACM materials, they should be assessed and abated during the project as required and in accordance with Ontario Regulation 278/05.

A description of the building and assessed finishes is provided below. Refer to Section 4.1 for a summary of findings.

| Building Element   | Description   |
|--------------------|---|
| Construction Date  | 1968  |
| Addition Date(s)   | 2013  |
| Levels             | 2   |
| Exterior Finishes  | Concrete<br>Brick veneer and mortar<br>Metal siding<br>Hard texture finish on overhangs<br>Sealants |
| Building Structure | Structural steel  |

| Building Element                      | Description  |
|---------------------------------------|--|
|                                       | Concrete block   |
| <b>Building Insulations</b>           | Not inspected  |
| <b>Mechanical Systems/Insulations</b> | Baseboard heating  |
|                                       | Fibreglass insulation on pipe straights, foil wrapped elbows |
| <b>Electrical/Plumbing Systems</b>    | Fluorescent Light tubes, bulbs                               |
| <b>Floor Finishes</b>                 | Vinyl floor tiles  |
|                                       | Ceramic tile & grout   |
|                                       | Terrazzo   |
| <b>Wall Finishes</b>                  | Concrete   |
|                                       | Drywall  |
| <b>Ceiling Finishes</b>               | Drywall  |
|                                       | 2' x 4' Ceiling tiles-post 2000                              |

As part of this assignment, MTE reviewed “Central Public School 2020 Asbestos Audit Update Report” which was prepared by MTE Consultants and dated September 2, 2020. Review of this report indicated the following Designated Substances has been confirmed or suspected present within the building:

| Item                 | Material Description                                     | Location              |
|----------------------|--|-----------------------|
| <b>Confirmed ACM</b> | Exterior Hard Texture Coat Overhangs (Chrysotile, 1.2 %) | Exterior Overhangs    |
|                      | Black Window Frame Sealant                               | Interior and Exterior |
|                      | Black Door Frame Sealant                                 | Exterior Doors        |
|                      | Black Floor Mastic                                       | Original Building     |
| <b>Suspected ACM</b> | Roofing Materials  |                       |

#### 4.1 Findings and Analytical Results

A summary of sampling locations and analytical results are included in **Appendix A** and is inclusive of historical sampling, as outlined in Section 4.0.

Laboratory certificates of analysis are included in **Appendix B**.

Figures of inspected areas are included in **Appendix C**.

A detailed summary of findings and recommended actions is provided in **Table 4.3 of Appendix A**.

#### Asbestos

Asbestos was used in building materials throughout the years with a peak usage in the 1950s and 1960s. While the manufacture of most ACM, was banned in the 1970s, buildings constructed in the 1980s have the potential for ACM as well. In 1986 legislation limiting the use of asbestos in consumer products was introduced.

No additional samples were collected during the November 2022 re-assessment.

As part of the project, a total of 18 bulk samples of suspect ACM were submitted for asbestos analysis with a total of 16 analyses being performed. The difference between the number of samples submitted and the number of samples analysed can be a function of either the stop-positive method or the requirement of analyzing multiple layers, performed by the laboratory, from a single sample reported as additional samples or subsets of a sample.

Bulk samples were submitted for asbestos analysis to Paracel Laboratories Ltd. (Paracel), in Mississauga, Ontario. Paracel is certified under the Canadian Association of Laboratory Accreditation to perform asbestos analysis of bulk samples. Laboratory analysis was conducted in accordance with the United States Environmental Protection Agency (USEPA), Test Method EPA/600-R-93/116: Method for the Determination of Asbestos in Bulk Building Materials, June, 1993 by Polarized Light Microscopy (PLM) as prescribed by O. Reg. 278/05.

Based on the building construction date and presence of concrete block walls, invasive inspection was also conducted for vermiculite loose-fill insulation. Representative invasive testing locations were selected based on location, function and wall construction type and included the following:

- Classroom 6 – Exterior concrete block wall – no vermiculite identified;
- Areas were excluded where concrete block was not present or concealed by building finishes, or where invasive inspection may either be hazardous to building occupants or cause significant aesthetic damage to building finishes;

For flooring mastics, floor tile replacements also occur after original construction and site specific sampling is recommended to delineate the extent of asbestos-containing mastic prior to any work than may impact it. Alternatively, all mastic can be deemed ACM.

Based on the laboratory results and visual identification, ACM was confirmed present at the time of the inspection. In addition, suspect ACM was either observed or may potentially be concealed by building finishes.

## **Lead**

Lead was historically used in mortar pigments, ceramic glazing; plumbing solder, electrical equipment and electronics solder, in pipe gaskets as packing in cast iron bell and spigot joints of sanitary drains, flexible plumbing connections, flashing panels, acoustical dampeners, phone cable casing and some architectural applications. In buildings constructed after 1990, these applications are no longer applicable outside of specialized uses (shielding for medical imaging etc.).

As part of the project, a total of 4 paint scrape samples were collected from surfaces and represent the paint colours which may be disturbed during the proposed project.

Samples were submitted for laboratory analysis by ASTM D3335-85A “Standard Method to Test for Low Concentrations of Lead in Paint by Atomic Absorption Spectrophotometry” following MOE Method E3470 Inductively Coupled Plasma Optical Emission Spectrometry to Paracel Laboratories Ltd., in Ottawa, Ontario. Paracel is accredited by the Canadian Association of Laboratory Accreditation to perform bulk lead analysis of paint.

Based on the laboratory results and visual identification, lead-containing materials were confirmed present at the time of the inspection. In addition, suspected lead-containing solder on

copper pipe connections or lead pipe gaskets may potentially be concealed in buried lines or wall cavities.

### **Mercury**

Mercury is typically used in building service applications such as fluorescent light tubes, compact fluorescent bulbs, metal halide (sodium halide) lamp bulbs, and neon lights as a vapour. Mercury may exist in thermostats and pipe or mechanical equipment thermometers as a liquid. Mercury is presumed to be present in the above materials.

Mercury-containing materials were visually identified at the time of the inspection.

### **Silica**

Silica is present in rock, stone, soil, and sand. Masonry products such as concrete block, brick, and mortar, as well as concrete and associated products contain silica. Due to its ubiquitous nature, silica was historically used in a wide variety of building materials and is still used today in new construction.

Building materials that are presumed to contain silica were visually identified at the time of the inspection.

## **4.2 Conclusions and Recommendations**

A detailed summary of recommended actions is provided in **Table 4.3 of Appendix A**.

In accordance with Section 30 of OHSA and Section 8 of O. Reg. 278/05 the owner must provide a copy of this report to all contractors doing work at the building. The owner must also provide a copy of this report to all prospective contractors.

Should any additional suspect Designated Substances be discovered during building renovation demolition, work in the vicinity should cease and the materials should not be disturbed until proper notification, testing and abatement instructions are provided. All waste generated as a result of any and all work at the Site must be handled, transported and disposed of in accordance with Ontario Regulation 347 made under the Environmental Protection Act and local by-laws. Based on the assessment findings and analytical results, the following abatement measures are presented. It should be noted that the recommended actions are the minimum required actions, as prescribed by the appropriate Acts, regulations, guidelines, standards, codes and general best practice measures.

### **Asbestos**

ACMs were identified during the assessment. If these materials, including those deemed or suspected, will be disturbed, or will likely be disturbed, during building maintenance, renovations, construction, or demolition activities, they must be handled and disposed of in accordance with the procedures prescribed by O. Reg. 278/05.

At the time of the audit, all ACM at the building was noted to be in good condition and no abatement action is required at this time.

All asbestos work must be conducted by contractors who are trained in the type of asbestos operations required, and should be overseen by a qualified third party Health, Safety and Environmental professional. In order to conduct Type 3 asbestos operations, contractors must be certified as Asbestos Abatement Workers AAW (Trade code 253W) and Asbestos Abatement Supervisors AAS (Trade code 253S) by The Ministry of Training, Colleges and Universities (Ministry of Advanced Education and Skills Development) as prescribed by Section

20 of O. Reg. 278/05. Suspect or visually confirmed ACM must be deemed to be asbestos-containing and treated as if they contain a type of asbestos other than Chrysotile.

ACM may be present in concealed locations and if construction, renovation, alteration, or maintenance activities are planned, invasive inspections of concealed locations for potential ACM must be performed prior to such activities.

Should any suspect ACM be discovered during the course of construction, renovation, alteration, or maintenance activities, work which disturbs the material must cease immediately. Suspect ACM must be treated as asbestos-containing or sampled prior to disturbance to assess the presence of asbestos.

There are no requirements under current legislation to remove ACM from a building simply because it is present. However, O. Reg. 278/05 requires that an Asbestos Management Program be implemented and maintained by the owner/employer where ACM is identified or suspected present.

### **Lead**

Lead-containing paint was identified. As such special requirements for the management, handling and disposal of lead-containing materials by the owner, constructor, contractor, sub-contractors and workers apply. The abatement contractor should consult Environmental Abatement Council of Ontario's (EACO) *Lead Guideline for Construction, Renovation, Maintenance or Repair (October 2014)* for the procedures and methods required to remove and dispose of lead-containing materials.

Low level lead-containing paint is present and the following general procedures are recommended as a precautionary measure as per Environmental Abatement Council of Ontario's (EACO) *Lead Guideline for Construction, Renovation, Maintenance or Repair (October 2014)*:

- General dust control;
- The washing of hands and face at on-site facilities;
- No smoking, eating, chewing gum or drinking in the work area; and
- No removal of painted surfaces by means of abrasive blasting.

### **Mercury**

Mercury-containing materials were identified. All mercury containing materials or sources should be removed, intact, prior to any work which may disturb or damage them and cause worker exposure to mercury liquid and/or vapour.

On-site crushing of mercury-containing materials should not occur. Care should be taken to ensure safe storage of the above until recycling or disposal can be coordinated. Under current legislation, mercury waste requires handling and disposal in accordance with Ontario Regulation 490/09 of the OHSA and Ontario Regulation 347 of the Environmental Protection Act.

### **Silica**

Silica is presumed to be present; therefore, special requirements for management and handling are required. The contractor should also consult MOL Occupational Health and Safety Branch's Guideline: *Silica on Construction Projects (April 2011)* for the procedures and methods required to remove and dispose of silica-containing materials.

## 5.0 Limitations

Services performed by **MTE Consultants Inc.** (MTE) were conducted in a manner consistent with the level of care and skill ordinarily exercised by members of the Environmental Engineering & Consulting profession. No other representation expressed or implied as to the accuracy of the information, conclusions or recommendations is included or intended in this report.

This report was completed for the sole use of MTE and the Client. It was completed in accordance with the approved Scope of Work referred to in Section 2.0. As such, this report may not deal with all issues potentially applicable to the site and may omit issues that are or may be of interest to the reader. MTE makes no representation that the present report has dealt with all-important environmental features, except as provided in the Scope of Work. All findings and conclusions presented in this report are based on site conditions, as they existed during the time period of the investigation. This report is not intended to be exhaustive in scope or to imply a risk-free facility.

Any use which a third party makes of this report, or any reliance on, or decisions to be made based upon it, are the responsibility of such third parties. MTE accepts no responsibility for liabilities incurred by or damages, if any, suffered by any third party as a result of decisions made or actions taken, based upon this report. Others with interest in the site should undertake their own investigations and studies to determine how or if the condition affects them or their plans.

It should be recognized that the passage of time might affect the views, conclusions and recommendations (if any) provided in this report because environmental conditions of a property can change. Should additional or new information become available, MTE recommends that it be brought to our attention in order that we may re-assess the contents of this report.

All of which is respectfully submitted,

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# Appendix A

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## Tables

**TABLE 4.1: BULK ASBESTOS SAMPLING SUMMARY**

| Sample #                               | Location              |                               | Material Description                           | Asbestos Content (%) | Fibre Type | Is Material ACM |
|--|-----------------------|-------------------------------|--|----------------------|------------|-----------------|
| <b>2009 Asbestos Audit Update</b>      |                       |                               |  |                      |            |                 |
| 32523-CENTRAL S01A                     | 2033                  |                               | Parging on Duct Insulation                     | 60                   | Chrysotile | Yes             |
| 32523-CENTRAL S01B                     | 2033                  |                               | Parging on Duct Insulation                     | NA                   | Chrysotile | Yes             |
| 32523-CENTRAL S01C                     | 2033                  |                               | Parging on Duct Insulation                     | NA                   | Chrysotile | Yes             |
| 32523-CENTRAL S02A                     | 2025                  |                               | 12" x 12" Floor Tile - Beige with Brown Fleck  | ND                   | -          | No              |
| 32523-CENTRAL S02B                     | 2025                  |                               | 12" x 12" Floor Tile - Beige with Brown Fleck  | ND                   | -          | No              |
| 32523-CENTRAL S02C                     | 2025                  |                               | 12" x 12" Floor Tile - Beige with Brown Fleck  | ND                   | -          | No              |
| 32523-CENTRAL S04A                     | 2016                  |                               | 12" x 12" Floor Tile - Oatmeal                 | ND                   | -          | No              |
| 32523-CENTRAL S04B                     | 2016                  |                               | 12" x 12" Floor Tile - Oatmeal                 | ND                   | -          | No              |
| 32523-CENTRAL S04C                     | 2016                  |                               | 12" x 12" Floor Tile - Oatmeal                 | ND                   | -          | No              |
| 32523-CENTRAL S05A                     | 2016                  |                               | Drywall Joint Compound                         | ND                   | -          | No              |
| 32523-CENTRAL S05B                     | 2016                  |                               | Drywall Joint Compound                         | ND                   | -          | No              |
| 32523-CENTRAL S05C                     | 2016                  |                               | Drywall Joint Compound                         | ND                   | -          | No              |
| 32523-CENTRAL S06A                     | 2011                  |                               | 12" x 12" Floor Tile - Beige with Brown Streak | 1.8                  | Chrysotile | Yes             |
| 32523-CENTRAL S06B                     | 2011                  |                               | 12" x 12" Floor Tile - Beige with Brown Streak | NA                   | Chrysotile | Yes             |
| 32523-CENTRAL S06C                     | 2011                  |                               | 12" x 12" Floor Tile - Beige with Brown Streak | NA                   | Chrysotile | Yes             |
| 32523-CENTRAL S07A                     | 1030                  |                               | Spray-Applied Fireproofing on Structural Beams | ND                   | -          | No              |
| 32523-CENTRAL S07B                     | 1030                  |                               | Spray-Applied Fireproofing on Structural Beams | ND                   | -          | No              |
| 32523-CENTRAL S07C                     | 1030                  |                               | Spray-Applied Fireproofing on Structural Beams | ND                   | -          | No              |
| 32523-CENTRAL S08A                     | Exterior              |                               | Hard Texture Coat                              | ND                   | Chrysotile | Yes             |
| 32523-CENTRAL S08B                     | Exterior              |                               | Hard Texture Coat                              | 1.2                  | Chrysotile | Yes             |
| 32523-CENTRAL S08C                     | Exterior              |                               | Hard Texture Coat                              | NA                   | Chrysotile | Yes             |
| 32523-CENTRAL S09A                     | Exterior              |                               | Caulking                                       | ND                   | -          | No              |
| 32523-CENTRAL S09B                     | Exterior              |                               | Caulking                                       | ND                   | -          | No              |
| 32523-CENTRAL S09C                     | Exterior              |                               | Caulking                                       | ND                   | -          | No              |
| <b>2014 Asbestos Audit Update</b>      |                       |                               |  |                      |            |                 |
| S01A (2014)                            | 2011                  |                               | 12"x12" Floor Tile – Black Mastic              | 0.73                 | Chrysotile | Yes             |
| S01B (2014)                            | 2011                  |                               | 12"x12" Floor Tile – Black Mastic              | NA                   | Chrysotile | Yes             |
| S01C (2014)                            | 2011                  |                               | 12"x12" Floor Tile – Black Mastic              | NA                   | Chrysotile | Yes             |
| S02A (2014)                            | 2016                  |                               | 12"x12" Floor Tile – Black Mastic              | ND                   | -          | No              |
| S02B (2014)                            | 2016                  |                               | 12"x12" Floor Tile – Black Mastic              | ND                   | -          | No              |
| S02C (2014)                            | 2016                  |                               | 12"x12" Floor Tile – Black Mastic              | ND                   | -          | No              |
| S03A (2014)                            | 2017                  |                               | Drywall Joint Compound                         | ND                   | -          | No              |
| S03B (2014)                            | 2010                  |                               | Drywall Joint Compound                         | ND                   | -          | No              |
| S03C (2014)                            | 2009                  |                               | Drywall Joint Compound                         | ND                   | -          | No              |
| S03D (2014)                            | 1009                  |                               | Drywall Joint Compound                         | ND                   | -          | No              |
| S03E (2014)                            | 1026                  |                               | Drywall Joint Compound                         | ND                   | -          | No              |
| S04A (2014)                            | 2025                  |                               | 12"x12" Floor Tile – Black Mastic              | ND                   | -          | No              |
| S04B (2014)                            | 2025                  |                               | 12"x12" Floor Tile – Black Mastic              | ND                   | -          | No              |
| S04C (2014)                            | 2025                  |                               | 12"x12" Floor Tile – Black Mastic              | ND                   | -          | No              |
| <b>2017 Asbestos Audit Update</b>      |                       |                               |  |                      |            |                 |
| S01A                                   | 2029                  |                               | Soft Texture Coat - Ceiling                    | < MDL                | Chrysotile | Yes             |
| S01B                                   | 2029                  |                               | Soft Texture Coat - Ceiling                    | 0.50%                | Chrysotile | Yes             |
| S01C                                   | 2029                  |                               | Soft Texture Coat - Ceiling                    | NA                   | Chrysotile | Yes             |
| <b>2020 Asbestos Audit Update</b>      |                       |                               |  |                      |            |                 |
| S01A                                   | 2015                  |                               | Interior Door Sealant - White                  | ND                   | -          | No              |
| S01B                                   | 2015                  |                               | Interior Door Sealant - White                  | ND                   | -          | No              |
| S01C                                   | 2015                  |                               | Interior Door Sealant - White                  | ND                   | -          | No              |
| S02A                                   | 2017                  |                               | Exterior Window Sealant - Black                | 1                    | Chrysotile | Yes             |
| S02B                                   | 2017                  |                               | Exterior Window Sealant - Black                | NA                   | Chrysotile | Yes             |
| S02C                                   | 2017                  |                               | Exterior Window Sealant - Black                | NA                   | Chrysotile | Yes             |
| S03A                                   | Original              |                               | Exterior Door Sealant - Black                  | 1                    | Chrysotile | Yes             |
| S03B                                   | Original              |                               | Exterior Door Sealant - Black                  | NA                   | Chrysotile | Yes             |
| S03C                                   | Original              |                               | Exterior Door Sealant - Black                  | NA                   | Chrysotile | Yes             |
| <b>2022 Designated Substance Audit</b> |                       |                               |  |                      |            |                 |
| Sample #                               | Location (Demo Plans) | Location (WRDSB Room Numbers) | Material Description                           | Asbestos Results (%) | Fibre Type | Is Material ACM |
| S01A                                   | 201A                  | 9                             | GREY DOOR SEALANT                              | ND                   | -          | NO              |
| S01B                                   | 203A                  | 5                             | GREY DOOR SEALANT                              | ND                   | -          | NO              |
| S01C                                   | 102C                  | 13                            | GREY DOOR SEALANT                              | ND                   | -          | NO              |
| S02A                                   | 202D                  | 206                           | BLACK WINDOW PANE PUTTY                        | ND                   | -          | NO              |
| S02B                                   | 203D                  | 204                           | BLACK WINDOW PANE PUTTY                        | ND                   | -          | NO              |
| S02C                                   | 203D                  | 204                           | BLACK WINDOW PANE PUTTY                        | ND                   | -          | NO              |
| S03A                                   | 117 AT 801            | 111 AT 801                    | YELLOW WINDOW PANE PUTTY                       | 2                    | CHRYSOTILE | YES             |
| S03B                                   | 117 AT 801            | 111 AT 801                    | YELLOW WINDOW PANE PUTTY                       | NA                   | CHRYSOTILE | YES             |
| S03C                                   | 117 AT 803            | 111 AT 803                    | YELLOW WINDOW PANE PUTTY                       | NA                   | CHRYSOTILE | YES             |
| S04A                                   | 102C-EXTERIOR         | 13-EXTERIOR                   | EXTERIOR BLACK WINDOW FRAME SEALANT            | 4                    | CHRYSOTILE | YES             |
| S04B                                   | 102C-EXTERIOR         | 13-EXTERIOR                   | EXTERIOR BLACK WINDOW FRAME SEALANT            | NA                   | CHRYSOTILE | YES             |
| S04C                                   | 102C-EXTERIOR         | 13-EXTERIOR                   | EXTERIOR BLACK WINDOW FRAME SEALANT            | NA                   | CHRYSOTILE | YES             |
| S05A                                   | 102C-EAST             | 13-EAST                       | YELLOW/BLACK SEALANT                           | ND                   | -          | NO              |
| S05B                                   | 102C-EAST             | 13-EAST                       | YELLOW/BLACK SEALANT                           | ND                   | -          | NO              |
| S05C                                   | 102C-EAST             | 13-EAST                       | YELLOW/BLACK SEALANT                           | ND                   | -          | NO              |
| S06A                                   | 102C-WEST             | 13-WEST                       | BLACK SEALANT                                  | ND                   | -          | NO              |
| S06B                                   | 102C-WEST             | 13-WEST                       | BLACK SEALANT                                  | ND                   | -          | NO              |
| S06C                                   | 102C-WEST             | 13-WEST                       | BLACK SEALANT                                  | ND                   | -          | NO              |



**TABLE 4.1: BULK ASBESTOS SAMPLING SUMMARY**

| Sample #   | Location |  | Material Description | Asbestos Content (%) | Fibre Type | Is Material ACM |
|--|----------|--|----------------------|----------------------|------------|-----------------|
| <p>A bulk material sample containing 0.5% or more asbestos therefore establishes that material as asbestos-containing. In accordance with Table 1 of O. Reg. 278/05, a minimum number of samples for the material to be classified as non asbestos. A homogeneous material is defined by O. Reg. 278/05 "as material that is uniform in colour and texture". Homogeneous samples are identified by an alphabetical suffix to sample names to represent multiple samples of a homogeneous material. When a homogeneous material is analysed it is determined to be asbestos-containing upon the first positive detection of asbestos equal to or greater than 0.5%. Subsequent samples of the same material are therefore not analysed. Some bulk samples are comprised of multiple layers and as such will require multiple analysis. In such cases each layer is isolated at the laboratory and analysed individually to determine asbestos content. As a result the laboratory may report additional samples beyond the submitted number of samples or include multiple analyses as subsets within a sample.</p> |          |  |                      |                      |            |                 |

**TABLE 4.2: LEAD IN PAINT SAMPLE SUMMARY TABLE**

| Sample # | Location | Colour       | Material             | Lead Content (ug/g) | Classification            |
|----------|----------|--------------|----------------------|---------------------|---------------------------|
| LP1      | 102C     | YELLOW       | CONCRETE BLOCK WALLS | 188                 | LOW LEVEL LEAD-CONTAINING |
| LP2      | 214      | GREY (BROWN) | DOOR FRAME           | <b>2,560</b>        | <b>LEAD-CONTAINING</b>    |
| LP3      | 201C     | LIGHT GREY   | CONCRETE BLOCK WALLS | 9                   | LOW LEVEL LEAD-CONTAINING |
| LP4      | 205      | DARK YELLOW  | CONCRETE BLOCK WALLS | 59                  | LOW LEVEL LEAD-CONTAINING |




"<": The samples analysed reported concentrations of lead to be less than 1000 ug/g and are therefore classified as low level lead-containing. However, no lead concentrations were reported above the sample specific laboratory detection limit.

As outlined in EACO's Lead Guideline for Construction, Renovation, Maintenance or Repair (October 2014), for the purpose of classifying surface coatings and mortars by laboratory analysis, any material containing lead at a concentration:

- Greater than 0.5% by weight (5,000 µg/g, mg/kg, ppm) is considered lead-based;
- Between 0.1 % and 0.5% by weight (1,000 to 5,000 µg/g, mg/kg, ppm) is considered lead-containing; or
- Less than 0.1% (1,000 µg/g, mg/kg, ppm) is considered low level lead-containing.



**Table 4.3 - Summary of Designated Substances and Recommended Actions**

**Central Public School | 175 Main Street, Cambridge**

| <b>Material</b>                 | <b>Location(s)<br/>(Demo Figures  <br/>WRDSB Room Numbers)</b> | <b>Material Description</b> | <b>Approximate<br/>Quantity</b>                       | <b>Photograph</b>   | <b>Management Requirements If<br/>No Impacts to Material</b> | <b>Recommended Actions If Material Will Be Or Likely Be Impacted By<br/>Maintenance, Renovation, Construction or Demolition Activities</b>   |
|---------------------------------|--|-----------------------------|---|---|--|--|
| <b>Asbestos<br/>Friable</b>     | AV Storage   108<br>Mechanical room 105                        | Pipe Fitting Insulation     | 1<br>76   | -   | In place management in<br>accordance with O. Reg. 278/05     | Removal in accordance with O. Reg. 278/05 as a Type 2 Glove Bag Operation  |
| <b>Asbestos<br/>Non-Friable</b> | Exterior Window Frames   | Black Sealant               | 5 m <sup>2</sup><br>(Sealant Area)<br>apx 15 windows  |    | In place management in<br>accordance with O. Reg. 278/05     | Removal in accordance with O. Reg. 278/05 as a Type 1 Operation  |
| <b>Asbestos<br/>Non-Friable</b> | 117   111  | White Window Pane Sealant   | 1-2 m <sup>2</sup><br>(Sealant Area)<br>Apx 4 windows |   | In place management in<br>accordance with O. Reg. 278/05     | Removal in accordance with O. Reg. 278/05 as a Type 1 Operation  |
| <b>Asbestos<br/>Non-Friable</b> | Exterior Overhangs   | Hard Texture Coat           | 16 m <sup>2</sup>                                     |  | In place management in<br>accordance with O. Reg. 278/05     | Removal in accordance with O. Reg. 278/05<br>Type 2 Operation – hand held tools only with dust suppression or power tools with<br>HEPA vacuum attachment in conjunction with dust suppression<br><br>OR<br><br>Type 3 Operation – power tools with no dust suppression |

**Table 4.3 - Summary of Designated Substances and Recommended Actions**

**Central Public School | 175 Main Street, Cambridge**

| Material  | Location(s)<br>(Demo Figures  <br>WRDSB Room Numbers)    | Material Description                                  | Approximate<br>Quantity | Photograph  | Management Requirements If<br>No Impacts to Material               | Recommended Actions If Material Will Be Or Likely Be Impacted By<br>Maintenance, Renovation, Construction or Demolition Activities   |
|---|--|---|-------------------------|---|--|--|
| <b>Suspect<br/>Asbestos<br/>Non-Friable</b>                 | Roof   | Roofing Materials<br>(Paper/Felts/Mastics/Sealants)   | -                       | -   | In place management in<br>accordance with O. Reg. 278/05           | Sample prior to maintenance/renovations/ construction/demolition activities and if<br>confirmed ACM, removal in accordance with O. Reg. 278/05   |
| <b>Suspected<br/>Potentially<br/>Concealed<br/>Asbestos</b> | Exterior Behind Metal<br>Panels                          | Asbestos Cement (Transite)                            | 30 m <sup>2</sup>       |    | In place management in<br>accordance with O. Reg. 278/05           | Invasive inspection prior to maintenance/renovations/construction/demolition<br>activities, if present and sampling confirms as ACM, removal in accordance with O.<br>Reg. 278/05  |
| <b>Potentially<br/>Concealed<br/>Asbestos</b>               | Doors Throughout Building                                | Door Core Insulation                                  | -                       | -   | In place management in<br>accordance with O. Reg. 278/05           | Invasive inspection prior to maintenance/renovations/construction/demolition<br>activities, if present and sampling confirms as ACM, removal in accordance with O.<br>Reg. 278/05  |
| <b>Lead-<br/>Containing<br/>Paint</b>                       | Doors and Door Frames<br>Throughout Original<br>Building | Grey Paint on Metal<br>(Brown Paint Under Grey Paint) | -                       |  | In place management in<br>accordance with EACO's Lead<br>Guideline | Removal as required prior to maintenance, renovations, construction or demolition<br>activities in accordance with EACO's Lead Guideline as a:<br>Class 1, Class 2A, Class 3A, or a Class 3B Operation                         |
| <b>Low Level Lead<br/>Containing<br/>Paint</b>              | Wall   | Light Yellow Paint on Wall Surfaces                   | -                       | -   | None   | General hygiene procedures during renovation activities:<br>General dust control,<br>Washing of hands and face at on-site facilities,<br>No smoking, eating, chewing gum or drinking in the work area,<br>No abrasive blasting |
|   | Walls  | Yellow Paint on Wall Surfaces                         | -                       | -   |  |  |
|   | Walls  | Light Grey Paint on Wall Surfaces                     | -                       | -   |  |  |

**Table 4.3 - Summary of Designated Substances and Recommended Actions**

**Central Public School | 175 Main Street, Cambridge**

| <b>Material</b>                   | <b>Location(s)<br/>(Demo Figures  <br/>WRDSB Room Numbers)</b> | <b>Material Description</b>  | <b>Approximate<br/>Quantity</b> | <b>Photograph</b> | <b>Management Requirements If<br/>No Impacts to Material</b> | <b>Recommended Actions If Material Will Be Or Likely Be Impacted By<br/>Maintenance, Renovation, Construction or Demolition Activities</b>                          |
|-----------------------------------|--|--|---------------------------------|-------------------|--|---|
| <b>Suspected Lead</b>             | Throughout Interior of Building on Plumbing Connections        | Lead Solder on Copper Pipe   | -                               | -                 | In place management in accordance with EACO's Lead Guideline | Removal prior to renovation/demolition activities in accordance with EACO's Lead Guideline as a:<br>Class 1 Operation   |
| <b>Potentially Concealed Lead</b> | Concealed on Sanitary/Waste Lines                              | Lead Packed Pipe Gaskets   | -                               | -                 | None   | Invasive inspection prior to renovation or demolition activities. If confirmed present, removal in accordance with EACO's Lead Guideline as a:<br>Class 1 Operation |
| <b>Mercury</b>                    | Throughout Interior of Building in Light Fixtures              | Fluorescent Light Tubes in Light Fixtures  | -                               |                   | None   | Intact removal and storage with no on-site crushing and disposal of materials to a licensed facility  |
| <b>Mercury</b>                    | Throughout Interior of Building in Light Fixtures              | Compact Fluorescent Bulbs,   | -                               | -                 | None   | Intact removal and storage with no on-site crushing and disposal of materials to a licensed facility  |
| <b>Silica</b>                     | Throughout Interior and Exterior of Building                   | Brick and Mortar, Terrazzo, Concrete, Ceramic Tile and Grout, Fill and Hardscaping | -                               | -                 | None   | Conduct any work during renovation, demolition activities in accordance with the Ministry of Labour Guideline Silica on Construction Projects                       |

Notes:

- 1) A copy of this report should be provided to all prospective contractors prior to quotation, in accordance with Section 30 of the Occupational Health and Safety Act.
- 2) Recommended actions are the minimum required actions, as prescribed by the appropriate Acts, regulations, guidelines, standards, codes and general best practice measures. Prior to demolition, the Contractor may choose to alter the approach and combine or break out sections of work. This is acceptable provided that the appropriate Acts, regulations, guidelines, standards and codes are followed and afford protection for the health and safety of workers, occupants and the public that is at least equal to the protection that would be provided by complying with the minimum requirements.
- 3) All waste generated is subject to characterization and disposal in accordance with Ontario Regulation 347.

## Appendix B

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# Laboratory Certificates of Analysis

## Certificate of Analysis

### MTE Consultants Inc. (Kitchener)

520 Bingemans Centre Dr.  
Kitchener, ON N2B 3X9  
Attn: Paul Semeniuk

Client PO: 34532-935

Project: 34532-935 Central PS

Custody:

Report Date: 4-Feb-2022

Order Date: 2-Feb-2022

**Order #: 2206230**

This Certificate of Analysis contains analytical data applicable to the following samples as submitted :

| Parcel ID  | Client ID |
|------------|-----------|
| 2206230-01 | S01A      |
| 2206230-02 | S01B      |
| 2206230-03 | S01C      |
| 2206230-04 | S02A      |
| 2206230-05 | S02B      |
| 2206230-06 | S02C      |
| 2206230-07 | S03A      |
| 2206230-08 | S03B      |
| 2206230-09 | S03C      |
| 2206230-10 | S04A      |
| 2206230-11 | S04B      |
| 2206230-12 | S04C      |

Approved By:



Heather S.H. McGregor, BSc

Laboratory Director - Microbiology

Any use of these results implies your agreement that our total liability in connection with this work, however arising, shall be limited to the amount paid by you for this work, and that our employees or agents shall not under any circumstances be liable to you in connection with this work.

Certificate of Analysis  
 Client: MTE Consultants Inc. (Kitchener)  
 Client PO: 34532-935

Report Date: 04-Feb-2022  
 Order Date: 2-Feb-2022  
 Project Description: 34532-935 Central PS

**Asbestos, PLM Visual Estimation    \*\*MDL - 0.5%\*\***

| Parcel ID  | Sample Date | Colour | Description | Asbestos Detected | Material Identification                               | % Content |
|------------|-------------|--------|-------------|-------------------|---|-----------|
| 2206230-01 | 31-Jan-22   | Grey   | Sealant     | No                | <b>Client ID: S01A</b><br>Non-Fibers                  | 100       |
| 2206230-02 | 31-Jan-22   | Grey   | Sealant     | No                | <b>Client ID: S01B</b><br>Non-Fibers                  | 100       |
| 2206230-03 | 31-Jan-22   | Grey   | Sealant     | No                | <b>Client ID: S01C</b><br>Non-Fibers                  | 100       |
| 2206230-04 | 31-Jan-22   | Black  | Putty       | No                | <b>Client ID: S02A</b><br>Non-Fibers                  | 100       |
| 2206230-05 | 31-Jan-22   | Black  | Putty       | No                | <b>Client ID: S02B</b><br>Non-Fibers                  | 100       |
| 2206230-06 | 31-Jan-22   | Black  | Putty       | No                | <b>Client ID: S02C</b><br>Non-Fibers                  | 100       |
| 2206230-07 | 31-Jan-22   | Beige  | Putty       | Yes               | <b>Client ID: S03A</b><br>Chrysotile<br>Non-Fibers    | 2<br>98   |
| 2206230-08 | 31-Jan-22   | Beige  | Putty       |                   | <b>Client ID: S03B</b><br>not analyzed, positive stop |           |
| 2206230-09 | 31-Jan-22   | Beige  | Putty       |                   | <b>Client ID: S03C</b><br>not analyzed, positive stop |           |
| 2206230-10 | 31-Jan-22   | Black  | Sealant     | Yes               | <b>Client ID: S04A</b><br>Chrysotile<br>Non-Fibers    | 4<br>96   |
| 2206230-11 | 31-Jan-22   | Black  | Sealant     |                   | <b>Client ID: S04B</b><br>not analyzed, positive stop |           |



Certificate of Analysis  
 Client: MTE Consultants Inc. (Kitchener)  
 Client PO: 34532-935

Report Date: 04-Feb-2022  
 Order Date: 2-Feb-2022  
 Project Description: 34532-935 Central PS

**Asbestos, PLM Visual Estimation    \*\*MDL - 0.5%\*\***

| Parcel ID  | Sample Date | Colour | Description | Asbestos Detected | Material Identification                        | % Content |
|------------|-------------|--------|-------------|-------------------|--|-----------|
| 2206230-12 | 31-Jan-22   | Black  | Sealant     |                   | Client ID: S04C<br>not analyzed, positive stop |           |

\*\* Analytes in bold indicate asbestos mineral content.

**Analysis Summary Table**

| Analysis                        | Method Reference/Description                       | Lab Location    | Lab Accreditation | * Analysis Date |
|---------------------------------|--|-----------------|-------------------|-----------------|
| Asbestos, PLM Visual Estimation | AppE to SubE of 40CFR Part753 and EPA/600/R-93/116 | 1 - Mississauga | CALA 3762         | 3-Feb-22        |

\* Reference to the NVLAP term does not permit the user of this report to claim product certification , approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

Mississauga Lab: 15 - 6800 Kitimat Rd Mississauga, Ontario, L5N 5M1

**Work Order Revisions | Comments**

None

## Certificate of Analysis

**MTE Consultants Inc. (Kitchener)**

520 Bingham Centre Dr.

Kitchener, ON N2B 3X9

Attn: Paul Semeniuk

Client PO: 34532-935

Project: 34532-935-Central PS

Custody:

Report Date: 4-Feb-2022

Order Date: 2-Feb-2022

**Order #: 2206229**

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

| Parcel ID  | Client ID |
|------------|-----------|
| 2206229-01 | LP1       |
| 2206229-02 | LP2       |
| 2206229-03 | LP3       |
| 2206229-04 | LP4       |

Approved By:



Mark Foto, M.Sc.  
Lab Supervisor

Any use of these results implies your agreement that our total liability in connection with this work, however arising shall be limited to the amount paid by you for this work, and that our employees or agents shall not under circumstances be liable to you in connection with this work

Certificate of Analysis

Report Date: 04-Feb-2022

Client: MTE Consultants Inc. (Kitchener)

Order Date: 2-Feb-2022

Client PO: 34532-935

Project Description: 34532-935-Central PS

**Analysis Summary Table**

| Analysis       | Method Reference/Description  | Extraction Date | Analysis Date |
|----------------|-------------------------------|-----------------|---------------|
| Metals, ICP-MS | EPA 6020 - Digestion - ICP-MS | 4-Feb-22        | 4-Feb-22      |

**Qualifier Notes:**

None

**Sample Data Revisions**

None

**Work Order Revisions/Comments:**

None

**Other Report Notes:**

n/a: not applicable

ND: Not Detected

MDL: Method Detection Limit

Source Result: Data used as source for matrix and duplicate samples

%REC: Percent recovery.

RPD: Relative percent difference.

Certificate of Analysis

Report Date: 04-Feb-2022

Client: MTE Consultants Inc. (Kitchener)

Order Date: 2-Feb-2022

Client PO: 34532-935

Project Description: 34532-935-Central PS

### Sample Results

| Lead       |           |             |       |     | Matrix: Paint |  |
|------------|-----------|-------------|-------|-----|---------------|--|
| Parcel ID  | Client ID | Sample Date | Units | MDL | Result        |  |
| 2206229-01 | LP1       | 31-Jan-22   | ug/g  | 5   | 188           |  |
| 2206229-02 | LP2       | 31-Jan-22   | ug/g  | 5   | 2560          |  |
| 2206229-03 | LP3       | 31-Jan-22   | ug/g  | 5   | 9             |  |
| 2206229-04 | LP4       | 31-Jan-22   | ug/g  | 5   | 59            |  |

### Laboratory Internal QA/QC

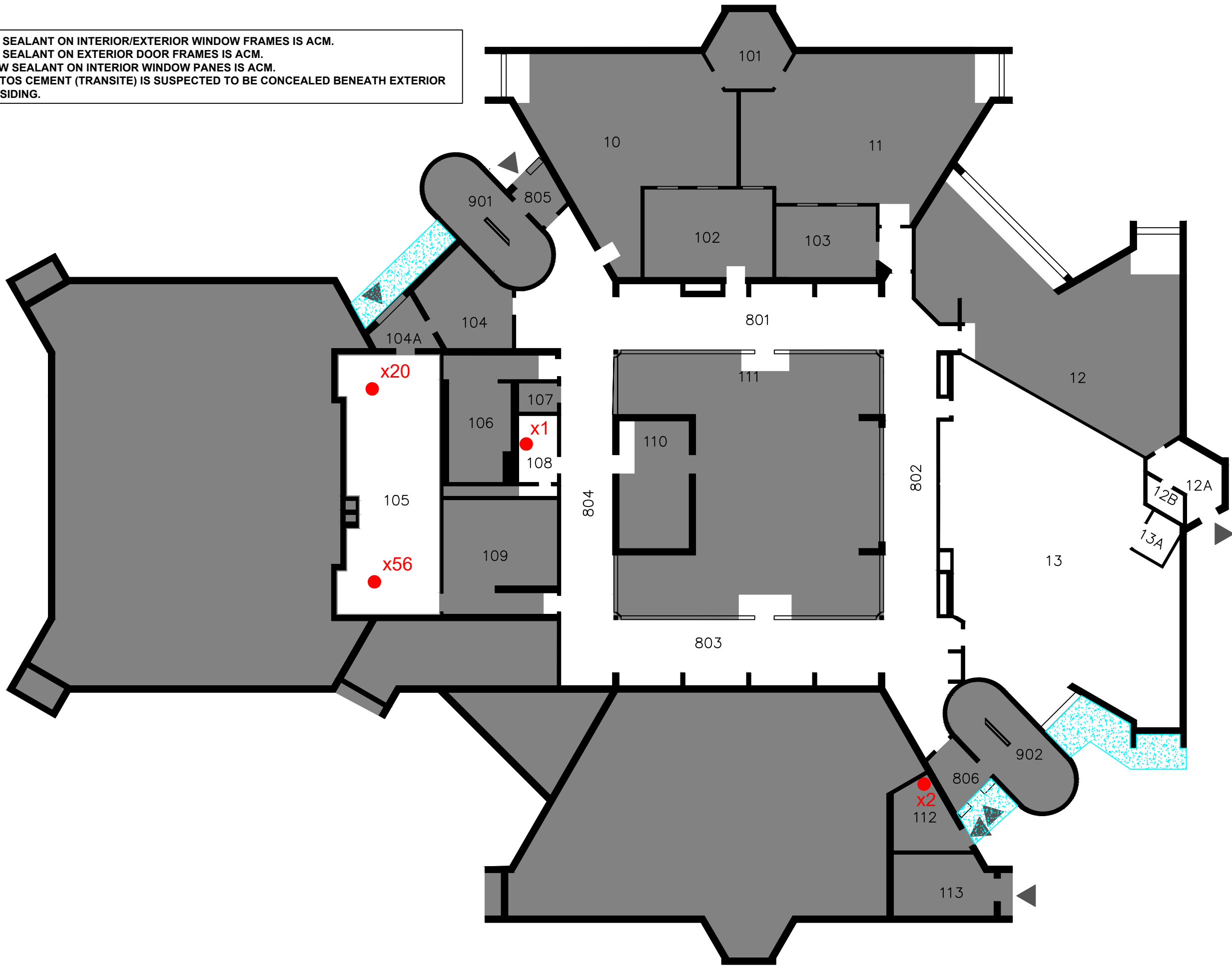
| Analyte                 | Result | Reporting Limit | Units | Source Result | %REC | %REC Limit | RPD   | RPD Limit | Notes |
|-------------------------|--------|-----------------|-------|---------------|------|------------|-------|-----------|-------|
| <b>Matrix Blank</b>     |        |                 |       |               |      |            |       |           |       |
| Lead                    | ND     | 5               | ug/g  |               |      |            |       |           |       |
| <b>Matrix Duplicate</b> |        |                 |       |               |      |            |       |           |       |
| Lead                    | 1170   | 5               | ug/g  | 1020          |      |            | 13.80 | 50        |       |
| <b>Matrix Spike</b>     |        |                 |       |               |      |            |       |           |       |
| Lead                    | 91.0   | 5.00            | ug/g  | 40.7          | 100  | 70-130     |       |           |       |

# Appendix C

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## Figures

BLACK SEALANT ON INTERIOR/EXTERIOR WINDOW FRAMES IS ACM.  
 BLACK SEALANT ON EXTERIOR DOOR FRAMES IS ACM.  
 YELLOW SEALANT ON INTERIOR WINDOW PANES IS ACM.  
 ASBESTOS CEMENT (TRANSITE) IS SUSPECTED TO BE CONCEALED BENEATH EXTERIOR STEEL SIDING.



**NOTES:**  
 ALL DRAWINGS TO BE REFERENCED WITH THE ASSOCIATED REPORT. LOCATIONS AND QUANTITIES ARE APPROXIMATE.  
 ALL KNOWN OR SUSPECT ASBESTOS-CONTAINING MATERIALS AND/OR DESIGNATED MATERIALS ARE NOT DEPICTED ON THIS DRAWING. REFER TO THE REPORT FOR A COMPLETE LIST OF IDENTIFIED MATERIALS.  
 THIS FIGURE IS COLOUR DEPENDENT. PHOTOCOPIES MAY ALTER INTERPRETATION OF THE FIGURE. ALWAYS REFER TO ORIGINAL DRAWINGS AND REPORT.

- Legend**
- 13 Fixed Reference Number
  - Outside Scope of Work
- Asbestos-Containing Materials (ACM):**
- Floor Tile
  - Friable Soft Textured Ceiling
  - Non-Friable Hard Textured Ceiling
  - Duct Insulation
  - x2(1) Pipe Fitting Insulation w Quantity (Brackets Indicate # of Damaged Fittings)
  - x2(1) Duct Expansion Joints w Quantity (Brackets Indicate # of Damaged Joints)

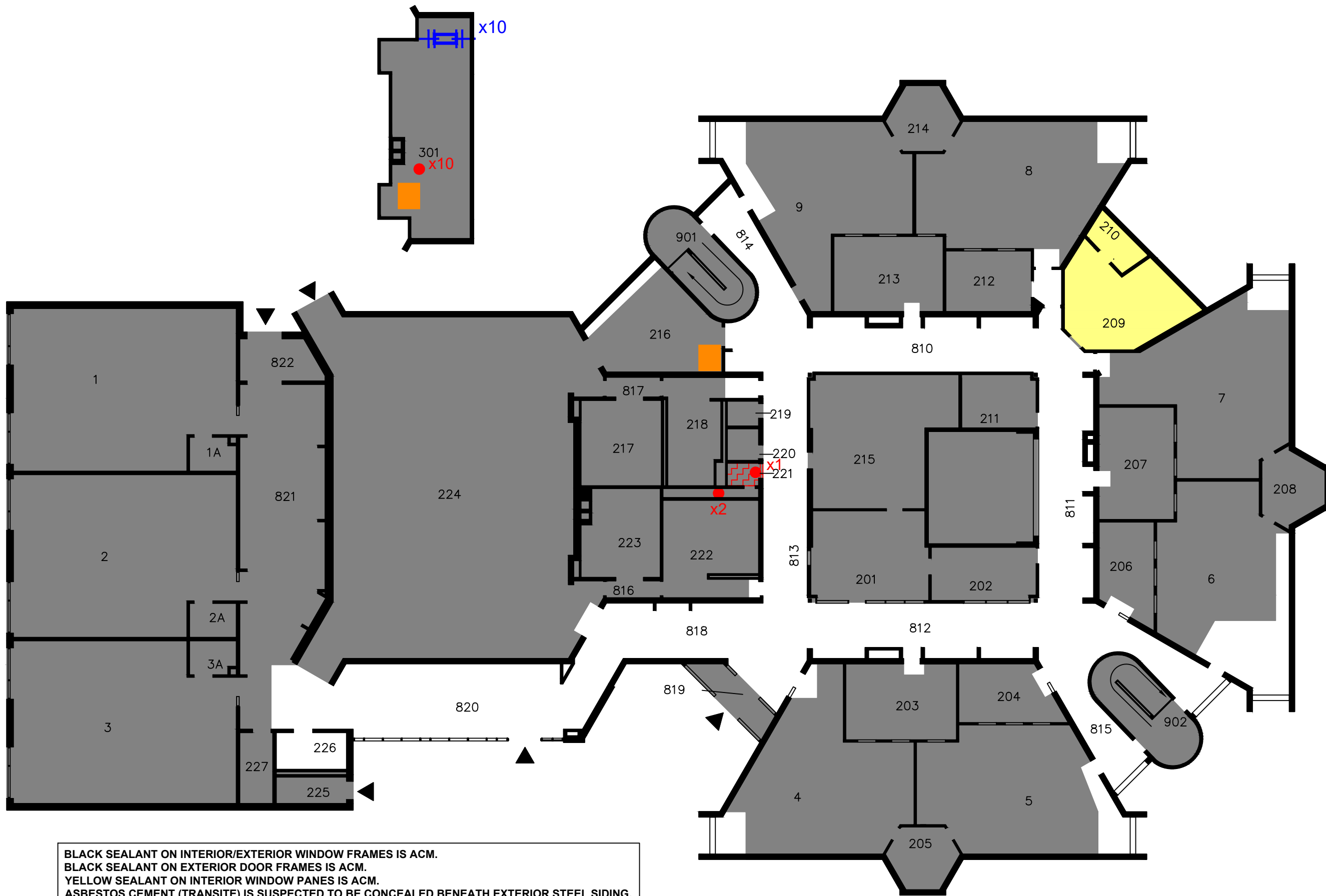


**CLIENT**  
 WATERLOO REGION DISTRICT SCHOOL BOARD

**PROJECT**  
 2022 DESIGNATED SUBSTANCE AUDIT

**DRAWING**  
 CENTRAL PUBLIC SCHOOL  
 LEVEL ONE

|                 |             |             |               |
|-----------------|-------------|-------------|---------------|
| Project Manager | P. Semeniuk | Date        | November 2022 |
| Design By       | WRDSB       | Project No. | 34532-935     |
| Drawn By        | P. Semeniuk | Drawing No. | 1.0           |
| Scale           | N.T.S.      |             |               |



BLACK SEALANT ON INTERIOR/EXTERIOR WINDOW FRAMES IS ACM.  
 BLACK SEALANT ON EXTERIOR DOOR FRAMES IS ACM.  
 YELLOW SEALANT ON INTERIOR WINDOW PANES IS ACM.  
 ASBESTOS CEMENT (TRANSITE) IS SUSPECTED TO BE CONCEALED BENEATH EXTERIOR STEEL SIDING.

**NOTES:**  
 ALL DRAWINGS TO BE REFERENCED WITH THE ASSOCIATED REPORT. LOCATIONS AND QUANTITIES ARE APPROXIMATE.  
 ALL KNOWN OR SUSPECT ASBESTOS-CONTAINING MATERIALS AND/OR DESIGNATED MATERIALS ARE NOT DEPICTED ON THIS DRAWING. REFER TO THE REPORT FOR A COMPLETE LIST OF IDENTIFIED MATERIALS.  
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- Legend**
- 13 Fixed Reference Number
  - Outside Scope of Work
- Asbestos-Containing Materials (ACM):**
- Floor Tile
  - Friable Soft Textured Ceiling
  - Non-Friable Hard Textured Ceiling
  - Duct Insulation
  - Pipe Fitting Insulation w Quantity (Brackets Indicate # of Damaged Fittings)
  - Duct Expansion Joints w Quantity (Brackets Indicate # of Damaged Joints)



**CLIENT**  
 WATERLOO REGION DISTRICT SCHOOL BOARD

**PROJECT**  
 2022 DESIGNATED SUBSTANCE AUDIT

**DRAWING**  
 CENTRAL PUBLIC SCHOOL  
 LEVEL TWO

|                 |             |             |               |
|-----------------|-------------|-------------|---------------|
| Project Manager | P. Semeniuk | Date        | November 2022 |
| Design By       | WRDSB       | Project No. | 34532-935     |
| Drawn By        | P. Semeniuk | Drawing No. | 2.0           |
| Scale           | N.T.S.      |             |               |



**Project Name:** Central Public School

**MTE File No.:** 34532-935

**Client:** Jeff Cull Waterloo Region District  
School Board

**Date:** November 14, 2022

Asbestos Abatement

---

## 1.0 General

### 1.1 General Requirements

- 1.1.1 Read this section in conjunction with all other sections so as to conform to Division 1, and the General Requirements of the project.
- 1.1.2 Inform all sub-trades of the presence of Asbestos Containing Materials identified in the documents.
- 1.1.3 The Contractor involved directly or indirectly with the removal, handling, management, transportation and disposal of Asbestos Containing Materials and Asbestos Waste in any and all aspects shall take all reasonable precautions, due care and diligence to prevent asbestos from becoming airborne and shall take all reasonable precautions to control and prevent the spread of airborne asbestos in the event of an incident, accidental release or loss of containment. Cost of additional work by the Contractor and/or Consultant to rectify unsatisfactory conditions, shall be charged to the Contractor.
- 1.1.4 No allowance will be made for any difficulties encountered or any expenses incurred on account of any conditions of the site or any item existing thereon that is visible or known or can be reasonably anticipated.
- 1.1.5 The Contractor shall be prepared to respond throughout the duration of the project in order to repair, encapsulate remove or otherwise manage additional asbestos as required. The abatement contractor shall provide an emergency contact phone number and be on call to provide emergency services.
- 1.1.6 The abatement contractor shall control all water migration (including leakage and spillage) from the abatement work area to areas below/adjacent. It is the responsibility of the contractor to protect all items from damage caused by water used in the abatement work area(s). The abatement contractor must immediately mitigate any and all damage to the satisfaction of the owner and Consultant resulting from water used in the abatement work area(s) at their own expense. No allowances shall be made as a result of lost time, resources, materials or equipment.
- 1.1.7 It is the Contractor's responsibility to ensure all construction aspects of the project are conducted in accordance with applicable construction safety legislation, regulations and general approved practice. This includes, but is not limited to; all means, methods, techniques, sequences, procedures, safety programs and precautions used.



## 1.2 Definitions

“Asbestos Containing Material”: Materials that contain 0.5 percent or more asbestos by dry weight.

“Asbestos Waste”: is material that contains asbestos in more than a trivial amount or proportion as defined by Ontario Regulation 347 as amended by Ontario Regulation 558/00 and includes the following:

- a) Solid or liquid waste that results from the removal of asbestos-containing construction or insulation materials and contains asbestos;
- b) Commercial waste and/or domestic waste that contains asbestos;
- c) Non-hazardous solid industrial waste that contains asbestos; and
- d) Materials determined or deemed contaminated with asbestos.

“Authorized Visitors”: The Consultant or their representative, Architect, Owner's representatives, and persons representing regulatory agencies.

“The Consultant and their representatives

“Consultant”: Owner’s Representative providing inspection and air monitoring.

MTE Consultants Inc., 520 Bingemans Centre, Kitchener, Ontario

Phone: (519) 743-6500 Fax: (519) 743-6513

Contacts: Paul Semeniuk (226-808-1329) , Jason Scozzafava(226-755-3383)

“Contractor”: Contractors or Sub-Contractor performing work included in this specification.

“Encapsulation”: refers to the application of canvas and lagging paste to asbestos containing materials.

“Friable material”: means material that:

- (a) When dry, can be crumbled, pulverized or powdered by hand pressure or
- (b) Is crumbled, pulverized or powdered.

“TWAEV”: Refers to the Time Weighted Average Exposure Value of 0.1 fibres per cubic centimetre of air (fibres/cc) of any form of asbestos whether individually or collectively as stated in Ontario Regulation 837/90 as amended by Ontario Regulation 386/00.

“HEPA or P 100”: High Efficiency Particulate Aerosol filter that is at least 99.97 per cent efficient in collecting and retaining a 0.3 micrometer aerosol and includes N 100, R 100, P100, HE or HEPA filters.

## 2.0 Scope of Work

### 2.1 Reports

**2.1.1** Refer to the following documents regarding Designated Substances within the work areas. The survey and documentation of Designated Substances is required by Section 30 of the Occupational Health and Safety Act.

**2.1.2** “Designated Substance Assessment – Central Public School, 175 Main Street, Cambridge, Ontario” dated February 2022, prepared by MTE Consultants Inc.

### 2.2 Summary of Materials

**2.2.1** Refer to Figures 1 and 2 included as an attachment to this document for locations of asbestos-containing materials (ACM) within the work area (s). Quantities and locations of ACM shown on the drawing are estimates only and have been provided as a courtesy.

**2.2.2** Materials to be removed within the work area(s) comprises of, but may not necessarily be limited to the following:

**Table 1: Summary of Materials to be Removed**

| Location(s)<br>(Demo Figures  <br>WRDSB Room<br>Numbers) | ACM                                    | Asbestos Operation   | Notes  |
|--|--|--|--|
| Exterior Window<br>Frames                                | Black Sealant                          | Type 1   | 5m <sup>2</sup> of material on<br>approximately 15 window<br>assemblies  |
| 117   111  | White Window Pane<br>Sealant           | Type 1   | 1-2 m <sup>2</sup> of material on<br>approximately 4 window<br>sections  |
| Exterior<br>Overhangs                                    | Hard Texture Coat                      | Type 2 Operation – hand held tools only<br>with dust suppression or power tools with<br>HEPA vacuum attachment in conjunction<br>with dust suppression<br>OR<br>Type 3 Operation – power tools with no<br>dust suppression | Approximately 16m <sup>2</sup>   |
| Exterior<br>(Behind Metal<br>Siding Façade)              | Asbestos Cement<br>(Transite) Sheeting | Inspect for presence prior to demolition, if<br>present assume ACM or sample to confirm<br>ACM content.<br>If ACM remove as a Type 1 procedure.  | Approximately 30 m <sup>2</sup>  |
| AV Storage 108,<br>Mechanical Room<br>105                | Pipe Fitting (1)                       | Type 2 Glove Bag   | Removal of the drywall<br>ceiling will occur in Rm 108,<br>electrical work will be<br>conducted in room 105<br>confirmation of potential<br>impacts and removal should<br>be made. |

|            |  |   |   |
|------------|--|---|---|
| Roofing    | Suspect Roofing Materials (Paper/Felts/Mastics / Sealants)     | Inspect for presence prior to demolition, if present assume ACM or sample to confirm ACM content.<br>If ACM remove as a Type 1 procedure.   | - |
| Door Cores | Potentially Concealed Asbestos containing Door Core Insulation | Inspect for presence of door core insulation prior to disposal. If confirmed present and suspected to be asbestos, either assume the material is ACM or sample to confirm ACM content.<br>If assumed or confirmed ACM, remove and dispose as a Type 1 procedure | - |

ACM may be present in concealed locations and become apparent during construction, renovation, alteration, or maintenance activities. Should any suspect ACM be discovered during the course of regular construction, renovation, alteration, or maintenance activities, work should cease and the materials should not be disturbed. Suspect ACM must be treated as asbestos-containing or sampled and proven to not contain asbestos. Any activities that require disturbance of ACM must be performed in accordance with Ontario Regulation 278/05. It is the responsibility of the constructor to provide supervision and training and undertake due care and diligence in situations where such discoveries can and would occur.

**2.2.3** Upon discovery of suspect or known ACM not identified or referred to in Section 2.0 or the reports referenced, the constructor shall immediately notify, orally and in writing; an inspector at the office of the Ministry of Labour nearest the workplace, the owner/representative, the Contractor and the joint health and safety committee or the health and safety representative, if any, for the workplace. The written notice shall include the following:

- a) The name and address of the person giving the notice;
- b) The name and address of the owner of the place where the work will be carried out;
- c) The municipal address or other description of the place where the work will be carried out sufficient to permit the inspector to locate the place, including the location with respect to the nearest public highway;
- d) A description of the work that will be carried out;
- e) The starting date of the work that will be carried out; and
- f) The name and address of the supervisor in charge of the work.

**2.2.4** No work that is likely to involve handling, dealing with or disturbing or removing the discovered materials shall be done unless; it has been determined whether the material is asbestos-containing; or, the work is performed in accordance to Ontario Regulation 278/05 as though the materials were asbestos-containing materials and, in the case of sprayed-on friable material, as though it contained a type of asbestos other than Chrysotile.

**2.3 Scheduling**

**2.3.1** Schedule to be determined by Owner

## 2.4 Inspection

- 2.4.1 From project set-up to completion of clean-up, the Asbestos Abatement Consultant will be present on both inside and outside of the work area.
- 2.4.2 Inspections will be conducted to confirm the Contractor's compliance. Failure to comply with the specified requirements may result in a stoppage of work at no additional cost to the Owner.
- 2.4.3 Promptly notify the Consultant of any ACM or potential ACM discovered during the work and not apparent in the audit, specifications or site meeting(s). DO NOT disturb such material until given direction by the Consultant. Assume such material to contain asbestos of a type other than Chrysotile until proven otherwise. Failure to notify the Consultant of ACM prior to removal will result in the dispute of payment of fees for any extra work performed.
- 2.4.4 The following inspections are recommended if all work is completed as Type 1/2 Abatement Operations. These will be conducted at the Contractor's/Owner's cost. Provide Consultant with minimum of 24 Hours verbal notice:
  - 2.4.5 Pre Start Inspection: conducted after completion of work area set-up and prior to start of contaminated work.
  - 2.4.6 Pre-Lock Down Visual Clearance: conducted after removal of all ACM, but prior to application of lock down agent.
  - 2.4.7 Final Visual Clearance: conducted after removal of all ACM, and application of lock down agent to confirm cleanliness. Additional labour or materials expended by the Asbestos Abatement Contractor to provide satisfactory performance to the level specified shall be at no additional cost.

## 2.5 Submittal Section

- 2.5.1 Refer to the requirements included in the Front End documents
- 2.5.2 The contractor shall have all asbestos waste transported under a current and valid Certificate of Approval or Provisional Certificate of Approval that specifically authorizes the transportation of asbestos waste in bulk. A copy of the Certificate of Approval will be maintained on-site and within the transport vehicle(s) and will be provided to the Consultant upon request.

## 2.6 Permits and Regulations

- 2.6.1 Comply with all federal, provincial and local requirements, Regulations and Acts as well as client/owner corporate policies and procedures pertaining to asbestos and health and safety, provided that in any case of conflict among these requirements or with these specifications the more stringent requirements shall apply.
- 2.6.2 Comply will all aspects of the Occupational Health and Safety Act Revised Statutes of Ontario, 2005.
- 2.6.3 Comply with Ontario Regulation 278/05 "Asbestos on Construction Projects and in Buildings and Repair Operations", made under the Occupational Health and Safety Act.
- 2.6.4 Comply with "Handling, Transportation and Disposal of Asbestos Waste' in accordance with Ontario Regulation 347 as amended by Ontario Regulation 558/00, under the Environmental Protection Act (General-Waste Management), June 1992.

**2.6.5** Before varying a measure or procedure described in Ontario Regulation 278/05, or these specifications, the contractor/constructor must ensure that the varied measure(s) and/or procedure(s), affords protection for the health and safety of workers and building occupants that is at least equal to the protection that would be provided by complying with Ontario Regulation 278/05. Written notice of the varied measure(s) and/or procedure(s) shall be given in advance to the joint health and safety committee and safety representative, if any, for the workplace. Such notice shall also be provided to the Consultant.

## **2.7 Instruction and Training**

**2.7.1** It shall be the responsibility of the Constructor to inform all workers involved in this project of the hazards in regard to the work to be performed and ensure appropriate training has been provided to all workers

**2.7.2** Every worker shall be properly trained in accordance with Section 19 of Ontario Regulation 278/05 in the removal/management of asbestos as a Type 1, Type 2 and Type 3 Operation and have had instruction and training in:

- a) Asbestos awareness;
- b) The hazards of asbestos exposure;
- c) Personal hygiene and work practices;
- d) The use, cleaning, maintenance, selection and disposal of respirators and protective clothing; and
- e) The measures and procedures prescribed by Ontario Regulation 278/05.

**2.7.3** Instruction and training related to personal protective equipment and hygiene shall include but shall not necessarily be limited to:

- a) Limitations of the equipment;
- b) Inspection and maintenance of the equipment;
- c) Fitting of the equipment; and
- d) Disinfecting and decontamination of the equipment.

**2.7.4** The abatement contractor shall ensure that every worker/supervisor involved in a Type 3 operation meets the training and certification requirements of Section 20 of Ontario Regulation 278/05.

## **2.8 Worker Protection**

**2.8.1** All personal protective equipment shall be used and maintained in accordance to the manufactures specifications and/or federal, provincial, local regulations and Acts and any corporate policies and procedures.

**2.8.2** All Personal protective equipment shall be of a nature that can be readily and effectively decontaminated or shall be of a disposable type.

- 2.8.3** Damaged, deteriorated or defective personal protective equipment shall be repaired or replaced immediately and the worker shall not continue with their duties until such damages, deterioration or defects have been corrected.
- 2.8.4** All personal protective equipment shall be durable enough and otherwise suitable to withstand the nature of the work being performed and the environmental conditions present within the work area(s).
- 2.8.5** The contractor shall provide all workers with personally issued respirators suitable for protection against asbestos and acceptable to the Ministry of Labour.
- 2.8.6** It shall be the responsibility of the contractor/constructor to ensure that all procedures for the use of respiratory equipment in accordance with Ontario Regulation 278/05 and manufacturers requirements are complied with. This shall include but shall not necessarily be limited to:
- The worker being physically able to perform the required duties while wearing the respirator;
  - Respirators must be fit checked by qualitative or quantitative fit testing. Instruction must be provided as defined by the Occupational Health and safety Act;
  - Air purifying respirators will be equipped with Ministry of Labour and NIOSH approved N 100, P 100, R 100 or HEPA hard exterior cassette style filters and shall be fitted so that an effective seal exists between the respirator and the workers face;
  - Supplied air respirators will have supply air meet the Canadian Standards Association (CSA) standard Z180.1-00, Compressed Breathing Air and Systems (March 2000)
  - Cleaning and disinfecting of respirator(s) after each use or more often if needed;
  - Inspection of respirator(s) and/or respiratory equipment before each use;
  - The proper storage in a clean, dry and sanitary location when respirator(s) are not in use; and
  - The development of written procedures regarding selection, use and care of respirators.
- 2.8.7** For Type 1 Operations, where respiratory protection is not required, because concentrations of airborne asbestos fibres are less than the TWAEV, but is requested by the worker(s); the contractor shall provide a NIOSH-approved respirator in accordance to Table 2 of Ontario Regulation 278/05 to the workers and the worker(s) shall use the respirator.
- 2.8.8** **2.8.8 Protective Clothing:** The contractor shall provide every worker who enters the work area with disposable coveralls and gloves which:
- Shall be made of a material that does not readily retain nor permit the penetration of asbestos fibres;
  - Shall consist of head covering and full body covering that fits snugly at the ankles, wrists and neck, in order to prevent asbestos fibres from reaching the garment and skin under the protective clothing;
  - Shall include suitable footwear; and
  - Shall be repaired or replaced if torn or damaged.
- 2.8.9** **2.8.9** The contractor shall provide worker(s) with Canadian Standards Association approved head, hearing and foot protection for the work being performed and as required by applicable construction safety regulations.

## 2.9 Authorized Visitor Protection

- 2.9.1 The contractor shall provide all prescribed personal protective equipment to authorized visitors to the work area(s).
- 2.9.2 Ensure authorized visitors have received required training prior to entry to the work areas.
- 2.9.3 Instruct authorized visitors in all relevant procedures to be followed while in and around the work area(s).

## 3.0 Approved Products

### 3.1 Materials and Equipment

Amended Water: Water with a surfactant agent added to reduce water tension for thorough wetting of fibres.

Decontamination Shower: For the purpose of worker decontamination, a portable self-contained shower equipped with the following shall be utilized:

- Hot and cold water connections;
- Interior hot and cold fixtures that can be controlled by the person using the shower; or provide a constant water temperature of not less the 40° Celsius but not greater 50° Celsius;
- A containment basin of sufficient capacity to collect and contain the quantity of water required for at least one worker to properly decontaminate; and
- Shall be supplied with soap and clean towels.

Drop Sheets: Fire retardant Polyethylene: 0.15 mm (6 mil) minimum thickness or Fire Retardant Fibre Reinforced (FR) polyethylene: 0.15 mm (6mil) minimum thickness. New Materials Only.

Exhaust Ducting: For use with Negative Air Unit(s) shall be flexible reinforced heavy duty type duct and be free of tears, punctures and damage and be otherwise suitable for the conditions of the work area(s). The cross sectional area of the ducting shall be maintained during the operation of the Negative Air Unit(s). And reasonable care shall be taken to ensure the ducting does not become damaged.

Micronic Water Filter: Shall be used to filter contaminated water that is to be discharged to local sanitary sewers. Contaminated water includes but is not necessarily limited to wash down water and decontamination shower water. The filter shall be equipped with a secondary 5 micrometer filter. As an alternative to filtration, contaminated water may be collected in appropriate waste containers for off-site disposal.

Negative Air Units: Shall be equipped with HEPA/P100 filters and shall have performance leak testing to verify efficiency of filters. Copies of filter tests shall be provided to the consultant upon request.

Power Tools: used in the cutting, grinding, drilling, abrading, sanding, vibrating or removal of Asbestos Containing Material, as a Type 2 Operation, shall be equipped with an effective dust collection device with a HEPA/P100 filtration system capable of capturing all debris and dust generated by the tool. All tools and assemblies of dust collection and filtration equipment will be subject to approval and testing by the Consultant as seen fit prior to use.

Pressure Differential Measuring Device: shall be capable of measuring pressure differential of 0.02 inches of water column and shall otherwise measure pressure differential in an appropriate range and  
*Engineers, Scientists, Surveyors.*

interval. The device shall be dedicated to the site/work area, properly calibrated, installed and maintained throughout the duration of work to measure pressure differential between the enclosed removal area and the occupied area and shall be acceptable to the consultant. Daily records shall be kept by the contractor, on site, and made available to the consultant.

Sealant: A suitable water based post-removal sealer appropriate for the lock-down and sealing of asbestos fibres to polyethylene sheeting and cleaned substrate.

Sprayer(s): Shall be capable of delivering low velocity mist pattern spray of Amended water or sealant. Sprayers may be hand held reservoir type or powered airless units.

Surfactant: A commercial or industrial agent that when added to potable water reduces surface tension.

Tape: shall be able to create and maintain a suitable seal on polyethylene and other materials within the work area under both wet and dry conditions and ambient temperatures for the duration of the work being performed and shall otherwise be suitable for the work being performed.

Waste Containers: Waste shall be contained in two overlying dust tight containers impervious to asbestos fibres. The outer container shall be a minimum of 0.15 mm (6 mil.) thick sealable polyethylene waste bag.

- Should the waste material include sharp objects/materials, the inner container shall be a sealable metal, cardboard, fibre or plastic type suitable to resist puncturing of the containers;
- Containers shall be cleaned with a damp cloth or vacuum equipped with a HEPA filter immediately before being removed from the work area;
- Outer waste containers shall have a pre-printed cautionary asbestos warning identifying it as asbestos waste in both official languages clearly visible and legible in a colour which contrasts with the background on which it is printed; and
- Be otherwise suited for the waste being contained.

Vacuums: Shall be equipped with HEPA/P100 filters and shall have performance leak testing to verify efficiency of filters. Copies of filter tests shall be provided to the consultant upon request.

## 3.2 Signage and Placards

**3.2.1** Before beginning work, post a sufficient number of signs at each entrance/exit to the work area(s) warning of asbestos hazards and restricting access to authorized persons wearing personal protective equipment.

**3.2.2** On both sides of all containers and vehicles used in the transport of asbestos waste in large easily legible letters of a minimum of ten centimetres (10 cm) in height which contrast in colour with the background of the container or vehicle the following words shall be clearly displayed:

- CAUTION; CONTAINS ASBESTOS FIBRES; Avoid Creating Dust and Spillage; and
- Asbestos May be Harmful To Your Health; Wear Approved Protective Equipment.



## **4.0 Execution**

### **4.1 General Requirements – All Procedures**

- 4.1.1** Before beginning work, post at each entrance/exit to the work area(s) a sufficient number of signs warning of asbestos hazards and restricting access to authorized persons wearing personal protective equipment.
- 4.1.2** Eating, drinking, chewing or smoking shall not be permitted in the work area.
- 4.1.3** Where wet removals are to take place de-energize and disable with proper lock-out tag-out procedures electrical systems.
- 4.1.4** Temporary electrical distribution systems equipped with Ground Fault Circuit Interrupters (GFCI) shall be supplied and used by the Contractor during wet removals.
- 4.1.5** Remove all items from the work area(s). If items are affixed or otherwise cannot be removed from the work area(s), ensure that they are pre-cleaned using a HEPA/P100 filtered vacuum or damp wiping and completely covered and sealed with polyethylene sheeting and otherwise adequately protected.
- 4.1.6** Before commencing with work, disable and seal all ventilation to and from the work area and ensure ventilation remains disabled throughout the duration of activities. Seal any and all openings within the work area(s).
- 4.1.7** Removal of Asbestos Containing Materials shall commence only after set-up is complete.
- 4.1.8** Frequently and at regular intervals during the Work and immediately upon completion of the work clean up and place all asbestos dust, debris and waste in approved waste containers.
- 4.1.9** Prevent the spread of dust from the Work Area.
- 4.1.10** At completion of Work or at the end of the work day, remove from work area(s) all asbestos waste and in accordance with requirements of Ontario Regulations and these specifications dispose of asbestos waste off-site.

### **4.2 Execution of Type 1 Operation**

#### **4.2.1 Set Up**

- 4.2.1.1.** The Owner to remove all contents from the work areas, including however not limited to drapes, curtains, blinds window coverings and all items adjacent to the window which may be impacted by window replacement work. If items are affixed or otherwise cannot be removed from the work areas, the Abatement Contractor to ensure they are pre-cleaned using a HEPA/P100 filtered vacuum or by damp wiping and isolated using polyethylene sheeting affixed with tape and otherwise adequately protected.
- 4.2.1.2.** Ensure adequate signage is posted restricting access to the work area to authorized personnel. Indicate alternate entry/transit routes, where applicable.
- 4.2.1.3.** Ensure electrical power to all accessibility doors are disabled in all work areas prior to start of work.
- 4.2.1.4.** Prevent the spread of dust from the work area using measures appropriate to the work to be done. Use single layer rip proof polyethylene sheeting to isolate roof penetrations, HVAC units and work adjacent work area(s).

- 4.2.1.5. Use single layer rip proof polyethylene sheeting to isolate windows from adjacent work area(s).
- 4.2.1.6. Prevent the spread of dust from the work area using measures appropriate to the work to be done. Use single layer rip proof polyethylene drop sheets. In areas with carpeted or textured floors which cannot be readily cleaned use double layer rip proof polyethylene over flooring in work area(s).
- 4.2.1.7. Provide facilities for washing hands and face.

#### **4.2.2 Asbestos Removal**

- 4.2.2.1. If a worker requests, the contractor shall supply a respirator in accordance with Ontario Regulation 278/05 Table 2 requirements, suitable for protection against asbestos and protective coveralls and the worker shall wear the respirator and coveralls.
- 4.2.2.2. Perform removal of ACM in a manner to reduce dust creation to lowest level practicable by:
  - Seal all existing openings and those created through the course of work to limit dust migration from the work area to the interior of the school;
  - Dust and waste shall not be permitted to fall freely from one work level to another;
  - Use of hand tools only for the removal of ACM;
  - Careful removal of ACM;
  - Continual wetting of Asbestos Containing Materials throughout the work;
  - Placing removed asbestos waste directly into approved waste containers; and
  - Use of appropriate dust-tight waste containers for ACM waste as it is removed.
- 4.2.2.3. All workers shall proceed to washing facilities and wash hands and face before leaving the work area.

#### **4.2.3 Clean Up**

- 4.2.3.1. After completion of the removal; perform final thorough cleanup of polyethylene, barriers, tools, equipment, items, work area(s) and adjacent areas using HEPA/P100 filtered vacuum or damp wiping methods. Ensuring work area(s) and all items within the work area(s) are free off asbestos dust, debris and waste. Place and seal all asbestos dust debris and waste in approved waste containers
- 4.2.3.2. Wet and fold polyethylene and barriers in a manner which contains asbestos dust, debris and waste, place and seal in approved waste containers.
- 4.2.3.3. If Personal Protective Equipment was requested and used by the worker prior to leaving the work area(s) clean all asbestos dust, debris and waste from clothing and personal protective equipment (PPE). Remove and place disposable PPE in approved waste container.
- 4.2.3.4. Immediately before their removal from the work area, clean each filled waste container using HEPA/P100 filtered vacuum and place and seal in a secondary clean waste container.

### 4.3 Execution of Type 2 Operation

#### 4.3.1 Set Up

4.3.1.1. Construct an enclosure using polyethylene sheeting that extends from floor to ceiling and encompasses the entire work area where asbestos containing materials will be removed or encapsulated. The enclosure shall include the following:

- Double flap weighted air lock doors at all entrances, exits and doorways of the enclosure and rooms within the enclosure;
- Transparent windows for inspection purposes from outside the enclosure area;
- Sealed edges of the entire enclosure using tape or other suitable methods; and
- Ensure all edges of enclosure are securely fixed.

4.3.1.2. Provide facilities for washing hands and face

#### 4.3.2 Asbestos Removal

4.3.2.1. Workers entering the work area shall don all appropriate personal protective equipment including coveralls and respiratory protection prior to entering the work area.

4.3.2.2. Before commencing with work and at the beginning and end of each work shift and at a minimum of at least once per day the enclosure shall be inspected for any defects or deficiencies.

4.3.2.3. Any defects or deficiencies observed shall be repaired forthwith and no work other than such repairs shall be conducted until repair activities are completed

4.3.2.4. Other than loose material which is pulverized, crumbled and or powdered and shall be removed by HEPA/P100 filtered vacuum, friable Asbestos Containing Materials to be removed or disturbed shall be thoroughly wetted with Amended Water before and during work unless wetting creates a hazard or causes damage.

4.3.2.5. Perform removal of ACM in a manner to reduce dust creation to lowest level practicable by:

- Dust and waste shall not be permitted to fall freely from one work level to another;
- Use of hand tools only for the removal of ACM;
- Careful removal of ACM;
- Continual wetting of Asbestos Containing Materials throughout the work; and
- Placing removed asbestos waste directly into approved waste containers.

4.3.2.6. Perform removal All workers shall proceed to the washing facilities while wearing respirator and shall wash hands and face before leaving the work area.

#### 4.3.3 Clean Up

4.3.3.1. After completion of the removal; perform final thorough cleanup of polyethylene, barriers, tools, equipment, items, work area(s) and adjacent areas using HEPA/P100 filtered vacuum or damp wiping methods. Ensuring work area(s) and all items within the work area(s) are free off asbestos dust, debris and waste. Place and seal all asbestos dust debris and waste in approved waste containers

- 4.3.3.2. Apply Sealant to all vertical and horizontal surfaces, enclosures, drop sheets and items within the enclosure. Allow sufficient time for sealant to dry.
- 4.3.3.3. Wet and fold polyethylene and barriers in a manner which contains asbestos dust, debris and waste, place and seal in approved waste containers.
- 4.3.3.4. Prior to leaving the work area(s) workers shall clean all asbestos dust, debris and waste from Personal Protective Clothing Using HEPA/P100 filtered vacuum or damp wipe methods prior to removing the clothing. Remove and place disposable Personal Protective Clothing in approved waste containers.
- 4.3.3.5. Immediately before their removal from the work area, clean each filled waste container using HEPA/P100 filtered vacuum and place and seal in a secondary clean waste container.

#### **4.4 Execution of Type 2 Glove Bag Operation**

##### **4.4.1 Set Up**

- 4.4.1.1. The work area shall be separated from the rest of the workplace by walls, barricades, fencing or other suitable means.
- 4.4.1.2. Surfaces directly below the work area shall be covered with drop sheets of Polyethylene.
- 4.4.1.3. The glove bag shall be made of material that is impervious to asbestos and sufficiently strong to support the weight of material the bag will hold.
- 4.4.1.4. The glove bag shall be equipped with:
  - i. Sleeves and gloves that are permanently sealed to the body of the bag to allow the worker to access and deal with the insulation and maintain a sealed enclosure throughout the work period.
  - ii. Valves or openings to allow insertion of a vacuum hose and the nozzle of a water sprayer while maintaining the seal to the pipe, duct or similar structure.
  - iii. A tool pouch with a drain.
  - iv. A seamless bottom and a means of sealing off the lower portion of the bag.
  - v. A high strength double throw zipper and removable straps, if the bag is to be moved during the removal operation.

##### **4.4.2 Asbestos Removal**

- 4.4.2.1. Workers entering the work area shall don all appropriate personal protective equipment including coveralls and respiratory protection prior to entering the work area.
- 4.4.2.2. A glove bag shall not be used to remove insulation from a pipe, duct or similar structure if:
  - i. It may not be possible to maintain a proper seal for any reason including, without limitation:
    - A. The condition of the insulation, or
    - B. The temperature of the pipe, duct or similar structure.
  - ii. The bag could become damaged for any reason including, without limitation:
    - A. The type of jacketing, or

B. The temperature of the pipe, duct or similar structure.

- 4.4.2.3. Immediately before the glove bag is attached, the insulation jacketing or coating shall be inspected for damage or defects, and if any damage or defect is present, it shall be repaired.
- 4.4.2.4. The glove bag shall be inspected for damage or defects:
  - i. Immediately before it is attached to the pipe, duct or other similar structure, and
  - ii. At regular intervals during its use.
- 4.4.2.5. If damage or defects are observed when the glove bag is inspected the glove bag shall not be used and shall be disposed of.
- 4.4.2.6. If damage or defects are observed at any time during the use of the glove bag:
  - i. The use of the glove bag shall be discontinued;
  - ii. The inner surface of the glove bag and the contents, if any, shall be thoroughly wetted with Amended Water;
  - iii. The glove bag and the contents, if any, shall be removed and placed in a waste container, and
  - iv. The work area shall be cleaned using a HEPA/P100 filtered vacuum before removal work is resumed.
- 4.4.2.7. All workers shall proceed to the washing facilities while wearing respirator and shall wash hands and face before leaving the work area.

#### **4.4.3 Clean Up**

- 4.4.3.1. When the removal work is completed:
  - i. The inner surface of the glove bag and the waste inside shall be thoroughly wetted with Amended Water and the air inside the bag shall be removed through the elasticized valve, by means of HEPA/P100 filtered vacuum.
  - ii. The pipe, duct or similar structure shall be wiped down and a sealant applied.
  - iii. The glove bag, with the waste inside, shall be placed in a waste container.
  - iv. The work area shall be cleaned using a HEPA/P100 filtered vacuum or by damp wiping.
- 4.4.3.2. Prior to leaving the work area(s) workers shall clean all asbestos dust, debris and waste from Personal Protective Clothing Using HEPA/P100 filtered vacuum or damp wipe methods prior to removing the clothing. Remove and place disposable Personal Protective Clothing in approved waste containers.
- 4.4.3.3. Immediately before their removal from the work area, clean each filled waste container using HEPA/P100 filtered vacuum and place and seal in a secondary clean waste container.

### **4.5 Execution of Type 3 Outdoor Operation Set Up**

#### **4.5.1 Set Up**

- 4.5.1.1. Construct an enclosure using polyethylene sheeting that extends from floor to ceiling and encompasses the entire work area where asbestos containing materials will be removed or encapsulated. The enclosure shall include the following:

- Double flap weighted air lock doors at all entrances, exits and doorways of the enclosure and rooms within the enclosure;
- Transparent windows for inspection purposes from outside the enclosure area;
- Sealed edges of the entire enclosure using tape or other suitable methods; and
- Ensure all edges of enclosure are securely fixed.

4.5.1.2. Construct a decontamination facility as close as practicable to the work area and shall include the following:

- i. A clean change room for changing into street clothes and storing clean clothing, clean towels and soap;
- ii. Decontamination shower room.

4.5.1.3. Arrange configuration of above-mentioned rooms so that (a) person(s) entering/exiting the enclosure must pass through each room in the correct order.

#### **4.5.2 Asbestos Removal**

4.5.2.1. Workers entering the work area shall don all appropriate personal protective equipment including coveralls and respiratory protection prior to entering the work area.

4.5.2.2. Before commencing with work and at the beginning and end of each work shift and at a minimum of at least once per day the enclosure shall be inspected for any defects of deficiencies.

4.5.2.3. Any defects or deficiencies observed shall be repaired forthwith and no work other than such repairs shall be conducted until repair activities are completed

4.5.2.4. Other than loose material which is pulverized, crumbled and or powdered and shall be removed by HEPA/P100 filtered vacuum, friable Asbestos Containing Materials to be removed or disturbed shall be thoroughly wetted with Amended Water before and during work.

4.5.2.5. Perform removal of ACM in a manner to reduce dust creation to lowest level practicable by:

- Dust and waste shall not be permitted to fall freely from one work level to another;
- Careful removal of ACM;
- Continual wetting of Asbestos Containing Materials throughout the work; and
- Placing removed asbestos waste directly into approved waste containers.

4.5.2.6. All workers shall proceed to the decontamination facilities before leaving the work area. Each Worker Shall:

- i. Prior to leaving the work area(s) clean all dust and debris from Personal Protective Equipment (PPE) Using HEPA/P100 filtered vacuum or damp wipe methods.
- ii. Proceed to first decontamination room and remove and place disposable PPE, except respirator, in approved waste containers.
- iii. Still wearing the respirator proceed to the decontamination shower. Thoroughly wash exposed skin and hair with soap and water until clean.
- iv. Thoroughly clean outside of respirator with soap and water.
- v. Remove the respirator and wash face with soap and water.

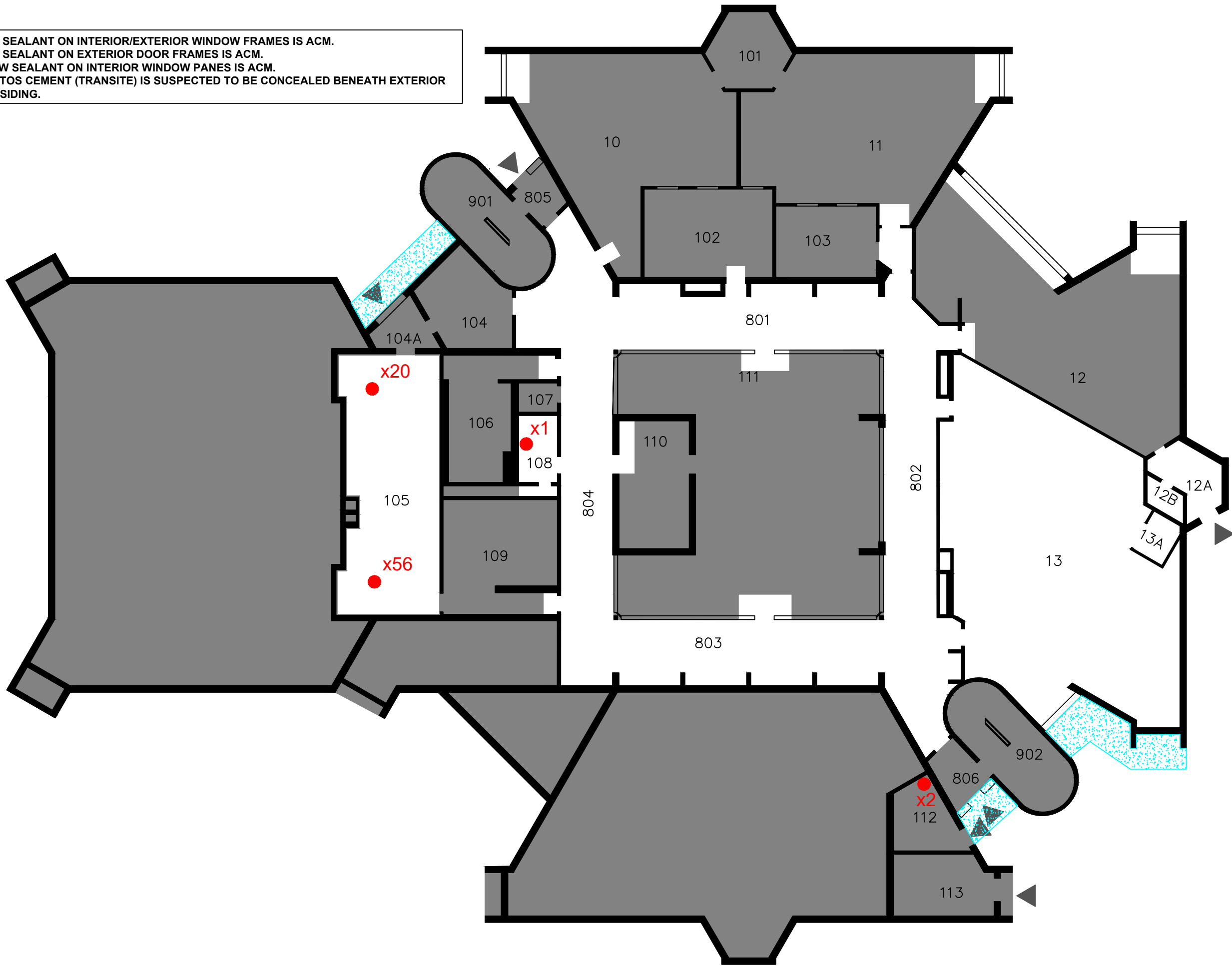
- vi. After showering, proceed to clean change room, dry-off and change into street clothes, or clean coveralls before eating, smoking, drinking or otherwise leaving work area(s).
- 4.5.2.7. Water to the shower and washing facilities shall be shut off and lines shall be bled at the end of each work shift to ensure that leaking and flooding of the work area does not occur.

### **4.5.3 Clean-Up**

- 4.5.3.1. After completion of the removal; perform final thorough cleanup of polyethylene, barriers, tools, equipment, items, work area(s) and adjacent areas using HEPA/P100 filtered vacuum or damp wiping methods. Ensuring work area(s) and all items within the work area(s) are free off asbestos dust, debris and waste. Place and seal all asbestos dust debris and waste in approved waste containers
- 4.5.3.2. Allow for inspection by Consultant to determine abatement is complete and an acceptable level of cleanliness prior to application of sealant.
- 4.5.3.3. Apply Sealant to all vertical and horizontal surfaces, enclosures, drop sheets and items within the enclosure. Allow sufficient time for sealant to dry.
- 4.5.3.4. Prior to leaving the work area(s) workers shall clean all asbestos dust, debris and waste from Personal Protective Clothing Using HEPA/P100 filtered vacuum or damp wipe methods prior to removing the clothing. Remove and place disposable Personal Protective Clothing in approved waste containers.
- 4.5.3.5. Immediately before their removal from the work area, clean each filled waste container using HEPA/P100 filtered vacuum and place and seal in a secondary clean waste container.
- 4.5.3.6. For exterior Type 3 work Final Clearance Air Testing is not required
- 4.5.3.7. Following confirmation by the Consultant the enclosure can be dismantled, wet and fold polyethylene and barriers in a manner which contains asbestos dust, debris and waste, place and seal in approved waste containers.

**End of Section**

BLACK SEALANT ON INTERIOR/EXTERIOR WINDOW FRAMES IS ACM.  
 BLACK SEALANT ON EXTERIOR DOOR FRAMES IS ACM.  
 YELLOW SEALANT ON INTERIOR WINDOW PANES IS ACM.  
 ASBESTOS CEMENT (TRANSITE) IS SUSPECTED TO BE CONCEALED BENEATH EXTERIOR STEEL SIDING.



**NOTES:**  
 ALL DRAWINGS TO BE REFERENCED WITH THE ASSOCIATED REPORT. LOCATIONS AND QUANTITIES ARE APPROXIMATE.  
 ALL KNOWN OR SUSPECT ASBESTOS-CONTAINING MATERIALS AND/OR DESIGNATED MATERIALS ARE NOT DEPICTED ON THIS DRAWING. REFER TO THE REPORT FOR A COMPLETE LIST OF IDENTIFIED MATERIALS.  
 THIS FIGURE IS COLOUR DEPENDENT. PHOTOCOPIES MAY ALTER INTERPRETATION OF THE FIGURE. ALWAYS REFER TO ORIGINAL DRAWINGS AND REPORT.

- Legend**
- 13 Fixed Reference Number
  - Outside Scope of Work
- Asbestos-Containing Materials (ACM):**
- Floor Tile
  - Friable Soft Textured Ceiling
  - Non-Friable Hard Textured Ceiling
  - Duct Insulation
  - x2(1) Pipe Fitting Insulation w Quantity (Brackets Indicate # of Damaged Fittings)
  - x2(1) Duct Expansion Joints w Quantity (Brackets Indicate # of Damaged Joints)



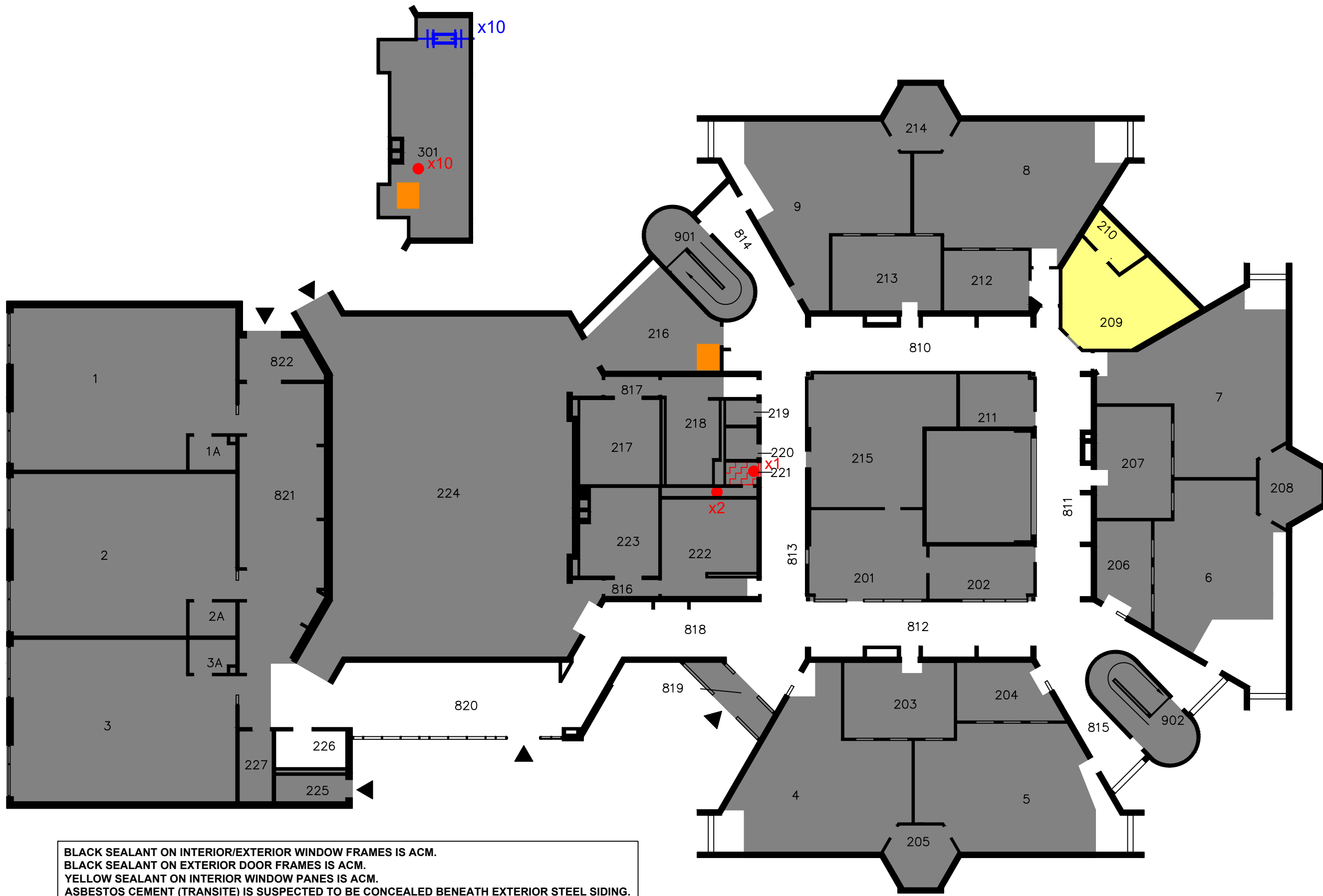
**CLIENT**  
 WATERLOO REGION DISTRICT SCHOOL BOARD

**PROJECT**  
 2022 ASBESTOS ABATEMENT SPECIFICATIONS

**DRAWING**  
 CENTRAL PUBLIC SCHOOL  
 LEVEL ONE

|                 |             |             |               |
|-----------------|-------------|-------------|---------------|
| Project Manager | P. Semeniuk | Date        | November 2022 |
| Design By       | WRDSB       | Project No. | 34532-935     |
| Drawn By        | P. Semeniuk | Drawing No. | 1.0           |
| Scale           | N.T.S.      |             |               |





**NOTES:**  
 ALL DRAWINGS TO BE REFERENCED WITH THE ASSOCIATED REPORT. LOCATIONS AND QUANTITIES ARE APPROXIMATE.  
 ALL KNOWN OR SUSPECT ASBESTOS-CONTAINING MATERIALS AND/OR DESIGNATED MATERIALS ARE NOT DEPICTED ON THIS DRAWING. REFER TO THE REPORT FOR A COMPLETE LIST OF IDENTIFIED MATERIALS.  
 THIS FIGURE IS COLOUR DEPENDENT. PHOTOCOPIES MAY ALTER INTERPRETATION OF THE FIGURE. ALWAYS REFER TO ORIGINAL DRAWINGS AND REPORT.

- Legend**
- 13 Fixed Reference Number
  - Outside Scope of Work
- Asbestos-Containing Materials (ACM):**
- Floor Tile
  - Friable Soft Textured Ceiling
  - Non-Friable Hard Textured Ceiling
  - Duct Insulation
  - Pipe Fitting Insulation w Quantity (Brackets Indicate # of Damaged Fittings)
  - Duct Expansion Joints w Quantity (Brackets Indicate # of Damaged Joints)

BLACK SEALANT ON INTERIOR/EXTERIOR WINDOW FRAMES IS ACM.  
 BLACK SEALANT ON EXTERIOR DOOR FRAMES IS ACM.  
 YELLOW SEALANT ON INTERIOR WINDOW PANES IS ACM.  
 ASBESTOS CEMENT (TRANSITE) IS SUSPECTED TO BE CONCEALED BENEATH EXTERIOR STEEL SIDING.



|                 |             |  |               |
|-----------------|-------------|--|---------------|
| CLIENT          |             | WATERLOO REGION DISTRICT SCHOOL BOARD  |               |
| PROJECT         |             | 2022 ASBESTOS ABATEMENT SPECIFICATIONS |               |
| DRAWING         |             | CENTRAL PUBLIC SCHOOL                  |               |
|                 |             | LEVEL TWO                              |               |
| Project Manager | P. Semeniuk | Date                                   | November 2022 |
| Design By       | WRDSB       | Project No.                            | 34532-935     |
| Drawn By        | P. Semeniuk | Drawing No.                            | 2.0           |
| Scale           | N.T.S.      |  |               |

**Part 1 General**

**1.1 SECTION INCLUDES**

- .1 Materials and installation for concrete floor hardeners, slip resistant coatings, and sheet curing materials.

**1.2 RELATED SECTIONS**

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 51 00 – Temporary Utilities
- .3 Section 03 33 00 – Cast-in-Place Concrete

**1.3 REFERENCES**

- .1 Health Canada - Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .2 CSA-A23.1-09: Concrete Materials and Methods of Concrete Construction

**1.4 SUBMITTALS**

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit WHMIS MSDS - Material Safety Data Sheets.
  - .1 WHMIS MSDS acceptable to Human Resources Development Canada-Labour and Health Canada for concrete floor hardeners.
  - .2 Indicate VOC content.

**1.5 WASTE MANAGEMENT AND DISPOSAL**

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 Collect and separate for disposal paper, plastic, polystyrene, and corrugated cardboard, packaging material in appropriate on-site bins for recycling.
- .3 Dispose of unused chemical additive materials at an official hazardous materials collections site approved by Consultant.
- .4 Unused chemical additive materials must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
- .5 Fold up metal banding, flatten and place in designated area for recycling.
- .6 Dispose of unused chemical additive materials at an official hazardous materials collections site approved by Consultant.

## 1.6 ENVIRONMENTAL REQUIREMENTS

- .1 Temporary lighting:
  - .1 Minimum 1200 W light source, placed 2.5 m above floor surface, for each 40 m<sup>2</sup> of floor being finished.
- .2 Electrical power:
  - .1 Sufficient electrical power to operate equipment normally used during construction.
- .3 Work area:
  - .1 Water tight protection against rain and detrimental weather conditions.
- .4 Temperature:
  - .1 Maintain ambient temperature of not less than 10 degrees Celsius or C° from 7 days before installation to at least 48 hours after completion of Work and maintain relative humidity not higher than 40% during same period.
  - .2 Maintain substrate temperature at 10 C° minimum.
- .5 Moisture:
  - .1 Ensure concrete substrate is within moisture limits prescribed by flooring manufacturer.
- .6 Safety:
  - .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.
- .7 Ventilation:
  - .1 Ventilate area of work as directed by Consultant by use of approved portable supply and exhaust fans.
  - .2 Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities.
  - .3 Provide continuous ventilation during and after coating application.
  - .4 Sufficient to prevent carbon monoxide or high levels of carbon dioxide and other injurious gases from affecting concrete.

## 1.7 SCOPE OF WORK

- .1 Provide liquid hardener at all exposed concrete\_slab-on-grade areas, and where exposed concrete is indicated on architectural drawings or in room finish schedule.

## Part 2 Products

### 2.1 FLOOR HARDENER

- .1 Concrete floor sealer (SCONC): where concrete curing agent/sealer/hardener is required, provide Shur-Seal as manufactured by Paul M. Wolff Co. Inc. (714) 974-0630 or Sure Hard manufactured by Dayton Superior's Canada Limited.

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**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Examine area and conditions under which the work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work and which do not conform to manufacturer's recommendations. Do not proceed until unsatisfactory conditions have been corrected.

**3.2 INSTALLATION**

- .1 On freshly poured concrete surfaces, no additional surface preparation will be required. All surfaces must be clean, sound and absorptive. Remove any concrete laitance and patch, fix all cracks and damaged areas. New concrete should be properly cured a minimum of seven (7) days, prior to placing the concrete floor hardener, in accordance with CSA A23.1 by one of the following methods: water, plastic sheeting or burlap.
- .2 On areas where forms are recently removed, remove all form oil and breaking compound residue to assure penetration of the product into the surface.
- .3 When applying near windows, mask the glass.
- .4 Avoid contact with plant life, glass, aluminum, and other finished surfaces. Where contact occurs, immediately wipe with a damp cloth or flush with water.
- .5 Avoid contact with asphaltic concrete.
- .6 On previously sealed existing concrete floors, completely strip floor of sealers and contaminants prior to application. Apply as for freshly poured surfaces.

**3.3 APPLICATION REQUIREMENTS**

- .1 Two applications are required. The first application at 5m<sup>2</sup>/litre followed by the second application at 10m<sup>2</sup>/litre as final coat in strict accordance with manufacturer's specifications.

**END OF SECTION**

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**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 This section to be read in conjunction with Section 04 22 00 for Execution Requirements
- .2 Section 01 33 00 – Submittal Procedures
- .3 Section 03 30 00 – Cast-in-Place Concrete
- .4 Section 05 12 23 – Structural Steel for Buildings
- .5 Section 03 41 00 – Plant- Precast Structural Concrete
- .6 Section 04 22 00 – Concrete Unit Masonry
- .7 Section 07 21 13 – Board Insulation

**1.2 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM).
  - .1 ASTM C126-99, Standard Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units.
- .2 Brick Industry Association (BIA).
  - .1 Technical Note No. 20-2000, Cleaning Brick Masonry.
- .3 Canadian Standards Association (CSA International).
  - .1 CAN/CSA A82-06: Fired Masonry Brick Made from Clay or Shale
  - .2 CAN/CSA-A165 SERIES-04 (R2009): Concrete Block Masonry Units
  - .3 CSA-A371-04 (R2009): Masonry Construction for Buildings
  - .4 CAN/CSA-A3001: Portland Cement
  - .5 CSA-A8-M88: Masonry Cement
  - .6 CSA S304.1-04: Design of Masonry Structures

**1.3 SUBMITTALS**

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

**1.4 QUALITY ASSURANCE**

- .1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

- 
- .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
  - .3 For clay units, in addition to requirements set out in referenced CSA and ASTM Standards include data indicating initial rate of absorption for units proposed for use.

## **1.5 PRODUCT DELIVERY STORAGE AND HANDLING**

- .1 Ensure that materials are delivered to job site in dry condition.
- .2 Except where wetting of bricks is specified, keep materials dry until use.
- .3 Store under waterproof cover on pallets or plank platforms held off ground by means of plank or timber skids.

## **1.6 COLD WEATHER REQUIREMENTS**

- .1 Supplement Clause 5.15.2 of CSA A371 with the following
  - .1 Maintain temperature of mortar between 5°C and 50°C until used.

## **1.7 HOT WEATHER REQUIREMENTS**

- .1 As per Clause 6.7.4 of CSA A37.

## **1.8 PROTECTION**

- .1 Until completed and protected by flashings or other permanent construction, keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain. Use waterproof coverings draped 600 mm (min.) down each side of wall and securely anchored.
- .2 Protect masonry and other work from marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.
- .3 Provide temporary bracing of masonry work during and after erection until permanent lateral support is in place.

## **1.9 WASTE MANAGEMENT AND DISPOSAL**

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site for recycling in accordance with Waste Management Plan.

## **1.10 JOB MOCK UP**

- .1 Construct mock-up panel of exterior masonry wall construction, 2000 mm x 2000 mm, showing all masonry materials and colors, fixtures, jointing, coursing, mortar and workmanship.

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**Part 2 Products**

**2.1 MANUFACTURED UNITS**

**.1 Concrete Masonry Veneer Units:**

- .1 All units: **90 mm x 90 mm x 390 mm** (HxDxL) in a smooth finish as manufactured by:
  - .1 Brampton Brick, Brampton, ON, tel. (800) 462-7425.
  - .2 Day & Campbell, Hamilton, ON, tel.: (905) 385-5315
  - .3 Richvale York Block Inc., Toronto, tel (877) 792-5625
- .2 **Masonry Veneer "A" (Colour - Light Grey-White):**
  - .1 Brampton Brick 'Finesse Series – Colour POLAR WHITE (*Suave*)
  - .2 Day & Campbell 'Modern Masonry Architectural' – Colour CAMEO WHITE #200 (*Honed*)
  - .3 Richvale York 'Cambridge Series' – Colour WELLINGTON (*Ground*)
- .3 All brick to be manufactured from single continuous run to ensure minimum colour and texture variations.
- .4 Hollow core units may be used. Provide solid units where required for corners and edges.
- .5 Install in a one-third lapped running bond pattern (typical). Refer to Interior Elevation drawings for masonry pattern in Cafeteria interior.
- .6 All units are to be manufactured from single continuous run to ensure minimum colour and texture variations.

**.2 Portland Cement:**

- .1 To CAN/CSA-A3001.

**.3 Masonry Cement:**

- .1 To CAN/CSA A8.

**.4 Hydrated Lime:**

- .1 To ASTM C207-74.

**.5 Aggregate:**

- .1 To CSA A82.56-M1976.

**.6 Water:**

- .1 Ensure that water contains no salts which may cause efflorescence.

**.7 Thru-wall Flashing and Air/Vapour Barrier Sheet Membrane Treatment: Self-adhering SBS modified bitumen membrane reinforced with non-woven fibrous glass. Acceptable materials: Blueskin TW by Bakor Inc., Mississauga or sheet air/vapour barrier membrane as specified as in Section 07 27 10 – Air Barriers.**

**.8 Bolts and Anchors: To CAN3-A370.**

**.9 Mortar:**

- .1 Generally: Use materials only as specified in CSA A179. Ensure that weather and aggregate used in mortar, other than in walls buried in earth, will not cause efflorescence.
- .2 Bonding Agent: Acrylic latex type by Sternson Limited, W.R. Meadows or Thoro Building Products. Use for all mortar except brick.
- .3 Mixes: Mix mortars as specified in CSA A179 using the Proportion Specification. Add bonding agent in accordance with manufacturer's instructions.
- .4 Mortar Types:
  - .1 For masonry walls in contact with earth and bedding for bearing plates and lintels: Mortar Type "S".
  - .2 For load-bearing walls: Mortar Type "S".
  - .3 For brick: Mortar Type "N" (1:1:6) premixed "Betomix 1-1-6" Type "S" portland cement hydrated lime as supplied by Daubois Inc., Jiffy Mortar Systems. Mix on site with sand and water.
  - .4 For all other (non-structural) masonry walls, use regular Type "N" mortar.
- .5 Grout: To CSA A179 Table 3.
- .6 Colouring Additive: A mineral-oxide pigment, harmless to mortar set and strength, shall be provided. Colour shall be one (1) colour per masonry unit type, as selected by the Consultant.
- .10 Mortar Dropping Control Device: "Mortar Net" manufactured by Mortar Net USA (Telephone: 1-800-664-6638).
- .11 Weepholes: 90 mm x 90 mm x 10 mm purpose made PVC, designed to drain cavities and with mesh to prevent insects from entering. Colour to be chosen by Architect from manufacturer's full range.
- .12 Date Stone: Date stone to be 390 x 390 x 90 deep solid limestone. Font: Technic Lite, 100mm high. Beveled edges. Polish finish. Location to be determined by Architect.
- .13 Time Capsule Stone: Time capsule stone to be 390 x 390 x 90 deep solid limestone. Font: Technic Lite, 100mm high. Beveled edges. Polish finish. Location to be under display cabinet in Entrance Foyer. Confirm final location and exact beveled wording with Architect.
- .14 Veneer Ties: Fero slotted block tie (Type II) c/w V-Tie manufactured from 4.76 mm diameter wire conforming to CSA Standard G30.3, hot dipped galvanized to ASTM A153.

### **Part 3 Execution**

#### **3.1 MANUFACTURER'S INSTRUCTIONS**

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

#### **3.2 WORKMANSHIP**

- .1 Build masonry plumb, level, and true to line, with joints in proper alignment.



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

### **3.3 TOLERANCES**

- .1 Clause 5.3 of CAN/CSA-A371 applies except as follows: Walls to receive thinset ceramic tile: plumb within 1:600.

### **3.4 EXPOSED MASONRY**

- .1 Remove chipped, cracked, and otherwise damaged units in exposed masonry and replace with undamaged units.
- .2 Parging on the face of exposed masonry units will be rejected.

### **3.5 JOINTING**

- .1 Except where indicated otherwise on drawings or details or as below, make concave joints, allow joints to set just enough to remove excess water, then tool with round jointer to provide smooth, compressed, uniformly concave joints. Where joints are to receive plaster, tile, insulation, or other applied material except paint or similar thin finish coating, strike flush.

### **3.6 WEEPHOLES**

- .1 Provide 10 x 90 x 90 mm PVC weepers at regular intervals at both top and bottom of walls as indicated on Drawings. Ensure weepers are clear and not blocked by mortar or mortar droppings.

### **3.7 JOINING OF WORK**

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

### **3.8 CUTTING**

- .1 Cut out neatly for electrical switches, outlet boxes, and other recessed or built-in objects.
- .2 Make cuts straight, clean, and free from uneven edges. Use masonry saw where necessary.

### **3.9 BUILDING-IN**

- .1 Build in items required to be built into masonry by other trades.
- .2 Prevent displacement of built-in items during construction. Check for plumbness, alignment, and correctness of position, as work progresses.
- .3 Brace door jambs to maintain plumbness. Fill door frame with concrete.

---

**3.10 WETTING OF BRICKS**

- .1 Except during winter, wet clay brick having an initial rate of absorption exceeding 1g/min/100mm<sup>2</sup>; wet to uniform degree of saturation, to 24 hours before laying, and do not lay until surface is dry.
- .2 Similarly, wet tops of walls built of bricks qualifying for wetting, when recommencing work on such walls.

**3.11 SUPPORT OF LOADS**

- .1 Except where drawing requirements are more stringent, comply with Clause 6.3 of CSA S304.1.
- .2 Where concrete fill is used in lieu of solid units, use minimum 25 MPa concrete to Section 03 30 00.
- .3 Install building paper below voids to be filled with concrete; keep paper 25 mm back from faces of units.

**3.12 PROVISION FOR MOVEMENT**

- .1 Leave 5 mm space below shelf angles.
- .2 Leave 6 mm space and do not use wedges between tops of non-load bearing walls and partitions and structural elements.

**3.13 LINTELS**

- .1 Install steel lintels above windows, doors and all mechanical and electrical as shown on structural drawings. Centre over opening width.
- .2 Install loose steel lintels supplied by Section 05 12 23. Centre lintel over opening width. Minimum 150 mm solid bearing each end.
- .3 Lintels over 2000 mm span to be complete with bearing plate and anchors each end.
- .4 Bridge openings less than 450 mm wide with 6 mm thick mild steel plate lintels, bearing minimum 100 mm on each side of opening and set on dry pack grout. Width of plate to be equal to the wall thickness less 25 mm.
- .5 Install precast concrete lintels supplied under Section 03 30 00.

**3.14 CONTROL AND EXPANSION JOINTS**

- .1 Except as noted following, control joints required at maximum of 6000 mm o.c. in continuous walls having no openings, intersections or column locations. Refer to elevations for locations on exterior walls and advise Consultant of variances prior to executing the work. Control joints are not shown for clarity on the drawings for interior walls. If in doubt, request assistance from the Consultant.
- .2 At doorway locations, unless indicated otherwise on elevation drawings, use one side of doorway beyond lintel. Use building paper to prevent that end of lintel to bond.

- 
- .3 Use standard block with concrete filled end core to form key. Line one side of core with building paper before filling core to prevent bonding. Complete vertical separation, full height and thickness of wall are required.
  - .4 Stop masonry reinforcing at each side of the joints. Caulking specified in Section 07 92 10 – Joint Sealers.
  - .5 At expansion joints in brick and veneer, install Rapid Expansion joint DA 2015, to leave vertical joint free of mortar to allow for horizontal expansion.

### **3.15 INSPECTION & TESTING**

- .1 Refer to Section 01 11 00 – Summary of Work, section 1.29.

### **3.16 CLEANING**

- .1 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.
- .2 On a weekly basis and at completion of work remove all debris, cut blocks and bricks, and mortar droppings.
- .3 Power wash or brush exterior masonry surfaces at completion of work.
  - .1 Soft, clean cloths.
- .4 Clean concrete brick masonry as work progresses.
  - .1 Allow mortar droppings on masonry to partially dry then remove by means of trowel, followed by rubbing lightly with small piece of brick and finally by brushing.
- .5 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures
- .2 Section 09 91 22 – Painting

**1.2 REFERENCES**

- .1 American Society for Testing and Materials International, (ASTM)
  - .1 ASTM A53/A53M-[02], Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
  - .2 ASTM A269-[02], Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
  - .3 ASTM A307-[02], Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.40-[97], Anti-corrosive Structural Steel Alkyd Primer.
  - .2 CAN/CGSB-1.181-[92], Ready-Mixed, Organic Zinc-Rich Coating.
- .3 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-G40.20/G40.21-[98], General Requirements for Rolled or Welded Structural Quality Steel.
  - .2 CAN/CSA-G164-[M92(R1998)], Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .3 CAN/CSA-S16.1-[01], Limit States Design of Steel Structures.
  - .4 CSA W48-[01], Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).
  - .5 CSA W59-[1989(R2001)], Welded Steel Construction (Metal Arc Welding) (Imperial Version).
- .4 The Environmental Choice Program
  - .1 CCD-047a-[98], Paints, Surface Coatings.
  - .2 CCD-048-[98], Surface Coatings - Recycled Water-borne.

**1.3 SUBMITTALS**

- .1 Shop Drawings
  - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

**1.4 DELIVERY, STORAGE, AND HANDLING**

- .1 Packing, Shipping, Handling and Unloading:
  - .1 Deliver, store, handle and protect materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Storage and Protection:
  - .1 Cover exposed stainless steel surfaces with pressure sensitive heavy protection paper or apply strippable plastic coating, before shipping to job site.
  - .2 Leave protective covering in place until final cleaning of building. Provide instructions for removal of protective covering.

- 1.5 WASTE MANAGEMENT AND DISPOSAL**
- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
  - .2 Divert unused metal materials from landfill to metal recycling facility approved by Consultant.

**Part 2 Products**  
**2.1 MATERIALS**

- .1 Steel sections and plates: to CAN/CSA-G40.20/G40.21, Grade 50 for tubes and Grade 44W for Plates and Flat Shapes.
- .2 Welding materials: to CSA W59.
- .3 Bolts and anchor bolts: to ASTM A307.
- .4 Stainless steel tubing: to ASTM A269, Type 302 or 304 alloy, Seamless welded with AISI No. 4 finish.
- .5 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours.

**2.2 PRIMERS, COATINGS AND SHOP PAINTING**

- .1 Interior Steel in Dry Areas: Quick drying oil alkyd conforming to CISC/CPMA 2.75.
- .2 Exterior Steel, Interior Steel in Unheated Areas, Steel Embedded in Concrete: Hot dip galvanized conforming to CSA G164, minimum Z275 coating. Galvanizing of structural steel components and loose lintels: refer to Section 5120.
- .3 Galvanized Coating Touch-Up: W.R. Meadows “Galvafroid” or Kerry Industries “Z.R.C.” zinc rich coating or similar manufacturer containing minimum 90% zinc by weight.
- .4 Apply one shop coat(s) of primer or coating as indicated above and according to manufacturer’s recommendations. Do not prime aluminum, stainless steel or those components to be galvanized or encased in concrete.
- .5 Use primer unadulterated, as provided by manufacturer. Paint on dry surfaces free from rust scale and grease. Do not paint when temperature is lower than 10 deg. Celsius and rising.
- .6 Clean surfaces to be field welded; do not paint.

**2.3 FASTENINGS**

- .1 Use nuts and bolts conforming to ASTM A307, A325, and A563 as applicable.
  - .1 For interior work, use cadmium-plated fastenings where other protection is not specified.
  - .2 For exterior work, use Type 300 or 400 stainless steel.

**2.4 ANCHORS AND SHIMS**

- .1 For exposed anchorage of aluminum, if applicable, use stainless steel and otherwise to match metal anchored. For non-exposed work, anchors and shims may be galvanized steel.

**2.5 PIPE**

- .1 To ASTM A53, extra strong steel pipe for bollards.

**2.6 BITUMINOUS PAINT**

- .1 Alkali-resisting to meet specified requirements of CAN/CGSB-1.108, Type 2. Use to insulate contact between dissimilar metals.

**2.7 FABRICATION**

- .1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.
- .2 Use self-tapping shake-proof flat headed screws on items requiring assembly by screws or as indicated.
- .3 Where possible, fit and shop assemble work, ready for erection.
- .4 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.
- .5 Weld all connections where possible, and bolt where not possible unless indicated otherwise on drawings.
- .6 Weld all stainless steel by the Argon Arc Process. Grind smooth and polish joints, crevice-free, and flush without seams.

**2.8 LIST OF MISCELLANEOUS METAL FABRICATIONS**

- .1 This Section includes, but is not limited to the following list as may be drawn or noted in the drawings or specified elsewhere. Note : Galvanize all exterior items and other items noted. Prime paint all interior items.
  - .1 Anchors, Bolts, Inserts, Sleeves for work in this Section.
  - .2 Hangers and Supports (for work in this Section).
  - .3 Lintels (if not by Structural Steel).
  - .4 other items identified on large format and AD drawings.

**Part 3 Execution**

**3.1 GENERAL**

- .1 Supply and install all miscellaneous metal work indicated on the Drawings and not indicated in work of other Sections in addition to items listed below.

**3.2 ERECTION**

- .1 Do welding work in accordance with CSA W59 unless specified otherwise.
- .2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.
- .3 Provide suitable means of anchorage acceptable to Consultant such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.
- .4 Exposed fastening devices to match finish and be compatible with material through which they pass.
- .5 Provide components for building by other sections in accordance with shop drawings and schedule.
- .6 Make field connections with bolts to CAN/CSA-S16.1, or weld.
- .7 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.
- .8 Touch-up rivets, field welds, bolts and burnt or scratched surfaces after completion of erection with primer.
- .9 Touch-up galvanized surfaces with zinc rich primer where burned by field welding. Spray or brush apply a minimum of three (3) coats of zinc-rich paint to achieve a dry

film thickness of 8 mils. Apply a finish coat of aluminum paint to provide a colour blend with

**3.3 GALVANIZED STEEL**

- .1 Galvanize steel members, fabrications, and assemblies after fabrication by the hot dip process in accordance with CSA G164, minimum Z275 coating.
- .2 Galvanize bolts, nuts and washers and iron and steel hardware components in accordance with CSA G164.
- .3 Safeguard products against steel embrittlement in conformance with ASTM A143.
- .4 Design features which may lead to difficulties during galvanizing shall be pointed out prior to dipping.
- .5 The composition of metal in the galvanizing bath shall be not less than 98.0% zinc.

**3.4 CLEANING**

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

**3.5 DISSIMILAR MATERIALS**

- .1 Where dissimilar metals are in contact, adequate drainage should be provided to avoid standing water which can act as an electrolyte and promote galvanic corrosion. Insulate materials from one another with bitumastic, paint or other inert coating. Stainless steel can be used in contact with, or inbedded in masonry, concrete and plaster, without danger of corrosive attack.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 03 10 00 – Concrete Forms and Accessories.
- .2 Section 08 11 14- Steel Doors and Frames.
- .3 Section 07 52 16 – SBS Modified Bituminous Membrane Roofing

**1.2 REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CSA B111-[1974(R1998)], Wire Nails, Spikes and Staples.
  - .2 CAN/CSA-G164-[M92(R1998)], Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .3 CSA O121-[M1978(R1998)], Douglas Fir Plywood.
  - .4 CAN/CSA-O141-[91(R1999)], Softwood Lumber.
  - .5 CSA O151-[M1978(R1998)], Canadian Softwood Plywood.
  - .6 CAN/CSA-O325.0-[92(R1998)], Construction Sheathing.
  - .7 CAN/CSA-086M-01(R2006), Engineering Design in Wood.
- .2 National Lumber Grades Authority (NLGA)
  - .1 Standard Grading Rules for Canadian Lumber [2000].

**1.3 QUALITY ASSURANCE**

- .1 Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .2 Plywood identification: by grade mark in accordance with applicable CSA standards.
- .3 Plywood, OSB and wood based composite panel construction sheathing identification: by grademark in accordance with applicable CSA standards.

**1.4 WASTE MANAGEMENT AND DISPOSAL**

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 Divert unused wood materials from landfill to recycling, reuse, composting facility approved by Consultant.
- .3 Do not dispose of preservative treated wood through incineration.
- .4 Do not dispose of preservative treated wood with materials destined for recycling or reuse.
- .5 Dispose of treated wood, end pieces, wood scraps and sawdust at sanitary landfill approved by Consultant.



- .6 Dispose of unused wood preservative material at official hazardous material collections site approved by Consultant.
- .7 Do not dispose of unused preservative material into sewer system, into streams, lakes, onto ground or in other locations where they will pose health or environmental hazard.

## **Part 2 Products**

### **2.1 LUMBER MATERIAL**

- .1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% or less in accordance with following standards:
  - .1 CAN/CSA-O141.
  - .2 NLGA Standard Grading Rules for Canadian Lumber.
- .2 Furring, blocking, nailing strips, grounds, rough bucks, cants, curbs, fascia backing and sleepers:
  - .1 Douglas fir Graded 122-C, construction or No. 2 Pine, pressure treated in accordance with CSA 080M.
  - .2 Board sizes: "Standard" or better grade.
  - .3 Dimension sizes: "Standard" light framing or better grade.
  - .4 Post and timbers sizes: "Standard" or better grade.
  - .5 Fasteners: Proprietary fasteners toggle bolts, expansion shields and lag bolts, crews and lead or inorganic fire plugs, explosive actuated fastening devices, recommended for purpose by manufacture. Use stainless steel or galvanized to CSA G164-M1981 fasteners for all exterior fastening and for any damp or moist areas.
  - .6 Wood Preservatives: Surface-applied wood preservative: clear copper naphthenate or 5% pentachlorophenol solution, water repellent preservative.
  - .7 Material shall be straight, sawn square, true, dressed four sides properly sized, shaped to correct dimensions from nominal sizes noted on Drawings.
- .3 Framing Lumber:
  - .1 Western Red Cedar species, well seasoned, processed and stamped at the same mill with appropriate grade markings. Conform to requirements of standard grading rule for Canadian Lumber of National Lumber Grades Authority (NLGA) with latest supplement, approved by Canadian Lumber Standard Administrative Board, as follows:
    - .1 Posts: 'Structural No.2 or Better' grade, with dressed smooth surfaces.
    - .2 Fence Boards and Framing: 'No.2 Clear or Better' grade with dressed smooth surfaces.

### **2.2 PANEL MATERIALS**

- .1 Douglas fir plywood (DFP): to CSA O121, standard construction, good one side with waterproof adhesive.

## **2.3 ACCESSORIES**

- .1 Nails, spikes, staples, screws, bolts anchors lag screws, special fastening devices and supports required for erection of all carpentry components: to CSA B111. Use galvanized components where exposed to exterior atmosphere.
- .2 Rough Hardware (cedar): Provide rough hardware such as nails, spikes, staples, bolts, nuts, washers, screws, clips, strap iron and including hardware for temporary enclosures. Nails shall be spiral type. All nails, spikes and staples shall conform to CSA B111. All rough hardware shall be galvanized unless otherwise noted.
- .3 Surface applied wood preservative: Green coloured copper naphthenate or 5% pentachlorophenol solution, water repellent preservative or same copper based preservative as used for shop impregnation, in accordance with CAN/CSA O80.
- .4 Fire retardant treatment of lumber and plywood: 'Dricon' fire retardant treatment by J. A. Biewer or approved equivalent, conforming to CAN/CSA-O80.20 and CAN/CSA-O80.27 respectively, to provide a flame spread rating of 25 or less in accordance with CAN/ULC-S102.
- .5 Tube Forms: Spirally wound, adhesive laminated fibre paper tube forms having bursting pressure of 965 kPa, coated with hot wax, diameters as required, 'Handiform', or 'Permaform' by Perma Tubes Ltd., or 'Sonotube' by Sonoco Limited.
- .6 Concrete: Minimum 20.684 MPa (3,000 psi) concrete conforming to CAN/CSA-A23.1/A23.2.

## **2.4 FINISHES**

- .1 Galvanizing: to CAN/CSA-G164, use galvanized fasteners for exterior work and interior highly humid areas.

## **Part 3 Execution**

### **3.1 GENERAL**

- .1 Supply and install all other carpentry shown on drawings or as required for completion of work. Co-operate with other trades in installing items supplied by other sections, cut openings in woodwork when so required and make good disturbed surfaces.

### **3.2 PREPARATION**

- .1 Do all wood framing in accordance with the Ontario Building Code and CAN3 - 086M – 01 - (2006).
- .2 Machine dressed work shall be slow fed using sharp cutters and finished members shall be free from drag, feathers, slivers or roughness of any kind.
- .3 Frame materials with tight joints rigidly held in place.
- .4 Design construction methods for expansion and contraction of the materials.

- .5 Erect work plumb, level, square and to required lines.
- .6 Be responsible for methods of construction for ensuring that materials are rigidly and securely attached and will not be loosened by the work of other trades.

### **3.3 FURRING AND BLOCKING**

- .1 Supply and install furring and blocking, required.
- .2 Align and plumb faces of furring and blocking to tolerance of 1:600.

### **3.4 ROUGH BUCKS AND NAILERS**

- .1 Install wood bucks and nailers, as indicated, including wood bucks and linings around frames for doors and windows.
- .2 Except where indicated, otherwise, use material at least 38 mm thick secured with 9 mm bolts located within 300 mm from ends of members and uniformly spaced at 1200 mm between.
- .3 Countersink bolts where necessary to provide clearance for other work.

### **3.5 ROOF FASCIAS, CANTS, NAILERS CURBS**

- .1 Install wood cants, fascia backing, nailers, curbs and other wood supports for roofing, sheet metal fork, roof mounted equipment.
- .2 Secure with galvanized 9 mm bolts, where indicated, galvanized nails elsewhere. Locate fastenings within 300 mm from ends and uniformly spaced between. Space bolts at 1200 mm and nails at 600 mm centres, except where indicated otherwise.
- .3 Staple vapour retardant sheet strip to underside of nailers before installation. Apply strip continuous with 200 mm overlap at joints, free of wrinkles and tears, with at least 200 mm exposed for overlap on roof deck.
- .4 Install wood nailers for roof hoppers, dressed, tapered and recessed slightly below top surface of roof insulation.

### **3.6 SUPPORTS FOR MECHANICAL UNITS**

- .1 Performed by Section 07 51 12. Refer to Details and Mechanical and Architectural Drawings and specifications.

### **3.7 PRESSURE TREATED WOOD**

- .1 Use wood pressure treated in accordance with CSA 080M for all wood members in contact with exterior walls and roofs.
- .2 Re-treat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation.

### **3.8 INSTALLATION OF HOLLOW METAL FRAMES**

- .1 Set frames plumb and square in their exact location and at correct elevation. Firmly block and brace to prevent shifting. Shim up where required to ensure proper alignment dimensions from finished floor to head of frame. Install temporary wood spreaders at mid-height.
- .2 Where pressed steel frames are installed in concrete walls, secure frames to concrete using lead expansion shields and anchor bolts through pipe sleeves. Perform drilling of concrete as required. Fill recessed bolt heads flush to frame face with approved metal filler and sand smooth.
- .3 Install fire rated door frames in accordance with requirements of National Fire Code Volume 4, produced by The National Fire Protection Association (NFPA 80).

### **3.9 GENERAL**

- .1 Supply and install all other carpentry shown on drawings or as required for completion of work. Co-operate with other trades in installing items supplied by other sections, cut openings in woodwork when so required and make good disturbed surfaces.

### **3.10 ERECTION**

- .1 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.
- .2 Countersink bolts where necessary to provide clearance for other work.

### **3.11 INSTALLATION**

- .1 Lay out work carefully and to accommodate work of others. Cut and fit accurately. Erect in position indicated by drawings. Align, level, square, plumb, and secure work permanently in place. Brace work temporarily as required. Join work only over solid bracing.
- .2 Bore holes true to line and to same size as bolts. Drive bolts into place for snug fit, and use plates or washers for bolthead and nut bearings. Turn up bolts and lag screws tightly when installed, and again just before concealed by other work or at completion of work.
- .3 Co-operate with work of other Sections to ensure that unity of actions will ensure orderly progress to meet construction schedule.
- .4 Provide anchors, bolts and inserts, required for attachment of the work of this Section, to those performing the work of other Sections and who are responsible for their installation.
- .5 Work shall include rough hardware such as nails, bolts, nuts, washers, screws, clips, hangers, connectors, and strap iron required for installation of work and all operating hardware required on work of this Section for temporary use.
- .6 Do not attach work by wood plugs or blocking in concrete or masonry. Use lead shields, expansion shields, concrete nails, or similar methods only as approved by the Architect.
- .7 Do not regard grounds, blocking, furring, and such other fastening provisions as shown on Drawings as exact or complete. Provide required provisions for fastening, located and secured to suit site conditions, and adequate for intended support.

- .8 Cut fastening work into lengths as long as practicable and with square ends. Erect work plumb, in true planes, and fastened rigidly in place.
- .9 Grounds around openings in cavity wall systems, under sills and thresholds to provide continuous support shall be 50mm (2”) minimum thickness, preservative treated.
- .10 Install supports and furring members as required to receive components of cabinetwork.
- .11 Install blocking at roofs, as indicated on Drawings, secured permanently to structure, trimmed and levelled to accommodate roofing components, and to receive flashings.
- .12 All members shall be accurately cut to length, angle and be true to line to assure tight joints.
- .13 Correct alignment and plumb must be maintained until specified lateral bracing is installed. Cutting and altering of trusses is not permitted except by approval by the Engineer. Heavy concentrated loads must not be placed on top of trusses until permanent bracing and decking have been installed. In any event, these temporary loads must not exceed the truss design loads.

### **3.12 SCHEDULES**

- .1 Provide electrical equipment backboards for mounting electrical equipment as indicated. Use 19mm thick plywood on 19 x 38 mm furring around spacing, perimeter and at maximum 300 mm intermediate

**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 06 10 11 – Rough Carpentry.
- .3 Section 09 91 22 - Painting.

**1.2 REFERENCES**

- .1 American National Standards Institute (ANSI)
  - .1 ANSI A208.1-[99], Particleboard.
  - .2 ANSI A208.2-[94], Medium Density Fiberboard (MDF).
- .2 American Society for Testing and Materials (ASTM)
  - .1 ASTM E1333-[96], Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates From Wood Products Using a Large Chamber.
  - .2 ASTM D2832-[92(R1999)], Standard Guide for Determining Volatile and Non-volatile Content of Paint and Related Coatings.
  - .3 ASTM D5116-[97], Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products.
- .3 Architectural Woodwork Manufacturers Association of Canada (AWMAC)
  - .1 AWMAC Quality Standards for Architectural Woodwork [, 1994].
- .4 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-71.20-[M88], Adhesive, Contact, Brushable.
- .5 Canadian Standards Association (CSA)
  - .1 CSA B111-[74(R1998)], Wire Nails, Spikes and Staples.
  - .2 CSA O112.4-[M1977(R1999)], Standards for Wood Adhesives.
  - .3 CSA O112.5-Series-M-[1977(R1999)], Urea Resin Adhesives for Wood (Room- and High-Temperature Curing).
  - .4 CSA O112.7-Series M-[1977(R1999)], Resorcinol and Phenol-Resorcinol Resin Adhesives for Wood (Room- and Intermediate-Temperature Curing).
  - .5 CSA O115-[M1982(R2001)], Hardwood and Decorative Plywood.
  - .6 CSA O121-[M89(R1998)], Douglas Fir Plywood.
  - .7 CAN/CSA O141-[91R1999], Softwood Lumber.
  - .8 CSA O151-[M1978(R1998)], Softwood Plywood.
  - .9 CSA O153-[M1980(R1998)], Poplar Plywood.
  - .10 CSA Z760-[94], Life Cycle Assessment.
- .6 Environmental Choice Program (EPC)
  - .1 ECP-44-[92], Adhesives.

- .2 ECP-45-[92], Sealants and Caulking Compounds.
- .3 ECP-76-[98], Surface Coatings.
- .7 International Organization for Standardization (ISO)
  - .1 ISO 14040-[97], Environmental Management-Life Cycle Assessment - Principles and Framework.
  - .2 ISO 14041-[98], Environmental Management-Life Cycle Assessment - Goal and Scope Definition and Inventory Analysis.
- .8 National Electrical Manufacturers Association (NEMA)
  - .1 NEMA LD-3-[95].
- .9 National Hardwood Lumber Association (NHLA)
  - .1 Rules for the Measurement and Inspection of Hardwood and Cypress [, January 1996].
- .10 National Lumber Grades Authority (NLGA)
  - .1 Standard Grading Rules for Canadian Lumber [, 2000].

### **1.3 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate details of construction, profiles, jointing, fastening and other related details.
  - .1 Scales: profiles full size, details 1/2 full size.
- .3 Indicate materials, thicknesses, finishes and hardware.

### **1.4 SAMPLES**

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit duplicate samples: sample size 300 x 300 mm samples of each type of paneling laminate, melamine and each type of solid wood or plywood to receive stain or natural finish.
- .3 Submit a typical prototype unit representative of the work of this section.

### **1.5 GUARANTEE**

- .1 This architectural woodworker shall furnish the Owner with a two (2) year Guarantee Certificate to the full value of the architectural woodwork sub-contract, certifying that

the architectural woodwork has been manufactured and/or installed in accordance with the standards incorporated in the AWMAC Quality Standards Manual. The Guarantee shall cover replacing and/or refinishing to make good any defects in architectural woodwork due to faulty workmanship or defective materials supplied by this architectural woodworker, which appear during a two (2) year period following the date of substantial completion of the project.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- .1 Protect millwork against dampness and damage during and after delivery.
- .2 Store millwork in ventilated areas, protected from extreme changes of temperature or humidity.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Softwood lumber: unless specified otherwise, S4S, moisture content 10 % or less for interior work in accordance with following standards:
  - .1 CAN/CSA-O141.
  - .2 NLGA Standard Grading Rules for Canadian Lumber.
  - .3 AWMAC premium grade, moisture content as specified.
- .2 Hardwood lumber: moisture content 10 % or less for interior work in accordance with following standards:
  - .1 National Hardwood Lumber Association (NHLA).
  - .2 AWMAC premium grade, moisture content as specified.
  - .3 Species: to be Maple unless otherwise noted.
- .3 Hardwood plywood: to CSA O115, of thickness indicated, rotary cut face veneer, birch plywood, veneer core, No. 1 grade. Select veneers to provide book match veneer strips to be 240 mm wide minimum.
  - .1 Species: to be Birch or Maple, unless otherwise noted.
- .4 Nails and staples: to CSA B111, galvanized for exterior work, interior high-humidity areas and for treated lumber; plain finish elsewhere. Use spiral thread nails except where specified elsewhere.
- .5 Particle Board core: to CAN3-0188.1-M78, minimum 45 density, in thickness indicated.

### **2.2 PLASTIC LAMINATE**

- .1 Conforming to CAN3-A172, General Purpose - standard grade (GP-S), 1.25 mm thick for tops, Post Forming - standard grade (PF-S) 1.25 mm thick for post forming. Balance all panels with 0.5 mm backing sheet (BK) by same manufacturer as face panel. Use waterproof adhesive capable of holding materials together without failure. Provide acid resistant grade where shown. "Matte" finish is typical.



- .2 Acceptable Manufacturers include: Formica, Nevamar-ARP abrasion resistant surface distributed by McFaddens, or Arborite. Submit product data. Allow for maximum of 4 colours from full range as chosen by Consultant.

**2.3 MELAMINE FACED PARTICLEBOARD**

- .1 To CAN3-0.188.1-M78, minimum 45 density, particleboard sanded faces, 13 mm, 16 mm, and 19 mm thickness, faced with laminated plastic on both sides. Melamine resin impregnated cover sheet with coloured and/or pattern paper inner layer. Thermally fuse to rigid particleboard substrate. Melamine faces shall be 8 mil thickness. Wood grain pattern to be “Hard Rock Maple”.
  - .1 Acceptable Material: Melamine faced particleboard as manufactured by Flakeboard, Formica or Arborite Division of Domtar Construction Materials Ltd., are of acceptable quality but colour/pattern requires approval prior to confirmation of full acceptance. No alternatives or substitutions are acceptable.

**2.4 EDGE BANDING**

- .1 Solid polyvinyl chloride (PVC), 3 mm thickness x full width of panel edge banding, colour/pattern to match finished face of melamine panel or as selected by Consultant. All exposed edges of banding to be radiused to 2 mm radius after installation on panels. Submit sample of edge-banded panel with radiused edges to Consultant for approval prior to fabrication of architectural woodwork.
  - .1 Acceptable Material: Solid PVC edging as manufactured by “Woodtape” Edge-Banding.
  - .2 Acceptable Material: Solid PVC edging as manufactured by “Complast Inc.”
- .2 All exposed edges are to have edge banding, including front facing edges of shelves within units, doors and gables (including edges facing floor).

**2.5 CABINET HARDWARE**

- .1 Furnish and install all hardware to custom casework as follows:
  - .1 Cupboard Doors - 19 mm thick.:
    - .1 Hinges 110° Blum or Hettich
    - .2 Roller Catches 807N 2G(SgDr) Onward
    - .3 Elbow Catches T03222 C15 (DhDr)
    - .4 Door Pulls CBH235-3 1/2” C32D
    - .5 Cupboard Locks 8703/8704 14a National
  - .2 Drawers - 19 mm thick.:
    - .1 Drawer Slides “Accuride Slide” 3832-2G full extension with ball bearing rollers, 100lb. capacity
    - .2 Drawer Pulls CBH235-3 1/2” C32D
    - .3 Drawer Locks 8703 - 14a National
  - .3 Shelving:
    - .1 System 32 with 5mm holes, 32mm apart
    - .2 Ferow sleeves for adjustable shelving
  - .4 Display Cabinet Shelving:

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- .1 Pilaster strips KV255 Zinc Knape & Vogt
  - .2 Shelf Clips KV256 Zinc Knape & Vogt
  - .5 Cupboard Doors - 35 mm thick.:
    - .1 Hinges F179 76x76 Stanley C15
    - .2 Roller Catches 504N Onward C26
    - .3 Surface bolt 043-4 X Angle Strike C15
    - .4 Door Pulls CBH245-4 1/2" C32D
    - .5 Cupboard Locks supplied and installed under Section 08710
  - .6 Closet Rods and Flanges
    - .1 Rods: chrome finish, Ø 33 mm.
    - .2 Flanges: chrome finish, closed flanges at both ends of rods.
  - .7 Shelf and Rod Steel, white enamel, model No. 1797, manufactured by Hager.
  - .8 Display Case Frame
    - .1 Tracks Knape & Vogt KV P1092
    - .2 Locks Knape & Vogt KV 963
    - .3 Standards Knape & Vogt KV 80
    - .4 Knife Brackets Knape & Vogt KV 180
  - .9 Kindergarten Toy Carts
    - .1 Rubber Bumpers, Colson 6905, Grey.
- .2 Acceptable alternates: equivalent cabinet hardware products by Blum, Hager & Stanley. 19mm Cabinet door hinges must be Blum or Hettich.
- .3 This section shall also include accessories such as rubber door silencers (2 per drawer or door), and other items necessary for the completion of the millwork.
- .4 Cabinet Keying: Key all cabinet and drawer locks alike for the entire school, except teachers' closets.

## 2.6 MELAMINE CLAD CABINETWORK

- .1 All cabinet frames whether for base, wall or tall floor standing cases, shall be fabricated so each is a self-contained module. Front side top and bottom, exterior and interior surfaces shall be finished allowing future relocation of any module, into any bench arrangement, without need of any additional finishing. Melamine gables are not to be in contact with floor. All wood bases are to be wrapped with rubber base.
- .2 Maximum width between gables shall be 900mm.
- .3 Gables and panels shall be fabricated from 19 mm thick melamine surfaced panels with a P.V.C. edging applied to all exposed edges including exposed edge facing floor.
- .4 Bottoms shall be fabricated utilizing the same materials and edge finish as gables. Front edge will be edged with solid 3 mm thick PVC edging. All other edges will be thoroughly sealed and moisture proofed prior to attachment to gables.
- .5 Rails shall be fabricated and machined to join the gables and form a rigid cabinet frame.

- .6 Tops (applies to wall and tall units only) shall be fabricated utilizing the same material and edge finish as gables. Front edge will be edged with P.V.C. edging.
- .7 Toe kick rail shall have a 100 mm x 19 mm section, machined to receive four screw nails for attachment to bottom front edge of gables. Cabinet base shall be plywood attached to melamine cabinet separately, insuring the melamine particle core gables do not come in contact with the floor.
- .8 Backs in base cupboards shall be fabricated from a 13 mm thick melamine surfaced panels.
- .9 Backs in wall and tall cabinets shall be fabricated from 13 mm thick melamine surfaced panels securely glued and screw nailed into the check out provided in the backs of gables, tops, and bottoms.
- .10 Shelves shall be fabricated from 25 mm melamine surfaced panels with a P.V.C. edging applied to front edge. All shelves shall be adjustable using System 32, with 5mm holes spaced at 32mm apart. Shelves are to have ferow sleeves inserted.
- .11 Doors shall be fabricated from 19 mm thick melamine surfaced panels. All four edges shall be P.V.C. edging.
- .12 Drawer fronts shall be fabricated from 19mm thick melamine surfaced panels. All four edges shall be P.V.C. edging. Fronts will be secured to drawer bodies with five screw nails through the front of the drawer body into the core of the drawer front.
- .13 Drawer bodies shall consist of box construction fabricated from 13 mm thick melamine surfaced panels front, sides and back with PVC edging on top edges. Joint front, sides and back with carefully fitted glued and tenoned joints. Alternately, Blum Metabox drawer body and side can be used.
- .14 Finish:
  - .1 Melamine surfaced panels shall be finished both sides in Hard Rock Maple.
  - .2 Miscellaneous solid hardwood pieces shall be sanded, then sealer coated, and sanded with two finish coats of catalytic type varnish.

## 2.7 SHOP FABRICATION

- .1 Shop install cabinet hardware.
- .2 Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes and other fixtures.
- .3 Shop assemble work for delivery to site in size easily handled and to insure passage through building openings.

## 2.8 BENCHES

- .1 32 x 92 solid maple boards with 32 x 108 solid maple edges. Lengths, as indicated on Plans, secured to metal supports. Polyurethane finish, semigloss.

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**2.9 PLASTIC LAMINATED WINDOW SILLS**

- .1 19 mm thick plywood core with post-forming grade plastic laminate finish bonded with resorginal formaldehyde resin glue. All window sills to be double layer at front edge, rounded.
- .2 All exposed edges to be finished with same material as used for the top.

**2.10 PLASTIC LAMINATED TOPS**

- .1 19 mm thick particle board core with post-forming grade plastic laminate finish bonded with resorginal formaldehyde resin glue to a particleboard core. All countertop front face to return vertically 35 mm  $\pm$  . All front and backsplash edges to be rounded.
- .2 Underside to receive a backing sheet, sanded one side and bonded same as surfacing material.
- .3 Exposed edges to be finished with same material as used for the top.
- .4 Drip grooves to be cut into underside of the top where exposed edges occur.
- .5 Splash backs, curbs and curb shelves are to be of similar construction as the tops.
- .6 At all wall termination, provide backsplash return.

**2.11 QUARTZ COMPOSITE COUNTERTOPS**

- .1 Countertops as noted to be engineered quartz composite by ‘Corian by Dupont’, coordinated, supplied and installed by this Section.
- .2 Fabricate counters as described on millwork AD drawings.
- .3 Allow for one (1) colour to be selected by Consultant from full colour line.
- .4 Fabricate quartz surface counters according to manufacturer’s recommendations to achieve design intent shown on details and dimensions on drawings.
- .5 Submit two 300 x 300 samples of all surfacing to show all edge details, cutouts, and splashes etc.

**2.12 MOULDING AND TRIMS**

- .1 Fabricate mouldings in maximum practical lengths to profile shown. Install with concealed fasteners.

**2.13 FABRICATION**

- .1 Set nails and countersink screws apply plain wood filler to indentations, sand smooth and leave ready to receive finish.
- .2 Shop install cabinet hardware for doors, shelves and drawers. Recess shelf standards unless noted otherwise.
- .3 Shelving to cabinetwork to be adjustable unless otherwise noted.

- .4 Provide cut-outs for plumbing fixtures, inserts, appliances, outlet boxes and other fixtures.
- .5 Shop assemble work for delivery to site in size easily handled and to ensure passage through building openings.
- .6 Obtain governing dimensions before fabricating items which are to accommodate or abut appliances, equipment and other materials.
- .7 Ensure adjacent parts of continuous laminate work match in colour and pattern.
- .8 Form shaped profiles and bends as indicated, using postforming grade laminate to laminate manufacturer's instructions.
- .9 Use straight self-edging laminate strip for flatwork to cover exposed edge of core material. Chamfer exposed edges uniformly at approximately 20 degrees. Do not mitre laminate edges.
- .10 Apply laminate backing sheet to reverse side of core of plastic laminate work.
- .11 Apply laminated plastic liner sheet where indicated.

## **2.14 CABINET LOCKS**

- .1 Supply and install matching locksets to all cupboard and drawer units.
- .2 Locksets for all groups of units to be keyed alike and keying to be grouped as follows:
  - .1 Key 1: Kindergartens
  - .2 Key 2: Library Resource and Work rooms and Computer Resource Room
  - .3 Key 3: Classrooms
  - .4 Key 4: Seminar and Resource Rooms
  - .5 Key 5: Work room, Heath Room and Ortho washroom.
- .3 Provide minimum of six identical keys matching all lock types.
- .4 Provide locks in the following numbers to specific units:
  - .1 Library Control desk units: all uppers and all lowers.
  - .2 Library Workroom: all uppers and all lowers.
  - .3 Kindergarten: all uppers and lowers and all tall cupboards
  - .4 Classrooms: all uppers and all lowers.
  - .5 PIP Room: to all upper and lower millwork units (kitchen area, perimeter storage, etc. except. Teachers Closet-refer to drawings.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Do architectural woodwork to Quality Standards of the Architectural Woodwork Manufacturers Association of Canada (AWMAC), except where specified otherwise.
- .2 Install prefinished millwork at locations shown on drawings. Position accurately, level, plumb straight.
- .3 Set and secure all material and components in place, rigid, plumb and square.

- .4 Provide heavy duty fixture attachments for wall mounted cabinets.
- .5 Use draw bolts in countertop joints.
- .6 At junction of plastic laminate counter back splash and adjacent wall finish, apply small bead of sealant.
- .7 Apply water resistant building paper over wood framing members in contact with masonry or cementitious construction.
- .8 After installation, fit and adjust operating hardware for wood and laminated plastic cabinet doors, drawers and shelves.

### **3.2 CLEANING**

- .1 Clean millwork and cabinet work inside cupboards and drawers and all outside surfaces.
- .2 Remove excess glue from surfaces.

### **3.3 PROTECTION**

- .1 Protect millwork and cabinet work from damage until final inspection.

**END OF SECTION**

**Part 1 General**

**1.1 SECTION INCLUDES**

- .1 Materials and installation for asphalt for use as waterproofing.

**1.2 RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 51 00 - Temporary Utilities.
- .3 Section 312310- Excavating, Trenching and Backfilling
- .4 Section 033000- Cast- in-Place Concrete
- .5 Section 042113- Masonry

**1.3 REFERENCES**

- .1 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-37.2-[M88], Emulsified Asphalt, Mineral-Colloid Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.
  - .2 CAN/CGSB 37.3-[M89], Application of Emulsified Asphalts for Dampproofing or Waterproofing.
  - .3 CAN/CGSB 37.5-[M89], Cutback Asphalt Plastic Cement.
  - .4 CGSB 37-GP-6Ma-[83], Asphalt, Cutback, Unfilled, for Dampproofing.
  - .5 CGSB 37-GP-9Ma-[83], Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing.
  - .6 CGSB 37-GP-11M-[76(R1984)], Application of Cutback Asphalt Plastic Cement.
  - .7 CGSB 37-GP-12Ma-[84], Application of Unfilled Cutback Asphalt for Dampproofing.
  - .8 CGSB 37-GP-15M-[76(R1984)], Application of Asphalt Primer for Asphalt Roofing, Dampproofing and Waterproofing.
  - .9 CAN/CGSB 37.16-[M89], Filled, Cutback, Asphalt for Dampproofing and Waterproofing.
  - .10 CAN/CGSB 37.28-[M89], Reinforced Mineral Colloid Type, Emulsified Asphalt for Roof Coatings and for Waterproofing.
  - .11 CGSB 37-GP-36M-[76], Application of Filled Cutback Asphalts for Dampproofing and Waterproofing.
  - .12 CGSB 37-GP-37M-[77], Application of Hot Asphalt for Dampproofing or Waterproofing.
- .2 Canadian Standards Association (CSA International)
  - .1 CSA A123.4-[98], Bitumen for Use in Construction of Built-Up Roof Coverings and Dampproofing and Waterproofing Systems.

- .3 Health Canada
  - .1 Workplace Hazardous Materials Information System (WHMIS)
    - .1 Material Safety Data Sheets (MSDS).
- .4 National Research Council Canada (NRC)/Institute for Research in Construction (IRC)
  - .1 Canadian Construction Materials Centre (CCMC)

#### **1.4 PRODUCT DATA**

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures .
- .2 Submit product data sheets for bituminous dampproofing products. Including:
  - .1 Product characteristics.
  - .2 Performance criteria.
  - .3 Application methods.
  - .4 Limitations.
- .3 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence, and cleaning procedures.

#### **1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Provide and maintain dry, off-ground weatherproof storage.
- .2 Store materials on supports to prevent deformation.
- .3 Remove only in quantities required for same day use.
- .4 Store materials in accordance with manufacturer's written instructions.
- .5 Store solvent base liquids away from excessive heat and open flame.
- .6 Store emulsion liquids at above freezing temperatures, free from contact with cold or frozen surfaces.

#### **1.6 WASTE MANAGEMENT AND DISPOSAL**

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 Ensure emptied containers are sealed and stored safely.
- .3 Fold up metal banding, flatten and place in designated area for recycling.
- .4 Divert unused bituminous waterproofing, sealing compounds and asphalt primer materials from landfill to recycling facility approved by Consultant.

#### **1.7 PROJECT/SITE ENVIRONMENTAL REQUIREMENTS**

- .1 Temperature, relative humidity, moisture content.



- .1 Apply waterproofing materials only when surfaces and ambient temperatures are within manufacturers' prescribed limits.
  - .2 Do not proceed with Work when wind chill effect would tend to set bitumen before proper curing takes place.
  - .3 Maintain air temperature and substrate temperature at dampproofing installation area above 5 degrees C for 24 hours before, during and 24 hours after installation.
  - .4 Do not apply dampproofing in wet weather.
- .2 Safety: Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of asphalt, sealing compounds, primers and caulking materials.
- .3 Ventilation:
- .1 Ventilate area of Work as directed by Consultant by use of approved portable supply and exhaust fans.
  - .2 Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities.
  - .3 Provide continuous ventilation during and after waterproofing application. Run ventilation system 24 hours per day during installation; provide continuous ventilation for 7 days after completion of waterproofing installation.

## **1.8 QUALIFICATIONS AND QUALITY ASSURANCE**

- .1 Waterproofing shall be carried out by applicators skilled and with previous similar experience in this work in strict accordance with manufacturer's printed instructions. Submit proof of experience upon Consultant's request.
- .2 Manufacturer's representative shall be called by the applicator to inspect the substrate prior to commencement of work.
- .3 Manufacturer's representative shall be retained by installer to provide technical assistance on a as-needed basis during course of installation of membrane.

## **1.9 EXTENDED WARRANTY**

- .1 Contractor performing the work of this Section, shall provide a full materials and labour warranty for 5 years from the date of Substantial Performance of the Contract.
- .2 Contractor hereby warrants that the waterproofing membrane will stay in place and remain leakproof in accordance with the Contract, but for 5 years.
- .3 Waterproofing membrane manufacturer shall provide a written warranty that the waterproofing membrane will remain in a watertight condition and will not leak as a result of faulty materials for a period of ten years.

**Part 2 Products**

**2.1 Above concrete slab over Basement Storage Areas 009B 009C & 009D**

- .1 Locations: Over structural concrete slabs, between slabs, under new exterior surfaces to provide waterproofing. Primary Waterproofing Membrane for Horizontal Exterior locations:
- .2 **Sikalastic®-320 SL** (self leveling), as manufactured by Sika Canada Inc. Single-component, Bitumen-modified Polyurethane waterproofing membrane
- .3 Single-component, liquid-applied, bitumen-modified, coal tar free, moisture-cured polyurethane waterproofing membrane, self-levelling (SL) for horizontal applications.

**2.2 At walls below grade at sodded and planted areas**

- .1 Locations: Walls below grade adjacent to new sodded and planted areas.
- .2 Primary Waterproofing Membrane for Vertical Foundation Walls: Cold applied elastomeric asphalt emulsion waterproofing membrane in compliance with CGSB 37.2 shall be Aqua-Bloc 720-38 Elastomeric Asphalt Emulsion Waterproofing Membrane as manufactured by Bakor, a one component waterproofing compound compatible with sheet waterproofing membranes and substrates, having the following characteristics:
  - .1 Elongation: 2000%,
  - .2 Maximum VOC: 10 g/l
  - .3 Water vapour permeance: 10 ng/Pa.m<sup>2</sup>.s, ASTM E96,
  - .4 Chemical resistance: Alkalis, calcium chloride, mild acid and salt solutions.
- .3 Fabric Reinforcement for Cold Applied Waterproofing: Fabric reinforcement shall be 990-06 Yellow Jacket as supplied by Bakor, a glass reinforcement sheet capable of allowing the membrane to bleed through adequately to provide a monolithic reinforced membrane system.
- .4 Prefabricated Drainage Board for Vertical Surfaces: Bakor DB 2000 Prefabricated Composite Drain Board, a polypropylene core board with polypropylene fabric attached, having the following physical properties:
  - .1 Flow Rate: 223 L/min/m,
  - .2 Compressive Strength: 11,000 psf,
  - .3 Thickness: 10 mm
- .5 Prefabricated Drainage Board Accessories
  - .1 Securement Bars: Continuous 6mm x 20mm (1/4" x 3/4") HDPE bar for screw attachment.
  - .2 Moulding Strip: Continuous 90mm wide "Z" flashing strip to fit over exposed top edge of drain board.
  - .3 Drain Board Plugs & Nails: HDPE pre-moulded washer to fit dimples c/w high strength, corrosion resistant concrete nails, UCAN AFH 37 or equal.
  - .4 Termination Sealant: Polybitume 570-05 Polymer Modified Sealing Compound as manufactured by Bakor, a polymer modified sealing compound, compatible

with sheet waterproofing membrane, substrate and insulation materials, complies with CGSB 37.29, remains flexible with ageing and chemically resistant to alkalis, calcium chloride, mild acid and salt solutions.

### **Part 3 Execution**

#### **3.1 WORKMANSHIP**

- .1 Refer to manufacturer's instructions for application.

#### **3.2 PREPARATION**

- .1 Before applying waterproofing:
  - .1 Seal exterior joints between foundation walls and footings, joints between concrete floor slab and foundation and around penetrations through waterproofing with sealing compound.
  - .2 Before commencing work, ensure environmental and site conditions are suitable for installation of waterproofing membrane.
  - .3 The substrate shall be clean and dry, free from surface water, ice, snow or frost, standing water, dust, laitance, grease, curing compounds, impregnations, dust, dirt, oil, wax, grease, curing compounds or any other foreign matter detrimental to the adhesion of the waterproofing membrane.
  - .4 Ensure concrete is smooth and free from voids and honeycombing prior to application of waterproofing membrane.
  - .5 Voids, cracks, holes and other damages to horizontal or vertical surfaces shall be repaired before application of the membrane.
  - .6 Notify Consultant and Contractor in writing of unsuitable surfaces and working conditions. Commencement of work shall imply acceptance of surfaces and working conditions.

#### **3.3 MOCK UP**

- .1 Construct a 3 m x 2 m mock-up area for each separate job condition for inspection by the Consultant prior to proceeding with the work. Mock-up may be part of finished work.
- .2 Notify Consultant and allow 24 hours for inspection by Consultant.

#### **3.4 DECK TO VERTICAL JUNCTURES, FOOTINGS/FOUNDATION WALLS, CRACKS IN SLABS AND PROTRUSIONS**

- .1 Coat penetrations, such as brackets, clips, braces, etc. that are set into the concrete with a 2.3 mm (90 mil) coating of primary waterproofing membrane to the height of the wearing course and around projections to ensure a complete seal prior to coating the entire area.
- .2 Penetrations subject to movement should be flashed with fabric reinforcement set into a minimum thickness of 2.3 mm (90 mil) of primary waterproofing membrane to required height on the wall and at least 100 mm (4") on the slab, embed fabric reinforcement into wet coating followed by second coat.

- .3 To all cracks and cold joints less than 3 mm (1/8") apply a coat of primary waterproofing membrane at a minimum thickness of 2.3 mm (90 mil) and reinforce with fabric reinforcement.
- .4 To all cracks greater than 3 mm (1/8"), prime area and install self-adhered flashing membrane. Overlap end joint of sheet a minimum 75 mm (3").
- .5 At monolithic wall/slab junctures, apply primary waterproofing membrane at a minimum thickness of 2.3 mm (90 mil) to required height on the wall and at least 100 mm (4") on the slab and embed fabric reinforcement into wet primary waterproofing membrane followed by a second coat.
- .6 At non-monolithic wall/slab junctures, prime area, trowel-in fillet bead to inside corners and install self-adhered flashing membrane sheet to the required height on the wall and at least 100 mm (4") on the slab. Lap primary waterproofing membrane over a minimum of 50 mm (2").
- .7 At footing to foundation wall junctions apply a coat of primary waterproofing membrane at a minimum thickness of 2.3 mm (90 mil) and reinforce with fabric reinforcement followed by second coat.

### **3.5 WATERPROOFING MEMBRANE HORIZONTAL APPLICATION**

- .1 Sikalastic®-320 SL may be applied with a brush, squeegee, trowel, or roller.
- .2 Flood Test: After Sikalastic®-320 has cured, plug drains and provide proper means to contain flood water. Flood deck with a 50 mm (2 in) head of water and allow to stand for 24 hours. Check for leaks and immediately make repairs if required. Retest after any repairs have been made. If a flood test cannot be completed in within three (3) days of application, cover Sikalastic®-320 with a protection course to prevent damage from other trade work until a successful flood test is completed.
- .3 Membrane Protection: As soon as possible after completion of a successful water test, visual inspection and/or repairs, cover all horizontal membranes with an approved drainage mat and optional protection board. Sikalastic®-320 should not be exposed to sunlight or UV radiation for more than 14 days. For all vertical membranes, cover immediately after cure with a protection course.
- .4 Joints, Cracks and Flashing: For all cracks up to 1.5 mm (1/16 in) in width, apply a 100 mm (4 in) wide, 30 mils thick stripe coat of Sikalastic®-320 centered over the crack. All cracks exceeding 1.5 mm (1/16 in) in width must be routed to at least 6 mm x 6 mm (¼ in x ¼ in) sealed with the appropriate Sikaflex® sealant and coated with a 10 mm (4 in) wide, 30 mils stripe coat centered on the sealant. Sika® Flexitape Heavy reinforcing fabric may be required for metal flashing transitions, plywood seams, and expansion joints by embedding reinforcing in 15 mils of membrane then coating with another 15 mils of membrane.
- .5 Reinforcement: Sika® Fleece-120 non-woven needle punched polyester fleece reinforcing fabric may be desired for some applications to enhance strength and durability of membrane. Embed Sika® Fleece-120 into a 60 mils coat of Sikalastic®-320 with a 13 mm (½ in) to 20 mm (¾ in) nap roller. Allow membrane to cure. Then apply

another 60 mils coat of Sikalastic®-320 on top of the existing coat. Overlap Sika® Fleece-120 75 mm (3 in) along the sides and 150 mm (6 in) at the roll ends.

- .6 Curing and Recoating: At 24 °C (75 °F) and 50 % relative humidity, allow each coat of Sikalastic®-320 to cure 16 to 24 hours\* minimum. When using water as a catalyst, allow Sikalastic®-320 to cure a minimum of 2 to 4 hours\* before proceeding to subsequent coats. If more than 48 hours pass between coats, the surface must be wiped with a solvent and primed with Sikalastic® Recoat Primer.

### **3.6 WATERPROOFING MEMBRANE VERTICAL APPLICATION**

- .1 Apply a full and continuous coat of primary waterproofing membrane at approximately 1.5 l/m<sup>2</sup> (3.6 gal. US/100ft<sup>2</sup>) and embed fabric reinforcement into coating ensuring no fishmouths or wrinkles are created and allow to set.
- .2 Apply second full and continuous coat of primary waterproofing membrane at 1.5 l/m<sup>2</sup> (3.6 gal./100ft.<sup>2</sup>) and allow to cure.

### **3.7 INSTALLATION OF PROTECTION BOARDS**

- .1 Protection Boards shall be installed over the waterproofing membrane to prevent damage from materials used in backfilling.
- .2 Allow waterproofing to cure dry and apply protection board adhesive in 12mm wide strips spaced at 450 mm o/c to cure waterproofing membrane. Immediately embed protection board and press into adhesive to ensure full contact.
- .3 Do not backfill until adhesive has cure dried. Do not use excessive levels of adhesive.

### **3.8 APPLICATION OF DRAINAGE BOARD VERTICAL**

- .1 Align and hang drainage up to foundation wall. Position bottom edge of drainage board to be in moderate contact with weeping tile system.
- .2 Secure drainage board to foundation wall with nails and washers spaced 450 mm o/c horizontally. Install minimum of 2 rows staggered and spaced 150 mm apart and min 150 from top edge.
- .3 Align and install termination strip along top edge with nails spaced 300 mm o/c and seal with termination sealant.
- .4 Align and install moulding strip over completed top edge detail.
- .5 Overlap end laps, pull back loose fabric to expose drain core and position core of second panel over the overlap flange of first panel.
- .6 Bend drain board to create inside corners and cut board to create outside corners, provide 75 mm of extra fabric to wrap corner.
- .7 Stagger or offset joints of drain board sheets.
- .8 Place all subsequent sheets in an overlapping single fashion.

- .9 Backfill bottom edge in conjunction with weeping tile system.

### **3.9 APPLICATION**

- .1 Do sealing work in accordance with CGSB 37-GP-11M except where specified otherwise.
- .2 Do priming of surface in accordance with CGSB 37-GP-15M except where specified otherwise.
- .3 Apply primer.

### **3.10 SCHEDULE**

- .1 Apply continuous, uniform coating to entire exterior faces of foundation walls from 50 mm below finished grade level to and including tops of foundation wall footings.
- .2 Apply continuous, uniform coating to exterior side of foundation walls enclosing rooms below finished grade. Include exterior portion of interior walls where floors in adjacent rooms are at different elevations.
- .3 Apply two additional coats of dampproofing to vertical corners and construction joints for a minimum width of 230 mm on each side, and all around and for 230 mm along pipes passing through walls.

### **3.11 CLEANING**

- .1 Promptly as the work proceeds and on completion clean up and remove from site all rubbish and surplus materials resulting from the foregoing work.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 04 21 13 – Masonry.
- .3 Section 07 27 10 – Air Barriers.
- .4 Section 07 55 00 – Roof insulation.
- .5 Section 07 21 19 – Spray in Place Urethane Foam Insulation.

**1.2 REFERENCES**

- .1 American Society for Testing and Materials International, (ASTM).
  - .1 ASTM E96-[00e1], Test Methods for Water Vapour Transmission of Materials.
- .2 Canadian General Standards Board (CGSB).
  - .1 CGSB 71-GP-24M-[77(R1983)], Adhesive, Flexible, for Bonding Cellular polystyrene Insulation.
- .3 Underwriters Laboratories of Canada (ULC).
  - .1 CAN/ULC-S604-[91], Type A Chimneys.
  - .2 CAN/ULC-S701-[01], Thermal Insulation, Polystyrene, Boards and Pipe Coverings.
- .4 Environmental Choice Program (EPC).
  - .1 CCD-016-[97], Thermal Insulation.

**1.3 SUBMITTALS**

- .1 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOC's insulation products and adhesives.
- .2 Manufacturer's Instructions:
  - .1 Submit manufacturer's installation instructions.

**1.4 QUALITY ASSURANCE**

- .1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

- .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

## 1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material [n appropriate on-site bins for recycling.

## Part 2 Products

### 2.1 INSULATION

- .1 Extruded polystyrene (XPS): to CAN/ULC-S701.
  - .1 RSI 3.48/R20.
  - .2 Thickness: **100 mm** or as indicated on drawings.
  - .3 Edges: ship-lapped.
  - .4 For use at typical cavity wall construction and at miscellaneous detail locations calling for rigid insulation..
  - .5 Acceptable Material: “**Styrofoam Cavity-Mate**” as manufactured by Dow Chemical Canada Inc.
  - .6 Acceptable Material: “**Foamular C200**” as manufactured by Celfortec Inc. (Owen Corning).
  - .7 or approved equal.
- .2 Extruded polystyrene (XPS): to CAN/ULC-S701.
  - .1 RSI 2.65/R15.
  - .2 Thickness: **75 mm** or as indicated on drawings.
  - .3 Edges: Ship lapped.
  - .4 For use on wall construction” below through-wall flashing below slab on grade as shown typical foundation details,
  - .5 Acceptable Material: “**Styrofoam SM**” as manufactured by Dow Chemical Canada Inc.
  - .6 Acceptable Material: “**Foamular C300**” as manufactured by Celfortec Inc. (Owen Corning).
- .3 Batt insulation: CAN/ULC-S702, Type 1.
  - .1 Friction fit batt insulation.
  - .2 For use in steel studs or locations indicated.



- .3 Acceptable Material: ‘Mineral Wool’ by Rockwool. ‘Cavity rock’ for exterior wall thermal insulating locations. ‘Safe’n’Sound’ for interior sound-proofing locations.
- .4 Or approved equal.

## **2.2 ADHESIVE**

- .1 Adhesive (for polystyrene): to CGSB 71-GP-24.
  - .1 Bakor Air Bloc 21.
  - .2 Compatible with respective rigid insulation, air/vapour and waterproofing membranes and recommended by manufacturers of those products. Use Bakor 230-21 rigid insulation adhesive for rigid insulation in contact with Blueskin air vapour barrier.

## **Part 3 Execution**

### **3.1 MANUFACTURER'S INSTRUCTIONS**

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

### **3.2 WORKMANSHIP**

- .1 Install insulation after building substrate materials are dry.
- .2 Install insulation to maintain continuity of thermal protection to building elements and spaces.
- .3 Fit insulation tight around electrical boxes, plumbing and heating pipes and ducts, around exterior doors and windows and other protrusions.
- .4 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from sidewalls of CAN4-S604 type A chimneys and CAN/CGA-B149.1 and CAN/CGA-B149.2 [type B] [and] [L] vents.
- .5 Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.
- .6 Offset both vertical and horizontal joints in multiple layer applications.
- .7 Do not enclose insulation until it has been inspected and approved by Consultant.

### **3.3 EXAMINATION**

- .1 Examine substrates and immediately inform Consultant in writing of defects.
- .2 Prior to commencement of work ensure:

- .1 Substrates are firm, straight, smooth, dry, free of snow, ice or frost, and clean of dust and debris.

### **3.4 RIGID PERIMETER FOUNDATION INSULATION INSTALLATION**

- .1 Apply adhesive to polystyrene in accordance with manufacturer's recommendations.
- .2 Apply adhesive to insulation board by spot method with daubs 40 mm diameter x 25 mm high at 200 mm o.c. each way
- .3 Interior application: extend boards vertically below bottom of finish floor slab as indicated on drawings, installed on inside face of perimeter foundation walls.
- .4 Exterior application: extend boards below finish grade as indicated on drawings. Install on exterior face of perimeter foundation wall with adhesive.
- .5 Under slab application: extend boards as indicated on drawings. Lay boards on level compacted fill.

### **3.5 RIGID CAVITY WALL INSULATION INSTALLATION**

- .1 System Comprised of:
  - .1 Specified thickness of rigid ship-lapped insulation on Henry-Bakor Blueskin SA air/vapour barrier.
  - .2 Henry-Bakor Airbloc 21 adhesive to be applied to all sides of insulation and continuous layer to all insulation surfaces in contact with air/vapour barrier. Butter all sides and back to ensure full air barrier integrity. Apply adhesive to polystyrene in accordance with manufacturer's recommendations
  - .3 Butter Air Bloc 21 at all brick tie penetrations to ensure a complete seal
  - .4 Install plastic LOC-Wedges at masonry veneer ties to ensure securement to structural wythe or back up wall and in full contact with air/vapour barrier on wall surfaces.

### **3.6 CLEANING**

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

**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 04 21 13 - Masonry.
- .2 Section 01 45 00 - Quality Control.
- .3 Section 01 51 00 - Temporary Utilities.
- .4 Section 07 21 13 – Board Insulation.
- .5 Section 07 55 00 – Protected Membrane Roofing.
- .6 Section 07 62 00 – Sheet Metal Flashing & Trim.
- .7 Section 07 27 10 – Air Barriers.

**1.2 REFERENCES**

- .1 Canadian Urethane Foam Contractors' Association Inc. (CUFCA)
- .2 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN/ULC-S101-[1989], Fire Endurance Tests of Building Construction and Materials.
  - .2 CAN/ULC-S102-[1988(R2000)], Surface Burning Characteristics of Building Materials and Assemblies.
  - .3 CAN/ULC-S705.1-[01], Standard for Thermal Insulation Spray Applied Rigid Foam, Medium Density, Material Specification.
  - .4 CAN/ULC-S705.2-[02], Standard for Thermal Insulation Spray Applied Rigid Foam, Medium Density, Installer's Responsibilities-Specification.

**1.3 TEST REPORTS**

- .1 Submit test reports, verifying qualities of insulation meet or exceed requirements of this specification, in accordance with Section 01 45 00 - Quality Control.
- .2 Submit test reports in accordance with CAN/ULC-S101 for fire endurance and CAN/ULC-S102 for surface burning characteristics.

**1.4 QUALITY ASSURANCE**

- .1 Applicators to conform to CUFCA Quality Assurance Program.

**1.5 SAFETY REQUIREMENTS**

- .1 Protect workers as recommended by CAN/ULC-S705.2 and manufacturer's recommendations:
  - .1 Workers must wear [gloves] [respirators] [dust masks] [long sleeved clothing] [eye protection] [protective clothing] when applying foam insulation.

- .2 Workers must not eat, drink or smoke while applying foam insulation.

## **1.6 PROTECTION**

- .1 Ventilate area in accordance with Section 01 51 00 - Temporary Utilities.
- .2 Ventilate area to receive insulation by introducing fresh air and exhausting air continuously during and [24] hour after application to maintain non-toxic, unpolluted, safe working conditions.
- .3 Provide temporary enclosures to prevent spray and noxious vapours from contaminating air beyond application area.
- .4 Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of insulation materials.

## **1.7 WASTE MANAGEMENT AND DISPOSAL**

- .1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling.
- .3 Fold up metal banding, flatten and place in designated area for recycling.
- .4 Dispose of waste foam daily in location designated by Consultant and decontaminate empty drums in accordance with foam manufacturer's instructions and CAN/ULC-S705.2.
- .5 Divert metal drums from landfill to metal recycling facility as approved by Consultant and to CAN/ULC-S705.2.

## **1.8 ENVIRONMENTAL REQUIREMENTS**

- .1 Apply insulation only when surfaces and ambient temperatures are within manufacturers' prescribed limits.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Insulation: spray polyurethane to CAN/ULC-S705.1.
  - .1 Density: 30.4 kg/m<sup>3</sup> (1.9 lb/ft<sup>3</sup>) minimum.
  - .2 Compressive Strength: >185 KPa (per ASTM D1622)
  - .3 Tensile Strength: > 330 KPa (per ASTM D1623)
  - .4 Air Barrier Classification:
    - .1 Type III (NRC) - permeance: 0.02 L/sec/m<sup>2</sup> maximum at 75 Pa pressure differential.

- .2 Air Barrier System Performance with leakage not exceeding  $0.0054 \text{ l/m}^2$  @75 Pa pressure when tested in Accordance with CCMC Air Barrier System Requirements.
- .3 All manufacturers/applicators shall submit test data reports prior to acceptance.
- .5 Water Permeance:  $125 \text{ ng/Pa.m}^2.\text{s}$  @25mm specimen thickness
- .6 Submit manufacturer's Material Data Safety Sheets in accordance with and Sections 013300 – Submittal Procedures and 013530 – Health and Safety.
- .7 Thickness: as required for thermal resistance indicated, or to match rigid board insulation thickness.
- .8 Acceptable material: Products meeting these specifications by BASF Canada Inc: Walltite CMO1, Heatlok 0240, Heatlok Soya, Polar Foam 7300 and Polarfoam Soya, Elastochem Insulathane Extreme, Genyk Boreal Nature Elite, CertaSpray Closed Cell Foam by CertainTeed Canada and Icynene MDC200.
- .9 Acceptable materials: products by other manufacturers meeting or exceeding these specifications as approved in writing by the Architect following specification, WMIS and test data submission.
- .10 Installation shall only be by applicators specifically approved by the manufacturer/distributor.
- .11 Blowing agents must have a GWP of 150 or lower per Environment Canada Regulations effective January 1, 2021.**
- .2 Primers: in accordance with manufacturer's recommendations for surface conditions.
- .3 Sheet Air/Vapour Barrier Transition Membrane and Thru-Wall Flashing:
  - .1 Self adhering SBS modified bitumen membrane reinforced with non-woven fibrous glass:
    - .1 Thickness: minimum 1.45 mm
    - .2 Water Vapour Permeance: 0.05 perms max value. ( $2.8 \text{ ng/Pa.m}^2.\text{s}$ )
    - .3 Air Permeance: less than  $0.01 \text{ l/m}^2$  at 75 Pa pressure differentials.
    - .4 Adhesion: 7 day min. Peel adhesion at 5 deg. C :
      - .1 to primed Concrete:  $> 20 \text{ N/cm}$
      - .2 to selfedge:  $> 20 \text{ N/cm}$
      - .3 to primed plywood:  $> 25 \text{ N/cm}$
      - .4 to metal:  $> 30 \text{ N/cm}$
    - .5 Submit manufacturer's Material Data Safety Sheets in accordance with and Sections 01333 – Submittal Procedures and 013520 – Health and Safety.
    - .6 Acceptable Material: Blueskin SA by Bakor and Blueskin TW as thru-wall transition at masonry locations.
  - .2 Overlap typically minimum 150 mm on all adjacent layers/materials or as detailed.

**Part 3 Execution**

**3.1 APPLICATION**

- .1 Apply insulation to clean surfaces in accordance with CAN/ULC-S705.2 and manufacturer's printed instructions. Use primer where recommended by manufacturer.
- .2 Apply sprayed foam insulation in thickness as indicated.

**3.2 WORKMANSHIP**

- .1 Certification
  - .1 Installation is to be only by certified CUFCA/NECA applicators and manufacturer of the product being applied. Applicator shall provide proof of both approvals.
- .2 Examination
  - .1 Install insulation after building substrata materials are dry, thoroughly clean and capable of providing a firm, uniform bonding surface and temperatures are within the range recommended by product manufacturers.
  - .2 Verify that surfaces and conditions are suitable to accept work required in this section.
  - .3 Report, in writing, defects in surfaces or conditions which may adversely affect the performance of products installed under this section to the Consultant; prior to commencement of work.
  - .4 Do not commence work until defects have been corrected.
- .3 Preparation-Sprayed Insulation:
  - .1 Mask and cover adjacent areas to protect from overspray.
  - .2 Apply primers for special conditions as required by foam manufacturer.
  - .3 Clean work area prior to commencing spray operations.
- .4 Preparation-Peel & Stick Membrane:
  - .1 Prime all surfaces using Blueskin Primer by Bakor or primer specifically approved by membrane manufacturer. Allow primer to dry. Apply primer only to areas to receive membrane within the same working day, or reprime surfaces.
- .5 Application-Sprayed Insulation:
  - .1 Apply insulation to clean surfaces in accordance with CAN/CGSB 51-39-92 and manufacturer's printed instructions. Use primer where recommended by manufacturer. Ensure full adhesion to transition membrane.
  - .2 Completely fill jambs of all hollow metal frames with insulation and ensure continuous contact with sheet membrane used at head of frames.
- .6 Application-Peel & Stick membrane:
  - .1 Ensure membrane widths capable of sealing to all door opens at heads of frames.
  - .2 Lap sides and ends a minimum of 100 mm or as per details. Ensure full adhesion as per details.

- .3 Position membrane for alignment with release film in place. Roll back, remove release film and press firmly in place. Roll all areas and laps with a steel or polyurethane roller.
- .4 Seal ends of membrane to substrate using Polybithume by Bakor. or product approved specifically by membrane manufacturer.
- .7 Tolerance
  - .1 Maximum variation from required thickness for sprayed insulation: 6 mm.
- .8 Firestopping
  - .1 Required in all cavity walls 25 mm air space or greater.
  - .2 Install firestopping at 20 m intervals maximum horizontally and 3 m maximum vertically, in accordance with OBC requirements and manufacturer's approved method of Roxul AFB and transition membrane protection.
  - .3 At wall extending more than 1 storey in height, install additional firestopping horizontally at intermediate floor elevation.

### **3.3 LOCATIONS**

- .1 Cavity Walls Above Grade: provide mineral wool horizontal and vertical fire stopping to perimeter of building cavity as required by OBC Division B.
- .2 In wall cavity, provide 450mm high band of rigid board insulation at the base of the wall cavity below the foamed in place insulation, to avoid sag and blocking of weep holes.
- .3 On all structural steel in concealed locations exterior to insulation wall assemblies where steel penetrates through thermal barrier of wall forming a “cold bridge, whether shown on drawings or not.
- .4 Concealed within Soffit Conditions: Refer to drawings.
- .5 Jambs of Hollow Metal Frames: Refer to Section 081115 – Door Schedule.
- .6 Behind Metal Siding/composite panels: Refer to Section 074143 – Aluminum Composite Panels.
- .7 All other miscellaneous locations to ensure integrity of a continuous air/vapour barrier and insulation layer.

**END OF SECTION**

## **PART 1 – GENERAL**

### **1.1 General**

- .1 Provided as required for **new window installation**. Ensure openings are properly prepared and waterproofing membrane flashing installed prior to window installation.
- .2 The General Conditions, the Supplementary Conditions, the Instructions to Bidders and Division One – General Requirements shall be read in conjunction with and govern this Section.
- .3 The Specification shall be read as a whole by all parties concerned. Each Section may contain more or less than the complete Work of any trade. The Contractor is solely responsible to make clear to the Sub-Contractors the extent of their Work.

### **1.2 Related Sections**

- .1 Section 04 20 00 – Unit Masonry
- .2 Section 07 92 00 – Joint Sealants
- .3 Section 08 50 50 – Aluminum Windows

### **1.3 References**

- .1 ASTM E96/E96M-05: Standard Test Methods for Water Vapour Transmission of Materials.

### **1.4 System Description**

- .1 Supply labour, materials, plant, tools and equipment to complete the Work as shown on the Drawings and as specified herein to bridge and seal the following air leakage pathways and gaps to provide continuity of the building envelope:
  - .1 Connections of the walls to the roof air/vapour barriers.
  - .2 Connections of the walls to the foundations.
  - .3 Seismic and expansion joints.
  - .4 Openings and penetrations of window and door frames, curtain wall.
  - .5 Piping, conduit, duct and similar penetrations
  - .6 Masonry ties, screws, bolts and similar penetrations.
  - .7 All other air leakage pathways in the building envelope.
- .2 Materials and installation methods of the primary air/vapour & rain barrier membrane system.
- .3 Materials and installation methods of dampproof coursing and through-wall flashing membranes.
- .4 Materials and installation methods for the adhesion of rigid and semi-rigid insulating materials.

### **1.5 Submittals**

- .1 Submit Product Data and Manufacturer's Installation Instructions as specified in Section 01 33 00.
- .2 Product Data: including material characteristics, performance criteria, and limitations.
- .3 Manufacturer's Installation Instructions: indicate preparation and installation requirements,



and/or techniques.

- .4 Prior to commencing the Work submit Manufacturers' complete set of standard Details for the air/vapour barrier membrane systems showing a continuous plane of air tightness throughout the building envelope.

## **1.6 Quality Assurance**

- .1 Perform Work to Sealant and Waterproofers Institute – Sealant and Caulking Guide Specification.
- .2 Submit in writing, a document stating that the applicator of the primary air/vapour barrier membranes specified in this Section is recognized by the Manufacturer as suitable for the execution of the Work.
- .3 Perform Work in accordance with the Manufacturer's written instructions of the air/vapour barrier membrane and this Specification.
- .4 Maintain one copy of Manufacturer's written instructions on site.
- .5 At the beginning of the Work and at all times during the execution of the Work, allow access to work site by the air/vapour barrier membrane Manufacturers' representative.
- .6 Components used in this Section shall be sourced from one Manufacturer, including sheet membrane, air/vapour barrier sealants, primers, mastics and adhesives.

## **1.7 Scheduling**

- .1 Sequence Work to permit installation of materials in conjunction with other barrier materials and seals.

## **1.8 Product Handling**

- .1 Handle and store membrane materials to prevent tearing, puncturing and other damage.
- .2 Store roll goods in upright position and protected from the weather.
- .3 Deliver materials to the job site in undamaged and original packaging indicating the name of the Manufacturer and product.
- .4 Store roll materials on end in original packaging.
- .5 Store adhesives and primers at temperatures of 5°C (40°F) and above to facilitate handling.
- .6 Keep solvent away from open flame or excessive heat.
- .7 Protect rolls from direct sunlight until ready for use.

## **1.9 Job Conditions**

- .1 Apply membrane during dry weather and to dry substrates only.
- .2 Apply materials only within acceptable application temperature range determined by Manufacturer. Use product from single Manufacturer throughout entire project.

## **1.10 Mock-Up**

- .1 Construct mock-up in accordance with Section 01 33 00 - Shop Drawings, Product Data, Samples and Mock-ups.

- .2 Where directed construct typical exterior wall panel, 2 metres (6'-6") long by 2 metres (6'-6") wide, incorporating substrate, window frame, attachment of insulation, and showing air/vapour barrier membrane application Details.
- .3 Allow 24 h for inspection of mock-up before proceeding with air/vapour barrier work. Mock-up may remain as part of the Work.

### 1.11 Warranty

- .1 Provide Manufacturer's standard 5-year material warranty.

## **PART 2 – PRODUCTS**

### 2.1 Materials

- .1 Air/vapour barrier membrane components and accessories must be obtained as a single-source from the membrane Manufacturer to ensure total system compatibility and integrity.
- .2 Self-Adhered Reinforced Membrane: Self-adhesive, modified bitumen membrane 450 mm (18") wide; one of the following; use the same product for entire project:
  - .1 Blueskin SA by Bakor
  - .2 Perm-A-Barrier by W.R. Grace
  - .3 Sopraseal STICK-1100 by Soprema
  - .4 Sealtight Airshield by W.R. Meadows
  - .5 Exo Air 110 by Tremco
- .3 Through-Wall Flashing: reinforced self-adhering membrane by Manufacturer of air/vapour barrier membrane.
- .4 Primer for Self-Adhesive Membrane: as recommended by membrane Manufacturer.
- .5 Adhesives, Mastics, Joint Backing: as recommended by membrane Manufacturer.
- .6 Roof vapour retarders as specified in Sections 07 51 00, 07 52 00 and 07 55 00.
- .7 Seal around masonry ties and other penetrations with liquid adhesive/mastic by membrane Manufacturer.
- .8 Adhesive: compatible with sheet barrier and substrate, permanently non-curing.
- .9 Termination Sealants: as recommended by membrane Manufacturer.
- .10 Joint Sealant: as specified in Section 07 92 00.

## **PART 3 – EXECUTION**

### 3.1 Examination

- .1 Verify that surfaces and conditions are ready to accept the Work of this Section. Notify Architect in writing of any discrepancies. Commencement of the Work or any parts thereof shall mean acceptance of the prepared substrate.
- .2 All surfaces must be sound, dry, clean and free of oil, grease, dirt, excess mortar or other contaminants. Fill spalled areas in substrate to provide an even plane. Strike masonry joints flush.
- .3 New concrete should be cured for a minimum of 14 days and must be dry before air/vapour barrier membranes are applied.

- .4 Where curing compounds are used they must be clear resin based without oil, wax or pigments.

### **3.2 Primer for Transition and Through-Wall Flashing Membrane**

- .1 Apply primer at rate recommended by Manufacturer.
- .2 Apply primer to all areas to receive transition sheet and/or through-wall flashing membrane, as indicated on Drawings by roller or spray and allow minimum 30 minute open time. Primed surfaces not covered by self-adhering transition membrane or self-adhering through-wall flashing membrane during the same working day must be re-primed.

### **3.3 Transition Membrane**

- .1 Align and position self-adhering transition membrane, remove protective film and press firmly into place. Ensure minimum 50 mm (2") overlap at all end and side laps.
- .2 Tie-in to window frames, aluminium screens, hollow metal doorframes, spandrel panels, roofing system and at the interface of dissimilar materials as indicated in Drawings.
- .3 Promptly roll all laps and membrane with a counter top roller to affect seal.
- .4 Ensure all preparatory work is complete prior to applying liquid applied air/vapour barrier membrane.

### **3.4 Through-Wall Flashing Membrane**

- .1 Apply through-wall flashing and dampproof coursing membrane in accordance with CSA A371-94 Masonry Construction for Buildings; along the base of masonry veneer walls, over windows, doors and other wall openings required to be protected.
- .2 Applications shall form a continuous flashing membrane and shall extend up a minimum of 200 mm (8") up the back-up wall and as shown on Drawings. Where shown on Drawings install pre-finished metal drip sandwiched between two (2) layers of membrane.
- .3 At the end of each day's work seal the top edge of the membrane where it meets the substrate using liquid air seal mastic. Trowel-apply a feathered edge to seal termination and shed water.
- .4 Ensure through-wall flashing membrane extends fully to the exterior face of the exterior masonry veneer. At locations where flashing terminates or intersects wall openings including door frames, "end dam" flashing to protect openings and redirect water out. Trim off excess as directed by the Consultant.
- .5 Align and position the leading edge of self-adhering through-wall flashing membrane with the front horizontal edge of the foundation walls, self angles and other substrates to be protected, partially remove protective film and roll membrane over surface and up vertically.
- .6 Press firmly into place. Ensure minimum 50 mm (2") overlap at all end and side laps. Promptly roll all laps and membrane to affect the seal.
- .7 Ensure all preparatory work is complete prior to applying self-adhering through-wall flashing membrane.
- .8 Ensure through-wall flashing membrane extends fully to the exterior face of the exterior masonry veneer. Trim off excess as directed by the Consultant.

### **3.5 Air/Vapour Barrier Membrane**

- .1 Apply self-adhering membrane complete and continuous to prepared and primed substrate in an overlapping shingle fashion and in accordance with Manufacturer's recommendations and written instructions. Stagger all vertical joints.
- .2 Align and position self-adhering membrane, remove protective film and press firmly into place. Ensure minimum 50 mm (2") overlap at all end and side laps. Promptly roll all laps and membrane with a counter top roller to affect the seal.
- .3 At the end of each day's work seal the top edge of the membrane where it meets the substrate using liquid air seal mastic. Trowel-apply a feathered edge to seal termination and shed water.
- .4 Tie-in to window frames, aluminium screens, hollow metal doorframes, spandrel panels, roofing system and at the interface of dissimilar materials as indicated in Drawings. Refer to Manufacturers' standard Details.
- .5 Ensure all projections, including wall ties, are properly sealed with a caulk application of liquid air seal mastic.
- .6 Mechanically fasten membrane through securement bars to all window, door, louvers and curtain wall sections as recommended by membrane Manufacturer where proper adhesion and bonding cannot be maintained.
- .7 Membrane applied to the underside of substrate surfaces shall receive special attention on application to ensure maximum surface area adhesion is obtained.

### **3.6 Installation of Insulation**

- .1 Co-ordinate with Cavity Wall Insulation Section 07 21 13 for insulating materials.
- .2 Upon the completion of the air/vapour barrier membrane system apply the liquid air seal mastic and insulation adhesive in a serpentine pattern over completed air/vapour barrier membrane system.
- .3 Immediately embed insulation into the adhesive and press firmly into place to ensure full contact. Apply additional adhesive if allowed to skin over.
- .4 Fully butter all joints of insulation panels with adhesive during installation, except at expansion joints.

### **3.7 Inspection**

- .1 Notify Architect when sections of Work are complete so as to allow for review prior to installing insulation.

### **3.8 Protection of Finished Work**

- .1 Membranes are not designed for permanent exposure. Product designed to withstand reasonable job site exposure, however good practice calls for covering as soon as possible.
- .2 Damp substrates must not be inhibited from drying out. Do not expose the backside of the substrate to moisture or rain.
- .3 Cap and protect exposed back-up walls against wet weather conditions during and after application of membrane. Drying time varies depending on temperature and relative humidity. At a temperature of 20°C (70°F) and 50% RH, protect air/vapour barrier work against wet weather conditions for a minimum of 24 hours.
- .4 Membranes are not designed for permanent exposure. Good practice calls for covering as soon as possible.

**END OF SECTION 07 26 00**

**Part 1 General**

**1.1 SECTION INCLUDES**

- .1 Materials and installation methods providing [primary] air vapour barrier materials and assemblies.
- .2 Air/vapour barrier materials to provide continuous seal between components of building envelope and building penetrations.

**1.2 RELATED SECTIONS**

- .1 Section 04 21 13 - Concrete and Clay Brick Unit Masonry Veneer
- .2 Section 07 21 13 – Rigid Board Insulation.
- .3 Section 07 44 56 – Composite Panels
- .4 Section 07 51 12 –Roofing.
- .5 Section 07 62 00 – Sheet Metal Flashing & Trim.

**1.3 REFERENCES**

- .1 Canadian Construction Documents Committee
  - .1 CCDC 2 - Stipulated Price Contract.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-19.13M-[M87], Sealing Compound, One Component, Elastomeric Chemical Curing.
  - .2 CAN/CGSB-19.18M-[M87], Sealing Compound, One Component, Silicone Base Solvent Curing.
  - .3 CAN/CGSB-19.24M-[M90], Multi-Component, Chemical Curing Sealing Compound.
  - .4 CGSB 19-GP-14M-[76], Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing.
- .3 NBCC 1995; Part 5 - Environmental Separation
- .4 Sealant and Waterproofer's Institute - Sealant and Caulking Guide Specification.

**1.4 SUBMITTALS**

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit manufacturer's product data sheets in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Submit manufacturer's installation instructions in accordance with Section 01 33 00 - Submittal Procedures.

## **1.5 QUALITY ASSURANCE**

- .1 Perform Work in accordance with Sealant and Waterproofer's Institute - Sealant and Caulking Guide Specification requirements for materials and installation.
- .2 Maintain one copy of documents on site.

## **1.6 QUALIFICATIONS**

- .1 Applicator: Company specializing in performing work of this section with documented experience with installation of air/vapour barrier systems. Completed installation must be approved by the material manufacturer. .
- .2 Applicator: Company who is currently licensed by National Air Barrier Association or certifying organization must maintain their license throughout the duration of the project.

## **1.7 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Deliver, store and handle materials in accordance with manufacture’s written instructions.
- .3 Avoid spillage. Immediately notify Consultant if spillage occurs and start clean up procedures.
- .4 Clean spills and leave area as it was prior to spill.

## **1.8 WASTE MANAGEMENT AND DISPOSAL**

- .1 Place materials defined as hazardous or toxic waste in designated containers.
- .2 Ensure emptied containers are sealed and stored safely for disposal away from children.

## **1.9 PROJECT ENVIRONMENTAL REQUIREMENTS**

- .1 Do not install solvent curing sealants or vapour release adhesive materials in enclosed spaces without ventilation.
- .2 Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities.
- .3 Maintain temperature and humidity recommended by materials manufactures before, during and after installation.

## **1.10 SEQUENCING**

- .1 Sequence work to permit installation of materials in conjunction with related materials and seals.

## **Part 2 Products**

### **2.1 SHEET MATERIALS**

- .1 Refer to technical data sheets for physical properties of product.
- .2 Sheet Seal: Self-Adhesive bitumen laminated to high-density polyethylene film, nominal total thickness of 1 to 4 mm as indicated.
  - .1 Acceptable material: Bakor Blueskin AG, adhesive grade membrane, use ‘peel and stick’ Blueskin where Air-Bloc 21 not present or equal Blueskin SA or TG or Soprema ‘Sopraseal Stick.’
  - .2 Sealant and Adhesive as recommended by Manufacturer.
  - .3 Transition membrane adhesive to be Bakor Air-Bloc 21.
  - .4 Air Barrier Membrane to be Bakor Air-Bloc 21.

### **2.2 SEALANTS**

- .1 Sealants in accordance with Section 07 92 10 - Joint Sealing.
- .2 Primer: Recommended by sealant manufacturer and Appropriate to application.
- .3 Substrate Cleaner: Non-corrosive type recommended by sealant manufacturer and compatible with adjacent materials.

### **2.3 ADHESIVES**

- .1 Adhesive to be ‘Air-Bloc 21’ by Bakor.

### **2.4 ACCESSORIES**

- .1 Thinner and cleaner for as recommended by sheet material manufacturer.
- .2 Stick-Clips: Perforated Galvanized steel anchors.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verify that surfaces and conditions are ready to accept the Work of this section.
- .2 Ensure all surfaces are clean, dry, sound, smooth, and continuous and comply with air barrier manufacturer=s requirements.
- .3 Report any unsatisfactory conditions to the Consultant in writing.
- .4 Do not start work until deficiencies have been corrected. Commencement of Work implies acceptance of conditions.



### **3.2 PREPARATION**

- .1 Remove loose or foreign matter which might impair adhesion of materials.
- .2 Ensure all substrates are clean of oil or excess dust; all masonry joints struck flush, and open joints filled; and all concrete surfaces free of large voids, spalled areas or sharp protrusions.
- .3 Ensure all substrates are free of surface moisture prior to application of self-adhesive membrane and primer.
- .4 Ensure metal closures are free of sharp edges and burrs.
- .5 Prime substrate surfaces to receive adhesive and sealants in accordance with manufacturer's instructions.

### **3.3 INSTALLATION**

- .1 Install materials strictly in accordance with manufacturer's instructions.
- .2 Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

### **3.4 PROTECTION OF WORK**

- .1 Protect finished Work in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Do not permit adjacent work to damage work of this section.
- .3 Ensure finished Work is protected from climatic conditions.

### **3.5 SCHEDULES**

- .1 Wall Air/Vapour Barrier Over Outer Surface of Inner Wythe of Masonry: Trowel seal Type F over masonry unit surface to a thickness of 6 mm, seal masonry anchor penetrations air tight.
- .2 Wall Air/Vapour Barrier over Exterior Surface of Gypsum Sheathing: Place sheet seal Type G over sheathing surfaces with Adhesive Type E. Seal with Type Y sealant.
- .3 Window Frame Perimeter: Lap sheet seal Type H from wall air seal surface with 75 mm of full contact over firm bearing to window frame with 25 mm of full contact. Edge seal with Type Z sealant.
- .4 Wall and Roof Junction: Lap sheet seal Type J from wall seal material with 150 mm of contact over firm bearing to roof air seal membrane with 100 mm of full contact. Seal with Type X sealant.
- .5 Roof System Air/Vapour Barrier Over Steel Deck: Gypsum sheathing, taped joints, apply membrane air seal Type K over sheathing surfaces with Adhesive Type D; edge seal membrane with Type Y sealant.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 78 00 – Closeout Submittals.
- .3 Section 07 27 10 – Air Barriers.
- .4 Section 07 21 13 – Thermal Insulation.

**1.2 REFERENCES**

- .1 American Society for Testing and Materials International, (ASTM)
  - .1 ASTM A653/A653M-09a, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.
- .2 Canadian Standards Association (CSA):
  - .1 CAN/CSA-G40.20/G40.21M-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels.

**1.3 DESIGN REQUIREMENTS**

- .1 Design exterior cementitious composite wall, soffit and canopy panels to withstand live, dead, lateral, wind, seismic, handling, transportation, and erection loads, imposed and other loads.
- .2 Design soffit system to accommodate expansion and contraction of soffit elements without causing buckling, failure of joints, undue stress on fasteners or other effects detrimental to appearance or performance.
- .3 Design cementitious composite panels in accordance with climatic design data for Oakville contained in the Ontario Building Code.
- .4 Design cementitious composite panel system to prevent rattling and vibration of panels, overstressing of fasteners and clips, and other detrimental effects on the system.
- .5 Design miscellaneous, additional structural framing members as required to complete composite panel system, where not indicated on Contract Drawings.

**1.4 SUBMITTALS**

- .1 Product data:
  - .1 Submit copies of manufacturer's Product data in accordance with Section 01 33 00 indicating:
    - .1 Performance criteria, compliance with appropriate reference standard, characteristics, limitations.

- .2 Product transportation, storage, handling and installation requirements.
- .2 Shop drawings: Submit shop drawings in accordance with Section 01 33 00 indicating elevations, details, profiles, dimensions, thickness of materials, finishes, methods of joining, joint location, methods of anchoring, anchors, types of sealants, details of other pertinent components of the work, and compliance with design criteria and requirements of related work.
- .3 Samples: Submit two 300 x 300 mm samples of panels in the selected colours and finish for approval.
- .4 Closeout Submittals: Provide maintenance instructions for incorporation into Operation and Maintenance Manual, specified in section 01 78 00.

## **1.5 QUALITY ASSURANCE**

- .1 Retain a licensed Professional Engineer, registered in Province of Ontario, to perform following services for composite panel Work:
  - .1 Design of cementitious composite panel system.
  - .2 Review, stamp, and sign shop drawings.
  - .3 Conduct shop and field inspections and prepare and submit inspection reports.
- .2 Installers qualifications: Perform Work of this Section by a company that has a minimum of ten years proven experience in the installation of composite building panel units of a similar size and nature and that is approved by manufacturer. Submit to Consultant, applicator's current certificate of approval by the material manufacturer as proof of compliance.
- .3 Mock-up:
  - .1 Fabricate, deliver, and erect a 1220 mm high x 3050 mm long mock-up panel of composite panel system in location acceptable to Consultant.
  - .2 Demonstrate finish, anchoring devices, air/vapour retarder sealing, and quality of workmanship.
  - .3 Mock-up may form part of final Work, if acceptable to Consultant. Remove and dispose of mock-ups which do not form part of Work.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- .1 Handle, transport, and store composite panel work as required by fabricator to prevent staining, soiling, and damage.
- .2 Store composite panel work to clear ground or other bearing surfaces, to prevent overstress, warp, twist, accumulation of water and snow in depressions and holes, and to afford free movement of air on all sides of each unit.

## **1.7 EXTENDED WARRANTY**

- .1 Submit warranty for composite panel Work in accordance with General Conditions, except that warranty period is extended to 20 years.
  - .1 Against leaking, warping, twisting, joint, and finish failure.

- .2 Coverage: Complete replacement including affected adjacent parts.

## **Part 2 Products**

### **2.1 ACCEPTABLE PRODUCTS AND MANUFACTURERS**

- .1 ‘Cemfort S’ by Arkea-Systems Inc. (1-877-929-2226)
- .2 ‘Natura’ by Engineered Assemblies Inc. (905 816-2218)
- .3 ‘fibre C’ by Sound Solutions (416 740-0303)
- .4 ‘Cemval Matrix’ by Cemtrade (416 789-1999 or 905 648-1881)
- .5 ‘Polycon’ – Rieger Architectural Projects (866)-385-8318 Ext 5
- .6 or approved alternative.

### **2.2 MATERIALS**

- .1 Cementitious composite panels:
  - .1 Smooth cement panels with composite core made of synthetic fibres, cement and active adhesives, manufactured under pressure.
  - .2 Panel thickness: 8–12 mm thick.
  - .3 Panel size: 1220 mm x 3050 mm.
  - .4 Density: Minimum 1,500 kg/m<sup>3</sup>.
  - .5 Finish and colour: Standard finish, in two colours as approved by the Consultant. Provide samples for the Consultant’s approval.
- .2 Structural shapes, plates, sag rods, and similar items: CAN/CSA-G40.20-G40.21-M, Grade 350W. Provide all additional structural supports not shown on Drawings as required.
- .3 Girts: Minimum 1.2 mm thick galvanized zinc-coated steel to ASTM A653/A653M, Grade A coating Z275.
  - .1 Preformed galvanized metal sheet, 1.22 mm thick minimum base steel nominal thickness, notched or perforated for drainage.
  - .2 Subgirt depth to suit insulation thickness and cavity behind panel systems.
  - .3 Girt locations as determined and approved by Structural Engineer.
  - .4 Cavity behind panel to be at least 25 mm of unrestricted space.
  - .5 EPDM for use between the panel and the vertical girt; type as recommended by the panel manufacturer.
- .4 Fasteners: Exposed tamperproof factory prefinished or stainless steel fasteners as recommended by panel manufacturer.
- .5 Bottom joint to include PVC flat strip in colour as selected by the Consultant.
- .6 Sealants: Sealant as approved by panel manufacturer in colour matching the panel as closely as possible. Sealant colour to be approved by Consultant.

### **2.3 FABRICATION**

- .1 Fabricate cementitious composite panels in accordance with reviewed shop drawings and manufacturer's written instructions.
- .2 Fabricate panels in accordance with reviewed shop drawings, flat, true, free of marks, without visible distortion and with edges straight and true. Make all planes true, and corners square and bend of minimum radius.
- .3 Form panels to dimensions indicated with tolerances to accommodate expansion and contraction between panels and structure members. Accurately form shaped panels.

### **Part 3 Execution**

#### **3.1 EXAMINATION**

- .1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of Work means acceptance of existing conditions.
- .2 Verify that backup construction is aligned for proper installation of wall panels before commencing erection.
- .3 Protect metal surfaces in contact with concrete, masonry mortar, plaster or other cementitious surface with isolation coating.

#### **3.2 INSTALLATION**

- .1 Supply and install miscellaneous, additional structural framing members, required to complete composite panel system, where not indicated on Contract Drawings.
- .2 Install composite panels, supports, and related items to lines and elevations indicated and in strict accordance with reviewed shop/erection drawings and manufacturer's printed instructions. Carefully co-ordinate work with other Sections.
- .3 Erect wall, soffit and canopy panel systems in accordance with manufacturer's instructions and under direct supervision of the manufacturer in straight lines, true, level, and plumb.
- .4 Maximum deflection of the building including the frame to be within L/360.
- .5 Finished work shall be securely anchored, free of distortion, free of surface imperfections and uniform in colour.

#### **3.3 SEALANT**

- .1 Prepare substrate surface and mask as recommended by sealant manufacturer.
- .2 Seal around all openings and all other locations indicated or required to provide weathertight and watertight seal.

**3.4 REPAIR**

- .1 Remove damaged, defectively finished, or tool marked components and replace with new to Consultant's approval.

**3.5 CLEANING**

- .1 Clean soiled panel surfaces in accordance with manufacturer's written instructions.
- .2 Clean soiled panel surfaces and replace elements not acceptable to Consultant.

**END OF SECTION**

**Part 1 General**

**1.1 SECTION INCLUDES**

- .1 Requirements for the installation of preformed metal cladding/siding and screen work.

**1.2 RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 05 31 00 – Steel Deck
- .3 Section 06 10 11 – Rough Carpentry.
- .4 Section 04 21 13 – Masonry.
- .5 Section 07 21 19 – Sprayed in Place Urethane Foam Insulation.
- .6 Section 07 41 43 – Aluminium Composite Panels

**1.3 REFERENCES**

- .1 American Society for Testing and Materials International, (ASTM).
  - .1 ASTM A653/A653M - 09a, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .2 ASTM A775/A775M - 07b, Standard Specification for Epoxy-Coated Steel Reinforcing Bars
- .2 American National Standards Institute (ANSI).
  - .1 ANSI B18.6.4-1998 (R2005), Screws, Tapping and Metallic Drive, Inch Series, Thread Forming and Cutting.
- .3 Canadian General Standards Board (CGSB).
  - .1 CGSB 93.5-92, Installation of Metal Residential Siding, Soffits and Fascia.
- .4 Canadian Standards Association (CSA International).
  - .1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
  - .2 CAN/CSA-G40.20/G40.21M-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels.
  - .3 CSA S136-07, Cold Formed Steel Structural Members.

**1.4 DESIGN REQUIREMENTS**

- .1 Design metal siding system in accordance with CSA S136, and to withstand live, dead, lateral, wind, seismic, handling, transportation, and erection loads.
- .2 Design metal siding system in accordance with Climatic Design Data contained in Ontario Building Code.

- .3 Design metal siding system to limit deflection under design loads, to  $L/240$ .
- .4 Design metal siding system to prevent restriction of thermal induced movement which would induce deformation such as warping, buckling, and failure of joint seals and fasteners. Design metal siding system to prevent vibration when subject to the effects of wind.
- .5 Design miscellaneous, additional structural framing members and sag rods, required to complete metal siding system, where not indicated on Contract Drawings.

## 1.5 SUBMITTALS

- .1 Shop Drawings:
  - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Indicate arrangement of sheets and joints, types and locations of fasteners and special shapes and relationship of panels to structural support members or support wall.
  - .3 Clearly detail and indicate locations of all Z clips, J-closures and edge trims.
  - .4 Describe in shop drawing details, suitable accommodation for the removal and joining of future cladding as described in 1.2.7 of this section and on drawings.
- .2 Samples:
  - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Submit duplicate 300 x 300 mm samples of siding material, of colour and profile specified.
- .3 Reports: Submit written field inspection and test report results after each inspection.
- .4 Manufacturer's Instructions:
  - .1 Submit manufacturer's installation instructions.

## 1.6 QUALITY ASSURANCE

- .1 Retain a licensed Professional Engineer, registered in Province of Ontario, to perform following services for metal siding Work:
  - .1 Design of metal siding Work.
  - .2 Review, stamp, and sign shop drawings.
  - .3 Conduct shop and field inspections and prepare and submit inspection reports.
- .2 Mock-up:
  - .1 Fabricate, deliver, and erect one full scale 1200 mm wide x 1800 mm high mock-up panel of metal siding construction, in location acceptable to Consultant.
  - .2 Demonstrate finish, colours, and quality of workmanship.
  - .3 Mock-up may form part of final Work, if acceptable to Consultant. Remove and dispose of mock-ups which do not form part of Work.



- .3 Pre-installation meeting: Arrange with manufacturer's representative, Contractor, and Consultant to inspect substrates, and to review installation procedures 48 hours in advance of installation.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- .1 Stockpile panels tilted to provide water run-off, free from ground contact on firm, level, non-staining supports extending full width of sheet and spaced not more than 450 mm apart. Cover components with opaque polyethylene sheet. Vent to allow air movement.

## **1.8 WASTE MANAGEMENT AND DISPOSAL**

- .1 Divert used metal cut-offs from landfill by disposal removed for disposal at the nearest metal recycling facility.
- .2 Divert reusable materials for reuse at nearest used building materials facility.
- .3 Divert unused caulking, sealants, and adhesive materials from landfill through disposal at hazardous material depot.

## **1.9 EXTENDED WARRANTY**

- .1 Submit a warranty for metal siding system, covering materials and labour and the repair or replacement of defective work in accordance with the Contract, but for five (5) years total.

## **Part 2 Products**

### **2.1 ACCEPTABLE MANUFACTURERS**

- .1 Metal siding:
  - .1 'Solarwall' by Conserval Engineering Inc. or approved alternative.
  - .2 Siding Location: Perforated metal panel for use on south & west elevations where noted

### **2.2 MATERIALS – METAL SIDING**

- .1 Perforated prefinished steel.
- .2 Profile as selected by the Consultant.
- .3 Siding: Galvanized steel, 26 gauge, ASTM A653 and ASTM A775.
- .4 Configuration: 32 mm ribs with 900 mm coverage.
- .5 Finish and finish: Silicon modified polyester (SMP) with inorganic and ceramic pigmentation.
  - .1 Colour: To be selected by Architect for manufacturer's full colour range.
- .6 Structural shapes, plates, sag rods, and similar items: CAN/CSA-G40.20-G40.21-M, Grade 300W.

- .7 Hollow structural sections: CAN/CSA-G40.20/G40.21-M Grade 350W, Class H.
- .8 Accessories:
  - .1 Stand-off components: Provide galvanized steel components to support panels in a manner as recommended by the manufacturer.
  - .2 Flashing: Provide flashing materials to match the metal and finish of the panels.
  - .3 Fasteners: Provide corrosion resistant self-drilling screws and rivets as recommended by the manufacturer. Exposed fasteners must be finished to match the panels.
  - .4 Touch-up paint: as recommended by panel manufacturer and compatible with prefinished coating.

### **Part 3 Execution**

#### **3.1 GENERAL**

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

#### **3.2 INSTALLATION**

- .1 Install cladding in accordance with CGSB 93.5, reviewed shop drawings and manufacturer's written instructions.
- .2 Supply and install miscellaneous, additional structural framing members, required to complete metal siding system, where not indicated on Contract Drawings.
- .3 Maintain joints in exterior siding, plumb, true to line, tight fitting, hairline joints.
- .4 Attach metal siding system components to prevent warping, buckling, and deformation induced by restriction of thermal induced movement.
- .5 Install sub-girts to masonry walls prior to the installation of the Urethane foam insulation
- .6 Install exterior finish siding to internal sub-girts with concealed fasteners.
- .7 Coordinate with mechanical Sections as required for ensure metal solar wall system is connected to fan inlet and ventilation system.
- .8 Provide notched and formed closures, sealed to arrest direct weather penetration at vertical profiles for exterior siding. Ensure continuity of "pressure equalization" of rain screen principle.
- .9 Provide alignment bars, brackets, clips, inserts, shims as required to securely and permanently fasten wall system to building structure.
- .10 Supply and install flashing at connection between roof and preformed metal siding.
- .11 Touch up marred surfaces with air dry formulation to match pre-finished siding if approved by Consultant, otherwise remove and replace damaged metal siding.

**3.3 CONTROL JOINTS**

- .1 Construct control joints, as indicated.
- .2 Use cover sheets, of brake formed profile, of same material and finish as adjacent material.
- .3 Use mechanical fasteners to secure sheet expansion joints materials.
- .4 Assemble and secure wall system to structural frame so stresses on sealants are within manufacturer's recommended limits.

**3.4 CLEANING**

- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.
- .2 Wash down exposed surfaces using solution of mild domestic detergent in warm water, applied with soft clean wiping cloths.
- .3 Remove excess sealant with recommended solvent.

**END OF SECTION**

1 General

1.1 INSTRUCTIONS

- .1 Comply with the Instructions to Bidders, the General Conditions of the Contract, the Supplementary Conditions and the General Requirements of Division 01.
- .2 Report in writing to the General Contractor any defects of surfaces or work prepared by other Sections which affect the quality or dimensions of the Work. Commencement of work implies acceptance of existing conditions and work by others.

1.2 SECTION INCLUDES

- .1 Cold Applied Built-up bituminous roofing system.

1.3 RELATED SECTIONS

- .1 Section 04 20 00 – Unit Masonry: Connection of wall vapour barrier system to roofing system.
- .2 Section 05 31 23 – Steel Roof Decking.
- .3 Section 06 10 00 - Rough Carpentry: cants, blocking and curbs.
- .4 Section 07 62 00 - Sheet Metal Flashing and Trim.
- .5 Section 07 72 00 - Roof Accessories: Manufactured hatches
- .6 Division 22 – Plumbing

1.4 REFERENCES

- .1 ASTM C931/931M-01: Standard Specification for Exterior Gypsum Soffit Board.
- .2 ASTM D4601-98: Standard Specification for Asphalt-Coated Glass Fibre Base Sheet Used In Roofing.
- .3 CSA A123.4 M1979: Bitumen for Use in Construction of Built Up Roof Coverings and Dampproofing and Waterproofing Systems.
- .4 CGSB 37 GP 9Ma: Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing.
- .5 CGSB 37-GP-52M: Roofing and Waterproofing Membrane, Sheet Applied, Elastomeric.
- .6 CAN/CGSB 51.33 M89: Vapour Barrier Sheet, Excluding Polyethylene, for Use in Building Construction.
- .7 CAN/ULC-S704-2001: Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.
- .8 CAN/ULC-S706-02: Standard for Wood Fibre Thermal Insulation for Buildings.

1.5 PERFORMANCE REQUIREMENTS

- .1 Install at specified Roof Area; - Cold Process Built Up Roof System Gravelled

- .1 Prime any new metal or wood components using Tremprime WB that are to receive asphaltic materials.
- .2 Install 0.5” DensDeck Prime into Low Rise Foam Adhesive.
- .3 Install self-adhering AVC membrane and associated primer over existing deck.
- .4 Build-up wood detail to suit new roof mounted equipment and insulation and thickness.
- .5 Install 2 layers of 2 1/2” Polyisocyanurate into Low Rise Foam Insulation Adhesive. Contractor is to verify existing insulation thickness at wall tie-in and are to match.
- .6 Install tapered insulation as per drawings into Low Rise Foam Insulation Adhesive.
- .7 Install Cover Board 2” (TopRock DD Plus by Rockwool) into Low Rise Foam Insulation Adhesive.
- .8 A built up roof membrane – 3 Ply Cold Process
- .9 Install Roofing Membrane as follows:
  - (1) Plies: Three
  - (2) Ply Type: Composite Felt, Three plies.
  - (3) Interply Adhesive: Burmastic Cold Process Adhesive
- .10 Surfacing: 3/8” Clean round pea gravel, free of all fines, splinters etc. into Cold Process Flood Coat.
- .2 Specified Flashings and accessories: Install flashings at all roof perimeters, projections, and drains incorporating:
  - .1 Reinforced EPDM/SBR Rubber sheet adhered with Elastomeric Bedding Adhesive as per detail drawings.
  - .2 Provide Products that are compatible with one another under field conditions, as demonstrated by roofing manufacturer.
  - .3 Provide watertight roofing system capable of resisting specified uplift pressures, thermally induced movement and exposure to weather without failing during the specified warranty period.
  - .4 Shop Drawings for Sloped Insulation: Indicate degree of slope and layout of sloping insulation on roof surfaces. Ensure positive drainage to roof drains. Provide drawings for crickets and roof drain sumps as required.

#### 1.6 CERTIFICATES

- .1 Manufacturer Certificates: Signed by roofing manufacturer verifying that installer is approved, authorized or licensed by manufacturer to install specified Products.
- .2 Installer Certificates: Signed by installer verifying that they have the specified qualifications described below.
- .3 Copy of Manufacturer’s 20 Year Warranty.

## 1.7 TEST REPORTS

- .1 Manufacturer Field Inspection Reports: manufacturer's written acceptance of roofing installation based on daily inspections.

## 1.8 QUALITY ASSURANCE

- .1 Manufacturer: qualified manufacturer having roofing systems listed by UL and approved for use by Factory Mutual.
- .2 Installer: a company and persons specializing in the application of protected elastomeric roofing, with documented experience and approved to apply roofing system by manufacturer.
- .3 Conform to CRCA Roofing Specifications and roofing membrane manufacturer's instructions.

## 1.9 PRE-INSTALLATION MEETINGS

- .1 Conduct pre-installation meeting.
- .2 Meeting: prior to commencement of deck installation, review and document methods and procedures related to roof deck and roofing system construction, including the following:
  - .1 Participants: authorized representatives of the General Contractor, Consultant, Owner, Roofing Subcontractor, Roofing Manufacturer, and installers of roof accessories and roof-mounted equipment.
  - .2 Review methods and procedures related to roofing installation, including manufacturer's written installation instructions.
  - .3 Review construction schedule and confirm availability of Products, Subcontractor personnel, equipment and facilities.
  - .4 Review deck installation criteria and finishes for conformance with roofing system criteria, including issues of flatness and fastening.
  - .5 Review structural loading conditions and limitations of roof deck both during and after roofing application.
  - .6 Review flashing details, special roofing details, roof drainage, roof penetrations, equipment curbs, and other conditions affecting roofing installation.
  - .7 Review governing regulatory requirements, and requirements for insurance and certificates as applicable.
  - .8 Review safety requirements, including temporary fall-arrest measures.
  - .9 Review field quality control procedures.

## 1.10 DELIVERY, STORAGE AND HANDLING

- .1 Deliver and store Products undamaged in original containers with manufacturer's labels and seals intact.
- .2 Store Products in designated areas elevated off the ground and protected from ultra-violet radiation, inclement weather and construction activities.

- .3 Store solvent-based liquids away from excessive heat and open flame.
- .4 Store adhesives and sealants at temperature above -5 degrees Celsius.
- .5 Store membrane rolls on end, dry, and protected from moisture and damage. Cover rolls, insulation and other moisture-sensitive Products with tarpaulins.
- .6 Store Products on roof deck in a manner to prevent overloading the structure and properly secured to prevent movement due to wind or other forces

#### 1.11 SITE CONDITIONS

- .1 Protect adjacent properties from damage as a result of contract operations.
- .2 Protect the Work and the Owner's property from damage as a result of contract operations.
- .3 Confine equipment, material storage, and operations of workers to limits indicated by laws, ordinances, permits, and prior arrangements with the Owner.
- .4 Do not interrupt or hamper occupant operations without prior written approval.
- .5 Remove progressively all debris created by the execution of the Work and dispose of same at appropriate disposal sites.
- .6 Alert the General Contractor to the expected presence of odours, fumes, or dust and co-ordinate the shielding of ventilation equipment or scheduling of process to achieve acceptable abatement.
- .7 Upon completion of the work, leave premises in original order and condition.

#### 1.12 ENVIRONMENTAL REQUIREMENTS

- .1 Do not install roofing during weather that might adversely affect the performance of the system.
- .2 Do not install roofing over surfaces that are wet, icy, dirty or otherwise unacceptable to the system being installed.
- .3 Secure the Work in a safe and watertight fashion before the onset of inclement weather and at the end of each day's work.

#### 1.13 WARRANTY

- .1 Submit warranties in accordance with the General Conditions of the Contract.
- .2 Installer's Warranty: standard 2 year warranty, commencing from the date of Substantial Performance of the Work.
- .3 Manufacturer's Warranty: a written guarantee that the manufacturer will replace, at no cost to the Owner, any portion of the roofing membrane which experiences actual leaks resulting from defects in the manufacture of the membrane for a period of 20 years, commencing from the date of Substantial Performance of the Work.

#### 1.14 MAINTENANCE

- .1 The Manufacturer shall issue a non-prorated warranty for a period of Twenty Years. All components from the vapour retarder up shall be covered under this warranty.

- .2 Warranty shall include inspections in years 2 and 5, 10 & 15 of the warranty. The following duties shall be carried out at no extra cost to the Owner as required, by the Manufacturer.
  - .1 sealing of flashing seams
  - .2 filling of pitch pockets
  - .3 repairs to blisters and ridges
  - .4 caulking at metal details as required
  - .5 written inspection report
  - .6 removal of light debris from the roof and premises
  - .7 cleaning of drain screens.
- .3 Documentation shall be provided that the manufacturer has personnel to carry out above noted warranty requirements and has a history of providing these for a minimum of 5 years.
- .4 Upon satisfactory completion, the warranty and all construction information regarding the roof installation shall be placed on an Online Roof Management Program at no additional cost to the Owner.
- .5 Prior to the 2 year expiration of the contractor's warranty, the manufacturer shall carry out an Infra-Red Scan of the roof areas completed under this contract.

## 2 Products

### 2.1 PRODUCTS

- .1 All primers, adhesives, sealants (including hardener), joint filler, grout, epoxy, sealers, and finishes applied on site and within weather barrier shall meet environmental requirements for low emitting materials.

### 2.2 MANUFACTURERS

- .1 Manufacturers of cold-applied built-up asphalt roofing systems having Products considered acceptable for use as per Tender 6862-KP-18:
  - .1 Tremco Canada.

### 2.3 MATERIALS

- .1 Primer:
  - .1 Tremprime WB by Tremco.
  - .2 Insulation and Substrate Board: To provide an average R Value of 35.
    - (1) DensDeck Prime 0.5"
    - (2) Insulation 2 layers of Polyisocyanurate 2 1/2"
    - (3) Overlay Insulation – 2" TopRock DD Plus by Rockwool.
    - (4) Tapered Insulation & Sumps: ModulR.



- .2 Insulation and Substrate Board Adhesive
  - .1 Low Rise Foam Insulation Adhesive by Tremco.
- .3 Vapour Retarder
  - .1 AVC Membrane and Primer.
- .4 Flashing Membrane
  - .1 TRA membrane
- .5 Cold Applied BUR. Burmastic by Tremco
  - .1 Three Ply Composite Ply Felt
- .6 Reinforcing Membrane:
  - .1 Burmesh by Tremco.
- .7 Ballast:
  - .1 3/8” Pea Gravel free of fines and long splinters.

## 2.4 ACCESSORIES

- .1 Stack Flashings: Prefabricated aluminum sleeves as manufactured by Thaler Metal Industries or equivalent.
- .2 Drains: Prefabricated drains as manufactured by Altra Metal Specialties – Mode ABD-CR-X-SS: Aluminum Body Roof Drain complete with clamping ring.
- .3 Metal Flashings and Coping
  - .1 Metal counter flashings and caps shall be 26 gauge, G90 galvanized Grade A steel conforming to ASTM A525. Finish to be Stelco 8000 series and colour to be as selected by the Board. Obtain written confirmation of colour prior to ordering.
  - .2 Two-piece gooseneck flashings are to be installed around all electrical projections.
- .4 Sealant
  - .1 One-part polyurethane – approved product and manufacturer – Dymonic by Tremco.

## 2.5 SHOP FINISHING

- .1 Galvanizing: to ASTM A653/A653M, zinc coating, hot dip process, minimum G90 coating.
- .2 Shop Painted Finish: baked ceramic pigmentation coating, applied to a minimum 1 mil dry film thickness and having a specular gloss of 30 (plus or minus 5) gloss units when measured with a Gardner 60 degree gloss meter; eg. Colorite HMP by Valspar, colour as selected by Consultant from standard range of colours.

3 Execution

3.1 PREPARATION – ROOF AREAS AS PER DRAWINGS

- .1 Examine all drains and report any plugged drains to the Inspector. Any drains not reported and found plugged at the end of the contract will be deemed the responsibility of the contractor. Use temporary plugs during roof removal operations and remove before the end of each working day or when rain is imminent.
- .2 Remove existing counter flashing at tie-in and dispose.
- .3 Remove existing roofing, insulation and vapour retarder at tie-in to existing roof.
- .4 Verify acceptability of deck, projections, curbs, parapets, walls and other constructions as these pertain to the roofing work and its expected performance.
- .5 Correct any deficiencies in these constructions or advise General Contractor of conditions believed to be beyond the Scope of Work.
- .6 Fill and pack all joints, cracks, seams, and openings in the deck and its appurtenances to prevent air leakage from the building interior.

3.2 ROOF DECK

- .1 Deck reattachment:
  - .1 Mechanically reattach loose sections of deck to steel or wood support members according to existing fastening pattern.
- .2 Deck replacement:
  - .1 Remove defective decking. Examine supports. If unsound, contact General Contractor immediately for future action.
  - .2 Install new decking in accordance with appropriate building regulations and CSSBI, (Canadian Sheet Steel Building Institute).
- .3 Deck protection (Metal):
  - .1 Remove loose flaking rust, down to clean, dust free, sound metal surface.
  - .2 Apply one coat of rust inhibitive paint over prepared surface at the rate of 6 m<sup>2</sup>/litre (250 ft<sup>2</sup>/gal).

3.3 AIR BARRIER

- .1 Apply primer and install on to substrate, overlapping side and end laps in conformance with manufacturer's written recommendations. Begin work at bottom of slopes, unroll and align on substrate. Ensure all edges are supported.
- .2 Remove release sheet and adhere membrane, working in sections to avoid wrinkles in membrane.
- .3 Seal membrane at insulation perimeters and around penetrations to ensure sealed connections with base sheet at upstands.
- .4 Sprayed in Place Foam:

- .1 Fill all cavities and joints with foam according to manufacturer's directions.

### 3.4 CARPENTRY

#### .1 Wood Blocking

- .1 Construct wood blocking as per details. Blocking, or several thicknesses of wood may be necessary so that the top of the nailer will be level with the top of the roof insulation or top of the deck (if no insulation is used).
- .2 Offset blocking layers 300mm (12 inches) and weave corners.
- .3 Assemble blocking using two staggered rows of nailing. Space nails in any row a maximum of 600mm (24 inches) on centre. Within 2440mm (8 feet) of outside corners, reduce maximum spacing to 300mm (12 inches) on centre.

#### .2 Wood Cants

- .1 Install wood cants over nailer. Nail two (2) rows staggered. Spacing in any one (1) row shall not exceed 600 mm (24 inches). Within 2440 mm (8 feet) of outside corner, spacing shall not exceed 300 mm (12 inches) in any one (1) row. Mitre all inside and outside corners of the wood cant.

### 3.5 THERMAL BARRIER UNDERLAY BOARD

- .1 Fully adhere thermal barrier underlay board to roof deck using Low Rise Foam Adhesive at manufacturers recommended rate.

### 3.6 VAPOUR RETARDER

#### .1 Self-Adhering Membrane

- .1 Apply primer and install on to substrate, overlapping side and end laps in conformance with manufacturer's written recommendations. Begin work at bottom of slopes, unroll and align on substrate. Ensure all edges are supported.
- .2 Remove release sheet and adhere membrane, working in sections to avoid wrinkles in membrane.
- .3 Seal membrane at insulation perimeters and around penetrations to ensure sealed connections with base sheet at upstands.

### 3.7 INSULATION

#### .1 NB: Adhered with Low Rise Foam Insulation Adhesive

- .1 Firmly butt each insulation board to surrounding boards. Do not jam or deform owners.
- .2 Minimize elevation variation between boards at joints to provide level surface to accommodate subsequent roofing.
- .3 Stagger joints at least 150mm (6 inches).
- .4 Leave no voids at blocking, penetrations, walls, or parapets.
- .5 At all drains and scuppers slope insulation for a radius of 1200 mm (48 inches) to ensure positive drainage.

- .6 Adhere insulation into ribbons of low rise foam insulation adhesive in ½” to ¾” beads approximately 12” o.c.
- .7 Immediately after placement, walk insulation boards into adhesive to achieve solid contact.

### 3.8 COLD APPLIED BUR

#### .1 Three Ply – Cold

- .1 Starting at the low point of the Roof, install three (3) plies of ply sheet, shingle fashion. Overlap starter strips 660 mm (26 inches) with first ply, then overlap each succeeding ply 625 mm (24 2/3 inches). Place ply sheets to ensure water will flow over or parallel to; but never against exposed edges.
- .2 Embed into Cold Process Adhesive, 300, 600 and 900 mm (12, 24 and 36 inch) wide plies to start and finish roof membrane along roof edges and terminations.
- .3 Solidly coat each ply of felt for the full width with Cold Process Adhesive. Immediately after installation, broom and/or roll ply sheet. Ensure complete and continuous seal and contact between adhesive and felts, including ends, edges and laps without wrinkles, fish mouths, or blisters.
- .4 Extend all plies to the top edge of all cant strips and cut off evenly.
- .5 Apply uniform and continuous pressure to exposed edge and end laps to ensure complete adhesion.
- .6 Avoid walking on plies until adhesive has set.
- .7 Overlap previous days’ work 600 mm (24 inches) as required.
- .8 Cut out fishmouths/side laps which are not completely sealed and patch. Replace all sheets which are not fully and continuously bonded.
- .9 Lap ply membrane ends 150 (6 inches). Stagger end laps 1 metre (3 feet) minimum.
- .10 Adhesive application rate: Minimum 1.0 Litres/Sq. Metre (2.5 Gals per 100 Sq. ft).

### 3.9 TEMPORARY WATERSTOP/TIE-INS

- .1 Remove embedded gravel, dirt and debris from top ply of felt along termination for a distance of 450 mm (18 inches).
- .2 Extend roofing system at least 300 mm (12 inches) onto prepared area installing insulation fillers as required.
- .3 Seal edge with 150 mm (6 inch) wide reinforcing membrane embedded between alternate courses of temporary waterstop adhesive.
- .4 At beginning of next day's work, remove temporary connection by cutting felts evenly along edge of existing roof system and remove insulation fillers.
- .5 Temporary waterstop adhesive application rate:
  - .1 Cold 3.3 l/m<sup>2</sup> (12 ft<sup>2</sup>/gallon)

### 3.10 PERMANENT WATERSTOP/TIE-INS

- .1 Remove embedded gravel, dirt and debris from top ply of felt along termination for a distance of 450 mm (18 inches).
- .2 Install 450 mm (18 inch) wide ply sheet(s) from exposed deck to the existing roofing with a continuous application of permanent waterstop adhesive.
- .3 Extend roofing system beyond permanent waterstop ply sheet and at least 300 mm (12 inches) onto prepared area of adjacent roofing.
- .4 Seal leading edge of new membrane with 300 mm (12 inch) wide reinforcing membrane embedded between alternate courses of flashing adhesive.
- .5 Permanent waterstop adhesive application rate:
  - .1 Cold Adhesive 3.3 l/m<sup>2</sup> (12 ft<sup>2</sup>/gallon)

### 3.11 FLASHINGS

- .1 Canted eave with fascia: Elastomeric sheeting including replacement of Gravel Stop Details.
  - .1 Extend reinforced elastomeric sheeting over outside face of cant and fascia and secure to underside of fascia. Mechanically fasten with 38 mm (1.5 inch) common roofing nails, 200 mm (8 inches) on centre.
  - .2 Extend reinforced elastomeric sheeting down over cant strip and embed in flashing adhesive onto roof surface a minimum of 150 mm (6 inches).
  - .3 Ensure complete bond and continuity without wrinkles or voids. Lap sheeting ends 100 mm (4 inches); and adhere with flashing adhesive.
  - .4 Overcoat lap edges with end lap stripping adhesive and membrane.
  - .5 Tie in leading edge of sheeting with stripping ply membrane embedded between alternate courses of stripping ply adhesive.
- .2 Low parapet wall flashing: Elastomeric Sheeting
  - .1 The exposed joint between the wall and deck shall be sealed securely to provide a complete air seal.
  - .2 Adhere elastomeric sheeting completely to flashing surface, cant, and roofing with flashing adhesive.
  - .3 Ensure complete bond and continuity without wrinkles or voids. Lap sheeting ends 100 mm (4 inches); and adhere with flashing adhesive.
  - .4 Extend elastomeric sheeting up and over parapet at least 38 mm (1.5 inches) and face nail with 38 mm (1.5 inches) common roofing nails, 200 mm (8 inches) O.C.
  - .5 Overcoat lap edges with end lap stripping adhesive and membrane.
  - .6 Tie in leading edge of sheeting with stripping ply membrane embedded between alternate courses of stripping ply adhesive.

.3 Wall Flashing: Elastomeric Sheeting

- .1 The exposed joint between the wall and deck shall be sealed securely to provide and complete air seal.
- .2 Adhere elastomeric sheeting completely to flashing surface, cant and roofing with flashing adhesive.
- .3 Ensure complete bond and continuity without wrinkles or voids. Lap sheeting ends 100 mm (4 inches) and adhere with flashing adhesive.
- .4 Elastomeric sheeting width: sufficient to extend at least 150 mm (6 inches) beyond toe of the cant onto roof surface and 200 mm (8 inches) above the roof surface.
- .5 Secure the top of the elastomeric sheeting to the vertical plane with a flashing termination bar. Mechanically fasten 300 mm (12 inches) O.C. Overcoat bar with end lap stripping adhesive and membrane.
- .6 Overcoat lap edges with end lap stripping adhesive and membrane.
- .7 Tie in leading edge of sheeting with stripping ply membrane embedded between alternate courses of stripping ply adhesive.
- .8 Flashing detail shall conform to drawing entitled, Base Flashing for wall flashing (with thru-wall counterflashing).

.4 Soil Stack Flashings:

- .1 Apply elastomeric flashing adhesive to the prepared area and place aluminum base over the pipe and set into the flashing adhesive.
- .2 Prime flange.
- .3 Install elastomeric sheeting with stripping ply adhesive and membrane.
- .4 Cover flange completely. Extend flashing at least 100mm (4 inches) onto adjacent roofing. Remove wrinkles and voids. Lap flashing ply ends 100mm (inches).
- .5 Tie in leading edge of sheeting with stripping ply membrane embedded between alternate courses of stripping ply adhesive.

.5 Pitch pans:

- .1 Apply 1.5 mm (1/16 inch) uniform layer of flashing adhesive to surface receiving metal flange.
- .2 Install pre-manufactured pitch pan into adhesive. Prime flange prior to installation.
- .3 Pitch pans shall be a 24-gauge galvanised steel, a minimum 100 mm (4 inches) high. There shall be at least 50 mm (2 inches) clearance between the projection and side wall.
- .4 Adhere elastomeric sheeting completely to flashing surface with flashing adhesive. Cover flange completely. Extend flashing at least 100mm (4 inches) onto adjacent roofing. Ensure complete bond and continuity without wrinkles and voids. Lap sheeting ends 100mm (inches).
- .5 Overcoat lap edges with end lap stripping adhesive and membrane.

- .6 Tie in leading edge of sheeting with stripping ply membrane embedded between alternate courses of stripping ply adhesive.
- .7 Fill pitch pan 25 mm (1 inch) from top with pitch pan base filler.
- .8 Fill remainder with pitch pan topping mastic. The mastic shall be crowned in order to ensure water run-off.
- .9 Install metal cap and caulk opening.

### 3.12 METAL FLASHINGS

- .1 Installation of metal flashing shall be in accordance with the metal flashing section of the Canadian Roofing Contractors' Association (CRCA) manual.

### 3.13 SURFACING APPLICATION

- .1 Gravel Finish
  - .1 Prior to application of surface treatment system, contractor shall inspect roof with manufacturer's representative.
  - .2 Ensure surface is clean and dry. Flood coat the entire roof with specified flood coat bitumen at the rate of 6 gallons per square (cold adhesive) or 60 lbs. per square
  - .3 Immediately broadcast minimum 25 kg per sq. metre (500 lbs. per 100 sq. ft.) of new, clean, dry roofing gravel. Cover flood coat material completely.
  - .4 Rake out gravel to provide a neat even surface.

### 3.14 CLEANING

- .1 Refer to Section 01 74 00.
- .2 Clean drains of debris, ensuring free drainage.
- .3 Clean adjacent roof surfaces, levels and ground level areas of debris and excess Products.

### 3.15 PROTECTION

- .1 Adequately protect Products and work from damage by weather, traffic and other causes.
- .2 At the end of each Working Day, seal exposed edges of roofing membrane to be watertight.
- .3 Protect adjacent Work from damage. Repair damage.

END OF SECTION

## 1. GENERAL

### 1.1 Section Includes

1. Section includes for provision of all labour, materials, equipment and services for sheet metal flashing and trim Work in accordance with Contract Documents.

### 1.2 Related Sections

1. Section 06 10 00 Rough Carpentry
2. Section 07 51 00 Built-up Bituminous Roofing
3. Section 07 51 01 2-Ply Modified Bitumen Roofing
4. Section 07 92 00 Joint Sealers
5. Section 08 50 50 Aluminum Windows

### 1.3 References

1. Sheet Metal and Air Conditioning Contractors' National Association, Inc. (SMACNA) – Architectural Sheet Metal Manual
2. ASTM A 525M, Standard Specification for Sheet Steel, Zinc Coated (Galvanized) by the Hot Dipped Process, General Requirements.
3. Canadian Roofing Contractors Association (CRCA) – Specification Manual
4. Canadian Sheet Steel Building Institute (CSSBI) Bulletin No. 9, Core and Maintenance of Pre-finished Sheet Steel Building Products.

### 1.4 Operations

1. Perform operations, at times designated by the *Owner*, that will not adversely affect occupants of building and operations in and around site access and egress.

### 1.5 Protection

1. Protect work of this section from damage. Damaged work which cannot be satisfactorily repaired, restored or cleaned, shall be replaced at no cost to *Owner*.

### 1.6 Submittals

1. Submit samples of flashing and sheet metal type and colour to *Consultant* and *Owner* for review prior to commencing work.

### 1.7 Mock-Up

1. Fabricate mock-ups in minimum 2440 mm (8 ft.) lengths with reviewed materials, approved methods including, joints, seams, expansion joints, starter strips and fasteners.
2. Mock-up, if accepted, shall represent the minimum standard for work. Mock-up may be included as part of final work



## 1.8 Quality Assurance

1. Flashing and Sheet Metal Work shall be executed in accordance with SMACNA Architectural Sheet Metal Manual - 1993 (Addendum No. 1 – October 31, 1997), by skilled trades having experience installing this product.

## 1.9 Warranty

1. Provide minimum two (2) year Warranty from date of Substantial Performance, as certified by *Consultant*. Warranty shall be submitted against defects in workmanship and materials.
2. *Contractor* must extend the Warranty on replaced parts and workmanship for a period of two (2) years from date of acceptance of replacement parts and workmanship. Defects will include but will not be limited to leaking, failure to stay in place, lifting, deformation and breaking of weathertight seals.
3. Provide all additional Warranties that may be available from manufacturer.

## 2. PRODUCTS

### 2.1 Material

1. Prefinished steel sheet: Galvanized steel, 0.71 mm (24 gauge) core nominal thickness, conforming to ASTM A525, Z275 zinc coated (galvanized) to designation G90 by the hot dip process, with a prefinished coat. Profiles as detailed.
2. Precoat Finish: Perspectra Plus Series, factory applied coating. Colour to be approved by *Owner* from standard colours listed in General Colour Card.
  1. Colour – to be selected by consultant from standard colours.
3. Starter strips: Fabricated from prefinished steel sheet, 0.87 mm (22 gauge) core nominal thickness. Minimum 75 mm (3 in.) wide face or as detailed and to be continuous.
4. Termination Bar: 3 mm x 25 mm (1/8 x 1 in.) extruded aluminum bar.
5. Touch-up paint: As supplied and recommended by sheet steel manufacturer.
6. Exposed Sheet Metal Fasteners: Self-Drilling Hex Head with washer and colour coded cap.
7. Cap, Counter and Fascia Metal to be fabricated to layouts and details shown on drawings and to extent required.
8. Overflow Scuppers: Overflow (Where Shown on Drawings): Fabricated from 0.71 mm (24 gauge) stainless steel. To be a minimum 200 mm wide x 100 mm high (8 x 4 in.) with continuously soldered seams with a 150 mm (6 in.) wide apron/flanges.
9. Fasteners: In accordance with Section 06 10 00 – Rough Carpentry
10. Sealants: In accordance with Section 07 92 00 – Joint Sealers

### **3. EXECUTION**

#### **3.1 Fabrication**

1. Shop fabricate flashing, sheet metal and trim in accordance with requirements of SMACNA and the Contract Documents. Form sheet metal on bending brake, shaping, trimming and hand seaming on bench.
2. Form sections square, true, and accurate to size. Flashings shall be free from distortion, oil canning, twists, buckles, discolouration and other defects detrimental to appearance and performance.
3. Double back all edges a minimum of 13 mm (1/2 in.). Raw cut-edges are not acceptable.
4. Form joints with S-locks and make allowances for movement. Mitre and form standing seams at all corners. Make allowance for movement at joints.
5. Fabricate cap flashings, counter flashings and starter strips to details shown and where required.
6. Fabricate metal in 2400 mm (8 ft.) maximum lengths with an unbroken face less than 225 mm (9 in.). Form flashings with an exposed unbroken face exceeding 225 mm (9 in.) and a girth greater than 610 mm (24 in.) in 1220 mm (4 ft.) maximum lengths.
7. Provide horizontal stiffening rib “V” on all face metal exceeding 225 mm (9 in.) in girth and where shown on drawings.
8. Provide an ‘S-Lock’ joint at all end joints and at all horizontal joints between the cap flashing and the vertical flashing and between the vertical flashing and base counter flashing.
9. Where soldered joints are absolutely necessary and where approved for use in prepainted metal, clean paint off both surfaces before soldering for minimum area necessary.
10. Exposed sheet metal coming in contact with a metal of a different type must be back painted with two (2) coats of isolation coating.

#### **3.2 Sheet Metal Flashing and Trim**

1. Provide a continuous starter strip on exterior side for all metal cap, fascia and counter flashings and secure at a maximum 305 mm (12 in.) on centre with flat headed screws.
2. Install flashings and sheet metal that includes but not limited to; cap flashings, counter flashings, curb and sleeper counter flashings, starter strips and other miscellaneous trim work in accordance with Contract Documents.

3. Parapet and perimeter cap flashings shall be installed with a **minimum 10% positive slope** to interior of roof. Slope to be provided by installation of continuous wood shims, plywood and wood blockings as detailed and in accordance with Section 06 10 00 – Rough Carpentry.
4. Saw cut new reglet, minimum 13 mm high x 25 mm deep (1/2 in. x 1 in.) into masonry surfaces to accommodate installation of sheet metal counter flashings.
5. Return top edge of metal counter flashings into reglet 19 mm (3/4 in.). Secure flashings with pin grips spaced at maximum 305 mm (12 in.) on centre and apply sealant bead to shed water.
6. Install sheet metal work with concealed fasteners. Install exposed fasteners only when and where permitted by *Consultant*. Install fasteners in an approved manner as to prevent water penetration at point of fastening and to be evenly and neatly distributed.
7. Provide continuous termination bar at top edge of membrane flashings. Fasten termination bar to substrate at a maximum 305 mm (12 in.) on centre with appropriate and approved fasteners. Top edge of counter flashing shall be inserted under cap flashings.
8. Fasteners are to be located minimum of 305 mm (12 in.) above roof membrane – where possible.
9. End joints of adjacent lengths shall be completed using ‘S-Lock’ joints. This shall be accomplished by inserting end of one length in a 25 mm (1 in.) deep "S" lock formed in end of adjacent length. Concealed portion of "S" lock shall extend 25 mm (1 in.) outwards and shall be secured to substrate with flat head screws at 100 mm (4 in.) on centre.
10. Provide three (3) exposed fasteners on interior side of cap flashing, evenly spaced at 610 mm (24 in.) per 2400 mm (8 ft.) length. Use colour ceded screws with washers.

### 3.3 Overflow Scuppers

1. Where indicated on drawings, install new scuppers and secure to substrate. Overflow scuppers shall be set no higher than 50 mm (2 in.) above lowest point of roof area.
2. Flash in scupper flanges in accordance with Section 07 52 16 SBS Modified Bituminous Membrane Roofing

### 3.4 Clean-up

1. Remove all excess materials, debris, tools and equipment as work proceeds and on completion, or sooner if requested by *Consultant*.

**End Of Section 07 62 00**

**Part 1 General**

**1.1 RELATED WORK**

- .1 Fire stopping and smoke seals within mechanical assemblies (i.e. inside ducts, dampers) and electrical assemblies (i.e. inside cable trays) are specified in Division 26 and 33 respectively.

**1.2 REFERENCES**

- .1 Underwriters Laboratories of Canada (ULC)
  - .1 ULC-S115-[1995], Fire Tests of Firestop Systems.

**1.3 SAMPLES**

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit duplicate 300 x 300 mm samples showing actual firestop material proposed for project.

**1.4 PRODUCT DATA**

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit manufacturer's product data for materials and prefabricated devices, providing descriptions are sufficient for identification at job site. Include manufacturer's printed instructions for installation.

**1.5 WASTE MANAGEMENT AND DISPOSAL**

- .1 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

**1.6 SYSTEM DESCRIPTION**

- .1 Firestopping Materials: CAN4-S115M ASTM E814 to achieve a fire protection rating as noted on Drawings.
- .2 It is the intent of this Section that in conjunction with Divisions 26 and 33 a competent, single source be responsible for the firestopping and smoke seals of the entire project.

**1.7 QUALITY ASSURANCE**

- .1 Manufacturer: Company specializing in manufacturing products of this Section with minimum five years documented experience.
- .2 Applicator: Approved, licensed and supervised by the manufacturer of firestopping materials. Company with minimum five years documented experience.
- .3 Product: Manufactured under ULC Follow-up Program. Each container or package shall bear ULC label.

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## **1.8 REGULATORY REQUIREMENTS**

- .1 Conform to applicable code for fire protection ratings.
- .2 Provide certificate of compliance for authority having jurisdiction indicating approval.

## **1.9 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver and store materials in a dry, protected area, off ground in original, undamaged, sealed containers with manufacturer's labels and seals intact.

## **1.10 PROJECT AND SITE CONDITIONS**

- .1 Application temperature and ventilation as per Manufacturer's instructions.

## **1.11 SEQUENCING AND SCHEDULING**

- .1 Sequence work to permit installation of firestopping and smoke seal materials to be installed after adjacent work is complete and before closure of spaces.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 A/D Firebarrier Firestop Systems, by A/D Fire Protection Systems Inc., capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of CAN4-S115 and not to exceed opening sizes for which they are intended.
- .2 Mineral Wool Backing Insulation: ULC labeled, preformed non-combustible material (A/D Firebarrier Mineral Wool) by A/D Fire Protection Systems Inc.
- .3 Retainers: Clips to support mineral wool.
- .4 Firestopping Sealant: ULC labeled, single component silicone based, A/D Silicone Firebarrier Sealant by A/D Fire Protection Systems Inc.
- .5 Firestopping Seal: ULC labeled, single component water-based seal, A/D Firebarrier Seal by A/D Fire Protection Systems Inc.
- .6 Firestopping Foam: ULC labeled, two component silicone foam, A/D Firebarrier RTV Foam by A/D Fire Protection Systems Inc.
- .7 Firestopping Mortar: ULC labeled, non-combustible fibre reinforced, foamed cement mortar, A/D Firebarrier Mortar by A/D Fire Protection Systems Inc.
- .8 Damming Material: In accordance with tested assembly being installed as applicable and as acceptable to authorities having jurisdiction.

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**Part 3 Execution**

**3.1 PREPARATION**

- .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.
- .2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.
- .3 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour barrier.
- .4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.
- .5 Verify that openings are ready to receive the Work of this Section.
- .6 Confirm compatibility of surfaces to receive firestopping and smoke seal materials.
- .7 Beginning of installation means acceptance of existing surfaces and substrate.

**3.2 INSTALLATION**

- .1 Install firestopping in wall cavities in accordance with the OBC 3.1.11., in cavities 25mm and greater, spaced 3.0m max. vertically and 20m max. horizontally.
- .2 Install fire stopping and smoke seal material and components in accordance with ULC certification and manufacturer's instructions.
- .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 are maintained.
- .4 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.
- .5 Tool or trowel exposed surfaces to a neat finish.
- .6 Remove excess compound promptly as work progresses and upon completion.
- .7 Apply in sufficient thickness to achieve rating to uniform density and texture.
- .8 Protect installed material until cured or set.

**3.3 INSPECTION**

- .1 Notify Consultant when ready for inspection and prior to concealing or enclosing firestopping materials and service penetration assemblies.

**3.4 SCHEDULE**

- .1 Firestop and smoke seal at:

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- .1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.
  - .2 Top of fire-resistance rated masonry and gypsum board partitions.
  - .3 Intersection of fire-resistance rated masonry and gypsum board partitions.
  - .4 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.
  - .5 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.
  - .6 Openings and sleeves installed for future use through fire separations.
  - .7 Around Mechanical and Electrical assemblies penetrating fire separations.
  - .8 Refer to Drawings for horizontal and vertical fire stop locations and for typical firestopping detail at cavity wall, for top of wall fire separation assembly and for fire separation locations.

### **3.5 CLEAN UP**

- .1 Remove excess materials and debris and clean adjacent surfaces immediately after application.
- .2 Remove temporary dams after initial set of fire stopping and smoke seal materials.

**END OF SECTION**

## **1. GENERAL**

### **1.1 Section Includes**

1. Section includes for provision of all labour, materials, equipment and services for joint sealers in accordance with Contract Documents.

### **1.2 Related Sections**

1. Section 06 10 00 Rough Carpentry
2. Section 07 52 16 SBS Modified Bituminous Membrane Roofing
3. Section 07 62 00 Sheet Metal Flashing and Trim

### **1.3 References**

1. Sealants acceptable for use on this project must be listed on CGSB Qualified Products List issued by CGSB Qualifications Board for Joint Sealant.
2. CAN/CGSB-19.24 - Multi-Component, chemical curing sealing compound.
3. CAN/CGSB-19.13 - Single Component, elastomeric, chemical curing sealing compound.
4. CGSB 19-GP-14 - Sealing Compound, One-Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing.

### **1.4 Operations**

1. Perform operations, at times designated by the *Owner*, that will not adversely affect occupants of building and operations in and around site access and egress.

### **1.5 Protection**

1. Protect work of this section from damage. Damaged work which cannot be satisfactorily repaired, restored or cleaned, shall be replaced at no cost to *Owner*.

### **1.6 Submittals**

1. Submit samples of sealant type and colour to *Consultant* and *Owner* for review prior to commencing work.

### **1.7 Quality Assurance**

1. Skilled trades with specific training and expertise in related experience shall execute Work.

### **1.8 Mock-Up**

1. Construct mock-up to show location, size, shape and depth of joints complete with back-up material, primer, sealant and tooling. Mock-up may be included as part of finished work.

### **1.9 Warranty**

1. Provide minimum two (2) year Warranty from date of Substantial Performance, as certified by *Consultant*. Guarantee shall be submitted against defects in workmanship and materials.



2. *Contractor* must extend Warranty on replaced parts and workmanship for a period of two (2) years from date of acceptance of replacement parts and workmanship. Defects will include but will not be limited 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 on surfaces.
3. Provide all additional Warranties that may be available from manufacturer.

#### **1.10 Environmental Requirements**

1. Conform to manufacturer's recommended temperatures, relative humidity and substrate moisture content for application and curing of sealants.
2. Materials must be stored at minimum of 20°C (68°F) immediately prior to application. Sealant applications must be carried out when ambient temperature is above 0°C (32°F).

### **2. PRODUCTS**

#### **2.1 Material**

1. All materials in a sealant system shall be compatible with each other and with substrate.
2. Colour(s) of sealants shall be selected to match adjacent substrate and shall be approved by *Consultant* or *Owner*.
3. Elastomeric Sealants: One part elastomeric, non-sag urethane based sealant, for masonry to masonry, masonry to metal junctions. Acceptable Material:
  1. Dymonic as manufactured by Tremco Incorporated.
  2. Precast Wall (Vertical Joints) - Three-component, chemically curing, epoxidized polyurethane sealant, 'Dymeric 240' by Tremco Incorporated.
4. Silicone sealants: Silicone based sealant, for metal to metal junctions. Acceptable Material:
  1. Spectrum 2 as manufactured by Tremco Incorporated.
  2. Dow Corning 999-A Silicone Building & Glazing Sealant by Dow Corning Canada Inc. Colour to match adjacent surfaces.
  3. DOWSIL983 Structural Glazing Sealant by Dow Corning Canada Inc.

5. Butyl sealants: Butyl rubber and polyisobutylene blend sealant. Butyl sealant to be compatible with modified bituminous membrane flashings. Acceptable Material:
  1. Tremco Butyl Sealant as manufactured by Tremco Incorporated.
  2. Modified Membrane manufacturer's approved sealant.
6. Joint Backing: Polyethylene, urethane, neoprene or vinyl, extruded foam recommended by the sealant manufacturer. Circular shape with diameter 25% greater than joint width before installation.
7. Void Filler: Glass fibre insulation with a nominal density of 14 kg/m<sup>3</sup> (Sized for 25% compression).
8. Primer: As recommended by sealant manufacturer to assure adhesion of compound and to prevent staining of substrate materials.
9. Joint Cleaner: Non-corrosive and non-staining type, compatible with joint forming materials and sealant as recommended by sealant manufacturer.
10. Bond Breaker Tape: Polyethylene bond breaker tape, which will not bond to sealant.

### **3. EXECUTION**

#### **3.1 Preparation**

1. Clean joint surfaces of: dust, oil, grease, oxidation, millscale, coatings and all other loose and deleterious material by cutting, brushing, scrubbing, scraping and grinding of substrate that may impair work.
2. Examine joint sizes and conditions to establish correct depth to width ratio for joint backing and sealant.
3. Rake out joints, cracks and crevices to receive sealant, to a depth measuring half the joint width. Provide new reglets at all masonry mortar joints to receive metal counter flashing and sealant.
4. Ensure joint surfaces are dry and frost free. Prepare substrate as recommended by sealant manufacturer ensuring adjacent surfaces are not damaged.
5. Commencement of Work implies acceptance of existing conditions and assuming full responsibility for finished condition of the Work.

### 3.2 Priming

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

### 3.3 Sealant Application

1. Install joint backing all joints prior to applying sealants. Diameter of backing material shall be 25% more than width of joint.
2. **Maintain minimum 2:1 width to depth ratio for sealant.**
3. Apply bond breaker tape where joints are of insufficient size to install joint backing or at 90° junctions or where required by sealant manufacturer or *Consultant*. Ensure bond surface area meets the minimum required size recommended by sealant manufacturer.
4. Apply sealant in continuous beads, in solid contact to underlying surfaces with sufficient pressure to fill voids and joints solid.
5. Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets and embedded impurities. Superficial skin bead is not acceptable.
6. Tool exposed surfaces before skinning occurs to attain concave shape using approved tools.
7. Cure sealant in accordance with the manufacturer's requirements. Do not cover up sealants until proper curing has taken place.

### 3.4 Clean-up

1. Clean adjacent surfaces immediately and leave work neat and clean.
2. Remove excess and droppings using recommended cleaners as work progresses.
3. Remove bonding tape after initial set of sealant.
4. Remove all excess material, debris, tools and equipment as work proceeds and on completion, or sooner if requested by *Consultant*.

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 07 92 10 - Joint Sealing: Caulking of joints between frames and other building components.
- .3 Section 08 71 10 - Door Hardware - General: Supply of finish hardware, including weatherstripping and mounting heights.
- .4 Section 09 91 23 - Interior Painting.
- .5 Section 09 91 13 - Exterior Painting.

**1.2 REFERENCES**

- .1 American Society for Testing and Materials (ASTM International)
  - .1 ASTM A653/A653M-[01a], Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .2 ASTM B29-[92(1997)], Specification for Refined Lead.
  - .3 ASTM B749-[97], Specification for Lead and Lead Alloy Strip, Sheet and Plate Products.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.181-[99], Ready-Mixed Organic Zinc-Rich Coating.
  - .2 CGSB 41-GP-19Ma-[84], Rigid Vinyl Extrusions for Windows and Doors.
- .3 Canadian Standards Association (CSA International)
  - .1 G40.20/G40.21-[98], General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .2 CSA W59-[M1989(R2001)], Welded Steel Construction (Metal Arc Welding) (Metric Version).
- .4 Canadian Steel Door Manufacturers' Association, (CSDMA).
  - .1 CSDMA, Specifications for Commercial Steel Doors and Frames, [1990].
  - .2 CSDMA, Recommended Selection and Usage Guide for Commercial Steel Doors, [1990].
- .5 National Fire Protection Association (NFPA)
  - .1 NFPA 80-[99], Standard for Fire Doors and Fire Windows.
  - .2 NFPA 252-[99], Standard Methods of Fire Tests of Door Assemblies.
- .6 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN4-S104-[80(R1985)], Fire Tests of Door Assemblies.
  - .2 CAN4-S105-[85(R1992)], Fire Door Frames Meeting the Performance Required by CAN4-S104.

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- .7 CAN/ULC-S701-[01], Thermal Insulation, Polystyrene, Boards and Pipe Covering.
  - .8 CAN/ULC-S702-[97], Thermal Insulation, Mineral Fibre, for Buildings.
  - .9 CAN/ULC-S704-[01], Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

### **1.3 DESIGN REQUIREMENTS**

- .1 Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -35°C to 35°C.
- .2 Maximum deflection for exterior steel entrance screens under wind load of 1.2 kPa not to exceed 1/175th of span.

### **1.4 WORK INCLUDED**

- .1 A single manufacturer shall fabricate products included within the scope of this Section.
- .2 Manufacturer shall be a member in good standing of the Canadian Steel Door Manufacturers Association (CSDMA).
- .3 Supply only of steel frame products including frames, transom frames, sidelight and window assemblies with provision for glazed, paneled or louvered openings, fire labeled and non-labeled, as scheduled or detailed by the Consultant.
- .4 Supply only of flush steel doors with provision for glazed, paneled or louvered openings, insulated and un-insulated, fire labeled, with or without temperature rise ratings and non-labeled, as scheduled or detailed by the Consultant.
- .5 Supply only of steel panels, similar in construction to steel doors, with flush or abetted bottoms for steel frames, transom frames, sidelight and window assemblies, fire labeled and non-labeled, as scheduled or detailed by the Consultant.

### **1.5 RELATED WORK**

- .1 Building-in of frame product into unit masonry, previously placed concrete, structural or steel or wood stud walls.
- .2 Supply and installation of wood, plastic or composite core doors.
- .3 Supply and installation of builders' hardware except as specified for acoustic assemblies.
- .4 Drilling and tapping for surface mounted or non-templated builders' hardware.
- .5 Caulking of joints between frame product and other building components.
- .6 Supply and installation of gaskets or weather-strip.
- .7 Supply and installation of louvers or vents.
- .8 Supply and installation of glazing materials.

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- .9 Site touch-up and painting.
  - .10 Wiring for electronic or electric hardware.
  - .11 Field measurements.
  - .12 Fasteners for frame product in previously placed concrete, masonry or structural steel.
  - .13 Steel lintels, posts, columns or other load-bearing elements.
  - .14 Field welding.

## **1.6 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazed, or louvred, arrangement of hardware and fire rating and finishes.
- .3 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings and reinforcing and fire rating finishes.
- .4 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.
- .5 Submit test and engineering data, and installation instructions.

## **1.7 REQUIREMENTS**

- .1 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN4-S104M [NFPA 252] for ratings specified or indicated.

## **1.8 WASTE MANAGEMENT AND DISPOSAL**

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 Divert unused paint and sealant materials from landfill to official hazardous material collections site approved by Consultant.
- .3 Do not dispose of unused paint and sealant materials into sewer systems, into lakes, streams, onto ground or in other locations where it will pose health or environmental hazard.
- .4 Divert unused metal materials from landfill to metal recycling facility approved by Consultant.
- .5 Damaged or broken glazing materials are not recyclable. These materials must not be disposed of with materials destined for recycling.

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**1.9 TESTING AND PERFORMANCE**

- .1 Door constructions covered by this specification shall be certified as meeting Level “A” (1,000,000 cycles) and Twist Test Acceptance Criteria (deflection not to exceed 6.4 mm /13.6kg force, total deflection at 136.1kg force not to exceed 63.5 mm and permanent deflection not to exceed 3.2 mm) when tested in strict conformance with ANSI-A250.4-1994. Test shall be conducted by an independent nationally recognized accredited laboratory.
- .2 Fire labeled product shall be provided for those openings requiring fire protection and temperature rise ratings, as determined and scheduled by the Architect. Doors, frames, transom frames and sidelight assemblies shall be tested in strict accordance with CAN4-S106. Product shall be listed by Underwriters Laboratories of Canada under an active Factory Inspection Program and shall be constructed as detailed in Follow-Up Service procedures issued to the manufacturer.
- .3 Should any door or frame specified by the Architect to be fire rated, not qualify for labeling due to design, hardware, glazing or any other reason, the Consultant shall be so advised before manufacturing commences.
- .4 Core materials for exterior doors shall attain a thermal resistance rating of RSI 1.06 (R6.0) when tested in accordance with ASTM C177 or ASTM C518.
- .5 Product shall be manufactured by a firm experienced in the design and production of standard and custom commercial steel door and frame assemblies, the integration of builders’ or electronic hardware and glazing materials and their impact on the scope of work.
- .6 Manufacturer shall be assessed and registered as meeting the requirements of Quality Systems under ISO 9001.
- .7 Product quality shall meet standards set by the Canadian Steel Door Manufacturers Association.

**1.10 TEST REPORTS**

- .1 All alternates to this specification shall be submitted to the Architect for acceptance ten (10) days prior to bid date, complete with test reports from independent, nationally recognized testing authorities, certifying that:
  - .1 Steel door and frame assemblies furnished under this section meet the acceptance criteria of ANSI-A250.4-1994, Level “A”.
  - .2 Insulated door cores furnished in exterior doors under this Section meet the specified thermal resistance rating.
- .2 All reports shall include name of testing authority, date of test, location of test facility, descriptions of test specimens, procedures used in testing and indicate compliance with acceptance criteria of the test.

**1.11 WARRANTY**

- .1 All steel door and frame product shall be warranted from defects in workmanship for a period of two (2) years from date of shipment.

- .2 All steel door and frame product shall be warranted against rust perforation for a period of ten (10) years when the installed and finish painted with a commercial quality paint to the manufacturers recommendations.
- .3 Finish paint adhesion on all door and frame product shall be warranted for a period of ten (10) years when the product has been properly cleaned and finish painted with a commercial quality paint applied as recommended by the paint manufacturer. This warranty shall not exceed that provided by the paint manufacturer.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Doors shall be fabricated from tension leveled steel to ASTM A924-M97, galvanized to ASTM A653-M97, Commercial Steel (CS), Type B, coating designation ZF75, known commercially as paintable Galvanneal.
  - .1 Acceptable Manufacturer: Flemming
  - .2 Acceptable Alternate Manufacturer: Trillium Steel Doors Limited, or others meeting these exact specifications outlined in this section and accepted in writing during the tender period.
- .2 Door Cores:
  - .1 Honeycomb:
    - .1 Structural small cell (25.4 mm maximum) kraft paper “honeycomb”. Weight: 36.3 kg per ream (minimum), density: 16.5 kg/m<sup>3</sup> (minimum), sanded to the required thickness.
  - .2 Polystyrene:
    - .1 Rigid extruded, fire retardant, closed cell board, density 16kg/m<sup>2</sup>, thermal values: RSI 1.06 minimum, conforming to ASTM C578.
  - .3 Temperature Rise Rated (TRR):
    - .1 Solid slab core of non-combustible, inorganic composite to limit temperature rise on the “unexposed” side of door to 250°C at 30 or 60 minutes, as required by governing building code requirements and determined and scheduled by the Architect.
  - .4 Adhesives:
    - .1 Honeycomb Cores and Steel Components: Heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement or ULC approved equivalent.
  - .5 Interlocking Edge Seams:
    - .1 Resin reinforced polychloroprene (RRPC), fire resistant, high viscosity, sealant/adhesive or UL approved equivalent.
  - .6 Polystyrene Cores:
    - .1 Heat resistant, epoxy based, low viscosity, contact cement.
  - .7 Primer:
    - .1 Rust inhibitive touch-up only.
  - .8 Exterior Top Caps:



.1 Rigid polyvinylchloride (PVC) extrusion.

## 2.2 DOOR FABRICATION

- .1 Contractor is to site confirm dimensions of all existing hollow metal frames to remain and receive new hollow metal doors, including coordination of all hardware installation between frame and door.
- .2 This section is based on doors and frames as manufactured by Fleming. Doors and frames by other manufacturers are acceptable subject to be similar to the one specified and meeting the terms of this section.
- .3 Doors shall be swinging, 44.4 mm thick of the types and sizes indicated on the Architect's schedules or drawings.
- .4 Exterior doors shall be lock seam, flush.
- .5 Face sheets for exterior doors shall be fabricated from (16) gauge steel.
- .6 Longitudinal edges of exterior doors shall be fully welded, ground smooth with no visible seams.
- .7 Face sheets of interior doors shall be fabricated from 18 gauge steel, except for heavy traffic doors (noted **HT** in Door Schedule) face sheet to be 16 gauge.
- .8 Longitudinal edge of heavy traffic doors (noted **HT** in Door Schedule) shall be mechanically interlocked, fully welded, ground smooth with no visible seams. Do not fill seams.
- .9 Interior doors shall be stiffened, insulated and sound deadened with honeycomb core laminated under pressure to each face sheet.
- .10 Stiffened, insulated and sound deadened with Fleming's propriety core where Temperature Rise Rated (TRR) fire labeled doors are specified on the Architect's schedules.
- .11 Longitudinal edges of interior doors shall be mechanically interlocked, adhesive assisted with edge seams and tack-welded every 150 mm and filled flush.
- .12 Door faces of all steel doors shall be fabricated without visible seams, free of scale, pitting, coil brakes, buckles and waves.
- .13 Formed edges shall be true and straight with a minimum radius for the thickness of steel used.
- .14 Lock and hinge edges shall be beveled 3 mm in 50 mm unless builders' hardware or door swing dictates otherwise.
- .15 Top and bottom of doors shall be provided with inverted, recessed, 16 gauge steel end channels, welded to each face sheet at 150 mm on center maximum.
- .16 Exterior doors shall be provided with factory installed flush PVC top caps. Fire labeled exterior doors shall be provided with factory installed flush steel top caps.

- .17 Unless ineligible due to design, size, hardware or glazing specified on the Architects' or hardware Suppliers' schedules or details, fire labeled doors shall be provided for those openings requiring fire protection ratings and temperature rise ratings, as determined and scheduled by the Architect.
- .18 Exterior doors and high traffic doors shall be internally reinforced with 20 gauge continuous; interlocking steel stiffeners at 150mm O.C. max, with voids between stiffeners filled and insulated with 24kg/m<sup>3</sup> density loose batt type fiberglass material to suit fully welded design.
- .19 Doors shall be factory blanked, reinforced, drilled and tapped for fully templated mortised hardware only, in accordance with the final approved schedule and templates provided by the hardware supplier.
- .20 Doors shall be factory blanked and reinforced only for mortised hardware that is not fully templated.
- .21 Doors shall be factory reinforced only for surface mounted hardware.
- .22 Templated holes 12.7mm diameter and larger shall be factory prepared, except mounting and through bolt holes, which shall be by the contractor responsible for installation on site, at the time of application. Templated holes less than 12.7mm diameter shall be factory prepared only when required for the function of the device (for knobs, levers, cylinders, thumb or turn pieces) or when these holes over-lap function holes.
- .23 Drilling and tapping for surface mounted hardware or mortised hardware that is not fully templated shall be by the contractor responsible for installation on site, at the time of application.
- .24 Hinge and pivot reinforcements shall be 10 gauge steel minimum high frequency type reinforcing.
- .25 Hinge reinforcements for acoustic doors and doors in excess of 2450mm rabbet height shall be 10 gauge minimum with each cutout provided with 114.3mm heavy weight (4.6mm) high frequency type.
- .26 Lock, strike and flush bolt reinforcements shall be 12 gauge steel minimum.
- .27 Reinforcements for concealed closers and holders shall be 12 gauge steel minimum.
- .28 For surface mounted hardware, reinforcements shall be 16 gauge steel minimum.
- .29 All pairs of fire labeled doors shall be provided with 12 gauge steel surface mounted flat bar astragal, shipped loose for application on site, by the contractor responsible for installation.
- .30 Pairs of doors up to 2450mm x 2450mm, to 1½ hour fire rating maximum shall be provided without astragals. Lock edge seam of such doors shall be tacked-welded and ground smooth. All other fire labeled pairs shall be provided with 12 gauge steel surface mounted flat bar astragal, shipped loose for application on site, by the contractor responsible for installation.

- .31 Where electrically or electronically operated hardware is specified on the Architects' schedules or details of the final approved schedule and templates provided by the hardware supplier, hardware enclosures and/or junction boxes, where indicated on the templates, shall be provided and interconnected with CSA Approved 12.7mm diameter conduit and connectors.
- .32 Prepare doors to receive security door contacts – refer to electrical drawings for locations. Door contacts to be installed at 100 mm from the latch side door edge.

### **2.3 GLAZING**

- .1 Where 6mm thick glazing materials are specified on the Architects schedules or details, doors shall be provided with 20 gauge steel glazing trim and snap-in glazing stops.
- .2 Where other than 6mm glazing is specified on the Architect's schedules or details, doors shall receive 20 gauge steel trim and screw fixed glazing stops. Screws shall be #6 x 32mm oval head scrulox (self-drilling) type at 300mm on center maximum.
- .3 Glazing trim and stops shall be accurately fitted, butted at corners, with removable glazing stops located on the 'push' side of the door.

### **2.4 LOUVER**

- .1 Where specified on the Architect's schedules or details, non-labeled doors shall be prepared on accordance with the louver manufacturer's details.
- .2 Where specified on the Architect's schedules or details, fire labeled doors shall be prepared for UL listed sight-proof fusible link louvers in accordance with the louver manufacturer's details.
- .3 Louvers shall be supplied and installed by others.

### **2.5 FINISHING**

- .1 Remove weld slag and splatter from exposed surfaces.
- .2 All tool marks, abrasions and surface blemishes shall be filled and sanded to present smooth uniform surfaces.
- .3 On exposed surfaces where zinc coating has been removed during fabrication, doors shall receive a factory applied touch-up primer.
- .4 Primer shall be fully cured prior to shipment.

### **2.6 PANELS**

- .1 Panels shall be fabricated from the same materials, construction and finished in the same manner as doors as specified in Section 2.1.

### **2.7 PRIMER**

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

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**2.8 PAINT**

- .1 Field paint steel doors and frames in accordance with Section[s] 09 91 22 – Painting. Protect weatherstrips from paint. Provide final finish shall be free of scratches or other blemishes.

**2.9 FRAMES FABRICATION GENERAL**

- .1 Steel:
  - .1 Frame product shall be fabricated from tension leveled steel to ASTM A924-M97, galvanized to ASTM A653-M97, Commercial Steel (CS), Type B, coating designated ZF75, known commercially as paintable Galvanneal.
- .2 Primer:
  - .1 Rust inhibitive touch up only.
- .3 Miscellaneous:
  - .1 Door Silencers: GJ-64, Single Stud rubber/neoprene type
  - .2 Thermal Breaks: Rigid polyvinylchloride (PVC) extrusion
  - .3 Fiberglass: Loose batt type, density: 24kg/m<sup>3</sup> (minimum), conforming to ASTM C665.
- .4 General:
  - .1 All steel frame product shall be as manufactured by Fleming of the types, sizes and profiles indicated on the Architects' schedules or details.
  - .2 Exterior frames shall be thermally broken, Fleming *Therma-Frame* Series, fabricated from 16 gauge steel.
  - .3 Exterior frame product shall be supplied profile welded (PW)
  - .4 Interior and exterior sections of thermally broken frames shall be separated by a continuous PVC thermal break.
    - .1 Thermally broken sections shall not be assembled by means of screws, grommets or other fasteners and welds shall not cause thermal transfers between interior and exterior surfaces of the frame sections.
    - .2 Closed sections (mullions and center rails) of thermally broken frames shall be factory insulated with 24kg/m<sup>3</sup> loose batt type fiberglass material.
- .5 Insulation of open sections (jambs, heads and sills) on exterior frame product shall be provided and installed by the contractor responsible for installation.
- .6 Interior frames shall be Fleming F-Series, fabricated from 16 gauge steel.
- .7 Interior frame product shall be supplied profile welded (PW)
- .8 Knocked-down and knocked-down drywall frames shall not be acceptable.
- .9 Jambs, heads, mullions, sills and center rails shall be straight and uniform throughout their lengths.
- .10 Frame product shall be square, free of defects, wraps or buckles.

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- .11 Corner joints shall be profile welded (PW) (continuously welded on the inside of the profiles' faces, rabbets, returns and soffit intersections with exposed faces filled and ground to a smooth, uniform, seamless surface)"
  - .12 Joints at mullions, transom bars, sills or center rails shall be coped accurately, butted and tightly fitted, with faces securely welded, matching corner joint faces.
  - .13 All steel mullions will be fabricated from the same materials as specified for the steel frames. Steel mullions will be fabricated as a fully assembled three piece unit consisting of a front, back and full height one piece attachment clip as per Fleming F Series. The attachment clip will completely fill the stop area of the mullion on both sides and span the void between each side forming a grid channel like structure. Mullions used as hinge mullions or strike mullions between doors will be filled with grout by the general contractor either prior to or following installation of the frame. The head of the frame shall have an opening sufficient for the grout to be poured in to the mullion.
  - .14 Mullions shall be fabricated with continuous 20 gauge galvaneal steel internal reinforcing clips.
  - .15 Frame product shall be fabricated with integral door stops having a minimum height of 16mm.
  - .16 Glazing stops shall be formed 20 gauge steel, 16mm height channel, accurately fitted, butted at corners and fastened to frame sections with #6 x 32mm oval head scrulox (self-drilling) type screws at 300mm on center maximum.
  - .17 Where required due to site access, as indicated on the Architects' schedules or details, when advised by the contractor responsible for co-ordination or installation, or when shipping limitations so dictate, frame product shall be fabricated in sections for splicing in the field.
    - .1 Field spliced jambs, heads and sills shall be provided with 16 gauge steel splice plates securely welded into one section, extending 100mm minimum each side of splice joint.
    - .2 Field splices at closed sections (mullions or center rails) shall be 16 gauge steel splice angles securely welded to the abutting member. Face of splice angle shall extend 100mm minimum into closed sections when assembled.
    - .3 Field splice joints shall be welded, filled and ground to present a smooth uniform surface by the contractor responsible for installation after assembly.
  - .18 Each door opening shall be provided with two (2) temporary steel jamb spreaders welded to the base of the jambs or mullions to maintain proper alignment during shipping and handling. Spreaders shall be removed by the contractor responsible for installation prior to anchoring of frame to floor.
  - .19 Each door opening shall be prepared for GJ-64 or equivalent, single stud door silencers, three (3) for single door openings, two (2) for double door openings. Silencers shall be shipped loose for installation by the contractor after finish painting.
  - .20 Unless ineligible due to design, size, hardware or glazing specified on the Architects' or Hardware Suppliers' schedules or details, fire labeled frame product shall be provided for those openings required fire protection ratings as determined and scheduled by the Architect.

.21 Hardware Preparations:

- .1 Frame product shall be blanked, reinforced, drilled and tapped for fully templated mortised hardware only, in accordance with the final approved schedule and templated provided by the hardware supplier.
- .2 Frame product shall be factory blanked and reinforced only for mortised hardware that is not fully templated.
- .3 Frame product shall be reinforced only for surface mounted hardware.
- .4 Drilling and tapping for surface mounted hardware or mortised hardware that is not fully templated shall be by the contractor responsible for installation on site, at the time of application.
- .5 Frames shall be prepared for 114.3mm standard weight hinges (minimum).
- .6 Hinge and pivot reinforcements shall be 10 gauge steel minimum reinforcing, high frequency type shall be provided.
- .7 Hinge reinforcements for acoustic frames and frames in excess of 2450mm rabet height shall be 10 gauge minimum with each cutout provided with 114.3mm heavy weight (4.6mm) high frequency type.
- .8 Strike reinforcements shall be 16 gauge steel minimum.
- .9 Reinforcements for surface mounted hardware, concealed closers and holders and flush bolts shall be 12 gauge steel minimum.
- .10 Mortised cutouts shall be protected with 22 gauge steel minimum guard boxes.
- .11 Where electrically or electronically operated hardware is specified on the Architects schedules or details or the final approved schedule and templates provided by the hardware supplier, hardware enclosures and/or junction boxes, where indicated on templates, shall be provided and inter-connected with CSA Approved 12.7mm diameter conduit and connectors.
- .12 Prepare frames to receive security door contacts – refer to electrical drawings for locations. Door contacts to be installed at 100 mm from the latch side door edge.

.22 Anchorage:

- .1 Frame product shall be provided with anchorage appropriate to floor, wall and frame construction.
- .2 Each wall anchor shall be located immediately above or below each hinge reinforcement on the hinge jamb and directly opposite on the strike jamb, except as indicated below.
- .3 Frame product installed in unit masonry partitions shall be provided with 4.0mm diameter steel wire anchors, 18 gauge steel adjustable stirrup and strap or “T” type anchors as conditions dictate.
- .4 Where frame product is installed prior to construction of the adjacent wall, each jamb shall be provided with 16 gauge steel floor anchors. Each anchor shall be provided with two (2) holes for mounting to the floor and shall be securely welded to the inside of the jamb.
- .5 Floor anchors for thermally broken exterior frames shall be designed so as not to permit thermal transfers from exterior to interior surfaces of the frame sections.
- .6 Frame product installed in drywall partitions shall be provided with 20 gauge steel snap-in or “Z” type stud type anchor.

- .7 Jamb of frames in previously placed concrete, masonry or structural steel shall be punched and dimpled to accept machine bolt anchors, 6.4mm diameter, located not more than 150mm from the top and bottom of each jamb. Anchor preparations and guides shall also be located immediately above or below the intermediate hinge reinforcing and directly opposite on the strike jamb. Each preparation shall be provided with 16 gauge anchor bolt guides.
  - .8 Anchor bolts and expansion shell anchors for the above preparations shall be provided by the contractor responsible for installation.
  - .9 After sufficient tightening of the anchor bolts, the heads shall be welded do as to provide a non-removable application. Welded bolt head and dimple shall be filled and ground to present a smooth uniform surface by the contractor responsible for installation, prior to finish painting.
  - .10 Where indicated on the Architects' schedules or details, channel extensions shall be provided from the top of the frame assembly to the underside of the structure above. Extensions shall be fabricated from 12 gauge steel formed channel, mounting angles welded to inside of frame head and adjusting brackets. Formed channels, adjusting brackets and fasteners shall be shipped loose. Channels shall be mechanically connected to mounting angles and adjusting brackets with supplied fasteners, on site, by contractor responsible for installation.
- .23 Finishing:
- .1 Remove weld slag and spatter from exposed surfaces.
  - .2 All tool marks, abrasions and surface blemishes shall be filled and sanded to present smooth and uniform surfaces.
  - .3 On exposed surfaces where zinc has been removed during fabrication, frame product shall receive a factory applied touch-up primer.
  - .4 Primer shall be fully cured prior to shipment.

## 2.10 SIZES AND TOLERANCES

- .1 All sizes and tolerances shall be in accordance with the Canadian Steel Door Manufacturers Association "Recommended Dimensional Standards for Commercial Steel Doors and Frames" as follows:
  - .1 Widths of door openings shall be measured from inside of frame jamb rabbet with a tolerance of +1.6mm, -0.8mm.
  - .2 Heights of door openings shall be measured from the finished floor (exclusive of floor coverings) to the head rabbet of the frame with a tolerance of  $\pm 1.2$ mm.
  - .3 Unless builders' hardware dictates otherwise, doors shall be sized so as to fit the above openings and allow a 3mm clearance at jambs and head. A clearance of 19mm between the bottom of the door and the finished floor (exclusive of floor coverings) shall be provided. Tolerances on door sizes shall be  $\pm 1.2$ mm.
  - .4 Manufacturing tolerances on formed frame profiles shall be  $\pm 0.8$ mm for faces, door stop heights and jamb depths. Tolerances for throat openings and door rabbet shall be  $\pm 1.6$ mm and  $\pm 0.4$ mm respectively. Hardware cutout dimensions shall be as per template dimensions, +0.4mm, -0.

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## **2.11 HARDWARE LOCATIONS**

- .1 Hardware preparations in frame product shall be as noted below and locations on doors shall be adjusted for clearances specified in 2.4.
- .2 Top of upper hinge preparation for 114.3mm hinges shall be located 180mm down from head, transom mullion or panel as appropriate. The top of the bottom hinge preparation for 114.3mm hinges shall be located 310mm from finished floor as defined in 2.4.3. Intermediate hinge preparations shall be spaced equally between top and bottom cutouts. For dutch door frames, top and bottom hinge locations shall be as above, with the tops of intermediate hinges located at 930mm and 1403mm from finished floor.
- .3 Strike preparations for unit, integral, cylindrical and mortise locks and roller latches shall be centered 1033mm from finished floor. Strikes for deadlocks shall be centered at 1200mm from finished floor. Strikes for panic or fire exit hardware shall be located as per device manufacturer's templates.
- .4 Push and/or pulls on doors shall be centered 10701mm from finished floor.
- .5 Preparations not noted above shall be as per hardware manufacturer's templates.
- .6 Hardware preparation tolerances shall comply with the ANSI A115 series standards.

## **Part 3 Execution**

### **3.1 SITE AND PROTECTION OF MATERIALS**

- .1 The contractor responsible for installation shall remove wraps or covers from door and frame product upon delivery at building site.
- .2 All materials shall be thoroughly inspected upon receipt and all discrepancies, deficiencies and/or damages shall be immediately reported in writing to the supplier. All damage shall be noted on the carriers' Bill of Lading.
- .3 Contractor responsible for installation shall ensure all materials are properly stored on planks or dunnage in a dry location. Product shall be stored in a vertical position, spaced with blocking to permit air circulation between them. Materials shall be covered to protect them from damage from any cause.
- .4 Contractor shall notify the supplier in writing of any errors or deficiencies in the product itself before initiating any corrective work.

### **3.2 INSTALLATION GENERAL**

- .1 Install labelled steel fire rated doors and frames to NFPA 80 except where specified otherwise.
- .2 Install doors and frames to CSDMA Installation Guide.
- .3 Install doors and frames in accordance with the Door and Hardware Institute "Installation guide for doors and hardware".
- .4 Set frame product plumb, square, aligned, without twist at correct elevation.



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- .5 Frame Product Installation Tolerances:
- .1 Plumbness tolerance, measured through a line from the intersecting corner of vertical members and the head to the floor, shall be  $\pm 1.6\text{mm}$ .
  - .2 Squareness tolerance, measured through a line  $90^0$  from one jamb at the upper corner of the product, to the opposite jamb, shall be  $\pm 1.6\text{mm}$ .
  - .3 Alignment tolerance, measured on jambs, through a horizontal line parallel to the plane of the wall, shall be  $\pm 1.6\text{mm}$ .
  - .4 Twist tolerance, measured at face corners of jambs, on parallel lines perpendicular to the plane of the wall, shall be  $\pm 1.6\text{mm}$ .
- .6 Fire labeled product shall be installed in accordance with NFPA-80.
- .7 Secure anchorages and connections to adjacent construction.
- .8 Brace frame product rigidly in position while building-in. Remove temporary steel shipping jamb spreaders. Install wood spreaders at mid points of frame rabbet height and at floor level to maintain frame widths. Provide vertical support at center of head for openings exceeding 1250mm in width. Remove wood spreaders after product has been built-in.
- .9 Frame product in unit masonry shall be fully grouted in place.
- .10 Install doors maintaining clearances outlined in Section 2.4.
- .11 Install louvers and vents.
- .12 Adjust operable parts for correct clearances and function.
- .13 Steel surfaces shall be kept free of grout, tar or other bonding materials or sealers.
- .14 Any grout or other bonding material shall be cleaned from products immediately following installation.
- .15 Exposed field welds shall be finished to present a smooth uniform surface and shall be touched-up with a rust inhibitive primer.
- .16 Exposed surfaces that have been scratched or otherwise marred during shipment, installation or handling shall be touched-up with a rust inhibitive primer.
- .17 Finish paint in accordance with Section 099116 and 099123.
- .18 Install glazing materials and door silencers.

### 3.3 INSPECTION

- .1 In accordance with Section 011100- Summary of Work, upon assignment of an inspection agency the following inspections shall be performed:
  - .1 review of shop drawings for compliance with specification
  - .2 shop inspection during production. Should inspection notification not be given suitable to review fabrication, destructive testing of one or more doors will be

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undertaken either in the shop or on site at no additional cost to the owner. Doors destroyed for invasive inspection shall be replaced as part of the contract price.

- .2 Upon notification of initial door installation, contractor shall notify inspector to witness installation practice and at periodic points for duration of installation period.

### **3.4 FINISH REPAIRS**

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

### **3.5 GLAZING**

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

**END OF SECTION**

**Part 1 General**

**1.1 GENERAL NOTES**

- .1 Find the Door Schedule on the following pages.
- .2 Refer to the large format drawings for door and frame types and details.

**1.2 ABBREVIATIONS CODE**

- .1 The following abbreviations are used in the Door Schedule.
- .2 Code Reference
- .3 DC Door Contact (security)
- .4 P Paint
- .5 HM Hollow Metal
- .6 TG Tempered Glass
- .7 45 MIN 45 minute fire rating
- .8 HT Heavy Traffic – see spec for welded seams, special reinforcing.
- .9 B/F Barrier-Free
- .10 WD Laminate Faced Wood Door
- .11 P.LAM Plastic Laminate Finish on Wood Door
- .12 ALUM. Aluminum
- .13 ANNO. Anodized Finish
- .14 ST Stained

**1.3 DOOR SCHEDULE**

- .1 Door Schedule designation “DC” refers to “Door Contacts” used in the security system. Refer to Electrical Drawings and Division 16 Specifications for locations, zoning and description of system.

**END OF SECTION**

**GENERAL NOTES**

- 1 This schedule MUST be read in conjunction with a complete set of drawings and a complete Hardware Schedule.
- 2 Refer to Drawing A-01 Series for door, frame & jamb types and details.

**ABBREVIATION CODES**

The following abbreviations are used in the Door Schedule

| <u>Code</u> | <u>Reference</u>  |
|-------------|---|
| DC          | Door Contact  |
| PT          | Paint   |
| ANNO.       | Anodized Finish   |
| HT          | Heavy Traffic - See specs for welded seams, special reinforcing |
| 20 MIN      | 20 minute Fire Rating   |
| 45 MIN      | 45 minute Fire Rating   |
| HM          | Hollow Metal  |
| TG          | Tempered Glass  |
| B/F         | Barrier-Free  |
| ALUM.       | Aluminum  |
| FR          | Fire Rated Glass  |
| LG          | Laminated Glass   |
| FDG         | Door Grille   |
| IGU         | Insulated glass unit  |
| CW          | Curtain wall  |
| PDO         | Power door Operator   |
| SC          | SCREEN  |
| EX          | Existing to Remain  |

**REMARK NOTES**

| DOOR               |                     | DOOR                              |        |         |      |      |       |     |       | FRAME |       |     |    |       | REMARKS  |
|--------------------|---------------------|-----------------------------------|--------|---------|------|------|-------|-----|-------|-------|-------|-----|----|-------|--|
| #                  | ROOM                | WIDTH                             | HEIGHT | FIRE    | H.T. | TYPE | MAT'L | FIN | GLASS | TYPE  | MAT'L | FIN | DC | GLASS |  |
| <b>LOWER FLOOR</b> |                     |                                   |        |         |      |      |       |     |       |       |       |     |    |       |  |
| 101AA              | CLASSROOM 10 - 101A | 950                               | 2085   | 45 MIN. | -    | C    | HM    | PT  | FR    | 1     | HM    | PT  | -  | -     |  |
| 101BA              | RESOURCE ROOM 101B  | EX.                               | EX.    | 45 MIN. | -    | C    | HM    | PT  | FR    | 1     | HM    | PT  | -  | -     | NEW HM DOOR AND FRAME SIZE TO MATCH EXISTING OPENING. B/F DOOR OPERATOR TO BE INSTALLED ON ROOM SIDE |
| 101CB              | CLASSROOM 11 - 101C | 950                               | 2085   | 45 MIN. | -    | C    | HM    | PT  | FR    | 1     | HM    | PT  | -  | -     |  |
| 101DA              | STORAGE 101D        | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |     |       |       |       |     |    |       |  |
| X101EA             | ALCOVE 101E         | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |     |       |       |       |     |    |       |  |
| X101EB             | ALCOVE 101E         | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |     |       |       |       |     |    |       |  |
| 102AA              | CLASSROOM 12 - 102A | EX.                               | EX.    | 45 MIN. | -    | C    | HM    | PT  | FR    | 1     | HM    | PT  | -  | -     | NEW HM DOOR AND FRAME SIZE TO MATCH EXISTING OPENING. B/F DOOR OPERATOR TO BE INSTALLED ON ROOM SIDE |
| 102CB              | CLASSROOM 13 - 102C | EX.                               | EX.    | 45 MIN. | -    | C    | HM    | PT  | FR    | 1     | HM    | PT  | -  | -     | NEW HM DOOR AND FRAME SIZE TO MATCH EXISTING. B/F DOOR OPERATOR TO BE INSTALLED ON ROOM SIDE         |
| X102CC             | CLASSROOM 13 - 102C | EX.                               | EX.    | EX.     | EX.  | EX.  | EX.   | PT  | EX.   | EX.   | EX.   | PT  | -  | -     |  |
| X102CD             | CLASSROOM 13 - 102C | EX.                               | EX.    | EX.     | EX.  | EX.  | EX.   | PT  | EX.   | EX.   | EX.   | PT  | -  | -     |  |
| X102DA             | COATS 102D          | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |     |       |       |       |     |    |       |  |
| X102DB             | COATS 102D          | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |     |       |       |       |     |    |       |  |
| X102EA             | WASHROOM 102E       | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |     |       |       |       |     |    |       |  |
| X102FA             | WASHROOM 102F       | EX.                               | EX.    | EX.     | EX.  | EX.  | EX.   | PT  | EX.   | EX.   | EX.   | PT  | -  | -     |  |
| X104A              | CUSTODIAN 104       | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |     |       |       |       |     |    |       |  |
| X104B              | CUSTODIAN 104       | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |     |       |       |       |     |    |       |  |
| X105A              | MECHANICAL 105      | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |     |       |       |       |     |    |       |  |
| X105B              | MECHANICAL 105      | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |     |       |       |       |     |    |       |  |

| DOOR  |                     | DOOR                              |        |         |      |      |       |       |       | FRAME |       |       |    |       | REMARKS   |
|-------|---------------------|-----------------------------------|--------|---------|------|------|-------|-------|-------|-------|-------|-------|----|-------|---|
|       |                     | WIDTH                             | HEIGHT | FIRE    | H.T. | TYPE | MAT'L | FIN   | GLASS | TYPE  | MAT'L | FIN   | DC | GLASS |   |
| #     | ROOM                |                                   |        |         |      |      |       |       |       |       |       |       |    |       |   |
| 106A  | BOY'S WASHROOM 106  | EX.                               | EX.    | 45 MIN. | -    | A    | HM    | PT    | -     | 1     | HM    | PT    | -  | -     | NEW HM DOOR AND FRAME SIZE TO MATCH EXISTING. ELECTROMAGNETIC HOLD OPEN                         |
| X107A | STAFF WR107         | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |       |       |       |       |       |    |       |   |
| 108A  | BF WR 108           | 950                               | EX.    | 45 MIN. | -    | A    | HM    | PT    | -     | 1     | HM    | PT    | -  | -     | B/F DOOR OPERATOR TO BE INSTALLED ON WASHROOM SIDE  |
| 109A  | GIRL'S WASHROOM 109 | EX.                               | EX.    | 45 MIN. | -    | A    | HM    | PT    | -     | 1     | HM    | PT    | -  | -     | NEW HM DOOR AND FRAME SIZE TO MATCH EXISTING. ELECTROMAGNETIC HOLD OPEN                         |
| X115A | TRANSFORMER 115     | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |       |       |       |       |       |    |       |   |
| X116A | SPRINKLER ROOM 116  | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |       |       |       |       |       |    |       |   |
| 117A  | LIBRARY 117         | 1000                              | 2150   | 45 MIN. | -    | D    | HM    | PT    | FR    | 4     | HM    | PT    | -  | FR    | B/F DOOR OPERATOR TO BE INSTALLED ON LIBRARY SIDE   |
| 117B  | LIBRARY 117         | 1000                              | 2150   | 45 MIN. | -    | D    | HM    | PT    | FR    | 4     | HM    | PT    | -  | FR    | B/F DOOR OPERATOR TO BE INSTALLED ON LIBRARY SIDE   |
| X119A | WORK ROOM 119       | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |       |       |       |       |       |    |       |   |
| X119B | WORK ROOM 119       | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |       |       |       |       |       |    |       |   |
| A131A | SEMINAR A131        | 1000                              | 2085   | -       | -    | E    | ALUM. | ANNO. | TG    | CW1   | ALUM. | ANNO. | -  | TG    | WEATHER STRIPPING. REFER TO STOREFRONT SCHEDULE.  |
| A131B | SEMINAR A131        | 1000                              | 2085   | 45 MIN. | -    | D    | HM    | PT    | FR    | 1     | HM    | PT    | -  | -     | B/F DOOR OPERATOR TO BE INSTALLED ON SEMINAR ROOM SIDE<br><b>NO LOCK - EXIT DOOR</b>            |
| A132A | MACHINE ROOM A132   | 950                               | 2085   | 45 MIN. | -    | A    | HM    | PT    | -     | 1     | HM    | PT    | -  | -     |   |
| A133A | SUMP PIT ROOM A133  | 950                               | 2085   | 45 MIN. | -    | A    | HM    | PT    | -     | 1     | HM    | PT    | -  | -     |   |
| X805A | VESTIBULE 805       | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |       |       |       |       |       |    |       |   |
| X805B | VESTIBULE 805       | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |       |       |       |       |       |    |       |   |
| X806A | VESTIBULE 806       | EX.                               | EX.    | EX.     | EX.  | EX.  | EX.   | PT    | EX.   | EX.   | EX.   | PT    | -  | -     | EXISTING DOOR AND FRAME TO BE PAINTED. NEW B/F DOOR OPERATOR TO BE INSTALLED ON VESTIBULE SIDE. |
| X806B | VESTIBULE 806       | EX.                               | EX.    | EX.     | EX.  | EX.  | EX.   | PT    | EX.   | EX.   | EX.   | PT    | -  | -     | EXISTING DOOR AND FRAME TO BE PAINTED. NEW B/F DOOR OPERATOR TO BE INSTALLED ON CORRIDOR SIDE.  |

SECOND FLOOR

| DOOR   |                        | DOOR                              |        |         |      |      |       |     |       | FRAME |       |     |    |       | REMARKS  |
|--------|------------------------|-----------------------------------|--------|---------|------|------|-------|-----|-------|-------|-------|-----|----|-------|--|
|        |                        | WIDTH                             | HEIGHT | FIRE    | H.T. | TYPE | MAT'L | FIN | GLASS | TYPE  | MAT'L | FIN | DC | GLASS |  |
| #      | ROOM                   |                                   |        |         |      |      |       |     |       |       |       |     |    |       |  |
| 201AA  | CLASSROOM 9 - 201A     | 950                               | 2085   | 45 MIN. | -    | C    | HM    | PT  | FR    | 1     | HM    | PT  | -  | -     |  |
| 201BA  | RESOURCE ROOM 201B     | EX.                               | EX.    | 45 MIN. | -    | C    | HM    | PT  | FR    | 1     | HM    | PT  | -  | -     | NEW HM DOOR AND FRAME SIZE TO MATCH EXISTING OPENING. B/F DOOR OPERATOR TO BE INSTALLED ON ROOM SIDE |
| 201CB  | CLASSROOM 2 - 201C     | 950                               | 2085   | 45 MIN. | -    | C    | HM    | PT  | FR    | 1     | HM    | PT  | -  | -     |  |
| X201DA | NURSE 201D             | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |     |       |       |       |     |    |       |  |
| X201EA | ALCOVE 201E            | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |     |       |       |       |     |    |       |  |
| X201EB | ALCOVE 201E            | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |     |       |       |       |     |    |       |  |
| 202AA  | CLASSROOM 7 - 202A     | EX.                               | EX.    | 45 MIN. | -    | C    | HM    | PT  | FR    | 1     | HM    | PT  | -  | -     | B/F DOOR OPERATOR TO BE INSTALLED ON ROOM SIDE   |
| 202BA  | RESOURCE ROOM - 202B   | EX.                               | EX.    | 45 MIN. | -    | C    | HM    | PT  | FR    | 1     | HM    | PT  | -  | -     | NEW HM DOOR AND FRAME SIZE TO MATCH EXISTING OPENING. B/F DOOR OPERATOR TO BE INSTALLED ON ROOM SIDE |
| 202CA  | CLASSROOM 6 - 202C     | 950                               | 2085   | 45 MIN. | -    | C    | HM    | PT  | FR    | 1     | HM    | PT  | -  | -     | DOOR SWING TO BE TOWARDS CLASSROOM   |
| 202DA  | SEMINAR 202D           | 950                               | 2085   | 45 MIN. | -    | C    | HM    | PT  | FR    | 3     | HM    | PT  | -  | FR    |  |
| X202EA | ALCOVE 202E            | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |     |       |       |       |     |    |       |  |
| X202EB | ALCOVE 202E            | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |     |       |       |       |     |    |       |  |
| 203AA  | CLASSROOM 5 - 203A     | 950                               | 2085   | 45 MIN. | -    | C    | HM    | PT  | FR    | 1     | HM    | PT  | -  | -     | DOOR SWING TO BE TOWARDS CLASSROOM   |
| 203BA  | SPECIAL EDUCATION 203B | EX.                               | 2085   | 45 min. | -    | C    | HM    | PT  | FR    | 1     | HM    | PT  | -  | -     | NEW HM DOOR AND FRAME SIZE TO MATCH EXISTING OPENING. B/F DOOR OPERATOR TO BE INSTALLED ON ROOM SIDE |
| 203CA  | CLASSROOM 4 - 203C     | 950                               | 2085   | 45 min. | -    | C    | HM    | PT  | FR    | 1     | HM    | PT  | -  | -     | DOOR SWING TO BE TOWARDS CLASSROOM.  |
| 203DA  | RESOURCE ROOM 203D     | 950                               | 2085   | 45 min. | -    | C    | HM    | PT  | FR    | 3     | HM    | PT  | -  | FR    |  |
| X203EA | ALCOVE 203E            | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |     |       |       |       |     |    |       |  |
| X203EB | ALCOVE 203E            | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |     |       |       |       |     |    |       |  |

| DOOR   |                      | DOOR                              |        |         |      |      |       |     |       | FRAME |       |     |    |       | REMARKS  |
|--------|----------------------|-----------------------------------|--------|---------|------|------|-------|-----|-------|-------|-------|-----|----|-------|--|
| #      | ROOM                 | WIDTH                             | HEIGHT | FIRE    | H.T. | TYPE | MAT'L | FIN | GLASS | TYPE  | MAT'L | FIN | DC | GLASS |  |
| X205B  | BOY'S WASHROOM 205   | EX.                               | EX.    | 45 MIN. | -    | A    | HM    | PT  | -     | 1     | HM    | PT  | -  | -     | NEW HM DOOR AND FRAME SIZE TO MATCH EXISTING. ELECTROMAGNETIC HOLD OPEN  |
| X206A  | STAFF WR 206         | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |     |       |       |       |     |    |       |  |
| X207A  | STAFF WR 207         | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |     |       |       |       |     |    |       |  |
| X208A  | CUSTODIAN 208        | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |     |       |       |       |     |    |       |  |
| X208B  | CUSTODIAN 208        | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |     |       |       |       |     |    |       |  |
| X209B  | GIRL'S WASHROOM 209  | EX.                               | EX.    | 45 MIN. | -    | A    | HM    | PT  | -     | 1     | HM    | PT  | -  | -     | NEW HM DOOR AND FRAME SIZE TO MATCH EXISTING. ELECTROMAGNETIC HOLD OPEN  |
| 211A   | GENERAL PURPOSE ROOM | EX.                               | EX.    | 45 MIN. | -    | D    | HM    | PT  | FR    | 2     | HM    | PT  | -  | -     | NEW HM DOOR AND FRAME SIZE TO MATCH EXISTING OPENING. B/F DOOR OPERATOR TO BE INSTALLED ON GYM SIDE, 180° DEGREE SWING |
| X211B  | GENERAL PURPOSE ROOM | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |     |       |       |       |     |    |       |  |
| X211C  | GENERAL PURPOSE ROOM | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |     |       |       |       |     |    |       |  |
| X211D  | GENERAL PURPOSE ROOM | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |     |       |       |       |     |    |       |  |
| X214A  | SUPPLY ROOM 214      | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |     |       |       |       |     |    |       |  |
| X214AA | KILN 214A            | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |     |       |       |       |     |    |       |  |
| X215A  | PRINCIPAL 215        | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |     |       |       |       |     |    |       |  |
| X215B  | PRINCIPAL 215        | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |     |       |       |       |     |    |       |  |
| 216A   | MAIN OFFICE 216      | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |     |       |       |       |     |    |       |  |
| X218A  | STAFF ROOM 218       | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |     |       |       |       |     |    |       |  |
| X218B  | STAFF ROOM 218       | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |     |       |       |       |     |    |       |  |
| X219A  | FRENCH ROOM          | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |     |       |       |       |     |    |       |  |
| X220A  | GYM STORAGE 220      | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |     |       |       |       |     |    |       |  |
| 221A   | BF WASHROOM          | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |     |       |       |       |     |    |       | NEW B/F DOOR OPERATOR TO BE INSTALLED ON WASHROOM SIDE.  |
| X221AA | STORAGE 221A         | EXISTING DOOR AND FRAME TO REMAIN |        |         |      |      |       |     |       |       |       |     |    |       |  |



| DOOR   |                      | DOOR                              |        |      |      |      |       |     |       | FRAME |       |     |    |       | REMARKS |
|--------|----------------------|-----------------------------------|--------|------|------|------|-------|-----|-------|-------|-------|-----|----|-------|---------|
|        |                      | WIDTH                             | HEIGHT | FIRE | H.T. | TYPE | MAT'L | FIN | GLASS | TYPE  | MAT'L | FIN | DC | GLASS |         |
| #      | ROOM                 |                                   |        |      |      |      |       |     |       |       |       |     |    |       |         |
| X222   | CUSTODIAN 222        | EXISTING DOOR AND FRAME TO REMAIN |        |      |      |      |       |     |       |       |       |     |    |       |         |
| X223   | KINDERGARTEN 3 - 223 | EXISTING DOOR AND FRAME TO REMAIN |        |      |      |      |       |     |       |       |       |     |    |       |         |
| X223AA | WASHROOM 223A        | EXISTING DOOR AND FRAME TO REMAIN |        |      |      |      |       |     |       |       |       |     |    |       |         |
| X224A  | KINDERGARTEN 2 - 224 | EXISTING DOOR AND FRAME TO REMAIN |        |      |      |      |       |     |       |       |       |     |    |       |         |
| X224AA | WASHROOM 224A        | EXISTING DOOR AND FRAME TO REMAIN |        |      |      |      |       |     |       |       |       |     |    |       |         |
| X225A  | KINDERGARTEN 1 - 225 | EXISTING DOOR AND FRAME TO REMAIN |        |      |      |      |       |     |       |       |       |     |    |       |         |
| X225AA | WASHROOM 225A        | EXISTING DOOR AND FRAME TO REMAIN |        |      |      |      |       |     |       |       |       |     |    |       |         |
| X816A  | CORRIDOR 816         | EXISTING DOOR AND FRAME TO REMAIN |        |      |      |      |       |     |       |       |       |     |    |       |         |
| X817A  | CORRIDOR 817         | EXISTING DOOR AND FRAME TO REMAIN |        |      |      |      |       |     |       |       |       |     |    |       |         |
| X818A  | CORRIDOR 818         | EXISTING DOOR AND FRAME TO REMAIN |        |      |      |      |       |     |       |       |       |     |    |       |         |
| X818B  | CORRIDOR 818         | EXISTING DOOR AND FRAME TO REMAIN |        |      |      |      |       |     |       |       |       |     |    |       |         |
| X820A  | CORRIDOR 820         | EXISTING DOOR AND FRAME TO REMAIN |        |      |      |      |       |     |       |       |       |     |    |       |         |
| X820B  | CORRIDOR 820         | EXISTING DOOR AND FRAME TO REMAIN |        |      |      |      |       |     |       |       |       |     |    |       |         |
| X822B  | VESTIBULE 822        | EXISTING DOOR AND FRAME TO REMAIN |        |      |      |      |       |     |       |       |       |     |    |       |         |
| X822A  | VESTIBULE 822        | EXISTING DOOR AND FRAME TO REMAIN |        |      |      |      |       |     |       |       |       |     |    |       |         |
| X901A  | STAIR 901            | EXISTING DOOR AND FRAME TO REMAIN |        |      |      |      |       |     |       |       |       |     |    |       |         |
| X902A  | STAIR 902            | EXISTING DOOR AND FRAME TO REMAIN |        |      |      |      |       |     |       |       |       |     |    |       |         |
| X902B  | STAIR 902            | EXISTING DOOR AND FRAME TO REMAIN |        |      |      |      |       |     |       |       |       |     |    |       |         |

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 01 33 00 Submittal Procedures.
- .2 Section 08 44 13 Glazed Aluminum Curtain Wall.
- .3 Section 08 80 50 Glazing.

**1.2 REFERENCES**

- .1 American Architectural Manufacturers Association (AAMA):
  - .1 AAMA 2605-05, Voluntary Specification for High Performance Coatings on Architectural Extrusions and Panels.
  - .2 AAMA CW-10-04, Care and Handling of Architectural Aluminum from Shop to Site.
- .2 American National Standards Institute (ANSI):
  - .1 ANSI, H35.1M-2009, Alloy and Temper Designation Systems for Aluminum (Metric).
- .3 American Society for Testing and Materials (ASTM):
  - .1 ASTM A167-99(2009), Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
  - .2 ASTM B221M-08, Specification for Aluminum-Alloy Extruded Bars, Rods, Wires, Shapes and Tubes.
  - .3 ASTM F738M-02(2008), Specification for Stainless Steel Metric Bolts, Screws, and Studs.
- .4 Canadian General Standards Board (CGSB):
  - .1 CAN/CGSB-1.108-M89, Bituminous Solvent Type Paint.
- .5 Canadian Standards Association (CSA):
  - .1 CSA W59-M-03(R2008), Welded Steel Construction (Metal Arc Welding).

**1.3 DESIGN REQUIREMENTS**

- .1 Design aluminum doors in accordance with following Climatic Design Data for Oakville contained in the Ontario Building Code:
  - .1 Design temperature: January 1%, July 2 1/2% .
  - .2 Hourly wind pressures: 1 in 50 year occurrence.
- .2 Design aluminum doors to accommodate following without producing detrimental effect:
  - .1 Cyclic 40 degrees C daily thermal swing of components.
  - .2 Cyclic, dynamic loading and release of loads such as wind loads.
  - .3 13 mm vertical deflection in supporting structure and movement of supporting structure due to live, dead load, and creep or deflections, seismic load, sway displacement and similar items.
- .3 Prevent deflection and permanent or progressive glazing displacement. Restrict horizontal and

vertical deflection to less than  $L/175$  (under uniformly distributed positive design wind load), and 10 mm maximum regardless of span.

#### **1.4 SUBMITTALS**

- .1 Shop drawings:
  - .1 Submit shop drawings in accordance with the Section 01 33 00 indicating:
    - .1 Plans, sections, details, type of extrusions, profiles, anchorage, glazing details, and finishes.
    - .2 Section and hardware reinforcement.
  - .2 Samples:
    - .1 Submit sampled in accordance with the Section 01 33 00 of the following:
      - .1 One complete corner detail of door frame, glazing, and finish for each door type.
      - .2 Each door hardware item for the Consultant's approval.
  - .3 Reports:
    - .1 Submit substantiating engineering data, and independent test results of pre-tested, existing doors to substantiate compliance with the design criteria.

#### **1.5 DELIVERY, STORAGE, AND HANDLING**

- .1 Handle aluminum work in accordance with AAMA CW-10.
- .2 Protect aluminum surfaces with strippable coating. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather. Do not remove before final cleaning of building.

### **Part 2 Products**

#### **2.1 ACCEPTABLE MANUFACTURER(S) AND SYSTEM(S)**

- .1 Aluminum doors:
  - .1 Interior – non-thermal, heavy duty: approved products:
    - .1 'Canadiana HD' by Alumicor Limited.
    - .2 '350 Tuffline' by Kawneer Company Canada Limited.

#### **2.2 MATERIALS**

- .1 General:
  - .1 All materials under Work of this Section, including but not limited to, sealants and coatings are to have low VOC content limits.
  - .2 Wherever possible, metals used in work of this Section are to contain recycled content.
- .2 Aluminum extrusions and channels: ASTM B211 and ANSI H35.1 AA6063 alloy, T6 temper.
- .3 Reinforcements and anchors: ASTM A167, Type 304 to AISI No. 2B finish. Size as shown.

- .4 Glass and glazing materials: As specified in Section 08 80 50.
- .5 Frame sealant: Type as recommended by the aluminum work manufacturer.
- .6 Screws, bolts and other fasteners: ASTM F738M; Stainless Steel Type 304.
- .7 Isolation coating: CAN/CGSB-1.108-M; Bitumastic coating, acid and alkali resistant material.
- .8 Foam insulation: One component polyurethane foam for installation within closures and fillers; Enerfoam by Dow Chemical Canada Inc.
- .9 Weatherstripping: Durable, non-absorbing material resistant to deterioration by aging and weathering.
- .10 Door hardware: Supplied by Section 08 71 00, preparation and installation by this Section.

### **2.3 FABRICATION**

- .1 Fabricate sections true to detail, free from defects impairing appearance, strength and durability. Fabricate extrusions with sharp, well defined corners.
- .2 Fabricate, fit, and secure framing joints and corners accurately, with flush surfaces, and hairline joints. Apply frame sealant at joints for weatherproof seams.
- .3 Conceal anchors, reinforcement and attachments from view. Fabricate reinforcement in accordance with design requirements.
- .4 Do not expose manufacturer's identification labels on aluminum assemblies.
- .5 Fabricate doors and frames complete with internal reinforcements, cut-outs, and recesses to accommodate finish hardware. Reinforce cut-outs to assure adequate strength.
- .6 Double weatherstrip doors. Install weatherstripping in specially extruded ports and secure to prevent shrinkage or movement.
- .7 Fabricate doors of welded construction.
- .8 Glazing stop: Square, snap-on type, designed for neoprene glazing system.

### **2.4 FINISH**

- .1 Extrusion finish: Exposed aluminum sections shall be given an anodic oxide treatment in accordance with Aluminum Association specification AA-M12C22A31: "Bronze anodized".

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install aluminum doors in accordance with reviewed shop drawings, and manufacturer's written instructions.
- .2 Install Work of this Section securely, in correct location, level, square, plumb, at proper elevations, free of warp or twist.
- .3 Apply isolation coating at 0.8 mm dry film thickness to prevent corrosive or electrolytic action between dissimilar materials such as aluminum to concrete, masonry, galvanized steel and similar conditions.
- .4 Fill voids between aluminum framing and adjacent construction with foam insulation.
- .5 Install aluminum door manufacturer's standard weatherstripping at door frame perimeter. Install weatherstripping throughout entire length and width of doors at jambs and heads.
- .6 Install doors and hardware to manufacturers' written instructions. Clean and adjust hardware for correct performance.
- .7 Adjust operable parts for correct function.
- .8 Remove damaged or unacceptable Products and assemblies from Site and replace to Consultant's acceptance.
- .9 Install glass presence markers, in two cross stripes extending from diagonal corners. Maintain markers until final clean-up.

### **3.2 CLEANING**

- .1 Maintain aluminum doors, inside and outside, in clean condition throughout construction period.
- .2 Remove labels, protective material, and glass presence markers from prefinished surfaces.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 61 00 - Common Product Requirements.
- .3 Section 01 78 00 - Closeout Submittals.
- .4 Section 05 50 00 - Metal Fabrications: Metal fabricated framed openings, structural support framing for sloped glazing.
- .5 Section 07 27 10 - Air Barriers - Descriptive or Proprietary.
- .6 Section 07 84 00 - Firestopping: Fire safing between floor edge and curtain wall system.
- .7 Section 07 92 10 - Joint Sealing: System perimeter sealant and back-up materials.
- .8 Section 08 80 50 - Glazing.
- .9 Section 09 91 23 - Interior Painting: Field painting of interior surface of infill.

**1.2 REFERENCES**

- .1 Aluminum Association Designation System For Aluminum Finishes (AA)-[1997].
  - .1 DAF 45 [2003], Designation System For Aluminum Finishes.
- .2 American Architectural Manufacturers Association (AAMA).
  - .1 AAMA CW-DG-1-[96], Aluminum Curtain Wall Design Guide Manual.
  - .2 AAMA CW-10-[97], Care and Handling of Architectural Aluminum From Shop to Site.
  - .3 AAMA CW-11-[85], Design Wind Loads for Buildings and Boundary Layer Wind Tunnel Testing.
  - .4 AAMA T1R-A1-[02], Sound Control for Fenestration Products.
  - .5 AAMA 501-[94], Methods of Test for Exterior Walls.
  - .6 AAMA 503-[92], Voluntary Specification for Field Testing of Metal Storefronts, Curtain Wall and Sloped Glazing Systems.
  - .7 AAMA 611-[98], Voluntary Specifications for Anodized Finishes Architectural Aluminum.
  - .8 AAMA 612-[02], Voluntary Specifications, Performance Requirements, and Test Procedures for Combined Coatings of Anode Oxide and Transparent Organic Coatings on Architectural Aluminum.
  - .9 AAMA 2603-[02], Voluntary Specification Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.

- .10 AAMA 2604-[02], Voluntary Specification Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
- .3 American Society for Testing and Materials International, (ASTM).
  - .1 ASTM A36/A36M-[103a], Specification for Carbon Structural Steel.
  - .2 ASTM A123/A123M-[02], Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - .3 ASTM A167-[99], Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
  - .4 ASTM A653/A653M-[03], Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .5 ASTM B209-[02a], Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
  - .6 ASTM B221-[02], Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
  - .7 ASTM E283-[91(1999)], Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
  - .8 ASTM E330-[02], Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls, by Uniform Static Air Pressure Difference.
  - .9 ASTM E331-[00], Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform Static Air Pressure Difference.
  - .10 ASTM E413-[87(1999)], Classification for Rating Sound Insulation.
  - .11 ASTM E1105-[00], Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference.
- .4 Canadian General Standards Board (CGSB).
  - .1 CAN/CGSB 1.108-[M89], Bituminous Solvent Type Paint.
  - .2 CAN/CGSB-12.20-[M89], Structural Design of Glass for Buildings.
- .5 Canadian Standards Association (CSA International).
  - .1 CSA-G40.20/G40.21-[98(R2003)], General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels.
  - .2 CAN/CSA-G164-[M92(R2003)], Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .3 CSA-S136-[01], North American Specification for the Design of Cold-Formed Steel Structural Members.
  - .4 CAN3-S157-[M83(R2002)], Strength Design in Aluminum.
  - .5 CSA W59.2-[M1991(R2003)], Welded Aluminum Construction.
- .6 Environmental Choice Program (ECP).
  - .1 CCD-45-[95], Sealants and Caulking Compounds.
  - .2 CCD-47-[1998], Surface Coatings.

- .3 CCD-48-[95], Recycled Water-Borne Surface Coatings.
- .7 Society for Protective Coatings (SSPC).
  - .1 SSPC - Paint 20 Zinc Rich Coating.
  - .2 SSPC - Paint 25 Alkyd, Zinc Oxide Linseed Oil and Primer for Use Over Hand Cleaned Steel Type 1 and Type 2.

### 1.3 SYSTEM DESCRIPTION

- .1 Work included: Furnish labour, materials and other services to complete the fabrication and installation of the framing, including all materials and fitments required for the operation of any entrance units included, in the manner, direction and performance shown on the shop drawings and specified herein. Work not included: Structural support of framing, interior trims. Related work specified elsewhere.

### 1.4 QUALITY ASSURANCE

- .1 Installation crews engaged or provided by the approved supplier shall have proven experience specifically trained and qualified in this work (written proof of minimum of five (5) years employment or service with the window manufacturer or similar manufacturer). Individuals are to be either employees of the manufacturer and/or workers approved by the manufacturer.
- .2 Provide one (1) thoroughly experienced, reliable, qualified and competent foreman in charge of the work to be on site at all times when work is taking place. Individual to be designated in charge from start of activities on site until final deficiencies are complete. Foreman may only be changed by written approval *or request* of the Consultant or owner.
- .3 Window supplier is to have adequate plant and skilled tradesmen and is known to have manufactured and installed similar windows for a minimum of five (5) years in the Province of Ontario.

### 1.5 PERFORMANCE REQUIREMENTS

- .1 Structural performance shall be based on CSA standard CAN3-S157 "Strength Design in Aluminum" and a maximum deflection of 1/175 of the span.
- .2 Air infiltration shall not exceed 0.06 cfm/ft<sup>2</sup> (0.0003 m<sup>3</sup>/s-m<sup>2</sup>) when tested in accordance with ASTM E283 at a pressure differential of 6.24 p.s.f. (300 Pa.)
- .3 There shall be no water infiltration when tested in accordance with ASTM E331 with a pressure differential of 15.0 p.s.f. (720 Pa.) Thermally, the grid members shall have a condensation resistance equal to or better than the area along the bottom of a 1" sealed glass unit with standard metal spacer edge construction.
- .4 Size glass units and glass dimensions to limits established in CAN/CGSB-12.20.
- .5 Provide system to accommodate, without damage to components or deterioration of seals:
  - .1 Movement within system.
  - .2 Movement between system and perimeter framing components.
  - .3 Dynamic loading and release of loads.



- .4 Deflection of structural support framing.
- .5 Shortening of building concrete structural columns.
- .6 Creep of concrete structural members.
- .6 Vapour seal with interior atmospheric pressure of 25 mm sp, 22 degrees C, 40% RH: No failure.
- .7 Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to the exterior by a weep drainage network.
- .8 Ensure no vibration harmonics, wind whistles, noises caused by thermal movement, thermal movement transmitted to other building elements, loosening, weakening, or fracturing of attachments or components of system occur.

## **1.6 PRODUCT DATA**

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide component dimensions; describe components within assembly, anchorage and fasteners, glass and infill, internal drainage details and water flow diagrams.

## **1.7 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate system dimensions, framed opening requirements and tolerances, internal millimeter reinforcement, adjacent construction, anchor details anticipated deflection under load, affected related Work, weep drainage network, expansion and contraction joint location and details, and field welding required.
- .3 Curtain wall shop drawings are to be approved for structural integrity by a Professional Engineer licensed to design structures in the Province of Ontario. Shop drawings are to bear Engineer's seal of approval.

## **1.8 SAMPLES**

- .1 Drawings and specifications for work of this section are based upon Thermawall 2600 series Curtain Wall system by Alumicor. For all approved products and acceptable alternatives, submit supporting technical literature, samples, drawings and performance data to meet or exceed these specifications.
- .2 Submit two samples 800 x 800 mm in size illustrating prefinished aluminum surface, finish, colour, texture, specified glass units, insulated infill panels, glazing materials illustrating edge and corner.

## **1.9 DESIGN DATA**

- .1 Submit design data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide framing member structural and physical characteristics, calculations, dimensional limitations, special installation requirements.

#### **1.10 TEST REPORTS**

- .1 Submit test reports in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit substantiating engineering data, test results of previous tests by independent laboratory which purport to meet performance criteria, and supportive data.

#### **1.11 REGULATORY REQUIREMENTS**

- .1 Conform to applicable code for acoustic attenuation, and sound transmission.
- .2 Use the following paragraph for assessing full sized erected assemblies for review of construction, coordination of work of several sections, testing, or observation of operation. A mock-up may also be used for assessing field applied finishes.

#### **1.12 MOCK-UP**

- .1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control.
- .2 Locate where directed.
- .3 Allow 24 hours for inspection of mock-up Consultant before proceeding with work.
- .4 When accepted, mock-up will demonstrate minimum standard for this work. Mock-up may not remain as part of finished work.

#### **1.13 PRE-INSTALLATION MEETING**

- .1 Convene one week before starting work of this section.

#### **1.14 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver, store, handle and protect materials in accordance with Division 1 requirements.
- .2 Handle work of this section in accordance with AAMA CW-10.
- .3 Protect prefinished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.

#### **1.15 ENVIRONMENTAL REQUIREMENTS**

- .1 Do not install sealants when ambient and surface temperature is less than 5 degrees C.
- .2 Maintain this minimum temperature during and after installation of sealants.

#### **1.16 SEQUENCING**

- .1 Coordinate work of this section with installation of fire stopping, air barrier placement, vapour retarder placement, flashing placement, installing ductwork to rear of louvers.

**1.17 WARRANTY**

- .1 Submit a manufacturer's warranty against defects in materials and workmanship covering the components of the window system for a period of ten (10) years. The manufacturer shall supply a non-pro-rated warranty covering labour, materials, tools and equipment to repair and/or replace any materials defects at no additional cost, for a period of ten (10) years including defects or failures due to poor workmanship and installation.
- .2 The supplier shall also submit a warrantee, in accordance with Section 088050-Glazing, for 10 years warranting the sealed units against defects.

**1.18 MAINTENANCE DOCUMENTS AND MATERIALS**

- .1 Provide 2 copies of data for maintenance and routine cleaning.
- .2 Provide 2 copies of final record reviewed shop drawings for owner's records.
- .3 Contractor shall supply all accessories as may be required for the operation and performance of the windows system.

**1.19 EXTRA MATERIALS**

- .1 Provide extra materials of glass units in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Provide protected and packaged in wood crates suitable for storage. Clearly identify each crate.
- .3 Deliver Consultant, upon completion of the work of this section.
- .4 Store where directed by Consultant.

**1.20 WASTE MANAGEMENT AND DISPOSAL**

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Drawings and Details are based on Thermawall 2600 series Curtain Wall by Alumicor (2 ½"- 63.5 mm x 149mm & 187mm – incl. glazing & cap).
- .2 Must be designed to withstand a wind load of min. 30 psf.
- .3 Fixed (non opening) thermally broken anodized aluminum curtain wall system, glazed with tempered, insulating vision glass and tempered spandrel glass.
- .4 Standard pressure cap for most locations. Provide 100mm extended pressure cap where noted on drawings.

- .5 Acceptable Materials : Curtain wall systems meeting or exceeding these specifications manufactured by:
  - .1 Alumicor
  - .2 Aerloc Industries
  - .3 Alwind Industries
  - .4 Kawneer Company of Canada
  - .5 Windspec Inc.
- .6 Extrusions shall be 6063 T54 alloy and temper.
- .7 Formed aluminum components shall be sheet of alloy and temper suitable for their purpose and finish.
- .8 Fasteners shall be 300 series stainless steel or 400 series stainless steel cadmium plated and of sufficient size and quantity to perform their intended function.
- .9 Weathering and glazing gaskets shall be extruded, black, closed cell or dense elastomer of durometer appropriate to the function.
- .10 Provide glazed and aluminum spandrel sections where indicated on drawings.
- .11 Provide structural silicone mullions where described on drawings.
- .12 Refer to Section 08 80 50 – Glazing for information on tinted glazing sections and glazed spandrel panels. Refer to drawings for locations.
- .13 Manufacturer / Installer to determine if mullions require internal reinforcement to achieve specified load resistance.
- .14 At all curtain wall spandrel panels exposed on interior of building, curtain wall spandrel panels shall be laminated with aluminum panel of same pre-finish as mullions with bent edges.
- .15 Allow for three (3) additional colours of exterior infill panels other than anodized. Enamel finish shall be PPG Duranar finish (Kynar 500), 10,000 series or approved alternate.
- .16 Curtain wall sunshades designated ‘SS’ to be 36” deep Kawneer Versoleil Sunshade, CRL 3600 or similar profile by McGill. Confirm compatibility of sunshade with curtainwall to be supplied. Sunshades must be supplied and installed by the installer of the curtain wall system as an integral component of framing.

## 2.2 FINISHES

- .1 BRONZE ANODIZED.
  - .1 Exposed aluminum sections shall be given an anodic oxide treatment in accordance with Aluminum Association specification AA-M12C22A31: “Bronze anodized”.

### 2.3 ALUMINUM SPANDRAL PANEL

- .1 Composition: Two sheets of aluminum sandwiching a core of extruded thermoplastic formed in a continuous process without the use of glues or adhesives between dissimilar materials. Bond integrity testing to adhere to ASTM D1781-76
- .2 Aluminum face sheets: Aluminum alloy 3003, thickness: 0.51 mm
- .3 Panel thickness: 4 mm
- .4 Panel weight: 5.28 kg/sq.m.
- .5 Tolerances:
  - .1 Panel bow: Maximum 0.8% of panel dimension (width or length).
  - .2 Panel Dimensions: Take site measurements before proceeding with production unless dimensions can be guaranteed by General Contractor.
  - .3 Panel lines, breaks and angles to be sharp and true; panel surfaces to be free from warp or buckle.
- .6 Panel System: Dry joint SL-2000 with 12.5 mm wide panel joints using proprietary aluminum extrusions.
- .7 Acceptable material and manufacturer:
  - .1 Alucobond Plus supplied by Sobotec Ltd., 67 Burford Road, Hamilton Ontario, L8E 3C6 Tel: 905-578-1278.
  - .2 Similar systems meeting the exact fire rated and compositional requirements of this specification section by “Alpolic” by Mitsubishi Chemical; Viewest (905 825-2252), Kanalco Ltd (tel: 905-623-2303) or Flynn Canada, or Alcotex as supplied by Ontario Panelization ( tel. 519 659-8900) or others approved by Consultant.
- .8 Aluminum Composite to have a fire resistant core, meeting OBC requirements for non-combustible materials.
- .9 Refer to ‘Glazing’ specification for glazed spandrel panels.
- .2 Panel finishes: Duranar, three coat, coil-coated baked enamel finish containing Kynar 500 polyvinylidene fluoride resin, metallic finish as specified below.
- .3 Panel Colours: Allow for 1 colour as follows:
  - .1 **Colour A:** to match quality level, finish and colour series as Alpolic Metallic Series, colour to be confirmed.
  - .2 Locations: spandrel wall panels noted on drawings.
  - .3 Contractor to submit triplicate samples of colours for review by Consultant prior to order and fabrication.

### 2.4 FABRICATION

- .1 Fabricate aluminum work in accordance with reviewed shop drawings and manufacturer’s written instructions.
- .2 Fabricate framing from extrusions of size and shape shown on shop drawings.

- .3 Vertical and horizontal members shall be tubular extrusions designed for shear block corner construction.
- .4 All joints shall be accurately machined, assembled and sealed to provide neat weather tight joints. Shielded drainage and pressure equalization vents shall be provided where required. AH horizontal members shall be sealed to vertical members to provide individual compartments within the system in accordance with the rain screen principle.
- .5 Fabricate system components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
- .6 Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.
- .7 Prepare components to receive anchor devices. Install anchors.
- .8 Arrange fasteners and attachments to ensure concealment from view.
- .9 Reinforce framing members for external imposed loads.
- .10 Visible manufacturer's identification labels not permitted.
- .11 Break shapes must be approved by the Consultant prior to use.
- .12 At all curtain wall spandrel panels exposed on interior of building, curtain wall spandrel panels shall be laminated w/ aluminum panel of same pre-finish as mullions with bent edges.
- .13 Provide spandrel panels at locations of exterior light fixtures as shown on elevations. Coordinate with Div. 16 for lighting location and size of openings.
- .14 All perimeter sections to be tubular/closed back sections for continuous adhesion and continuity of building envelope membrane.
- .15 Spandrel panels:
  - .1 Fabricate insulated spandrel panel inner facing of 20 gauge aluminum sheet. Wrap edges with aluminum sheet, enabling installation and minor movement of perimeter seal.
  - .2 Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.
  - .3 Place insulation within panel, adhered to exterior face of interior panel sheet over entire area of sheet with impale fasteners.
  - .4 Provide integral reinforcing and stiffeners as required to reinforce panel against deflection caused by wind and suction loads.
  - .5 Provide non-metallic spacers as necessary to separate dissimilar metals.
  - .6 Ventilate and pressure equalize the air space outside the exterior surface of the insulation, to the exterior.
  - .7 Arrange fasteners and attachments to ensure concealment from view.

- .8 Glass panels: Consists of spandrel glass in accordance with Section 08 80 50 to the exterior with insulated backpan to the inside. Interior face of panel to be finished with a pre-finished aluminum sheet of the same grade as the exterior, colour matching the exterior. Insulation thickness shall be as indicated, retained with stick clips. Seal all joints in shop with high grade butyl sealant, including perimeter seal at backpan. Colour to later selection by Consultant.
- .9 Metal panels: Consists of an exterior prefinished flush aluminum panel with panel stiffeners as required, to match colour of window framing, with insulation core thickness as indicated and galvanized sheet back-pan. Interior face of panel to be finished with a pre-finished aluminum sheet of the same grade as the exterior, colour matching the exterior.

### **Part 3 Execution**

#### **3.1 EXAMINATION**

- .1 Verify dimensions, tolerances, and method of attachment with other work.
- .2 Verify wall openings and adjoining air barrier and vapour retarder materials are ready to receive work of this section.

#### **3.2 INSTALLATION**

- .1 Framing shall be installed, glazed and adjusted by experienced personnel in accordance with the manufacturer's instructions and approved shop drawings. All items in this section shall be set in their correct location and shall be set level, square, plumb and at proper elevations and in alignment with other work.
- .2 Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- .3 Provide alignment attachments and shims to permanently fasten system to building structure. Clean weld surfaces; apply protective primer to field welds and adjacent surfaces.
- .4 Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances and align with adjacent work.
- .5 Provide thermal isolation where components penetrate or disrupt building insulation.
- .6 Co-ordinate attachment and seal of perimeter air barrier and vapour retarder materials.
- .7 Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- .8 Install fire-safing in areas as indicated.

#### **3.3 FIELD QUALITY CONTROL**

- .1 Inspection will monitor quality of installation and glazing.

- .2 Test to ASTM E1105, and AAMA 501.
- .3 Evaluate installed system by thermo-photographic scan.

### **3.4 ADJUSTING**

- .1 Adjust operating sash for smooth operation.

### **3.5 CLEANING**

- .1 Remove protective material from prefinished aluminum surfaces.
- .2 Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
- .3 Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

### **3.6 PROTECTION**

- .1 Protect finished Work from damage.
- .2 Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.”

**END OF SECTION**



**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 11 – Final Cleaning.
- .3 Section 08 80 50 – Glazing.
- .4 Section 07 92 10 - Joint Sealing.

**1.2 REFERENCES**

- .1 American Architectural Manufacturers Association (AAMA).
  - .1 AAMA 611-98, Voluntary Specifications for Anodized Finishes Architectural Aluminum.
- .2 American Society for Testing and Materials International, (ASTM).
  - .1 ASTM B209-07, Specification for Aluminum and Aluminum Alloy Sheet and Plate.
  - .2 ASTM B221-08, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- .3 Canadian General Standards Board (CGSB).
  - .1 CAN/CGSB-19-GP-14M-1984, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing.
- .4 Canadian Standards Association (CSA) International
  - .1 CSA-A440-00/A440.1-00 (R2005), A440-00 (R2005), Windows / Special Publication A440.1-00 (R2005), User Selection Guide to CSA Standard A440-00 (R2005), Windows.

**1.3 DESIGN REQUIREMENTS AND PREQUALIFIED WINDOW SUPPLIERS**

- .1 Base performance standard: Products to be supplied from the list of acceptable manufacturers listed below shall meet or exceed the following performance standard product upon which this specification is largely based: 970 Series with 1350 Series Vents as manufactured by Alumicor Ltd.
- .2 Acceptable Manufacturers/Suppliers: Aluminum Windows meeting this specification for this project shall be supplied by one of the following pre-approved suppliers:
  - .1 Aerloc Industries Ltd. (905) 628-6061
  - .2 Alwind Industries Ltd (905) 738-4266
  - .3 Barton Glass (905) 385-3599
  - .4 Glass Canada Limited (519) 642-4100
  - .5 KW Glass Systems Inc (519) 725-9305
  - .6 Sherwood Windows Group (416) 675-3262
  - .7 Windspec Inc (905) 738-8311

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Note: All window frames have been drawn to a std. framing depth of 5 1/4”.

All curtain wall framing has been drawn to match windows so that curtain wall framing is inset 67 mm from the veneer face. Provide data at drawn sizes to design loads required.

- .3 Design framing and glazing to withstand design loads as per Ontario Building Code with a maximum reflection of 1/200th of clear span.
- .4 Work of this Section must be designed by and bear stamp of a Professional Engineer licensed to design structures in the Province of Ontario certifying their strength and safety.
- .5 By submitting a price for supply and install, the Contractor, for Work to this Section, shall guarantee that he has carried products and pricing from one of the above approved manufacturers.

#### **1.4 PERFORMANCE**

- .1 The overall thermal transmittance of fenestration assemblies shall be less than 0.81 Btu. Thermal transmittance for the fenestration shall be determined using ASHRAE 90.1 calculation procedures and shall include the effect of sash, frame, edge effect and spacer for multiple-glazed units.
- .2 Fenestration shall meet CAN/CSA – A440 windows:
  - .1 Air Leakage: A3
  - .2 Water Leakage: B7
  - .3 Wind Load Resistance: C5
  - .4 Condensation Resistance Factor: fixed frame: 60 minimum
  - .5 Glass: 59 minimum
- .3 Window shall also meet the requirements for blocked operation, ease of operation, sash strength, stiffness and resistance to forced entry.
- .4 Submit manufacturer's certificate, certifying compliance with the above-noted requirements.

#### **1.5 QUALITY ASSURANCE**

- .1 Installation crews engaged or provided by the approved supplier shall have expertise and proven experience specifically trained and qualified in this work. Individuals are to be either employees of the manufacturer and/or workers approved by the manufacturer.
- .2 Provide one (1) thoroughly experienced, reliable, qualified and competent foreman in charge of the work to be on site at all times when work is taking place. Individual to be designated in charge from start of activities on site until final deficiencies are complete. Foreman may only be changed by written approval *or request* of the Consultant or owner.
- .3 Window supplier is to have expertise and adequate skilled tradesmen who have installed similar windows within the Province of Ontario.
- .4 Mock-up: Construct a window mock-up in accordance with Section 01 45 00 – Quality Control. Allow 24 hours for inspection of mock-up by Consultant before proceeding

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with the Work. When accepted, mock-up will demonstrate minimum standard for this Work. Mock-up may not remain as part of finished Work.

## **1.6 SUBMITTALS**

- .1 Submittals:
  - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Clearly indicate on shop drawings all materials and large scale details for head, jamb and sill as they will be installed in contact with building components for this project, profiles of components, elevations of unit, anchorage details, location of isolation coating, location of insulation to jambs head and sill, drainage locations, description of related components and exposed finishes and fasteners.
  - .3 Show paths of interior drainage and venting.
- .2 Samples:
  - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Submit samples of each window hardware item for Consultant's approval of type, finish and material.
- .3 Certificates: Submit manufacturer's certificate, and test performance data certifying compliance with specification requirements, for:
  - .1 windows
  - .2 finishes.
  - .3 removable self framed insect screens.
  - .4 infiltration/exfiltration rates.
  - .5 thermal transfer resistance of frames.
  - .6 locking hardware
  - .7 vandal resistance
- .4 Closeout submittals:
  - .1 Submit closeout submittals in accordance with Section 01 78 00.
  - .2 Provide 2 copies of data for maintenance and routine cleaning.
  - .3 Provide 2 copies of final record reviewed shop drawings for owner's records.
  - .4 Contractor shall supply all accessories as may be required for the operation and performance of the windows system.

## **1.7 WASTE MANAGEMENT AND DISPOSAL**

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 Collect and separate for disposal recyclable packaging materials in appropriate on-site for recycling.
- .3 Unused or damaged glazing materials are not recyclable and must not be diverted to municipal recycling programs.

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- .4 Divert unused or damaged wood materials from landfill to recycling facility approved by Consultant.
  - .5 Divert unused metal materials from landfill to metal recycling facility approved by Consultant.
  - .6 Divert unused caulking material from landfill to official hazardous material collections site approved by Consultant.
  - .7 Plastic caulking tubes are not recyclable and must not be diverted for recycling with other plastic materials.

## **1.8 WARRANTY**

- .1 Submit a manufacturer's warranty against defects in materials and workmanship covering the components of the window system for a period of ten (10) years. The manufacturer shall supply a non-pro-rated warranty covering labour, materials, tools and equipment to repair and/or replace any materials defects at no additional cost, for a period of ten (10) years including defects or failures due to poor workmanship and installation.
- .2 The supplier shall also submit a warrantee, in accordance with Section 088050-Glazing, for 10 years warranting the sealed units against defects.

## **Part 2 Products**

### **2.1 SYSTEMS AND MANUFACTURERS**

- .1 Drawings and Details are based on 970 Series with 1350 Series Vents as manufactured by Alumicor Ltd. (416) 745-4222.
- .2 Approved exterior window systems meeting or exceeding these specifications by the following manufacturers will be considered:
  - .1 Alumicor
  - .2 Aerloc Industries
  - .3 Alwind Industries
  - .4 Kawneer Company of Canada
  - .5 Windspec Inc.

### **2.2 MATERIALS**

- .1 DARK BRONZE ANODIZED (TO MATCH EXISTING)
  - .1 Exposed aluminum sections shall be given an anodic oxide treatment in accordance with Aluminum Association specification AA-M12C22A31.
- .2 Extrusions shall conform to ASTM B221 and be AA6063 T54 alloy and temper for framing.
- .3 Formed aluminum sheet and plate components shall be AA1100-H14 alloy and temper suitable for their purpose and finish.

- .4 Exposed anodized sheet and plate shall conform to ASTM B209, to AA5005-H14 alloy and temper or AA1100-H14 alloy and temper (anodizing quality, 1.6 mm thickness).
- .5 Non-exposed sheet and plate to AA3003-H14 alloy and temper, mill finish.
- .6 Fasteners shall be 300 series stainless steel or 400 series stainless steel cadmium plated and of sufficient size and quantity to perform their intended function.
- .7 Weathering and glazing gaskets shall be extruded, black, closed cell or dense elastomer of durometer appropriate to the function.
- .8 Glass and glazing materials: In accordance with Section 08 80 50 – Glazing.
- .9 Glazing tapes shall be preformed polyisobutylene-butyl glazing tape with integral shim strip, 10-15 durometer, hardness, paper release, black color. Acceptable materials: Tremco Polyshim II by Tremco Ltd.
- .10 Exterior Sills: extruded aluminum, minimum 3 mm thick, complete with joint covers, complete with jamb drip deflectors on both sides of each sill (refer also to drawings for type), chairs, anchors, anchoring devices. All corners shall be ground or rounded to eliminate burrs and sharp edges. Submit details with shop drawings. Sills to be one continuous piece along sill of window.
- .11 Sealants: ASTM C920, Type S, Grade NS, Class 100; One-part, Moisture -curing silicone, '790 Silicone Building Sealant' by Dow Corning Corporation or Spectrum 1 by Tremco. Colour: As selected by Consultant.
- .12 Foam Backer Rod: to be extruded, closed cell foam, round polyethylene rope, minimum 25% wider than width of joint cavity to be caulked. To be compatible with primers and sealants.
- .13 Void filler foam: one part expanding polyurethane closed cell foam by BASF, Hilti or approved alternate specifically designed for window applications. To be compatible with primers and sealers
- .14 Bedding Compound: to CGSB 19-GP-14M.
- .15 Isolation Coating: alkali resistant bituminous paint.
- .16 Window hardware: Heavy duty roto operator window hardware to include all components as required for smooth, secure and complete operation and to be reviewed by the Consultant prior to ordering. Provide samples for Consultant's approval.
- .17 All perimeter sections to be tubular/closed back sections for continuous adhesion and continuity of building envelope membrane.
- .18 Window supplier / installer to provide and install continuous angles or clips as required for fastening windows to building structure.

## 2.3 FABRICATION

- .1 Fabricate aluminum windows in accordance with reviewed shop drawings and manufacturer's written instructions.

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- .2 Fabricate in accordance with CSA-A440/A440.1 supplemented as follows:
  - .3 Fabricate framing from extrusions of size and shape shown on shop drawings. Interior and exterior extruded aluminum framing sections shall be integrated with a glass reinforced nylon thermal break to form a rigid composite assembly without the use of fasteners or other thermal bridging elements.
  - .4 Composite frame assembly shall have a minimum of 1100 lbf/4 in. (4815N/ 100 mm) resistance to shear between the aluminum and the thermal break materials.
  - .5 Dry shrinkage of the thermal break shall not exceed 0.1% of the framing member length.
  - .6 All framing joints shall be accurately machined, assembled, and sealed to provide neat weather tight connections. Coupling mullions shall be designed to provide a functional split to permit modular construction and allow for thermal expansion. Glass stops shall be lock-in screwless type.
  - .7 Elastomeric air seal gasket shall be installed around the full perimeter of glass and sealed at corners with silicone sealant. Air seal gasket must provide adhesion with silicone sealant.

## **2.4 ALUMINUM FINISHES**

- .1 Exposed aluminum sections and infill panels or interior column covers, if any, shown on drawings be given an anodic oxide treatment in accordance with Aluminum Association specification AA-M12C22A31. and CAN/CSA-A440 dark bronze anodized Class II, 10µm (.0004 inch.) in accordance with AAMA 611.
- .2 For exterior spandrel panels –if required on the project, to be a clear anodized infill panel to match windows finish complete with solid support substrate and insulation layer, clear anodized aluminum smooth or textured finish to Consultant selection.
- .3 If Colour finish other than anodized is indicated on drawings or required to match existing, enamel finish shall be PPG Duranar finish (minimum 8000 series) or approved alternate.
- .4 Final approval of finish and colour to be made by Consultant.

## **2.5 HARDWARE**

- .1 Provide heavy duty roto operator hardware in conjunction with friction arms, aluminum hinges, and concealed allen key with removable type knob handle and all required additional components. Provide samples for Consultant's approval.
- .2 Limiting stops: All operable windows within reach of occupants to have limiting stops to each hinge to restrict the opening to a maximum of 225mm.
- .3 Operating pole: Provide one varnish finished hardwood pole with blunt end hook suitable for spring catch latch, for each room in which operating hardware is more than 1800 mm from floor.
- .4 Verify all site conditions regarding location and exact assembly requirements.

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**2.6 INSECT SCREENS**

- .1 Fly screens: Provide to all operable units meeting CGSB 79-GP-1M and CSA/CAN-A440 rating heavy duty shall consist of extruded aluminum frame having a wall thickness of 1.9 mm, finish to match windows. Screen cloth shall be 18 x 14 aluminum mesh, spring loaded plunger retainers, 4 per frame.

**2.7 ISOLATION COATING**

- .1 Isolate aluminum from following components, by means of isolation coating:
  - .1 Dissimilar metals except stainless steel, zinc, or white bronze or small area.
  - .2 Concrete, mortar and masonry.
  - .3 Wood.

**2.8 GLAZING**

- .1 Prepare windows to receive 25 mm thick double glazed insulating glass specified under Section 088050 – Glazing. Glaze windows in accordance with CSA-A440/A440.1.

**2.9 THRU-WALL FLASHING**

- .1 Sub-sill flashings to be Blueskin SA by Bakor in locations shown on drawings. Adhere to substrate using primer approved by manufacturer. Ensure clean-up of excess primer and no visible edges of flashing upon completion of the work.

**2.10 EXTRUDED SILLS**

- .1 Sills are to be a minimum of 7 degree (7°) downward slope and integral drip which extends a minimum of 25 mm from the face of the wall cladding.
- .2 Install metal sills with uniform wash to exterior, level in length, straight in alignment with plumb upstands and faces. Break form shapes are not permitted.

**2.11 ALUMINUM PANNING**

- .1 Panning to be extruded aluminum minimum 1.6 mm thick with pre-coated finish to be identical process and match to aluminum frames and sills. Break form shapes are not permitted.
- .2 Submit samples of panning along with samples of other extrusions and materials.
- .3 Metal panning to be designed to lock into new window frames and have true flat planes with no twists, buckles dents, “oil canning” or other similar visual defects caused by manufacturing or handling.

**Part 3 Execution**

**3.1 PREPARATION**

- .1 Protect adjacent surfaces from damage resulting from work under this specification.

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### **3.2 WINDOW INSTALLATION**

- .1 Install in accordance with CSA-A440/A440.1, reviewed shop drawings and manufacturer's written instructions.
- .2 Coordinate with Section 08 80 50 as required for installation of glass and glazing materials.
- .3 Arrange components to prevent abrupt variation in colour.
- .4 Install the windows in accordance with the manufacturer's instructions. Install the windows plumb, level and true relative to building structure. Do not exceed 3mm in 3050 mm (1/8" in 10'0") variation from plumb and level. Foam insulate between the frame members and the window opening using a single component polyurethane foam, insulating sealant.

### **3.3 SILL INSTALLATION**

- .1 Install metal sills with uniform wash to exterior, level in length, straight in alignment with plumb upstands and faces. Ensure integral end caps are secured with no burrs or exposed sharp edges and do not require excessive caulking due to profiles at jamb. Break form shapes are not permitted.

### **3.4 CAULKING**

- .1 Seal joints between frame members and other non-operating components with sealant to provide weathertight seal at outside.
- .2 Seal joints between windows and window sills with sealant. Bed sill expansion joint cover plates and drip reflectors in bedding compound. Caulk between sill upstand and window-frame. Caulk butt joints in continuous sills.
- .3 Apply sealant in accordance with manufacturer's written instructions and additional requirements as outlined in Section 07 92 10 - Joint Sealing. Conceal sealant within window units except where exposed use is permitted by Consultant.
- .4 Interior trims and sealant not to be applied until installed window has been inspected and approved by the Consultant.

### **3.5 ADJUSTING**

- .1 Adjust operable units to move smoothly, with proper tension, throughout their full range of motion and to fit tightly when closed and locked.
- .2 Lubricate hardware in accordance with manufacturer's instructions.
- .3 Ensure that weatherstripping makes weathertight contact and does not cause binding to affect closing and locking.

### **3.6 CLEAN UP**

- .1 Clean glass at the factory. For final cleaning of glass to remove job site soiling refer to Section 088050 - Glazing. Leave all surfaces clean, free from sealants, caulking or other



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foreign material. Remove all surplus materials and debris resulting from the work of this Trade.

- .2 Refer to other sections for requirements to make good all finishes.

### **3.7 PROTECTION**

- .1 Aluminum shall be isolated from concrete, mortar, plaster or dissimilar metals with bituminous paint or epoxy solution. Framing shall be protected from other building materials during and after installation until acceptance.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Division 1
- .2 Section 06 40 00 – Architectural Woodwork.
- .3 Section 08 11 14 – Metal Steel Doors and Frames.
- .4 Section 16 – Electrical wiring for magnetic strikes, hold open devices, electric releases and electric locks.

**1.2 SECTION INCLUDES**

- .1 For continuity and ready reference, this section includes hardware Installation and Inspection which in total will involve more than one contractor, as described following. The General Contractor will ensure in submitting his tender that specific roles and scope delineations are clear.
- .2 Hardware Supply: It is the intention of this contract that the **Supply is by a specialist hardware supplier as part of the Cash Allowance.**
- .3 Hardware Installation: It is the intention of this section that Installation is by the General Contractor if so qualified or qualified personnel appointed by the General Contractor for all systems and methods described herein. **Installation of all hardware is to be included in the base bid price.**
  - .1 Scope: Installation of door hardware for all interior and exterior steel doors, locksets to teachers closets and coordination of installation of automatic operators with Division 26.
- .4 Hardware Inspection: It is the intention of this section that Installation is by the General Contractor for all systems and methods described herein.
  - .1 Scope: inspection of installation of door hardware.

**1.3 REFERENCES**

- .1 CAN/CGSB-69.17-M86 – Bored and Pre-assembled Locks and Latches
- .2 CAN/CGSB-69.18-M90/ANSI/BHMA-A156.1-1981 – Butts & Hinges
- .3 CAN/CGSB-69.19-M93/ANSI/BHMA-A156-3-1989 – Exit Devices
- .4 CAN/CGSB-69.20-M90/ANSI/BHMA-A156-4-1986 – Door Controls (Closers)
- .5 CAN/CGSB-69.29-93/ANSI/BHMA-A156-13-1930 – Mortise Locks & Latches
- .6 CAN/CGSB-69.34-93/ANSI/BHMA-A156.18-1987 – Materials & Finishes
- .7 Canadian Steel Door & Frame Manufacturers Association (CSDFMA),

.8 Canadian Metric Guide for Steel Doors & Frames (Modular Construction)

.9 NFPA 80-1995 – Fire Doors and Fire Windows

#### **1.4 REQUIREMENTS FOR REGULATORY AGENCIES**

.1 Hardware for doors in fire separations and exit doors shall be certified by a Canadian Certification Organization accredited by the Standards Council of Canada.

#### **1.5 SUBMITTALS**

.1 Samples:

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

.1 Butt hinges

.2 Continuous hinges

.3 Door closers

.4 Exit devices

.5 Overhead stops

.6 Storeroom set with lever trim

.2 Identify each sample by a label indicating location for installation, applicable specification paragraph number, brand name and number, finish, and hardware package number.

.3 Samples will be retained by the Consultant during the initial review period, but not exceeding one month. Samples will be returned at that time and, if acceptable, they may be incorporated into the Work.

.4 Substitute new samples for those rejected by the Consultant.

.5 Do not supply door hardware to the site until all samples are approved by the Consultant.

.2 Hardware List:

.1 Submit contract hardware list in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit six copies of a detailed final door hardware list prepared by a qualified Architectural Hardware Consultant.

.3 List all items to be furnished and delivered under this section.

.4 Indicate door hardware proposed, identifying each item by manufacturer name, manufacturer's catalogue model number, material, function, finish, location, and other pertinent information.

.5 The list shall be in the same format as the door hardware list bound in this project manual.

.6 Approval of the Final Door Hardware List by the Consultant and the Owner shall not relieve the Contractor from responsibility for providing all required door hardware.

.3 Template:

- .1 Within ten working days of being requested by the Consultant or the Contractor, submit templates for door and frame preparations and mounting of door hardware items.
- .2 Identify each template by label indicating applicable specification paragraph number, brand name and number, door number, and hardware package number.
- .3 Submit manufacturer's specifications, catalogue cuts, and other data required to identify individual components listed and to demonstrate compliance with specified requirements for items contained in the final door hardware list. Submission of manufacturer's full line brochures is not acceptable.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- .1 Packing, Shipping, Handling and Unloading:
  - .1 Package each item of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.
- .2 Storage and Protection:
  - .1 Store finishing hardware in locked, clean and dry area.

## **1.7 WASTE DISPOSAL AND MANAGEMENT**

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 Dispose of recyclable packaging material in appropriate on-site bin for recycling.

## **1.8 MAINTENANCE DATA**

- .1 Provide parts list, manufacturers' instructions, and operation and maintenance data for each type of door hardware for incorporation into maintenance manual specified in Section 017800 – Closeout Submittals.
- .2 Brief the Owner's maintenance staff regarding proper care, cleaning, and general maintenance of door hardware.

## **1.9 MAINTENANCE MATERIALS**

- .1 Supply four sets of wrenches for door closers, locksets, latchsets, and exit devices.
- .2 Supply four sets of other special parts or tools required for proper maintenance and adjustment of door hardware (excluding tools required for keying.)

## **1.10 WARRANTY**

- .1 Submit a warranty for door hardware on a form approved by the Owner and in accordance with the General Conditions, but for a period of three (3) years unless specified otherwise. Where a manufacturer's standard warranty period exceeds three years it shall prevail.
- .2 The warranty for both fire exit devices and power door operators shall be for a period of five (5) years.
- .3 The warranty for door closers shall be for a period of ten (10) years.

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- .4 Provide a lifetime warranty for all mortise hinges.
  - .5 Door hardware warranties shall cover all defects in material and workmanship that become apparent during the warranty period and such defects shall be made good or the defective product shall be replaced, to the satisfaction of the Owner and at no cost to the Owner.

## **Part 2 Products**

### **2.1 HARDWARE ITEMS**

- .1 Not applicable. Supply of hardware part of the project's Cash Allowance.

## **Part 3 Execution**

### **3.1 MANUFACTURER'S INSTRUCTIONS**

- .1 Furnish door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware. Advise door and frame manufacturers to be aware that strike heights as listed in the table below are required for this project.
- .2 Furnish manufacturers' instructions for proper installation of each hardware component.

### **3.2 INSTALLATION**

- .1 ALL DOORS, FRAMES, AND FINISHING HARDWARE SHALL BE INSTALLED BASED ON DHI INSTALLATION GUIDE FOR DOORS AND HARDWARE (ANSI/DHI A115.1G-1994 – Approved 8/19/94)
- .2 Power door operators, complete with hook-up to power rough-in, low voltage control wiring, and exit device release, shall be installed by the manufacturers' recommended installer.
- .3 Power door operators to be installed by hardware supplier. Low voltage control wiring to push button locations, exit device release, and 4" x 4" back boxes to be completed by Division 26 (Electrical Contractor.)
- .4 CONSULTANTURAL HARDWARE CONSULTANT:
  - .1 The hardware supplier shall have in its employ an Architectural Hardware Consultant who is a current member of the American Society of Hardware Consultants, and who shall be made available for consultation during the course of construction at no additional cost to the Owner.
  - .2 The Architectural Hardware Consultant must supervise hardware installation, provide assistance to the Hardware Installer, and carry out inspection and provide written certification of the finished door hardware installation.
  - .3 Allow for a minimum of three inspections during the course of hardware installation and one final inspection.
  - .4 Ten percent (10%) of this subtrade's contact will be considered as fair value for supervision and inspection with regard to progress certificates.

- .5 Locate and mount hardware at standard location dimensions in accordance with CSDFMA, Canadian Metric Guide for Steel Doors and Frames (Modular Construction), and as indicated in the following table:

| <b>HARDWARE MOUNTING HEIGHTS</b> |                                       |
|----------------------------------|---------------------------------------|
| <b>HARDWARE ITEM</b>             | <b>DIMENSION ABOVE FINISHED FLOOR</b> |
| LOCKSET or LATCHSET              | 950 mm to Centreline of Strike        |
| DEADLOCK                         | 1200 mm to Centreline of Strike       |
| EXIT DEVICE                      | 950 mm to Centreline of Strike        |
| PUSH PLATE/DOOR PULLS            | 900 mm to Centreline of Strike        |

**.5 HARDWARE MOUNTING HEIGHTS**

- .1 The Hardware Installer shall carefully check manufacturer’s installation instructions supplied with hardware products for conflicts with the above noted dimensions.
- .2 The Hardware Installer shall use manual or “Yankee” screw drivers to turn screws into pre-drilled pilot holes for installation of hinges on mineral core fire protection rated doors. Please note that other methods of installation may void the door manufacturer’s warranty.
- .3 Refer to AD drawings for mounting heights. Center latch/levers in center of stiles, and off set panic bars on opposite side of door if required to achieve centered latches.
- .4 Locate door stops to contact doors 75mm from latch edge.
- .5 Install hardware and trim square and plumb to doors.
- .6 Install mullion stabilizers on all double doors with panic hardware.
- .7 Supply locksets to Section 064000 – Architectural Woodwork for 35mm and 45mm thick doors where such doors are a part of millwork units. Keying shall be in accordance with the building keying system for

**3.3 ADJUSTING**

- .1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.
- .2 Ensure doors with closers close firmly and against wind and building air pressure, and can be opened readily as suitable for installation.
- .3 Inspection:
  - .1 The Hardware Supplier shall have in his employ an Architectural Hardware Consultant who is a current member of the American Society of Hardware Consultants, and who shall be made available for consultation during the course of construction at no additional cost to the Board.
  - .2 In addition to this available consultant, a Hardware Inspector shall be engaged upon recommendation to the Board by the Consultants and costs for inspection paid for from Cash Allowances.

- .3 The Consultant shall advise the Contractor that Hardware Inspector shall be assigned to supervise the hardware installation, provide assistance to the Hardware Installer, and carry out inspection and provide written certification of the finished door hardware installation. Costs for this inspection shall be paid from the Cash Allowance. The Contractor shall notify the Hardware Inspector at least 72 hours prior to commencing the installation and cooperate with the advice of the inspector.
  - .4 Upon completion of door hardware installation, the Architectural Hardware Inspector shall conduct an inspection of all door hardware as installed, accompanied by the Consultant, the Owner's representative, and the Contractor.
  - .5 If requested by the Consultant, the manufacturer's technical representative for each make of the hardware used in the Work shall be in attendance during the hardware inspection.
  - .6 During the inspection, the Architectural Hardware Inspector shall note all unsatisfactory installations and products and re-inspect these items after re-adjustment or replacement to ensure all hardware is in optimum working condition and specified function.
- .4 Upon completion of door hardware installation, the Hardware Supplier shall submit a written certificate that all hardware has been correctly supplied and installed in accordance with the drawings, specifications, schedules, and approved final door hardware list, for type, function, and location, and that door hardware has been checked and adjusted.
  - .5 Clean hardware after installation following the hardware supplier's recommendations.
  - .6 At project completion all items of door hardware shall be clean and free from disfigurement. The Contractor shall repair or replace hardware found to be defective.

### **3.4 CLEANING**

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .2 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacture's instructions.
- .3 Remove protective material from hardware items where present.
- .4 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 11 – Final Cleaning.
- .3 Section 01 78 00 - Closeout Submittals
- .4 Section 08 11 14 – Metal Doors and Frames.
- .5 Section 08 50 50 – Aluminum Windows.
- .6 Section 07 92 10 - Joint Sealing: caulking of joints between frames and other building components.
- .7 Section 10 28 10 – Toilet, Bath and Laundry Accessories.

**1.2 REFERENCES**

- .1 American National Standards Institute (ANSI).
  - .1 ANSI/ASTM E330-[02], Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- .2 American Society for Testing and Materials International, (ASTM).
  - .1 ASTM C542-[94(1999)], Specification for Lock-Strip Gaskets.
  - .2 ASTM D790-[02], Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
  - .3 ASTM D1003-[00], Test Method for Haze and Luminous Transmittance of Plastics.
  - .4 ASTM D1929-[96(R2001)e1], Test Method for Determining Ignition Temperature of Plastics.
  - .5 ASTM D2240-[02b], Test Method for Rubber Property - Durometer Hardness.
  - .6 ASTM E84-[01], Test Method for Surface Burning Characteristics of Building Materials.
  - .7 ASTM F1233-[98], Test Method for Security Glazing Materials and Systems.
- .3 Canadian General Standards Board (CGSB).
  - .1 CAN/CGSB-12.1-[M90], Tempered or Laminated Safety Glass.
  - .2 CAN/CGSB-12.2-[M91], Flat, Clear Sheet Glass.
  - .3 CAN/CGSB-12.3-[M91], Flat, Clear Float Glass.
  - .4 CAN/CGSB-12.4-[M91], Heat Absorbing Glass.
  - .5 CAN/CGSB-12.5-[M86], Mirrors, Silvered.
  - .6 CAN/CGSB-12.6-[M91], Transparent (One-Way) Mirrors.
  - .7 CAN/CGSB-12.8-[97], Insulating Glass Units.



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- .8 CAN/CGSB-12.9-[M91], Spandrel Glass.
  - .9 CAN/CGSB-12.10-[M76], Glass, Light and Heat Reflecting.
  - .10 CAN/CGSB-12.11-[M90], Wired Safety Glass.
  - .11 CAN/CGSB-12.12-[M90], Plastic Safety Glazing.
  - .12 CAN/CGSB-12.13-[M91], Patterned Glass.
  - .13 CAN/CGSB-12.1-M90 Tempered or Laminated Safety Glass
  - .14 CAN/CGSB-12.3-M76 Glass, Polished Plate or Float, Flat, Clear
- .4 Canadian Standards Association (CSA International).
    - .1 CSA A440.2-[98], Energy Performance Evaluation of Windows and Sliding Glass Doors.
    - .2 CSA Certification Program for Windows and Doors [2000].
  - .5 Environmental Choice Program (ECP).
    - .1 CCD-045-[95], Sealants and Caulking.
  - .6 Flat Glass Manufacturers Association (FGMA).
    - .1 FGMA Glazing Manual - [1997].
  - .7 Laminators Safety Glass Association (LSGA).
    - .1 LSGA Laminated Glass Design Guide [2000].

### **1.3 SAMPLES**

- .1 Submit a 300 x 300 sample of all glass products in accordance with Section 01 33 00 - Submittal Procedures.

### **1.4 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Section 013300 – Submittal Procedures. Coordinate location with Consultant.

### **1.5 WARRANTY**

- .1 Contractor hereby warrants glass against defects and failure, including leakage, under normal conditions of use, in accordance with the Contract, but for ten (10) years total, as follows:
  - .2 Supplier shall submit a written warranty from the insulated glass manufacturer to replace or repair any defects in materials or sealed units for a period of ten (10) years from the date of Substantial Completion.
- .3 Mirrors:
  - .1 Submit a warranty for mirrors, covering the repair or replacement of defective work in accordance with the Contract, but for five (5) years total.
  - .2 Warranty shall apply against defects in workmanship and materials and, against silver deterioration and loosening of fastenings.

### **1.6 WASTE MANAGEMENT AND DISPOSAL**

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

- .2 Collect and separate for disposal [paper] [plastic] [polystyrene] [corrugated cardboard] packaging material [in appropriate on-site] for recycling.
- .3 Unused or damaged glazing materials are not recyclable and must not be diverted to municipal recycling programs.
- .4 Divert unused or damaged wood materials from landfill to [recycling] [reuse] [composting] facility approved by Consultant.
- .5 Divert unused metal materials from landfill to metal recycling facility approved by Consultant.
- .6 Divert unused caulking material from landfill to official hazardous material collections site approved by Consultant.
- .7 Plastic caulking tubes are not recyclable and must not be diverted for recycling with other plastic materials.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Acceptable Manufacturers:
  - .1 AFG Glass Inc
  - .2 Libby-Owens Ford
  - .3 PPG Industries
- .2 Exterior Tempered Safety Glass: All exterior Vision Glass to exterior windows, curtain wall and non-fire-rated screens to be sealed insulated units conforming to CAN/CGSB-12.8. Exterior lite 6mm tempered clear glass, Solarban 67 Low Emmissivity Coating on inner pane (2nd surface), 13mm Argon filled air space, inner lite 6 mm clear tempered glass.
  - .1 All tempered glass to conform to CAN2-12.1 M-90 Type 2 tempered glass, Class B Double glazed units to have an integral non-metallic space creating a 13 mm hermetically sealed Argon filled air space. Spacers shall be continuous with butt joints (if any) at corners only. Pieces are not permitted. Butyl based spacers are not permitted.
- .3 Polished Plate or Float Glass: To CAN/CGSB-12.3 clear.
- .4 Spandrel Glass (SP): CAN/CGSB-12.9-M, 6 mm thick unless otherwise indicated, with water-based silicone emulsion coating applied to backside, 'Opaci-Coat 300' by ICD High Performance Coatings or approved alternative. Colour: To be selected by the Consultant.
- .5 Interior Tempered Safety Glass: CAN/CGSB-12.1-M, Type 2, Class B, Category II, clear, minimum 6 mm thick.
  - .1 Interior Vision Glass to non-fire rated locations to be tempered 6 mm tempered clear float glass complete with etched tempered glass designation visible, unless identified otherwise.

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- .6 Fire Rated Glazing ('FR' 'FRG' or 'GW'): Fire rated glazing to be impact safety rated, intumescent or ceramic laminated glazing to meet required fire resistance rating. Coordinate glazing thickness with screen frame manufacturer.
- Location: replacement and new doors and screens:
- .1 Fireswiss by Glas Trosch
  - .2 Pyrostop by Pilkington
  - .3 Pyrobel by AGC
  - .4 ContraFlam by VetroTech/St-Gobain
- .7 Georgian Wired rated glazing: not to be used on this project.
- .8 Mirrors: Refer to Section 10 28 10 Washroom Accessories.
- .9 Setting blocks: neoprene, 80 durometer hardness, 102 mm x 6 mm width to suit glass to extend from the fixed stop to the opposite face of the glazing unit.
- .10 Spacer Blocks: neoprene, thickness to provide a minimum glass to face clearance of 3mm.
- .11 Glazing tape: preformed polyisobutylene-butyl glazing tape with integral shim strip, 10-15 durometer, hardness, paper release, black color. Acceptable materials: Tremco Polyshim II by Tremco Ltd. or approved alternate.
- .12 Gasket: black neoprene "U" cavity type with lock strip.
- .13 Sealant: one component silicone, Spectrem 2 by Tremco Ltd. Refer to Section 07900.
- .14 Display cases: shelves to be 13mm tempered glass with polished rounded edges. Door to 6mm tempered glass. Coordinate sizes and provide to Section 06 40 00 for installation.

## 2.2 FABRICATION

- .1 Fabricate in accordance with CSA-A440/A440.1 supplemented as follows:
- .2 Make field measurements before cutting and assembling materials.
- .3 Maintain minimum bite or lap of glass as recommended by the glazing unit manufacturer.
- .4 Each glass lite shall be labeled with the name of the product, weight and quality and year manufactured.
- .5 If requested, provide owner or consultant access to the plant or shop to review fabrication. Consultant or owner to provide 24 hour advance notice of visit.

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**Part 3 Execution**

**3.1 MANUFACTURER'S INSTRUCTIONS**

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

**3.2 EXAMINATION**

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

**3.3 PREPARATION**

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

**3.4 INSTALLATION:**

- .1 Inspect all glazing channels prior to application. All openings in joints and channels to be sealed shall be clean, dry and free of dust, oil, grease, loose mortar or any foreign material.
- .2 All surfaces to receive glazing tape shall be wiped dry with a clean rag dampened in Xylol, followed by a dry wipe.
- .3 Examine all sashes prior to glazing to determine if the openings are square and plumb. Any butt and miter joints which are open shall be sealed prior to glazing. Adjust all operating sashes and glaze in the closed position.
- .4 Compression Glazing:
  - .1 When butt joint is in a vertical direction, the glazier shall first run the tape on the head and sill members while going over the joint. If joints at the sash run horizontally, the tape must be applied first to the jambs so that it crosses over the joint.
  - .2 When an offset condition exists at each corner where a horizontal member passes behind vertical mullions, two different sized tapes shall be used to equalize the pressure seal. The thinner tape is to applied first on the glazing leg closest to the interior. The thicker tape shall be cut to the length between the two tapes and applied.
  - .3 Each section of tape shall butt the adjoining tape and be united with a tool to eliminate any openings. Lapping of the adjoining tapes at the corners is not permitted.
  - .4 Remove paper backing just prior to setting glass and apply a toe bead of sealant 150 mm long in each of the corners.

- .5 Position one setting block at the quarter point of each corner on the sill members or as recommended by IGMA guidelines.
- .6 Set the glass on the setting blocks and press firmly in place. Snap in the interior glazing stops.
- .7 Set the spacer blocks to prevent any “walking” of the lite.
- .5 Mirrors:
  - .1 Install mirrors by means of concealed vandalproof clips. If clips are used, install cushioning tape completing around perimeter of mirror back, set in concealed location within 25 mm of edge. Install fixed mirrors in washrooms at two different heights as indicated on drawings.
  - .2 Follow manufacturer’s installation recommendations.
- .6 Install any wired glass with the wire parallel to the opening.
- .7 Replace any loose glazing stops and tighten all screws.
- .8 Contractor shall include for needle point (cap beads) at all lower horizontal rail joints of all sash/glazing units at the discretion of and as may be requested by the Consultant or owner.

### **3.5 CLEANING**

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .2 Remove traces of primer, caulking.
- .3 Remove glazing materials from finish surfaces.
- .4 Remove labels after work is complete.
- .5 Immediately upon job completion and when sealants have cured, remove any temporary protection and clean all exposed interior and exterior surfaces. Use proper cleaning materials only which will not harm the window components or any adjacent surfaces.
- .6 Ensure all temporary labels have been removed and fully cleaned.
- .7 Mirrors:
  - .1 Clean mirrors using non-abrasive soap or detergent and rinse with clean water. Leave in clean, polished condition for Owner occupancy.

### **3.6 INSPECTION**

- .1 Where inspection is called for elsewhere in the specification, perform Window air and water leakage test to ensure installation meets performance requirements stated herein. Should test fail, take remedial measures and re-test a different location at not additional cost to the owner until the test passes.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 04 21 13 – Masonry
- .3 Section 09 22 16 – Non-structural Metal Framing.
- .4 Supply of access doors for mechanical and electrical devices in mechanical and electrical sections.

**1.2 REFERENCES**

- .1 Aluminum Association
  - .1 Designation for Aluminum Finishes-[1997].
- .2 American Society for Testing and Materials International, (ASTM)
  - .1 ASTM C36/C36M-[01], Specification for Gypsum Wallboard.
  - .2 ASTM C79/C79M-[01], Standard Specification for Treated Core and Non-treated Core Gypsum Sheathing Board.
  - .3 ASTM C442/C442M-[01], Specification for Gypsum Backing Board, Gypsum Coreboard, and Gypsum Shaftliner Board.
  - .4 ASTM C475-[01], Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
  - .5 ASTM C514-[01], Specification for Nails for the Application of Gypsum Board.
  - .6 ASTM C557-[99], Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.
  - .7 ASTM C630/C630M-[01], Specification for Water-Resistant Gypsum Backing Board.
  - .8 ASTM C840-[01], Specification for Application and Finishing of Gypsum Board.
  - .9 ASTM C931/C931M-[01], Specification for Exterior Gypsum Soffit Board.
  - .10 ASTM C954-[00], Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
  - .11 ASTM C960/C960M-[01], Specification for Pre-decorated Gypsum Board.
  - .12 ASTM C1002-[01], Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
  - .13 ASTM C1047-[99], Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
  - .14 ASTM C1280-[99], Specification for Application of Gypsum Sheathing Board.
  - .15 ASTM C1177-[01], Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
  - .16 ASTM C1178/C1178M-[01], Specification for Glass Mat Water-Resistant Gypsum Backing Board.

- .3 Association of the Wall and Ceilings Industries International (AWEI)
- .4 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-51.34-[M86(R1988)], Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
  - .2 CAN/CGSB-71.25-[M88], Adhesive, for Bonding Drywall to Wood Framing and Metal Studs.
- .5 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN/ULC-S102-[1988(R2000)], Surface Burning Characteristics of Building Materials and Assemblies.

### **1.3 DELIVERY, STORAGE AND HANDLING**

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

### **1.4 SITE ENVIRONMENTAL REQUIREMENTS**

- .1 Maintain temperature minimum 10 degrees C, maximum 21 degrees C for 48 hours prior to and during application of gypsum boards and joint treatment, and for at least 48 hours after completion of joint treatment.
- .2 Apply board and joint treatment to dry, frost free surfaces.
- .3 Ventilation: Ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment material immediately after its application.

### **1.5 WASTE MANAGEMENT AND DISPOSAL**

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 Collect and separate for disposal [paper] [plastic] [polystyrene] [corrugated cardboard] packaging material [in appropriate on-site] for recycling.
- .3 Divert unused gypsum from landfill to gypsum recycling facility for disposal approved by Consultant.
- .4 Divert unused metal materials from landfill to metal recycling facility approved by Consultant.
- .5 Divert unused wood materials from landfill to [recycling] [composting] facility approved by Consultant.
- .6 Divert unused paint and caulking material from landfill to official hazardous material collections site approved by Consultant.

- .7 Do not dispose of unused paint and caulking materials into sewer systems, into lakes, streams, onto ground or in other locations where it will pose health or environmental hazard.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Standard board: to ASTM C36/C36M, 16 mm or 19 mm thick or as indicated, tapered edges.
- .2 Standard board: to ASTM C36/C36M, X Rated, 16 mm or 19 mm thick or as indicated, tapered edges.
- .3 Water-resistant board: to ASTM C630/C630M, 13 mm water resistant, tapered edges (WRGB in Finish Schedule). Reinforced cement board may be used in lieu of water-resistant gypsum board.
- .4 Abuse resistant/Fire rated: to CSA A82.27-M1977 Fire-Rated Type X, 5/8" thick, "Abuse Resistant Fire Code" gypsum board panels, tapered edges, by CGC, Fibrerock interior AquaTuff panel. All gypsum board to have anti-microbial and anti-mould properties.
- .5 Moisture resistant sheathing: 13mm (1/2") DensShield as manufactured Georgia-Pacific.
- .6 All gypsum board to have Anti-Microbial and Anti Mold properties.
- .7 Nails: to ASTM C514.
- .8 Steel drill screws: to ASTM C1002.
- .9 Stud adhesive: to CAN/CGSB-71.25.
- .10 Laminating compound: as recommended by manufacturer, asbestos-free.
- .11 Concrete Anchors: Phillips Red Head TW-614 or equivalent. Do not use powder activated fasteners for ceiling support.
- .12 Tie Wire: #16 ga. galvanized soft annealed steel wire.
- .13 Caulking: Acoustical sealant.
- .14 38 mm thick mineral wool batts ULC labeled, if indicated on drawings.
- .15 Casing beads, corner beads, control joints and edge trim: to ASTM C1047, 0.5 mm base thickness commercial sheet steel with G90 zinc finish, perforated flanges, and one piece length per location.
- .16 Sealants: in accordance with Section 07 92 10 - Joint Sealing.
- .17 Insulating strip: rubberized, moisture resistant, 3 mm thick closed cell neoprene strip, 12 mm wide, with self sticking permanent adhesive on one face, lengths as required.



- .18 Joint compound: to ASTM C475, asbestos-free.

## 2.2 ACOUSTIC INSULATION MATERIALS FOR ALL PARTITION WALLS

- .1 **Location: All interior Gypsum Board Partition walls:** Note that all walls extend to underside of Deck and shall be assembled with the following materials in addition to those specified above.
- .2 Acoustic insulation inside all GB partitions: AFB Acoustic Fire Bat by Roxul or equivalent product by Fibrex, or Quietzone by Owens Corning.
- .3 Steel deck closures: Emseal 25V Expanding Foam Sealant sized and shaped to fit flutes.
- .4 Acoustic Insulation: mineral fibre acoustical batt insulation, as specified under Section 07210. Thickness of 90% of wall assembly cavity depth; Acceptable products:
- .1 Fibrex ‘Sound Attenuation Fire Batt (SAFB)’
  - .2 Johns Manville ‘Sound-SHIELD’.
  - .3 Roxul ‘AFB’.
  - .4 Owens-Corning ‘QuietZone’.
- .5 Acoustical sealant: CAN/CGSB-19.21-M87; non-skinning acoustic sealant, non-hardening type.
- .6 Fasteners: use mechanical fasteners to secure batts into position as recommended by manufacturer.

## Part 3 Execution

### 3.1 ERECTION

- .1 Do application and finishing of gypsum board in accordance with ASTM C840 except where specified otherwise.
- .2 Erect hangers and runner channels for suspended gypsum board ceilings in accordance with ASTM C840 except where specified otherwise.
- .3 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.
- .4 Install work level to tolerance of [1:1200].

### 3.2 APPLICATION

- .1 Do not apply gypsum board until bucks, anchors, blocking, sound attenuation, electrical and mechanical works are approved.
- .2 Apply single layer gypsum board to metal furring or framing using screw fasteners and laminating adhesive. Maximum spacing of screws 300 mm on centre.
- .1 Single-Layer Application:

- .1 Apply gypsum board on ceilings prior to application of walls in accordance with ASTM C840.
- .2 Apply gypsum board vertically or horizontally, providing sheet lengths that will minimize end joints.
- .2 Double-Layer Application:
  - .1 Install gypsum board for base layer and exposed gypsum board for face layer.
  - .2 Apply base layer to ceilings prior to base layer application on walls; apply face layers in same sequence. Offset joints between layers at least 250 mm.
  - .3 Apply base layers at right angles to supports unless otherwise indicated.
  - .4 Apply base layer on walls and face layers vertically with joints of base layer over supports and face layer joints offset at least 250 mm with base layer joints.
- .3 Apply water-resistant gypsum board or cement board at all locations where wall tiles or special coating are to be applied, and adjacent to slop sinks or janitors closets if not constructed of Concrete Block. Apply water-resistant sealant to edges, ends, cut-outs which expose gypsum core and to fastener heads. Do not apply joint treatment on areas to receive tile finish.
- .4 Apply gypsum board to concrete block surfaces, where indicated, using laminating adhesive.
- .5 Apply type X gypsum board where indicated, in accordance with U.L.C. requirements and with supplement to the National Building Code of Canada to obtain the required fire protection, fire rating and fire separation.
- .6 Install ceiling boards in direction that will minimize number of end-butt joints. Stagger end joints at least 250 mm.
- .7 Where indicated on drawings, staple blanket to wallboard in accordance with ULC design requirements. Blanket shall be continuous and tightly fitted between studs and at perimeter.
- .8 Install gypsum board on walls vertically to avoid end-butt joints. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs, except where local codes or fire-rated assemblies require vertical application.
- .9 Install gypsum board with face side out.
- .10 Do not install damaged or damp boards.
- .11 Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite sides of wall.
- .12 Where a floor or roof structural member interferes with an interior partition wall at which a smoke or fire separation is required, a gypsum board enclosure with a fire rating not less than required for the wall must be provided to continue the required, a gypsum board enclosure with a fire rating not less than required for the wall must be provided to continue the required separation to the floor or roof above (typical)

### 3.3 INSTALLATION

- .1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure [at [150] mm on centre] [using contact adhesive for full length].
- .2 Install casing beads around perimeter of suspended ceilings.
- .3 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. [Seal joints with sealant.]
- .4 Construct control joints of [preformed units] [two back-to-back casing beads] set in gypsum board facing and supported independently on both sides of joint.
- .5 Provide continuous polyethylene dust barrier behind and across control joints.
- .6 Locate control joints [where indicated] [at changes in substrate construction] [at approximate [10] m spacing on long corridor runs] [at approximate [15] m spacing on ceilings].
- .7 Install control joints straight and true.
- .8 Construct expansion joints [as detailed], at building expansion and construction joints. Provide continuous dust barrier.
- .9 Install expansion joint straight and true.
- .10 Install cornice cap where gypsum board partitions do not extend to ceiling.
- .11 Fit cornice cap over partition, secure to partition track with two rows of sheet metal screws staggered at [300] mm on centre.
- .12 Splice corners and intersections together and secure to each member with 3 screws.
- .13 Seal with acoustical sealant at ceilings, floors, wall intersections and all penetrations such as electrical outlets.
- .14 Install access doors to electrical and mechanical fixtures specified in respective sections.
  - .1 Rigidly secure frames to furring or framing systems.
- .15 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces.
- .16 Gypsum Board Finish: finish gypsum board walls and ceilings to following levels in accordance with Association of the Wall and Ceiling Industries (AWCI) International Recommended Specification on Levels of Gypsum Board Finish:
  - .1 Levels of finish:
    - .1 Level 0: No taping, finishing or accessories required.

- .2 Level 1: Embed tape for joints and interior angles in joint compound. Surfaces to be free of excess joint compound; tool marks and ridges are acceptable.
- .3 Level 2: Embed tape for joints and interior angles in joint compound and apply one separate coat of joint compound over joints, angles, fastener heads and accessories; surfaces free of excess joint compound; tool marks and ridges are acceptable.
- .4 Level 3: Embed tape for joints and interior angles in joint compound and apply two separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.
- .5 Level 4: Embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.
- .6 Level 5: Embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; apply a thin skim coat of joint compound to entire surface; surfaces smooth and free of tool marks and ridges.
- .17 Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.
- .18 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.
- .19 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.
- .20 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.
- .21 Apply one coat of white primer sealer over surface to be textured. When dry apply textured finish in accordance with manufacturer's instructions.
- .22 Mix joint compound slightly thinner than for joint taping.
- .23 Apply thin coat to entire surface using trowel or drywall broadknife to fill surface texture differences, variations or tool marks.
- .24 Allow skim coat to dry completely.
- .25 Remove ridges by light sanding or wiping with damp cloth.
- .26 Provide protection that ensures gypsum drywall work will remain without damage or deterioration at time of substantial completion.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 09 21 16 - Gypsum Board Assemblies.

**1.2 REFERENCES**

- .1 American Society for Testing and Materials International, (ASTM).
  - .1 ASTM C645-[00], Specification for Nonstructural Steel Framing Members.
  - .2 ASTM C754-[00], Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
- .2 Canadian General Standards Board (CGSB).
  - .1 CAN/CGSB-1.40-[97], Primer, Structural Steel, Oil Alkyd Type.
- .3 Environmental Choice Program (ECP).
  - .1 CCD-047a -[98], Paints - Surface Coatings.
  - .2 CCD-048-[98], Surface Coatings - Recycled Water-borne.

**1.3 WASTE MANAGEMENT AND DISPOSAL**

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 Collect and separate for disposal [paper] [plastic] [polystyrene] [corrugated cardboard] packaging material in appropriate on-site bins for recycling.
- .3 Divert unused metal materials from landfill to metal recycling facility approved by Consultant.
- .4 Divert unused gypsum materials from landfill to recycling facility approved by Consultant.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Non-load bearing channel stud framing: to ASTM C645, roll formed from 0.59mm thickness hot dipped galvanized steel sheet, for screw attachment of gypsum lath and metal lath. Knock-out service holes at 150 mm centres.
- .2 Floor and ceiling tracks: to ASTM C645, in widths to suit stud sizes, 30 mm legs for floor track, 50 mm for ceiling track.
- .3 Metal channel stiffener: 38 mm size, 2 mm thick cold rolled galvanized steel.
- .4 Metal Accessories: CSA A82.30-1965 (R-1971).
- .5 “Unistrut” support channel framing, by Tyco Electrical and Metal Products.

**Part 3 Execution**

**3.1 ERECTION**

- .1 Align partition tracks at floor and ceiling and secure at 600 mm on centre maximum.
- .2 Place studs vertically at 400 mm on centre and not more than 50 mm from abutting walls, and at each side of openings and corners. Position studs in tracks at floor and ceiling. Cross brace steel studs as required to provide rigid installation to manufacturer's instructions.
- .3 Erect metal studding to tolerance of 1:1000.
- .4 Attach studs to bottom track using screws.
- .5 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.
- .6 Install steel frames and anchor frames securely to studs using minimum of three (3) anchors per jamb for jambs up to 2100 mm high and a minimum of four (4) anchors per jambs for jambs over 2100 mm high.
- .7 Provide two (2) studs at each side of openings wider than stud centre specified.
- .8 Install, cut to length, piece of runner horizontally over door frames and at top and bottom of rough opening in glazed partitions.
- .9 Provide 38 mm x 89 mm vertical and horizontal wood studs secured between metal studs for attachments of bathroom fixtures, accessories, cabinet work, and other fixtures, including grab bars, towel rails, attached to steel stud partitions.
- .10 Install steel stud or furring channel between studs for attaching electrical and other boxes.
- .11 Extend all partitions to underside of deck above for sound and fire separation.
- .12 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs.

**3.2 CEILING FURRING TO CANOPIES & CEILING PANELS**

- .1 Provide to all interior and exterior canopies where shown to receive wood slat or plywood finishes.
- .2 Framing channel to be model P1000 ( 1-5/8" ) ; 12 ga.
- .3 For exterior locations provide with 4 m dia. Holes at 500 o.c. for drainage and hot dip galvanize.
- .4 Provide shop drawings for layouts.
- .5 Refer to drawings for locations.

### **3.3 ACOUSTICAL SEALANT**

- .1 Apply acoustical sealant to all sills, headers, jambs and furring channels in contact with walls floors and ceiling deck as part of the acoustical insulation system for interior partitions. Refer to *Section 09 21 16 - Gypsum Board Assemblies*.

### **3.4 CEILING FURRING**

- .1 Install runners level to tolerance of 3 mm over 3.5 m. Provide runners at interruptions of continuity and change in direction.
- .2 Frame with furring channels, perimeter of openings to accommodate access panels, light fixtures, diffusers, grilles, etc.
- .3 Furr for bulkheads within or at termination or ceilings.
- .4 Install furring channels at 400 mm o.c. maximum.

### **3.5 WALL FURRING**

- .1 Install steel furring, as indicated.
- .2 Frame opening and around built-in equipment on four (4) sides with channels.
- .3 Box-in beads, columns, pipes, and around exposed services.

### **3.6 FIRE RATED ASSEMBLIES**

- .1 If required, install Metal Stud System and Furring in accordance with appropriate ULC Design and with supplement to the National Building Code of Canada 1985.

### **3.7 CLEANING**

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

**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 07 92 10 - Joint Sealing.

**1.2 REFERENCES**

- .1 American National Standards Institute (ANSI)/Ceramic Tile Institute (CTI)
  - .1 ANSI A108.1-[99], Specification for the Installation of Ceramic Tile (Includes ANSI A108.1A-C, 108.4-.13, A118.1-.10, ANSI A136.1).
  - .2 CTI A118.3-[92], Specification for Chemical Resistant, Water Cleanable Tile Setting and Grouting Epoxy and Water Cleanable Tile Setting Epoxy Adhesive (included in ANSI A108.1).
  - .3 CTI A118.4-[92], Specification for Latex Portland Cement Mortar (included in ANSI A108.1).
  - .4 CTI A118.5-[92], Specification for Chemical Resistant Furan Resin Mortars and Grounds for Tile Installation (included in ANSI A108.1).
  - .5 CTI A118.6-[92], Specification for Ceramic Tile Grounds (included in ANSI A108.1).
- .2 American Society for Testing and Materials (ASTM International) International
  - .1 ASTM C144-[99], Specification for Aggregate for Masonry Mortar.
  - .2 ASTM C 207-[91(1997)], Specification for Hydrated Lime for Masonry Purposes.
  - .3 ASTM C847-[95(2000)], Specification for Metal Lath.
  - .4 ASTM C979-[99], Specification for Pigments for Integrally Coloured Concrete.
- .3 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-51.34-[M86(R1988)], Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
  - .2 CGSB 71-GP-22M-[78], Adhesive, Organic, for Installation of Ceramic Wall Tile.
  - .3 CAN/CGSB-75.1-[M88], Tile, Ceramic.
  - .4 CAN/CGSB-25.20-[95], Surface Sealer for Floors.
- .4 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-A3000-[98], Cementitious Materials Compendium (Consists of A5-98, A8-98, A23.5-98, A362-98, A363-98, A456.1-98, A456.2-98, A456.3-98).
  - .2 CSA A123.3-[98], Asphalt Saturated Organic Roofing Felt.
- .5 Terrazzo Tile and Marble Association of Canada (TTMAC)
  - .1 Tile Specification Guide 09300 [2000], Tile Installation Manual.



.2 Tile Maintenance Guide [2000].

### 1.3 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Include manufacturer's information on:
  - .1 Ceramic tile, marked to show each type, size, and shape required.
  - .2 Chemical resistant mortar and grout (Epoxy and Furan).
  - .3 Cementitious backer unit.
  - .4 Dry-set Portland cement mortar and grout.
  - .5 Divider strip.
  - .6 Elastomeric membrane and bond coat.
  - .7 Reinforcing tape.
  - .8 Levelling compound.
  - .9 Latex-Portland cement mortar and grout.
  - .10 Commercial Portland cement grout.
  - .11 Organic adhesive.
  - .12 Slip resistant tile.
  - .13 Waterproofing isolation membrane.
  - .14 Fasteners.

### 1.4 SAMPLES

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Base tile: submit 300 x 300 mm sample panels of each colour, texture, size, and pattern of tile.
- .3 Floor tile: submit 300 x 300 mm sample panels of each colour, texture, size, and pattern of tile.
- .4 Trim shapes, bullnose cap and cove including bullnose cap and base pieces at internal and external corners of vertical surfaces, each type, colour, and size.
- .5 Stair Accessories: submit duplicate samples of each trim.
- .6 Adhere tile samples to [11] mm thick plywood and grout joints to represent project installation.
- .7 Prepare a 2 m x 3m mock-up sample on site to ensure demonstration of installation details and quality control. Include stair accessories in mock-up.

### 1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials in containers with labels legible and intact and grade-seals unbroken.
- .2 Store material so as to prevent damage or contamination.
- .3 Store materials in a dry area, protected from freezing, staining and damage.
- .4 Store cementitious materials on a dry surface.

### 1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

- .2 Collect and separate for disposal packaging material in appropriate on-site bins for recycling.
- .3 Unused adhesive, sealant and coating materials must be disposed of at an official hazardous material collections site as approved by the Consultant.
- .4 Unused adhesive, sealant and coating materials must not be disposed of into the sewer system, into streams, lakes, onto the ground or in other location where it will pose a health or environmental hazard.
- .5 Broken ceramic materials must be diverted from landfill to a local facility as approved by Consultant.

## **1.7 ENVIRONMENTAL CONDITIONS**

- .1 Maintain air temperature and structural base temperature at ceramic tile installation area above 12 °C for 48 h before, during, and 48 h after, installation.
- .2 Do not install tiles at temperatures less than 12 °C or above 38 °C.
- .3 Do not apply epoxy mortar and grouts at temperatures below 15 °C or above 25 °C.

## **1.8 EXTRA MATERIAL**

- .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Provide minimum 5% of each type and colour of tile required for project for maintenance use. Store where directed.
- .3 Maintenance material to be of same production run as installed material.

## **1.9 EXTENDED WARRANTY**

- .1 Submit a warranty for entire wall tile installation, covering materials and labour and the repair or replacement of defective work in accordance with the Contract, but for three (3) years total.

## **Part 2 Products**

### **2.1 FLOOR TILE**

- .1 Porcelain floor tile (Designation: POR): to CAN/CGSB-75.1.
  - .1 Acceptable Materials: Size 300 mm x 600 mm; “Mayfair” by Centura, “Regal” by Olympia Tile, “Ultra Modern” by Daltile, or “Anchorage” by Daltile, all in matte finish. Allow for one (1) field colour from manufacturer’s full line and two (2) accent floor tiles.
  - .2 Locations: Refer to Room Finish Schedule for locations.
  - .3 Install in a one-third staggered pattern.

- .4 Provide prefabricated movement joints in conjunction with slab saw cuts approx. 3500-6000mm distance (refer to floor pattern drawing).
- .2 Porcelain floor tile bull-nose base (Designation: POR): to CAN/CGSB-75.1.
  - .1 Acceptable Materials: Size 76mm or 100 mm x 300 mm ‘sit-on’ bull-nose base; “Vitra”, by Centura or “Omnia”, by Olympia Tile, “Ultra Modern” by Daltile, or “Anchorage” by Daltile, all in matte finish. Allow for two (2) colours from manufacturer’s Category/Group 2 colours.

## 2.2 WALL TILE

- .1 Ceramic tile (Designation: CWT): to CAN/CGSB-75.1, Type 5, Class MR 4, **100mm (4”) x 400mm (16”) x 6 mm** size, glazed surface. Allow for three (3) colors or sheens. Thin-set application.
- .2 Acceptable Materials: “Maple Leaf CDC”, by Olympia Tile or “Rainbow”, by Centura.
- .3 Tile Edging: Purpose-made, anodized aluminum, polished chrome finish, metal edge strips as manufactured Schluter Systems at all exposed tile edging: Profile – JOLLY; thickness as required for tile and tile set. Provide square tile return to wall at tops and sides of tile areas in Vestibule 9, with purpose made outside edging.
- .4 Locations: Refer to Room Finish Schedule. Allow for 3 colours: 75% field and 25% accent. Patterns to be issued by Architect during construction.

## 2.3 TRIM SHAPES

- .1 Conform to applicable requirements of adjoining floor and wall tile.
- .2 Use slip resistant trim shapes for horizontal surfaces of showers, overflow ledges, recessed steps, shower curbs, drying area curbs, and stools.
- .3 Use trim shapes sizes conforming to size of adjoining field wall tile, including existing spaces, unless specified otherwise.
- .4 Internal and External Corners: Provide trim shapes as follows where indicated.
  - .1 Bullnose shapes for external corners including edges.
  - .2 Coved shapes for internal corners.
  - .3 Special shapes for:
    - .1 Base to floor internal corners to provide integral coved vertical and horizontal joint.
    - .2 Base to floor external corners to provide bullnose vertical edge with integral coved horizontal joint. Use as stop at bottom of openings having bullnose return to wall.
    - .3 Wall top edge internal corners to provide integral coved vertical joint with bullnose top edge.
    - .4 Wall top edge external corners to provide bullnose vertical and horizontal joint edge.
- .5 Provide cove and bullnose shapes for where indicated and required to complete tile work.

## 2.4 MORTAR AND ADHESIVE MATERIALS

- .1 Manufacturer's of commercial mortar, grout and adhesive having Product considered acceptable for use:
  - .1 Mapei
  - .2 Laticrete
  - .3 Flexile
- .2 Walls: Mortarcrete Latex Mortar conforming to ANS1A118.4-1973, manufactured by L & M Ceramo Inc.
- .3 Floors:
  - .1 Cement Mortar: Mixture of 1 part Portland cement, 4 parts dry sand and 1/10 hydraulic lime. Materials shall conform to the following:
  - .2 Portland Cement: To CAN3-A, Type 10.
  - .3 Hydrated Lime: To ASTM C-206 or 207, Type 5.
  - .4 Sand: To CSA A82.56, passing 1.6 mm sieve.
  - .5 Water: Potable, containing no contaminants which cause efflorescence.
  - .6 Thin Set Mortar: field mixed, blended sand-Portland cement-latex mortar, "Kerabond/Keralastic by Mapei."
    - .1 Acceptable Alternates: "Laticrete 4237 distributed by Ceratec Inc., or Flexile 52 thin set.
    - .2 Latex Additive: "Cemtex" by Master Builders, Laticrete 2022" distributed by Ceratec Inc.,

## 2.5 GROUT

- .1 Colouring Pigments:
  - .1 Pure mineral pigments, limeproof and nonfading, complying with ASTM C979.
  - .2 Colouring pigments to be added to grout by manufacturer.
  - .3 Job coloured grout are not acceptable.
  - .4 Use in Commercial Portland Cement Grout, Dry-Set Grout, and Latex-Portland Cement Grout.
- .2 Chemical-Resistant Grout for Walls:
  - .1 Epoxy grout: to ANSI A108.1, having quality, colour and characteristics to match epoxy bond coat. Adhesive and grout by same manufacturer.
  - .2 Epoxy Grout: "Latapoxy SP-100" Stainless, chemical resistant epoxy grout by Laticrete International. Colour from manufacturer's full range. Alternate: Kerapoxy by Mapei.
- .3 Floors:
  - .1 Polymer modified grout as manufactured by MAPEI.

## 2.6 ACCESSORIES

- .1 Stairs Nosings and Edge Trims:

- .1 Stair nosing to be Schluter, TREP-S, Aluminum support with thermoplastic rubber insert (26mm), installed in conjunction with porcelain tile as per manufacturer's recommendations. Thermoplastic rubber insert piece colour to be selected by consultant.
- .2 SCHIENE edge protection by Schluter, anodized aluminum to installed at all exposed stair tile edges. Mitre joints to suite stair angle. Size as required for tile and mortar bed.
- .2 Prefabricated Movement Joints: purpose made Schluter, Dilex-KSN aluminum, sized as required for tile and mortar bed. Colour to be selected by consultant. To be installed directly above slab saw-cuts. Refer to floor pattern drawing for locations.
- .3 Reinforcing mesh: 50 x 50 x 1.6 x 1.6 mm galvanized steel wire mesh, welded fabric design, in flat sheets.
- .4 Divider strips:
  - .1 Laminated strips, core 32 x 3 mm black neoprene, outsides (both sides) brass 32 x 1.29 mm complete with anchors, both sides spaced at 150 mm on centre.
  - .2 Brass complete with anchors, both sides spaced at 150 mm on centre.
- .5 Cleavage plane: [polyethylene film to CGSB 51-34] [No. 15 asphalt saturated felt to CSA A123.3] .
- .6 Metal lath: to ASTM C847 finish, 10 mm rib at 2.17 kg/m<sup>2</sup>.
- .7 Transition Strips: purpose made metal extrusion; stainless steel type.
- .8 Reducer Strips: purpose made metal extrusion; stainless steel type; maximum slope of 1:2.
- .9 Prefabricated Movement Joints: purpose made, having a Shore A Hardness not less than 60 and elasticity of plus or minus 40 percent when used in accordance to TTMAC Detail 301EJ.
- .10 Sealant: in accordance with Section 07 92 10 - Joint Sealing.
- .11 Floor sealer and protective coating: [to CAN/CGSB-25.20, Type [1] [2]] [to tile and grout manufacturers recommendations].

## 2.7 MIXES

- .1 Portland Cement:
  - .1 Scratch coat: 1 part portland cement, 1/5 to 1/2 parts hydrated lime to suit job conditions, 4 parts sand, 1 part water, [and latex additive where required]. Adjust water volume depending on water content of sand.
  - .2 Slurry bond coat: portland cement and water mixed to creamy paste. Latex additive may be included.
  - .3 Mortar bed for floors: 1 part portland cement, 4 parts sand, 1 part water. Adjust water volume depending on water content of sand. [Latex additive may be included].

- .4 Mortar bed for walls and ceilings: 1 part portland cement, 1/5 to 1/2 parts hydrated lime to suit job conditions, 4 parts sand and 1 part water. Adjust water volume depending on water content of sand. [Latex additive may be included].
- .5 Levelling coat: 1 part portland cement, 4 parts sand, minimum 1/10 part latex additive, 1 part water including latex additive.
- .6 Bond or setting coat: 1 part portland cement, 1/3 part hydrated lime, 1 part water.
- .7 Measure mortar ingredients by volume.
- .2 Dry set mortar: mix to manufacturer's instructions.
- .3 Organic adhesive: pre-mixed.
- .4 Mix bond and levelling coats, and grout to manufacturer's instructions.
- .5 Adjust water volumes to suit water content of sand.

## **2.8 PATCHING AND LEVELING COMPOUND**

- .1 Portland cement base, acrylic polymer compound, manufactured specifically for resurfacing and levelling concrete floors. Products containing gypsum are not acceptable.
- .2 Have not less than the following physical properties:
  - .1 Compressive strength - 25 MPa.
  - .2 Tensile strength - 7 MPa.
  - .3 Flexural strength - 7 MPa.
  - .4 Density - 1.9.
- .3 Capable of being applied in layers up to 50 mm thick, being brought to feather edge, and being trowelled to smooth finish.
- .4 Ready for use in 48 hours after application.

## **2.9 TERRAZZO FLOOR PATCHING**

- .1 Where applicable, saw cut existing terrazzo floor and base as required and remove to nearest metal 'panel' joint to enable replacement at a full panel. Replace with terrazzo flooring to match existing as closely as possible. Provide sample to consultant for approval.

## **2.10 CLEANING COMPOUNDS**

- .1 Specifically designed for cleaning masonry and concrete and which will not prevent bond of subsequent tile setting materials including patching and levelling compounds and elastomeric waterproofing membrane and coat.
- .2 Materials containing acid or caustic material are not acceptable.

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**Part 3 Execution**

**3.1 WORKMANSHIP**

- .1 Do tile work in accordance with TTMAC Tile Installation Manual 2000, "Ceramic Tile", except where specified otherwise.
- .2 **Patch or grind existing floor slab as required to ensure new tile is level with existing tile.**
- .3 Apply tile [or backing coats] to clean and sound surfaces.
- .4 Fit tile around corners, fitments, fixtures, drains and other built-in objects. Maintain uniform joint appearance. Cut edges smooth and even. Do not split tiles.
- .5 Maximum surface tolerance 1:800.
- .6 Make joints between tile uniform and approximately [1.5 mm] wide, plumb, straight, true, even and flush with adjacent tile. Ensure sheet layout not visible after installation. Align patterns.
- .7 Lay out tiles so perimeter tiles are minimum 1/2 size.
- .8 Install floor tiles as per pattern. Layout and install flash cove tile first, before floor tile, ensuring a flush edge on the horizontal surface by feathering to masonry walls as required to produce a straight line on the floor. Install floor tiles to pattern supplied by Architect at a later date. Contact consultant to review when approximately no more than 10 sq. m has been installed.
- .9 Sound tiles after setting and replace hollow-sounding units to obtain full bond.
- .10 Make internal angles square, external angles rounded.
- .11 Make internal angles square, external angles chamfered at 45° with narrow tile strip.
- .12 Construct cove base, as described using all special pieces available for inside and outside corners.
- .13 For Floors: Use bull nose edged tiles at termination of wall tiles, except where tiles abut projecting surface or differing plane.
- .14 Seal grouted joints with sealer.
- .15 Keep building expansion joints free of mortar or grout.
- .16 For Walls: Use round edged tiles at termination of wall tile panels, except where panel abuts projecting surface or differing plane.
- .17 Install divider strips at junction of tile flooring and dissimilar materials.
- .18 Allow minimum 24 h after installation of tiles, before grouting.
- .19 Clean installed tile surfaces after installation and grouting cured.

**3.2 FLOOR TILE**

- .1 Install in accordance with TTMAC to applicable thinset detail.

**3.3 STAIR TILE ACCESSORIES**

- .1 Install all accessories specified per manufacturer's instructions using whole lengths.
- .2 Provide sample installation for architect for review.

**3.4 FLOOR SEALER AND PROTECTIVE COATING**

- .1 Apply in accordance with manufacturer's instructions.

**END OF SECTION**



**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 78 00 - Closeout Submittals.
- .3 Section 06 10 10/06101 - Rough Carpentry: Wood strapping.
- .4 Fabrication: to ASTM 365-78 and CAN/GSB-92.1-M77.
- .5 Installation: to ASTM C636-76, except where specified otherwise.

**1.2 REFERENCES**

- .1 American Society for Testing and Materials (ASTM)
  - .1 ASTM E1264-[98], Classification for Acoustical Ceiling Products.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-51.34-[M86], Vapour Barrier, Polyethylene Sheet, for Use in Building Construction.
  - .2 CAN/CGSB-92.1-[M89], Sound Absorptive Prefabricated Acoustical Units.
- .3 Canadian Standards Association (CSA)
  - .1 CSA B111-[74(R1998)], Wire Nails, Spikes and Staples.
- .4 Underwriters Laboratories of Canada (ULC)
  - .1 CAN/ULC-S102-[88(R2000)], Surface Burning Characteristics of Building Materials.

**1.3 SAMPLES**

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit two each 300 x 300 mm samples of each individual tile and grid type in accordance with Section 01340.

**1.4 REGULATORY REQUIREMENTS**

- .1 Fire-resistance rated floor/ceiling and roof/ceiling assembly: certified by a Canadian Certification Organization accredited by Standards Council of Canada.

**1.5 DESIGN CRITERIA**

- .1 Maximum deflection 1/360 of span to ASTM 365-78 deflection test.

**1.6 WASTE MANAGEMENT AND DISPOSAL**

- .1 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan

## 1.7 ENVIRONMENTAL REQUIREMENTS

- .1 Permit wet work to dry before commencement of installation.
- .2 Maintain uniform minimum temperature of [15]<sup>0</sup>C and humidity of [20] - [40] % before and during installation.
- .3 Store materials in work area [48] hours prior to installation.

## 1.8 EXTRA MATERIALS

- .1 Provide extra materials of acoustic units in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Provide acoustical units amounting to [2] % of gross ceiling area for each pattern and type required for project.
- .3 Extra materials to be from same production run as installed materials.
- .4 Clearly identify each type of acoustic unit, including colour and texture.
- .5 Store where directed by Consultant.

## Part 2 Products

### 2.1 MATERIALS

- .1 Acoustic units for suspended ceiling system: to CAN/CGSB-92.1.
- .2 Acoustic Ceiling Panels, Designation LAP: Acoustic Ceiling Panels, wet formed mineral fibre panels, by Armstrong World Industries Canada Inc., Mississauga. Colour: White; Types as noted below:
- .3 **Panel Types:**
  - .1 LAP: 600 x 1200 mm x 15.9 mm thick; 'Cortega' Fire Guard, Square Lay-In, #823; Location: Refer to Room Finish Schedule.
- .4 Acceptable alternates: similar fire-rated purpose-designed high humidity ceiling panels by CGC Interiors, BPB Canada Inc. and Certainteed.
- .5 **Suspension system Type 1:** 23.8 mm (15/16") "Prelude XL Fire Guard" exposed tee bar grid, including wall moulding, by Armstrong. Colour: white. Acceptable alternate: similar suspension system by CGC Interiors, Oakville and Chicago Metal Corp. Grid sizes to suit ceiling panel types as shown on drawings.
- .6 Hold down clips: purpose made clips to secure tile to suspension system, approved for use in fire-rated systems.
- .7 Hangers: 2.6 mm galvanized soft annealed steel wire.
- .8 Accessories: splices, clips, retainers, etc., to complement suspension system components.

- .9 Adhesive: low VOC type recommended by acoustic unit manufacturer.
- .10 Staples, nails and screws: to CSA B111 non-corrosive finish as recommended by acoustic unit manufacturer.

### **Part 3 Execution**

#### **3.1 EXAMINATION**

- .1 Do not install acoustical panels and tiles until work above ceiling has been inspected by Consultant.

#### **3.2 INSTALLATION**

- .1 Install acoustical panels and tiles in ceiling suspension system.
- .2 Install acoustic units parallel to building lines with edge unit not less than 50% of unit width.
- .3 Scribe acoustic units to fit adjacent work. Butt joints tight, terminate edges with moulding.
- .4 Support suspension system main runners at 1200 oc maximum with hangers from structure. Assembly shall support super-imposed loads. Maximum permissible deflection, 1/360 of span.
- .5 Attach cross member to main runner to provide rigid assembly.
- .6 Install suspension assembly to manufacturer's written instructions.
- .7 Install flush edge moulding at junction of acoustic unit ceiling and other materials around entire length of joint. Secure to construction. Butt joints neatly, square and true in alignment.
- .8 Set acoustic units in place.
- .9 Set all ceiling levels by the use of transit or laser level.
- .10 Ensure all installations are clean upon owner acceptance. Be responsible for monitoring damage and soiling after installation and before owner occupancy. Prior to owner takeover, replace all tiles with damage, blemishes or soiling whether caused by subcontractor handling or post installation above-ceiling adjustments, balancing, cabling, etc.
- .11 Provide for Owner twelve (12) complete, undamaged ceiling tiles of each type, sealed and boxed. Leave in location as directed by Architect.

**3.3 INTERFACE WITH OTHER WORK**

- .1 Co-ordinate ceiling work to accommodate components of other sections, such as light fixtures, diffusers, speakers, sprinkler heads, to be built into acoustical ceiling components.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures

**1.2 REFERENCES**

- .1 American Society for Testing and Materials (ASTM International)
  - .1 ASTM F1303-[99], Specification for Sheet Vinyl Floor Covering with Backing.
- .2 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-ISO 14040-[97], Environmental Management - Life Cycle Assessment - Principles and Framework (Adopted ISO 14040:1997, first edition).

**1.3 SAMPLES**

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit duplicate 300 x 300 mm sample pieces of sheet material, 300 mm long base, nosing, feature strips, treads, edge strips.

**1.4 CLOSEOUT SUBMITTALS**

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

**1.5 ENVIRONMENTAL REQUIREMENTS**

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

**1.6 WASTE MANAGEMENT AND DISPOSAL**

- .1 Do not dispose of unused sealant and adhesive materials into landfill. Divert materials to municipal hazardous materials depot approved by Consultant.
- .2 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Consultant.
- .3 Remove from site and dispose of packaging materials at appropriate recycling facilities.

**1.7 QUALITY ASSURANCE**

- .1 Supplier shall be an established firm experienced in the field.
- .2 Installer:
  - .1 Flooring contractor experienced in the field and approved by the manufacturer.

- .2 Flooring contractor shall have manual instructions and be trained by the manufacturer and distributor.
- .3 Manufacturer's recommendations for the correct preparation, finishing and testing sub floor surface.

## **1.8 EXTENDED WARRANTY**

- .1 Submit a warranty for all the installation of all resilient sheet flooring, covering materials and labour and the repair or replacement of defective work in accordance with the General Conditions of the Contract, but for seven (7) years total.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Resilient Sheet Flooring (SF): Acceptable materials:
  - .1 Acceptable Materials:
    - .1 IQ Homogeneous Vinyl, 'Optima' by Tarkett.
    - .2 Mipolam Affinity by Gerflor.
    - .3 Palletone by PolyFlor.
  - .2 Locations: Refer to Room Finish Schedule.
  - .3 Allow for four (4) colours from manufacturer's full range.
- .2 Self Levelling Underlayment: "Ultraplan 1" by Mapei fast setting, polymer-modified; for over cured concrete, plywood, ceramic tile, old cutback adhesive, and old vinyl and vinyl composition flooring, feather edge to 1 1/2" (38 mm).for use to prepare floor at locations where existing flooring has been removed and subfloor is not level..
- .3 Filler and Cover Former:
  - .1 As recommended by manufacturer to suit subfloor on which its material is installed and to suit vertical wall/floor junctions.
- .4 Primers and Adhesives: As recommended by manufacturer of material to suit subfloor condition.
- .5 Cleaner: Neutral chemical compound that will not damage sheet or affect its colour.
- .6 Welding Rod: PVC welding rod, colour to match resilient sheet flooring.
- .7 Cap strip: sized to suit application, type recommended by flooring manufacturer, Altro Stainless Steel Cap, mechanically fastened to wall

## **Part 3 Execution**

### **3.1 SITE VERIFICATION OF CONDITIONS**

- .1 Ensure concrete floors are clean and dry by using test methods recommended by flooring manufacturer.

### **3.2 PREPARATION**

- .1 Scope includes preparation of floor using self levelling coating and patching compound as required.
- .2 Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler.
- .3 Clean floor and apply filler; trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler cured and dry.
- .4 Remove or treat old adhesives to prevent residual, old flooring adhesives from bleeding through to new flooring and/or interfering with the bonding of new adhesives.
- .5 As required, seal concrete slab to resilient flooring manufacturer's printed instructions.

### **3.3 INSTALLATION**

- .1 Install on a smooth, flat concrete finish, which will be achieved manually or mechanically.
- .2 Ensure concrete sub floor temperature to be maintained at a minimum of 70°F during installation and ensure the moisture content does not exceed 3 Lbs per 1000 Sq Ft per 24 hours or lower.
- .3 Paint game lines using approved game line paint primer and game line paint in strict accordance with the game line paint manufacturer's instructions.
- .4 Before proceeding with any work, inspect the sub floor surface and report, in writing, to the project manager and the General Contractor any visible defect on the surface, such as cracks, bumps, rough areas or variations in planarity.
- .5 This installation is to proceed on an existing concrete slab in addition to new concrete work as required for mechanical services. Ensure slab is adequately cured and free of moisture or contaminants. If necessary, as part of the work of this section, scarify existing surfaces to prepare surface for adhesive, or to meet manufacturer's installation requirements. Fill joints, cracks, and holes in these surfaces and level surface irregularities with filler. Remove prime paint and wire brush steel base surfaces.
- .6 Check for any grease, oil, paint, duct or any combination remaining on the concrete sub floor.
- .7 Before proceeding with installation, clean concrete surface to remove any dirt or foreign materials, rinse thoroughly and allow eight (8) hours minimum to dry, if required, sanding is necessary in all installations.
- .8 Fill any areas not meeting  $\pm 1/8''$  in 10' for level before installation. This will insure levelness and proper adhesion of material.
- .9 Lay each material in accordance with manufacturer's specifications.
- .10 Weld joints on flooring and internal and external angles of coves using welding rod in matching plain colours, and the standard hot-air-welding technique.

- .11 Install standard rubber base at resilient sheet flooring locations.
- .12 Flash into drain openings; do not cut on surface at edge of drain cover. Coordinate with Division 15 for installation with suitable drain type and cover. Bond flooring to drain flange under clamping ring using epoxy adhesive.
- .13 Extend resilient sheet under all cabinet work and casework to the wall line.

### **3.4 CLEANING**

- .1 Remove excess adhesive from floor, base and wall surfaces without damage.
- .2 Clean, seal and wax floor and base surface to flooring manufacturer's printed instructions.

### **3.5 PROTECTION**

- .1 Protect new floors from time of final set of adhesive, with polyethelene or Kraft paper until final inspection.
- .2 Prohibit traffic on floor for 48 hours after installation.
- .3 Do not wax.

**END OF SECTION**



**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 03 30 00 – Cast-in-Place Concrete.
- .3 Section 03 35 05 – Concrete Floor Hardeners.

**1.2 REFERENCES**

- .1 American Society for Testing and Materials (ASTM International)
  - .1 ASTM F1066-[99], Specification for Vinyl Composition Floor Tile.
  - .2 ASTM F1344-[00], Specification for Rubber Tile.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-25.20-[95], Surface Sealer for Floors.
  - .2 CAN/CGSB-25.21-[95], Detergent-Resistant Floor Polish.

**1.3 SAMPLES**

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit duplicate tile in size specified, [[300] mm long] [base,] [nosing,] [feature strips,] [treads,] [edge strips].

**1.4 WASTE MANAGEMENT AND DISPOSAL**

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling.
- .3 Dispose of unused finish and adhesive materials at official hazardous material collections site approved by Consultant.
- .4 Do not dispose of unused finish and adhesive materials into sewer system, into streams, lakes, onto ground or in other locations where it will pose health or environmental hazard.

**1.5 ENVIRONMENTAL REQUIREMENTS**

- .1 Maintain air temperature and structural base temperature at flooring installation area above 20°C for 48 hours before, during and for 7 days after installation.

**1.6 EXTRA MATERIALS**

- .1 Provide 6 m<sup>2</sup> or 3% of each colour, pattern and type flooring material required for this project for maintenance use.

- .2 Extra materials to be from same production run as installed materials.
- .3 Clearly identify each container of floor tile and each container of adhesive.
- .4 Store where directed by Consultant.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Vinyl composition tile (VCT): to ASTM F1066, Composition 1 - non asbestos, 3 mm, 300 x 300 mm size.
- .2 Allow for total of eight (8) colours from full line. Allow for 10% accent tile in pattern, to all rooms, to later issue in the Colour schedule. Note that only “through-colour” and “through-pattern” products will be acceptable.
- .3 Acceptable Manufacturers:
  - .1 Armstrong: Standard Excelon field & Multicolour accents.
  - .2 Tarkett VCT II
- .4 Resilient base (RR): rubber, top set coved, 3 mm thick, rubber, 100 mm high minimum 1200 mm long, including premoulded end stops and external corners. Acceptable materials: non-shrink Rubber Wall Base with toe as manufactured by Johnsonite, Roppe or approved alternates. Colours: Six (6) from full Johnsonite "Coloright" colour line.
- .5 Primers and adhesives: waterproof, recommended by flooring manufacturer for specific material on applicable substrate, above, at or below grade. Use Johnsonite 990 Solvent Free Environmentally Safe White Acrylic Cove Base Adhesive for rubber base. Use Roberts #2057 clear water resistant low odour adhesive for VCT or acceptable alternate approved during tender period by consultant. Submit data sheets for any alternate products considered.
- .6 Sub-floor filler and leveller: white premix latex requiring water only to produce cementitious paste, as recommended by flooring manufacturer for use with their product.
- .7 Metal edge strips: aluminum extruded, smooth, with lip to extend under floor finish, shoulder flush with top of adjacent floor finish.
- .8 Polyethylene sheet: to CAN2 51.33-M77, Type 2, for protection.
- .9 Nose filler: Epoxy caulking compound Johnsonite 930.

## **Part 3 Execution**

### **3.1 INSPECTION**

- .1 Ensure concrete floors are dry, by using test methods recommended by tile manufacturer. Inspect for negative alkalinity, carbonization or dusting.

- .2 Commencement of work indicates acceptance of conditions by flooring installer.

### **3.2 SUB-FLOOR TREATMENT**

- .1 Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler.
- .2 Clean floor and apply filler; trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler cured and dry.

### **3.3 TILE APPLICATION**

- .1 Apply adhesive uniformly using recommended trowel in accordance with flooring manufacturer's instructions. Do not spread more adhesive than can be covered by flooring before initial set takes place.
- .2 Lay flooring with joints parallel to building lines to produce symmetrical tile pattern. Border tiles minimum half tile width.
- .3 Install tiles in corridor as per pattern provided by Consultant. Pattern will be provided at a later date.
- .4 Cut tile and fit neatly around fixed objects.
- .5 Install flooring in pan type floor access covers. Maintain floor pattern.
- .6 Terminate flooring at centerline of door in openings where adjacent floor finish or colour is dissimilar.
- .7 Install metal edge strips at unprotected or exposed edges where flooring terminates.
- .8 At doorways to incrapack units, extend tile and base fully into door opening to incrapack classroom.
- .9 Install solid colour vinyl strips, manufactured for this purpose, to form gymnasium game lines, as indicated on drawings. Cut field tiles tight and smooth contour against game lines. Strips to be minimum of 300 mm long on curves and of indicated width and colour.
- .10 Install solid colour vinyl strips, manufactured for this purpose, to indicate the hazardous zone around equipment in the STAC classroom. Cut field tiles tight and smooth contour against the solid coloured lines.

### **3.4 STAIR APPLICATION**

- ~~.1 Areas to receive stair treads shall be clean, fully enclosed, weathertight, and maintained at a uniform temperature of at least 70°F for 24 hours before, during, and after the installation is completed. The stair treads and adhesives shall be conditioned in the same manner. Stair steps shall be smooth, flat, level, permanently dry, clean and free of all foreign material, such as dust, paint, grease, oils, solvents, curing and hardening compounds, sealers, asphalt and old adhesive residue. An epoxy caulking nose filler shall be applied to ensure a tight fit and eliminate any open spaces between the step edge and stair tread nosing. Stair treads shall be trimmed to within 1/16" of the riser and~~

~~stringer to allow for expansion. Adhesives shall be applied to the stair step surface and the back and nosing area of the stair tread. Stair treads shall be rolled, with a J hand roller, after installation, to ensure proper bonding.~~

### **3.5 BASE APPLICATION**

- .1 Lay out base to keep number of joints at minimum. Use lengths as long as practicable and not less than minimum 500 mm long.
- .2 Clean substrate and prime with one coat of adhesive.
- .3 Apply adhesive to back of base.
- .4 Set base against wall and floor surfaces tightly by using 3 kg hand roller.
- .5 Install straight and level to variation of 1:1000.
- .6 Scribe and fit to door frames and other obstructions. Use premoulded end pieces at flush door frames.
- .7 Miter internal corners. Use premoulded corner pieces at all external corners and ensure full adhesion through to ends of corner pieces. See detail for termination at door frames.
- .8 Install toeless type base before installation of carpet on floors.
- .9 Leave in the building one (1) complete carton of each of two (2) colours of floor tile and twelve (12) tiles of each of the remaining colours. Colours of extra tile to be specified by Consultant.

### **3.6 INITIAL MAINTANANCE AFTER INSTALLATION**

- .1 Broom sweep or vacuum thoroughly.
- .2 Do not wet mop, wash, scrub, or strip the floor. These procedures will be done by the Owner.

### **3.7 PROTECTION OF FINISHED WORK**

- .1 Following broom sweeping, protect new floors with 0.15 mm thick Polyethylene cover and lay planking in all necessary traffic areas to minimize damage by other trades. Maintain until just before final inspection.
- .2 Prohibit traffic on floor for 48 hours after installation.

### **3.8 PREPARATION FOR INSPECTION**

- .1 Only if so notified by Architect, and in the presence of the Owner, scrub the floor using a neutral detergent and a floor machine of 170-250 rpm capability equipped with a scrub brush or a scrubbing pad (3M blue or equal).
- .2 Lightly rinse and allow to dry. Note: Do not flood the floor with rinse water, scrubbing, or stripping solutions. Final re-washing, if required, and waxing will be done by owner.

**END OF SECTION**

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**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 06 40 00 - Architectural Woodwork.
- .3 Section 05 12 23 – Structural Steel for Buildings.
- .4 Section 05 50 00 – Metal Fabrications.
- .5 Section 08 11 14 – Metal Doors and Frames.
- .6 Section 09 91 27 – Finish and Colour Notes.
- .7 Section 09 91 30 – Door and Room Finish Schedule.

**1.2 REFERENCES**

- .1 Architectural Painting Specifications Manual, Master Painters Institute (MPI).
- .2 Ontario Painting Contractors Association (OPCA) Architectural Specification Manual - referenced as OPCA Manual, latest Edition. Paint formulations and methods referred to herein refer to this Manual. If contractor is unfamiliar with this reference standard, contact the OPCA at (416) 498-1897.

**1.3 WARRANTY**

- .1 At outset of the contract, contractor to register with the OPCA for the inspection service paid for from Cash Allowances.
- .2 Upon completion of the inspection program, contractor to furnish a 2 Year Guarantee. The Guarantee shall warrant that the work has been performed with respect to the standards and requirements incorporated in the OPCA specification manual-latest edition.

**1.4 ENVIRONMENTAL PERFORMANCE REQUIREMENTS**

- .1 Do not apply paint finish in areas where dust is being generated.
- .2 Conform to requirements of OPCA Manual.
- .3 Comply with the requirements of Section 01 35 30- Health and Safety.

**1.5 JOB MOCK-UP**

- .1 Complete a mock-up room to be reviewed and approved by Owner, Consultant, and OPCA Inspector for approval on application of block filler and finish paint coats.

**1.6 SCHEDULING OF WORK**

- .1 Submit work schedule for various stages of painting to Consultant for approval. Submit schedule minimum of 72 hours in advance of proposed operations.

- .2 Obtain written authorization from Consultant for any changes in work schedule.
- .3 Schedule painting operations to prevent disruption of occupants in and about the building.

#### **1.7 EXTRA MATERIALS**

- .1 Submit one - four litre can of each type and colour of [primer] [stain] [finish coating]. Identify colour and paint type in relation to established colour schedule and finish system.
- .2 Deliver to Contractor and store where directed.

#### **1.8 DELIVERY, HANDLING AND STORAGE**

- .1 Labels shall clearly indicate:
  - .1 Manufacturer's name and address.
  - .2 Type of paint or coating.
  - .3 Compliance with applicable standard.
  - .4 Colour number in accordance with established colour schedule.
- .2 Remove damaged, opened and rejected materials from site.
- .3 Provide and maintain dry, temperature controlled, secure storage.
- .4 Observe manufacturer's recommendations for storage and handling.
- .5 Store materials and supplies away from heat generating devices.
- .6 Store materials and equipment in a well ventilated area with temperature range 7<sup>0</sup>C to 30<sup>0</sup>C.
- .7 Store temperature sensitive products above minimum temperature as recommended by manufacturer.
- .8 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Consultant. After completion of operations, return areas to clean condition to approval of Consultant.
- .9 Remove paint materials from storage only in quantities required for same day use.
- .10 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.
- .11 Fire Safety Requirements:
  - .1 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
  - .2 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

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**1.9 FINISHES AND COLOURS**

- .1 Review the requirements outlined in Section 099127, Finish Schedule and Colour Notes. A separate colour schedule will be issued after contract award.
- .2 Allow for 10 colours total from all formulations for this project including room wall accent colours.

**1.10 WASTE MANAGEMENT AND DISPOSAL**

- .1 Paint, stain and wood preservative finishes and related materials (thinners, solvents, etc.) are regarded as hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from Provincial Ministries of Environment and Regional levels of Government.
- .2 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.
- .3 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.
- .4 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into ground the following procedures shall be strictly adhered to:
  - .1 Retain cleaning water for water-based materials to allow sediments to be filtered out.
  - .2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.
  - .3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.
  - .4 Dispose of contaminants in an approved legal manner in accordance with hazardous waste regulations.
  - .5 Empty paint cans are to be dry prior to disposal or recycling (where available).
- .5 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.
- .6 Set aside and protect surplus and uncontaminated finish materials: galvanized touch up; wood stain, prefinished metal touch up paint. Deliver to or arrange collection by recycling organization for verifiable re-use or re-manufacturing.
- .7 Close and seal tightly partly used sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Acceptable Manufacturer's: Where OPCA code numbers are not referenced, use Products from one of the following manufacturers:
  - .1 Benjamin Moore & Co. Ltd.



- 
- .2 Canadian Industries Ltd.
  - .3 ICI (Glidden) Paints.
  - .4 Para Paints.
  - .5 Pratt & Lambert Inc.
  - .6 SICO Coatings.
  - .7 The Sherwin-Williams Company.
- .2 Manufacturers of intumescent coatings having Product considered acceptable for use:
- .1 A/D Fire Protection Systems Inc.
  - .2 Carboline.
- .3 Paint materials for paint systems shall be products of a single manufacturer.
- .4 Acceptable products: Per Chapter 5 OPCA Manual and as listed.
- .5 Paint materials for each paint system to be products of a single manufacturer.
- .6 Use low-VOC and low-odour paints only.

### **Part 3 Execution**

#### **3.1 GENERAL**

- .1 Prepare surfaces to receive paint per Chapter 3 OPCA Manual.

#### **3.2 APPLICATION**

- .1 Sand and dust between each coat to remove defects visible from distance up to 1.5 m.
- .2 Finish closets and alcoves as specified for adjoining rooms.
- .3 Apply each coat at the proper consistency. Each coat of finish should be fully dry and hard before applying the next coat, unless the manufacturer's instructions state otherwise.
- .4 Method of application to be as approved by Consultant. Apply paint by [brush] [roller] [air sprayer] [airless sprayer]. Conform to manufacturer's application instructions unless specified otherwise.
- .5 Brush and Roller Application:
  - .1 Apply paint in a uniform layer using brush and/or roller of types suitable for application.
  - .2 Work paint into cracks, crevices and corners.
  - .3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.
  - .4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces shall be free of roller tracking and heavy stipple unless approved by Consultant.

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- .5 Remove runs, sags and brush marks from finished work and repaint.
  - .6 Spray application:
    - .1 Provide and maintain equipment that is suitable for intended purpose, capable of properly atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.
    - .2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.
    - .3 Apply paint in a uniform layer, with overlapping at edges of spray pattern.
    - .4 Brush out immediately all runs and sags.
    - .5 Use brushes to work paint into cracks, crevices and places which are not adequately painted by spray.
  - .7 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access and only when specifically authorized by Consultant.
  - .8 Apply coats of paint as a continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.
  - .9 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.
  - .10 Sand and dust between coats to remove visible defects.
  - .11 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.
  - .12 Finish inside of cupboards and cabinets as specified for outside surfaces.
  - .13 Finish closets and alcoves as specified for adjoining rooms.
  - .14 Finish top, bottom, edges and cut-outs of doors after fitting as specified for door surfaces.

### **3.3 MECHANICAL/ELECTRICAL EQUIPMENT**

- .1 Refer also to Finish Notes in Section 099127- Finish and Colour Notes.
- .2 Paint exposed conduits, pipes, hangers and other mechanical and electrical equipment occurring in finished areas as well as inside cupboards and cabinet work. Colour and texture to match adjacent surfaces, except as noted otherwise. Coordinate with mechanical trades applying banding and labeling after pipes have been painted. Do not paint white PVC covers on exposed mechanical water, drain and other lines
- .3 Paint gas piping standard yellow where visible on roof or in service spaces. Do not paint gas meter or gas equipment in wall niche yellow—colour to later selection by Architect.
- .4 Paint surfaces inside of ductwork and elsewhere behind grilles where visible using primer and one coat of matte black paint.
- .5 Paint both sides and edges of plywood backboards for equipment before installation.

- .6 Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

### 3.4 PAINT SYSTEMS

- .1 System references listed are based on Chapters 4A and 4B of OPCA Manual and are OPCA Premium Grade, unless noted otherwise.

### 3.5 INTERIOR FINISHES

- .1 Wood, where applicable:
  - .1 Miscellaneous trim: INT. 1-A, Alkyd Semi-Gloss Finish, Premium Grade
  - .2 Casework and miscellaneous wood items:
    - .1 Exterior surfaces: INT. 1-A, Alkyd Semi-Gloss Finish, Premium Grade
    - .2 Interior surfaces: INT. 1-A, Alkyd Semi-Gloss Finish, Premium Grade
    - .3 Wood Benches and Upper Shelves: INT. 2-F, Stained Alkyd Satin Finish, Premium Grade.
  - .2 Gypsum board: INT.4-B, Latex Eggshell Finish, Premium Grade.
  - .3 Concrete Block: EP - All corridors, stairwells and vestibules - 100 percent zero VOC epoxy.
  - .4 Concrete Block: INT.8-C -modified; Areas other than corridors, stairwell and vestibules - Latex Semi-Gloss Finish, Premium Grade. Modified system refers to all work where 2 full coats of block filler shall be applied.
  - .5 Concrete Floors; refer to Section 03 35 05 Concrete Floor Hardeners
  - .6 Miscellaneous metal:
    - .1 Primed: INT. 12-A, Alkyd Semi-Gloss Finish, Premium Grade
    - .2 Galvanized: INT. 13-A, Alkyd Semi-Gloss Finish, Premium Grade
    - .3 INT. 12-G, Water based Epoxy finish, two coats on a rust inhibitive primer for all exposed steel railings, guards, etc..
  - .7 Galvanized metal: INT. 13-A, Alkyd Semi-Gloss Finish, Premium Grade
  - .8 Hollow Metal Doors and Frames: Without exception, all wipecoated Galvanized Hollow Metal Doors, Frames and Screens, interior and exterior shall be field cleaned with solvent, galvanized prime paint coated and then finished with INT. 13-A Premium Grade, Gloss Finish. Base coat primer shall be submitted for review in advance or door/frame painting shall be rejected by Consultant. For exterior hollow metal frames, if any, adjacent to aluminum windows, provide finish coat as an exterior premium grade metallic gloss finish to match anodized windows or Aluminum Composite panels. Colour to be confirmed by Architect during construction.
  - .9 Other Painting:
    - .1 In the any rooms with exposed metal deck including mechanical rooms and storage rooms:
      - .1 Allow for single colour for deck and joists.

- .2 Allow for complete painting of all hangers and equipment brackets including but not limited to, electrical and mechanical equipment, etc.
- .3 painting deck/floor slab and structural steel is part of painting contract.

### 3.6 EXTERIOR PAINTING

- .1 Pavement markings: To CGSB 1-GP-74M, alkyd traffic paint.
  - .1 Sandblast existing line painting on asphalt to Owner's satisfaction, prior to application of new markings.
  - .2 Colour: to CGSB 1-GP-12C, white 513-301.
  - .3 Thinner: to CAN/CGSB-1.5
  - .4 All paint to confirm to OPSS #1712 and be supplied by one of the following suppliers.

|                                     |             |
|-------------------------------------|-------------|
| White Paint Code                    |             |
| Niagara Paint and Chemical Co. Ltd. | #87932      |
| Ibis Products Ltd.                  | #40-2478    |
| CIL                                 | #7612-26992 |
| Sherwin Williams                    | #C97WG129   |
| Sico Paints                         | #3007649W   |
- .2 Miscellaneous metal:
  - .1 Primed: EXT. 11-A-Gloss, Premium Grade
  - .2 Galvanized: Touch up any welds, cuts or damage with 'Galvafroid' Paint by W.R. Meadows prior to prime and finish coats.; Finish System EXT. 12-A-Gloss, Premium Grade
- .3 Galvanized Structural Steel: Touch up any welds, cuts or damage with 'Galvafroid' Paint by W.R. Meadows prior to prime and finish coats.; Finish System: EXT. 12-A-Gloss, Premium Grade.
- .4 Steel - high heat: EXT. 15-A
- .5 Paint exterior vents and louvres located in masonry to match adjacent masonry in colour.

### 3.7 INSPECTIONS

- .1 Provide Architect with all formulations at outset of project.
- .2 Cooperate at all times with the paint inspection agency in the performance of their duties as required as part of the work of this Section.
- .3 Inspection costs to be paid from Cash Allowance.

**END OF SECTION**

**Part 1 General**

**1.1 GENERAL FINISH NOTES**

- .1 The Material and Colour Schedule will be issued by the Consultant after tender. It shall be read in conjunction with the Drawings, Specifications, Room Schedule and Door Schedule. Colour and material references named will be based on one manufacturer, as carried by the Contractor or, in the case that no specific manufacturer is carried, based on the Consultant's choice.
- .2 Approved alternative manufacturers will be acceptable only as indicated in the specifications. However, approved alternate products submitted must match the products named in the Specification to the Consultant's selection. Alternate products other than those named in the specifications will not be allowed unless previously approved by the Consultant.
- .3 Consult Consultant prior to painting any surface not included in the formulae as listed.
- .4 Final colour for exterior painted surfaces and prominent interior areas shall be approved on the job site by the Consultant.
- .5 Paint samples: Contractor to submit paint samples for all areas required to "Match Adjacent Finish".
- .6 All similar paint formulations are to be identical when dry. Variations in tone, texture or sheen shall not be accepted.
- .7 Submit two 300 mm x 300 mm paint samples of each colour required for approval by the Architect.
- .8 Exact locations of accent paint called for in the Material and Colour Schedule, to be issued after Contract award, not specifically identified on the drawings are to be verified on site with the Consultant.

**1.2 EXTERIOR FINISH NOTES**

- .1 All exposed metal (doors, frames, lintels, stairs, handrails, mechanical equipment, etc.) to be painted except for prefinished metal louvres, stainless steel, and aluminum. Mechanical equipment is to be painted whether delivered to the site pre-painted or not (exhaust fans, goosenecks, exhaust stacks, supports, HVAC units, HRU units, etc.). Colours to match adjacent material-generally either to match brick or tan to match flashing or siding material. Do not paint exposed white PVC pipe covers on interior. Architect will advise on jobsite which other items mentioned above, if any, do not require painting.
- .2 All unfinished metal work provided by landscaping is to be painted by Section 099122-Painting.

**1.3 INTERIOR FINISH NOTES**

- .1 All heating units, recessed convectors, grilles, pipes, access panels, hangers and miscellaneous exposed metal work (except stainless steel or anodized aluminum) to be painted to match the surfaces on which they occur unless noted otherwise on the colour schedule, prefinished in suitable colour or directed by the Consultant. If prefinished equipment is damaged, it shall be re-painted. Painting to be by formulations specified in Section 09 91 12- Painting.
- .2 All interior fitments, casework, millwork, etc. to be melamine unless otherwise noted. Refer to Sections for specific requirements regarding materials, construction, finishes and hardware. Note that drawer and cupboard interiors are to be considered as exposed surfaces and will therefore be finished.
- .3 Do not paint over nameplates, identification tags, etc.
- .4 Make good all existing surfaces and finishes that are damaged during construction.

**END OF SECTION**

## **PART 1 - GENERAL**

### **1.1 General Notes**

1. Find the **Room Finish Schedule** on the following page.
2. Refer to interior elevations, plans sections and reflected ceiling plans to coordinate finish notes and extents of materials.
3. Refer to various specifications sections for different types of materials including, but not limited to:
  - .1 flooring materials such as resilient tile
  - .2 ceiling materials such as Lay-In Acoustical panel (LAP)
  - .3 Acoustical wall treatment
4. Abbreviations Legend:

| <b><u>Code</u></b> | <b><u>Reference</u></b>                     |
|--------------------|---|
| ASD                | Acoustic Steel Deck                         |
| CMT                | Ceramic Mosaic Tile                         |
| CPT                | Carpet Tile                                 |
| CWT                | Ceramic Wall Tile                           |
| CB                 | Concrete Block                              |
| GWB                | Gypsum Board                                |
| LAP                | Lay-in Acoustic Panel                       |
| LVT                | Luxury Vinyl Tile                           |
| EP                 | Epoxy Paint                                 |
| EX                 | Existing                                    |
| EXIST              | Existing                                    |
| POR                | Porcelain Tile                              |
| PT                 | Paint                                       |
| RR                 | Resilient Rubber                            |
| RSTR               | Rubber Stair Tread & Riser                  |
| SF                 | Resilient Sheet Flooring                    |
| S.CONC             | Sealed Concrete (refer to Section 03 35 05) |
| TER                | Terazzo                                     |
| VCT                | Vinyl Composite Tile                        |
| WRGB               | Water-Resistant Gypsum Board                |

END OF SECTION

**Central P.S. - Accessibility, HVAC Window Upgrades  
Room Finish Schedule**

| ROOM FINISH SCHEDULE |                  | FLOOR      |      | WALL         |              | CEILING     |         |            | REMARKS  |
|----------------------|------------------|------------|------|--------------|--------------|-------------|---------|------------|--|
| NO.                  | NAME             | FIN.       | BASE | MAT'L        | FIN.         | MAT'L       | FIN.    | HEIGHT(mm) |  |
| <b>GROUND FLOOR</b>  |                  |            |      |              |              |             |         |            |  |
| 101A                 | CLASSROOM 10     | EX. / VCT  | EX.  | EX. CB/EX.GB | P            | EX          | EX./P   | EX.        | EXISTING GYPSUM BOARD BULKHEADS TO BE PAINTED. REFER TO FLOOR PATTERN PLANS FOR LOCATION OF NEW VCT                      |
| 101C                 | CLASSROOM 11     | EX./ / VCT | EX.  | EX. CB/EX.GB | P            | EX.         | EX./P   | EX.        | EXISTING GYPSUM BOARD BULKHEADS TO BE PAINTED. REFER TO FLOOR PATTERN PLANS FOR LOCATION OF NEW VCT                      |
| 101E                 | ALCOVE           | EX.        | EX.  | EX. CB/EX.GB | P            | LAP         | -       | +/-2400    |  |
| 102A                 | CLASSROOM 12     | SF         | RR   | EX.CB        | P            | LAP/GYP     | -       | EX.        |  |
| 102C                 | CLASSROOM 13     | SF         | RR   | EX. CB/CB    | P            | LAP/EX. GYP | P       |            | NEW CEILING TO BE 1 HR RATED. REFER TO SPECIFICATIONS. EXISTING GYPSUM BOARD BULKHEADS TO BE PAINTED                     |
| 106                  | BOY'S WASHROOM   | EX.        | EX.  | EX CB        | P            | EX. GYP     | P       | EX.        |  |
| 107                  | STAFF WR         | EX.        | EX.  | EX. CB       | P            | EX.         | EX.     | EX.        |  |
| 108                  | BF WR            | POR        | POR  | EX. CB/CB    | CWT          | GYP         | P       | 2540       | CWT FULL HEIGHT ON ALL WALLS   |
| 109                  | GIRL'S WASHROOMS | EX.        | EX.  | EX CB        | P            | EX. GYP     | P       | EX.        |  |
| 116                  | SPRINKLER ROOM   | EX.        | EX.  | EX CB        | EX P/P       | EX.         | EX./P   |            | PAINT WALLS AND GYPSUM BULKHEADS TO MATCH EXISTING AT NEW STRUCTURAL WALL PLATES.  |
| 117                  | LIBRARY          | EX. CPT    | EX.  | EX.CB/GYP.   | EX. PT/NEW P | EX. GYP.    | EX. P/P | EX.        | PATCH EXISTING GYP CEILING AT LOCATION OF NEW WALLS AND NEW LIGHT FIXTURES. EXISTING GYPSUM BOARD CEILINGS TO BE PAINTED |



| ROOM FINISH SCHEDULE |               | FLOOR          |                             | WALL        |        | CEILING          |       |            | REMARKS   |
|----------------------|---------------|----------------|-----------------------------|-------------|--------|------------------|-------|------------|---|
| NO.                  | NAME          | FIN.           | BASE                        | MAT'L       | FIN.   | MAT'L            | FIN.  | HEIGHT(mm) |   |
| 119                  | WORKROOM      | EX.            | EX.                         | EX.         | EX.    | EX.              |       |            | PAINT WALLS AND CEILINGS IN AREAS OF WORK.  |
| A131                 | SEMINAR       | SF             | RR                          | EX.CB/CB    | P      | LAP              | -     | 2600       | NEW CEILING TO BE 1 HR RATED. REFER TO SPECIFICATIONS.  |
| A132                 | MACHINE ROOM  | S.CONC         | RR                          | EX.CB/CB    | P      | GYP              | P     | 2400       | NEW CEILING TO BE 1 HR RATED. REFER TO SPECIFICATIONS.  |
| A133                 | SUMP PIT ROOM | S.CONC         | RR                          | EX.CB/CB    | P      | GYP              | P     | 2400       | NEW CEILING TO BE 1 HR RATED. REFER TO SPECIFICATIONS.  |
| 801                  | CORRIDOR      | EX.<br>VCT/VCT | EX. / RR                    | EX.         | EX. /P | EX.              | EX.   | EX.        | NEW PAINT FINISH EXTENT AS SHOWN IN PROPOSED FLOOR PLAN AT CLASSROOM 10. PROVIDE NEW PAINT FINISH TO MATCH EXISTING WALLS AT ALL NEW DOOR FRAMES A MIN. 610MM |
| 802                  | CORRIDOR      | EX.            | EX.                         | EX.         | EX. /P | EX.              | EX.   | EX.        | PROVIDE NEW PAINT FINISH TO MATCH EXISTING WALLS AT ALL NEW DOOR FRAMES A MIN. 610MM  |
| 803                  | CORRIDOR      | EX.<br>VCT/VCT | EX. / RR                    | EX. CB      | EX. /P | EX.<br>GYP./GYP. | P     | EX.        | VCT IN FRONT OF NEW DOORS. PAINT ALL NEW WALLS AND CEILINGS. NEW GYPSUM BOARD CEILING TO BE 1 HR RATED.   |
| 804                  | CORRIDOR      | EX.            | EX. / RR                    | EX. CB / CB | EX. /P | EX.<br>GYP./GYP. | EX./P | EX.        | PROVIDE NEW PAINT FINISH TO MATCH EXISTING WALLS AT ALL NEW DOOR FRAMES A MIN. 610MM. NEW CEILING TO BE 1 HR RATED. REFER TO SPECIFICATIONS.                  |
| A850                 | ELEVATOR      | PORC           | PER ELEVATOR SPECIFICATIONS |             |        | GYP              |       |            | NEW CEILING TO BE 1 HR RATED. REFER TO SPECIFICATIONS.  |

**Central P.S. - Accessibility, HVAC Window Upgrades  
Room Finish Schedule**

| ROOM FINISH SCHEDULE |          | FLOOR          |      | WALL        |        | CEILING |      |            | REMARKS  |
|----------------------|----------|----------------|------|-------------|--------|---------|------|------------|--|
| NO.                  | NAME     | FIN.           | BASE | MAT'L       | FIN.   | MAT'L   | FIN. | HEIGHT(mm) |  |
| A852                 | CORRIDOR | EX.VCT/<br>VCT | RR   | EX. CONC/CB | P/ CWT | GYP     | P    | +/-2530    | NEW VCT AS SHOWN ON PROPOSED PLAN. CWT FULL HEIGHT ON WALLS SHOWN ON PROPOSED PLAN. NEW CEILING TO BE 1 HR RATED. REFER TO SPECIFICATIONS. |

| ROOM FINISH SCHEDULE |                  | FLOOR     |      | WALL         |      | CEILING |       |            | REMARKS   |
|----------------------|------------------|-----------|------|--------------|------|---------|-------|------------|---|
| NO.                  | NAME             | FIN.      | BASE | MAT'L        | FIN. | MAT'L   | FIN.  | HEIGHT(mm) |   |
| <b>SECOND FLOOR</b>  |                  |           |      |              |      |         |       |            |   |
| 201A                 | CLASSROOM 9      | SF        | RR   | EX. CB/EX.GB | P    | EX. LAP | -     | -          | EXISTING GYPSUM BOARD BULKHEADS TO BE PAINTED   |
| 201C                 | CLASSROOM 8      | EX.       | EX.  | EX. CB/EX.GB | P    | EX. LAP | -     | -          | EXISTING GYPSUM BOARD BULKHEADS TO BE PAINTED   |
| 201E                 | ALCOVE           | EX.       | EX.  | EX. CB/EX.GB | P    | LAP     | -     | +/-2400    | NEW CEILING TO BE 1 HR RATED. REFER TO SPECIFICATIONS.  |
| 202A                 | CLASSROOM 7      | SF        | RR   | EX. CB/EX.GB | P    | EX. LAP | -     | -          | EXISTING GYPSUM BOARD BULKHEADS TO BE PAINTED   |
| 202C                 | CLASSROOM 6      | SF        | RR   | EX. CB/EX.GB | P    | EX. LAP | -     | -          | EXISTING GYPSUM BOARD BULKHEADS TO BE PAINTED   |
| 202E                 | ALCOVE           | SF        | RR   | EX. CB/EX.GB | P    | LAP     | -     | +/-2400    | NEW CEILING TO BE 1 HR RATED. REFER TO SPECIFICATIONS.  |
| 203A                 | CLASSROOM 5      | EX. / VCT | EX.  | EX. CB/EX.GB | P    | EX. LAP | -     | -          | EXISTING GYPSUM BOARD BULKHEADS TO BE PAINTED. REFER TO FLOOR PATTERN PLANS FOR LOCATION OF NEW VCT |
| 203C                 | CLASSROOM 4      | EX./ VCT  | EX.  | EX. CB/EX.GB | P    | EX. LAP | -     | -          | EXISTING GYPSUM BOARD BULKHEADS TO BE PAINTED. REFER TO FLOOR PATTERN PLANS FOR LOCATION OF NEW VCT |
| 203E                 | ALCOVE           | EX.       | EX.  | EX. CB/EX.GB | P    | LAP     | -     | +/-2400    | NEW CEILING TO BE 1 HR RATED. REFER TO SPECIFICATIONS.  |
| 205                  | BOY'S WASHROOM   | EX.       | EX.  | EX. CB       | P    | EX.     | P     | EX.        |   |
| 206                  | STAFF WR         | EX.       | EX.  | EX. CB       | P    | EX.     | EX.   | EX.        |   |
| 207                  | STAFF WR         | EX.       | EX.  | EX. CB       | P    | EX.     | EX.   | EX.        |   |
| 209                  | GIRL'S WASHROOMS | EX.       | EX.  | EX. CB       | P    | EX.     | P     | EX.        |   |
| 216                  | MAIN OFFICE      | EX.       | EX.  | EX.          | EX.  | EX,     | EX./P | EX.        | PATCH AND PAINT EXISTING GYPSUM BOARD CEILING AS REQUIRED AFTER NEW LIGHT INSTALLATION              |

| ROOM FINISH SCHEDULE   |             | FLOOR   |          | WALL     |               | CEILING      |         |            | REMARKS  |
|--|-------------|---------|----------|----------|---------------|--------------|---------|------------|--|
| NO.  | NAME        | FIN.    | BASE     | MAT'L    | FIN.          | MAT'L        | FIN.    | HEIGHT(mm) |  |
| 218  | STAFF ROOM  | EX.     | EX.      | EX.      | EX.           | EX,          | EX./P   | EX.        | PATCH AND PAINT EXISTING GYPSUM BOARD CEILING AS REQUIRED AFTER NEW LIGHT INSTALLATION |
| 221  | BF WASHROOM | EX. POR | EX. POR. | EX.CB    | EX .P/EX. CWT | EX. GYP.     | EX. P   | EX.        |  |
| 810  | CORRIDOR    | EX.     | EX.      | EX.      | EX. /P        | EX.          | EX.     | EX.        | PROVIDE NEW PAINT FINISH TO MATCH EXISTING WALLS AT ALL NEW DOOR FRAMES A MIN. 610MM   |
| 811  | CORRIDOR    | EX.     | EX.      | EX.      | EX. / P       | EX.          | EX.     | EX.        | PROVIDE NEW PAINT FINISH TO MATCH EXISTING WALLS AT ALL NEW DOOR FRAMES A MIN. 610MM   |
| 812  | CORRIDOR    | EX.     | EX.      | EX.      | EX. / P       | EX.          | EX.     | EX.        | PROVIDE NEW PAINT FINISH TO MATCH EXISTING WALLS AT ALL NEW DOOR FRAMES A MIN. 610MM   |
| 813  | CORRIDOR    | EX.     | EX.      | EX.      | EX. / P       | EX.          | EX.     | EX.        | PROVIDE NEW PAINT FINISH TO MATCH EXISTING WALLS AT ALL NEW DOOR FRAMES A MIN. 610MM   |
| A853   | CORRIDOR    | POR     | EX. POR. | EX.CB/CB | EX./P         | EX. GYP/GYP. | EX. P/P | EX.        |  |
| GENERAL NOTES: NEW RUBBER BASE TO BE INSTALLED ONLY IN LOCATIONS WHERE REMOVED (NOT OVER BRICK BASE) |             |         |          |          |               |              |         |            |  |

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1 **General**

1. **SUMMARY**

.1 Section Includes:

- .1 Compliance with requirements of the sections of Division 1 of the specifications.
- .2 Requirements for providing the concrete floor sealer parts of the Work.

2. **SUBMITTALS**

.1 Product Data:

- .1 Submit manufacturer's technical data, installation instructions, maintenance instructions and general recommendations for concrete floor sealer.

.2 Samples:

- .1 Provide samples as specified in section 01 33 00 Samples, supplemented as follows:
  - .1 Submit 300 mm x 300 mm square sample of concrete floor sealer applied to a smooth trowel finish concrete paver.
  - .2 Submit each type of sample in triplicate.
  - .3 Modify and resubmit samples as many times as may be necessary to obtain Consultant's approval.

.3 Closeout Documents:

- .1 Provide manuals that contain the floor sealer manufacturer's maintenance and repair manual. The maintenance and repair manuals shall give specific warning of maintenance practices, Products and materials which may cause damage and disfigurement.

3. **QUALITY ASSURANCE**

.1 Single Source Responsibility:

- .1 Obtain concrete floor sealer Products from the same manufacturer with not less than ten (10) years of successful experience in manufacturing and installing principal materials described in this section. Contractor must have completed at least five projects of similar size and complexity. Provide secondary materials only of type and from source recommended by manufacturer of primary materials.

.2 Pre-installation Meeting:

- .1 Hold a pre-installation meeting at the Place of the Work.

.3 Mock-up:

- .1 At site, under manufacturer's supervision, apply for approval 9 m<sup>2</sup> of each type of complete floor finish in area designated, to match submitted samples. When approved, site applied sample to be standard for appearance, texture, workmanship, etc. All Work to conform to this sample.

4. **DELIVERY, STORAGE AND HANDLING**

- .1 Deliver Products to the Place of the Work. Check material for completeness and shipping damage prior to job start.

- .2 All materials must be factory pre-weighed and pre-packaged in single, easy to manage batches to eliminate on site mixing errors. No on site weighing or volumetric measurements allowed.
- .3 Store Products in a dry, enclosed area protected from exposure to moisture. Temperature of storage area shall be maintained between 16° and 32°C.

**5. PROJECT CONDITIONS**

- .1 Environmental Requirements:
  - .1 Concrete substrate must be properly cured for a minimum of 30 days.
- .2 Temperature:
  - .1 Maintain ambient temperature of not less than 18 deg.C/65 deg.F and a floor temperature of not less than 16 deg.C/60 deg.F from 7 days before installation to at least 48 hours after completion of work and maintain relative humidity not higher than 40% during same period.
- .3 Moisture:
  - .1 Ensure substrate is within moisture limits prescribed by concrete floor sealer manufacturer.
- .4 Protection:
  - .1 Areas to accept concrete floor sealer shall be free of other trades during, and for a period of 24 hours, after floor installation.
- .5 Manufacturer's Representative:
  - .1 Manufacturer's representative must be on job site at start of installation.

**6. WASTE MANAGEMENT AND DISPOSAL**

- .1 Collect and separate packaging material for recycling in accordance with the Waste Management Plan.
- .2 Remove from the Place of the Work and dispose of packaging materials at appropriate recycling facilities.
- .3 Dispose of unused finish and adhesive materials at official hazardous material collections site.

**7. WARRANTY**

- .1 Furnish a single, written warranty covering both material and workmanship for a period of three (3) full years from date of Substantial Performance of the Work. The Warranty shall cover defects such as cracking, delamination under impact and under heavy loaded carts and under thermal shock, and excessive wear.

## 2 Products

### 1. MATERIALS

#### .1 Manufacturers:

- .1 The specifications are based on Products manufactured by Sika Canada Inc. Products by Duochem Inc, division of Corrosion Services, CPD Construction Products, Niagara Protective Coatings, Selby/Ucrete,. Stonhard Ltd. Euclid or other approved manufacture may be approved on condition of being able to furnish evidence of equivalency or better to the specified Products.

#### .2 Concrete Floor Sealer System (EWPM)

##### .1 General:

- .1 Two-component, clear, water based mat epoxy coating, Sika MRW roller applied two coat system on a sealed/primed substrate.

##### .2 Characteristics

- .1 Seamless and very easy to clean.
- .2 Abrasion and chemical resistant.
- .3 No odour typical of solvent based coatings

##### .3 Minimum Technical requirements

- .1 Solids content: 100% by weight, 100% by volume.
- .2 Pot life 90 mins.
- .3 Application method: Brush, or roller.
- .4 Number of coats: Two.
- .5 Dry film thickness per coat: as per manufacturer's instructions
- .6 Cleaning solvent: Warm water.
- .7 Cure time: Touch dry: 4-5 hours.
  - .1 Hard dry: 16-18 hours.
  - .2 Complete cure: 7 days.
- .8 Recoat time: 16 hours.

##### .4 Minimum Physical properties

- .1 Abrasion resistance: 175 mg loss per ASTM D 4060 CS-17 wheels 1000 revolutions 1000 gr/wheel.
- .2 Tensile strength 2.1 MPa per ASTM D 2370 (2.8 mils D.F.T.)
- .5 Primer: as recommended by manufacturer.

## 3 Execution

### 1. WORKMANSHIP

#### .1 General

- .1 Handle, mix and apply Products as per the Product manufacturer's printed surface preparation and application specifications, and as specified in this specification section 09 97 24.
- .2 Application tools and equipment shall be as per the Product manufacturer's printed requirements.

### 2. PREPARATION

- .1 Prepare concrete by sanding smooth and for removal of bond inhibiting substances.
- .2 Apply as per manufacturer's instructions.

3. **APPLICATION**

- .1 Apply concrete sealer as indicated.
- .2 Rolling direction of each coat shall be the same.

4. **FIELD QUALITY CONTROL**

- .1 The Owner reserves the right to invoke the following material testing procedure at any time, and any number of times during period of flooring application.
- .2 The Owner may engage service of an independent testing laboratory to sample materials being used on the jobsite. Samples of material will be taken, identified and sealed, and certified in presence of Contractor.
- .3 Testing laboratory will perform tests for any of characteristics specified, using applicable testing procedures referenced herein, or if none referenced, in manufacturer's product data.
- .4 If test results show materials being used do not comply with specified requirements, the Contractor may be directed by Owner to stop work; remove non-complying materials; pay for testing; reapply flooring materials to properly prepared surfaces which had previously been coated with unacceptable materials.

5. **CURING, PROTECTION AND CLEANING**

- .1 Cure concrete floor sealing materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process. Close area of application for a minimum of 24 hours.
- .2 Protect concrete floor sealing from damage and wear during construction operation. Where temporary covering is required for this purpose, comply with manufacturer's recommendations for protective materials and method of application. Contractor is responsible for protection and cleaning of surfaces after final coats.
- .3 Cleaning: Remove temporary covering and clean flooring just prior to final inspection. Use cleaning materials and procedures recommended by the concrete floor sealer manufacturer.

**END OF SECTION**



**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 01 33 00 – Submittal Procedures.

**1.2 SUBMITTALS**

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

**1.3 WASTE MANAGEMENT AND DISPOSAL**

- .1 Remove from site packaging materials at appropriate recycling facilities.
- .2 Dispose of recyclable packaging material in appropriate on-site bin for recycling.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Tack Boards (TB) - As manufactured by Architectural School Products, Mississauga; natural coloured cork tackboard:
  - .1 Natural cork tackboards to be 12.7mm (1/2") factory prelaminated consisting of 6mm (1/4") thick a.s.p. natural cork laminated to 6mm (1/4") particle board or masonite substrate under mechanical pressure in maximum panel sizes of 1219mm x 2438mm (4'0" x 8'0"). Bonding of materials by a waterproof adhesive that will not delaminate or rupture at the contact surfaces.
  - .2 All tackboards shall meet the minimum requirements of the applicable building code and/or Ontario Fire Marshall's office.
  - .3 Acceptable alternates: Global School Products Inc.
  - .4 Shop finish rear faces of tackboard units being installed in horizontal sliding trim to a matte black finish.
  - .5 Refer to Construction Drawings for locations & sizes required.
- .2 White Boards (WB) - "Vit-Rite: Rite on, Wipe off" model as manufactured by Architectural School Products, Mississauga.

- .1 Whiteboards to be sandwich type construction composed of face panel, core and balancing rear sheet, in maximum panel sizes of 1219mm x 2438mm (4'0" x 8'0").
  - .2 Face Panel – 22 gauge high quality enamelling steel base with a porcelain enamel writing surface used to a ground coat of not less than 0.076mm (.003") nor more than 0.127mm (.005") after firing at temperatures between 700°C (1300°F) and 800°C (1500°F) in accordance with the Porcelain Enamel Institute Standards PEI S104 as regards to durability, smoothness of texture, colour continuity and a gloss factor of 6 – 8 as measured by 45° glossometer.
  - .3 Core – 11.1mm (7/16") impregnated sound absorbing fibreboard laminated under heat and pressure to face panel and back sheet utilizing adhesives that ensure rupturing of the component materials before failure of joint contact surfaces.
  - .4 Back up balancing sheet – 28 gauge zinc coated stretcher leveled steel in one unjointed section. Overall thickness of Whiteboard lamination shall be 12.7mm (1/2").
  - .5 Colour: White
  - .6 Acceptable alternates: Global School Products Inc.
  - .7 Refer to Construction Drawings for locations & sizes required.
  - .8 Manufacturer's Warranty: warrant White Boards for a period of 10 years against defects due to normal usage and wear.
- .3 White Board, Tack Board and Bulletin Board Fixed Trim: ASP Series 200 to match details and profiles shown on architectural drawings. Aluminum to be 6063-T5 alloy with 0.051 mm thick clear anodized satin finish, free from extruding draw marks and surface scratches; components as follows:
- .1 Perimeter Trim: extruded aluminum trim for all tackboards and also vertical jambs of chalkboards; e.g. ASP No. 205.
  - .2 Divider Bar: extruded aluminum trim to adjacent chalkboard/tackboard panels and adjacent tackboard panels of elevations greater then 2,440 mm; e.g. ASP No. 207.
  - .3 Map Rail: extruded aluminum trim complete with integral tan cork insert, end stops and two combination roller map hooks for ever 1.83 linear metres of map rail; e.g. ASP No. 206.
  - .4 Marker Tray: extruded aluminum triangular box section for chalkboard elevation only complete with contour fitting end castings; 102 mm projection from finished wall; e.g. ASP No. 212.
  - .5 Marker Tray Over Millwork: extruded aluminum trims section for elevations mounted directly on or above millwork; 70 mm projection from finished wall; e.g. ASP No. 264.
  - .6 Display rail above each chalkboard, tackboard and whiteboard: one of the following products:
    - .1 "Kwikgrip" Display Rail by Architectural School Products Ltd. (Model 200).
    - .2 "Grip-A-Strip" by Global.
  - .7 Chalk rail below each chalkboard and markerboard: A.S.P. #212 (no cabinets below) and #264 (cabinets below).
  - .8 Refer to Construction Drawings for locations & sizes required.
- .4 Expansion Joint Sealers and Covers:

- .1 To be installed where shown on Construction Drawings. Colour to be selected by Consultant.
  - .1 Walls and Floors
    - .1 52mm (2") wide floor and wall expansion joints. Colourseal/ Seismic Colourseal Extend full length of expansion joint.
    - .2 Expansion Joint Cover: Model PCW-200 by Construction Specialties, or approved alternate.
    - .3 50% movement required.
    - .4 Acceptable manufacturers: Construction Specialties, Emseal or McGill.
    - .5 Required at floors and walls were required.
  - .2 Ceilings
    - .1 Expansion Joint Cover: Model FCFC-200 by Construction Specialties, or approved alternate.
    - .2 Acceptable manufacturers: Construction Specialties, Emseal or McGill.
    - .3 Required at acoustic tile or gypsum board ceilings were required.
  - .3 Roof
    - .1 Extruded aluminum frame, factory formed transitions, capable of approximately 50% all way movement, all aluminum in contact with concrete to have zinc chromate finish and mill finish on exposed 'Type BRJ 300' by C/S Construction Specialties Ltd., 'Series RXH' by McGill Products or approved alternative.
  - .4 Exterior
    - .1 52mm (2") wide wall expansion joints. Extend full length of expansion joint.
    - .2 Model: Security Seal SSW, or approved alternate.
    - .3 50% movement required.
    - .4 Acceptable manufacturers: Construction Specialties, Emseal or McGill.
    - .5 Required at all exterior expansion joint locations.
  - .5 Expansion joint covers not required over vertical and horizontal locations in utility, electrical, storage & mechanical rooms where students do not have access.
    - .1 Spring Clips: Stainless steel to manufacturer's standard.
    - .2 Concealed fasteners and anchors to manufacturer's standard.
    - .3 Filler strip adhesive to manufacturer's standard.

### **Part 3 Execution**

#### **3.1 MANUFACTURER'S INSTRUCTIONS**

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

#### **3.2 INSTALLATION**

- .1 Install where indicated on drawings and as per manufacturer's instructions.

#### **3.3 DEMONSTRATION AND TRAINING**

- .1 Provide demonstration of operation to the Owner and his representatives.
- .2 Provide training for operation, maintenance and repairs.

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**3.4 CLEANING**

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .2 Clean surfaces after installation using manufacturer's recommended cleaning procedures.
- .3 Clean aluminum with damp rag and approved non-abrasive cleaner.
- .4 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 10 21 14 – Metal Toilet Compartments.
- .3 Section 10 28 10 – Plastic Toilet Compartments.
- .4 Section 08 80 50 – Glazing: Mirrors.

**1.2 REFERENCES**

- .1 American Society for Testing and Materials (ASTM)
  - .1 ASTM A167-[99], Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
  - .2 ASTM B456-[95], Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
  - .3 ASTM A653/A653M-[99], Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .4 ASTM A924/A924M-[99], Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.81-[M90], Air Drying and Baking Alkyd Primer for Vehicles and Equipment.
  - .2 CAN/CGSB-1.88-[92], Gloss Alkyd Enamel, Air Drying and Baking.
  - .3 CAN/CGSB-12.5-[M86], Mirrors, Silvered.
  - .4 CGSB 31-GP-107Ma-[90], Non-inhibited Phosphoric Acid Base Metal Conditioner and Rust Remover.
- .3 Canadian Standards Association (CSA)
  - .1 CAN/CSA-B651-[95], Barrier-Free Design.
  - .2 CAN/CSA-G164-[M92], Hot Dip Galvanizing of Irregularly Shaped Articles.

**1.3 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures
- .2 Shop drawings of units for use by the handicapped shall be distinctly marked and cross-referenced to the corresponding article in the specifications.

**1.4 WASTE MANAGEMENT AND DISPOSAL**

- .1 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Ferrous Steel: Sheet, cold-rolled furniture steel, double annealed, mill stretched and leveled, and fully pickled. Otherwise, steel shall be hot-rolled or cold-rolled of alloy to suit needs of fabrication, use, and appearance.
- .2 Galvanized Steel: For sheet, Z275 zinc coating designation in accordance with ASTM Specification A525. For irregular sections, hot dip galvanized to comply with CSA G164.
- .3 Stainless steel sheet metal: to ASTM A167, Type 304, with No. 4 finish.
- .4 Anchors and Fastenings: Where exposed, use stainless steel and otherwise to match metal anchored. Where non-exposed, use the same as that specified for exposed, or use galvanized steel. Anchors and fastenings shall be of the type appropriate for the substrate to which accessory unit is secured.

### **2.2 COMPONENTS**

- .1 Fixed Grab Bars (GB): 32 mm outside diameter; 1.2 mm thick stainless steel; pended non-slip finish; round or oval concealed flange attachments, as described below:
  - .1 Straight Profile: e.g. Frost Model 1001-DP-24.
  - .2 L-Shaped Profile: e.g. Frost Model 1003-DP-30x30.
  - .3 All bars to have concealed mounting hardware
  - .4 Quantity: refer to drawings
  - .5 All bars to withstand horizontal and vertical pull of 2.2 Kn
  - .6 Location: Refer to drawings for locations and quantities.
- .2 Sanitary Napkin Disposal (SN): Model 620, by Frost
  - .1 Quantity: 1 per washroom
  - .2 Location: Refer to drawings for locations and quantities.
- .3 Convenience Shelves (CS): Model B295x16 by Bobrick
  - .1 Quantity: refer to drawings
  - .2 Location: Staff Washroom and Washrooms where noted, refer to drawings.
- .4 Safety Release Coat Hook (BH):
  - .1 Refer to drawings for locations.
  - .2 High strength polycarbonate coat hook with safety release weight under downward pressure to not exceed 12 kg (26 lbs.)
  - .3 Supply all suitable mounting hardware for a vandal proof, secure installation using stainless steel sleeve bolts on partition doors or panels. Do not supply standard Robertson or Phillips head screws.
  - .4 Colours:
    - .1 Allow for one (1) colour from Manufacturers standard line

- .5 Acceptable Materials: “HenkelHook” as manufactured/distributed by Henkel Diversified Inc, London ON, tel (519) 641-5872 or “Model 1150 – Safety Coat Hook” with stainless steel base as manufactured/distributed by Frost.
- .6 Locations: Washrooms
- .5 Mirrors
  - .1 Fixed Mirrors (designation Type M):
    - .1 Best quality, 6 mm thick float glass, with concealed tamperproof clip fasteners.
    - .2 24 ga., Type 302 or 304 No 4 finish stainless steel frames on all edges and galvanized iron backing with concealed mounts.
    - .3 Sizes: each unit 610 mm x 915 mm.
    - .4 Locations: as shown on Drawings.
    - .5 Acceptable Materials: Frost ‘Stock series’ model 941TG Tempered Glass; 24” x 36” each.
    - .6 Acceptable alternate: B-2908 Series, Bobrick Washroom Equipment Co.
- .6 Toilet Paper Dispenser (TD):
  - .1 To be provided by Owner and installed by Contractor.
- .7 Paper Towel Dispenser (PTD):
  - .1 To be provided by Owner and installed by Contractor.
- .8 Soap Dispenser (SD):
  - .1 To be provided by Owner and installed by Contractor.
- .9 Acceptable Alternates to those items listed above as manufactured by Bradley Corp. & Supplied by Wentworth Assoc. Ltd., Frost Products Ltd., Watrous (ASI) or Bobrick Washroom Equipment Co. and Saferail meeting or exceeding these specifications.

## **2.3 FABRICATION**

- .1 Construction: Fabricate with materials, component sizes, metal gauges, reinforcing, anchors and fasteners of adequate strength to withstand intended use.
- .2 Where specified as frameless, provide stainless steel accessories with one-piece fronts having 90 degree formed returns at their edges and openings.
- .3 Where accessory fronts are framed, frame edges, both inside and outside, with 90 degree formed returns continuously welded and ground smooth at the corners. Doors shall also have 90 degree formed returns as specified.
- .4 Unless otherwise specified, hinges shall be semi-concealed stainless steel piano hinges extending full-length of hinged element. Provide hinged elements with concealed, mechanically-retained rubber bumpers for silent closing, and shall close flush with faces of fronts or frames.
- .5 Ensure that work will remain free of warping, buckling, opening of joints and seams, distortion and permanent deformation.

- .6 No exposed fixings permitted. Cut edges and openings square and smooth. Chamfer corners of edges and cut-outs 1.6 mm.
- .7 **Assembly:** Accurately cut, machine and fit joints, corners, copes and mitres so that junctions between components fit together tightly and in true planes.
- .8 Fasten work with concealed methods, unless otherwise indicated on Drawings.
- .9 Weld all connections where possible, bolt where not possible and cut off bolts flush with nuts. Countersunk bolt heads, and provide method to prevent loosening of nuts. Ream holes drilled for fastening.
- .10 Welded joints shall be tight, flush, and in true planes with base metals. Make welds continuous at joints where entry of water into voids of members or assemblies is possible.
- .11 Provide for differential movements within assemblies and at junctions of assemblies with surrounding work.
- .12 Welds in exposed locations shall be ground and polished smooth.
- .13 **Finish Work:** Provide holes and connections for related work installed under other Sections of this specification, if applicable.
- .14 Cleanly and smoothly finish exposed edges of materials, including holes.

### **Part 3 Execution**

#### **3.1 INSPECTION OF SECTION**

- .1 Take site measurements to ensure that work is fabricated to fit surrounding construction around obstructions and projects in place, or as shown on drawings, and to suit service locations.

#### **3.2 INSTALLATION**

- .1 Install all accessories in accordance with manufacturers' instructions at their recommended mounting heights unless noted otherwise on drawings.
- .2 Securely fasten accessories plumb, true, square, straight, level, and accurately and tightly fitted together and to surrounding work. Install in locations shown and specified herein. Mounting heights as shown or in accordance with the OBC in the case of barrier-free accessories.
- .3 Work shall include anchor bolts, bolts, washers and nuts, lag screws, expansion shields, toggles, straps, sleeve brackets, clips, and other items necessary for secure installation, as required by loading and by Jurisdictional Authorities.
- .4 Attach work at wood by screws through countersunk holes in metal.
- .5 Attach work to masonry with lead plugs and non-corrosive fastenings, to support load with a safety factor of 3. Perform all drilling necessary to install the work.



- .6 Insulate between dissimilar metals or between metals and masonry or concrete with bituminous paint, to prevent electrolysis.
- .7 Coordinate installation with the work of other trades adjacent to accessories to achieve the reveals or other edge conditions shown, where their front faces are flush with the finished wall surfaces.
- .8 Owner to supply and install remainder of washroom accessories not specified here (toilet paper dispensers, etc.). Cooperate with Owner as required.

### **3.3 CLEANING UP AND ADJUSTMENT**

- .1 Upon completion of the work, or when directed, remove all traces of protective coatings or paper.
- .2 Test mechanisms, hinges, locks and latches, and where necessary, adjust and lubricate and ensure that accessories are in perfect working order.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 01 11 00 – Summary of Work: Protection of openings; temporary power and lighting.
- .2 Section 01 52 00 – Construction Facilities: Protection of openings; temporary power and lighting.
- .3 Section 03 30 00 - Cast-in-Place Concrete: Elevator pit, elevator motor and pump foundation, and grouting thresholds
- .4 Section 05 50 00 - Metal Fabrications: Divider beams, support for entrances and rails, hoisting beam at top of hoistway.
- .5 Section 04 21 13 – Masonry: Masonry hoistway enclosure, building-in and grouting hoistway door frames, grouting thresholds.
- .6 Section 05 50 00 – Metal Fabrications: Divider beams, support for entrances and rails, hoisting beam at top of hoistway.
- .7 Division 26: Electrical service to main disconnect in elevator machine room; machine room; machine room and pit receptacles with ground-fault current protection; lighting in machine room and pit; wiring for telephone service to machine room, cab telephone wiring.

**1.2 SUMMARY**

- .1 This specification is based on a **Vertech Elevator 2890 lbs (1311 kg) Deep Cab, Front Only** hydraulic elevator.
- .2 Acceptable Alternates: Elevators meeting or exceeding these base specifications by Thyssen, Kone, Delta Elevator, or others providing they meet this specification and complete data is submitted to the Architect’s office not later than 4 business days prior to close of Tender and approved and formally accepted in writing by the Consultant during the tender period.
- .3 Tender price shall include the complete price for supply and install and the **3 year** maintenance contract specified herein. Note that the bidder shall identify his Maintenance Contract component separately and this shall be provided as “Itemized Price No. 2” in *Section 00 22 00-Supplementary Form of Tender* to be submitted 24 hrs. after tender.

**1.3 REFERENCES**

- .1 ADAAG, Americans with Disabilities Act Accessibility Guidelines.
- .2 ANSI/NFPA 70, National Electrical Code.
- .3 ANSI/NFPA 80, Fire Doors and Windows.

- .4 ANSI/UL 10B, Fire Tests of Door Assemblies.
- .5 CAN/CSA C22.1, Canadian Electrical Code.
- .6 CAN/CSA-B44, Safety Code for Elevators and Escalators.
- .7 Model Building Codes.
- .8 Ontario Building Code and all other local applicable codes.
- .9 American National Standards Institute (ANSI)
  - .1 ANSI/NEMA MG1-[1993], Motors and Generators.
- .10 Canadian Standards Association (CSA)
  - .1 CAN/CSA-B44-[M94], Safety Code for Elevators.
  - .2 CAN/CSA-B651-[95], Barrier-Free Design - Public Safety.
- .11 National Building Code (NBC)

#### 1.4 SYSTEM DESCRIPTION

- .1 Performance Requirements for Elevators:
  - .1 Quantity & Elevator Numbers: 1 Elevator
  - .2 Type: Twin telescopic hydraulic cylinders without well holes
  - .3 Number of Stops: 2 Front Only
  - .4 Number of Openings: 2 at front and 1 at rear
  - .5 Rise: As per drawings
  - .6 Rated Capacity/Speed: 3000 pounds, 100/ fpm (1361 kg, 0.50/ m/sec.)
  - .7 Minimum Car Inside: Front Opening: Model 3000: 6' 8" wide x 4' 9" deep (2032 mm x 1448 mm)
  - .8 Inside Cab Height: 8'0"(2438 mm); Height Under Ceiling: 7' 4 1/2"(2223mm)
  - .9 Entrance Width & Type: Model 3000: Single-Slide Door 3' 6" x 7' 0" (1067 mm x 2134 mm)
  - .10 Main Power Supply: 600 Volts + or - 5% of normal, 3 Phase, with a separate equipment grounding conductor.
  - .11 Lighting Power Supply: 120 Volts, 1 Phase, 15 Amp, 60 Hz.
  - .12 Stopping Accuracy:  $\pm 1/4"$  (6.4 mm) under any loading condition or direction of travel.
  - .13 Door Opening Time for 7ft. painted hoist way and car doors: Model 3000: 4.0 seconds – Single Slide 42" door.
- .2 Simplex Collective Operation: Using a microprocessor-based controller, operation shall be automatic by means of the car and hall buttons. If all calls in the system have been answered, the car shall park at the last landing served.
- .3 Provide microprocessor-based control system, which utilizes on-board diagnostics for servicing, trouble-shooting, and adjusting without requiring the use of an outside service tool. If an on-board diagnostic system is not provided, a handheld service tool (or

laptop), owner's license, operation manual, and tool instructions must be provided in addition to the control system.

.4 Car Operating Features

- .1 Full Collective Operation.
- .2 Single Speed Fan.
- .3 On/Off Light Switch.
- .4 Solid State Starting
- .5 Remote elevator monitoring REM® ready.
- .6 Car-Stall Protection.
- .7 Top of Car Inspection.

.5 Door Control Features:

- .1 Closed Loop Door Operator is a closed loop, microprocessor based door operator system. The door operator will facilitate smooth operation under varying environmental influences such as, temperature, wind, friction, and component variation. The processor will monitor the door's actual position and velocity compared to its desired position and velocity. If variations are detected in the profile the command will be automatically corrected. The Closed Loop Door Operator control system shall not require machine room door control equipment.
- .2 Door noise not to exceed 58dBA.
- .3 Door control to open doors automatically when car arrives at a landing in response to a normal hall or car call.
- .4 Door control to open doors automatically when car arrives at a landing in response to a normal hall or car call.
- .5 Elevator doors shall be provided with a reopening device that will stop and reopen the car door(s) and hoistway door(s) automatically should the door(s) become obstructed by an object or person.
- .6 Primary door protection shall consist of a two dimensional, multi-beam array projecting across the car door opening. Under normal operation and for any door position, the system shall detect as a blockage an opaque object that is equal to or greater than 1.3 inches (33 mm) in diameter when inserted between the car doors at vertical positions from within 1 inch (25 mm) above the sill to 71 inches (1800 mm) above the sill. Under degraded conditions (one or more blocked or failed beams), the primary protection shall detect opaque objects that are equal to or greater than 4" (100 mm) in diameter for the same vertical coverage. If the system performance is degraded to the point that the 4" object cannot be detected, the system shall maintain the doors open or permit closing only under nudging force conditions.
- .7 The door reopening device shall also include a secondary, three dimensional, triangular infrared multi-beam array projecting across the door opening and extending into the hoistway door zone. The door opening device will cause the doors to reopen when it detects a person(s) or object(s) entering or exiting the car in the area between the hoistway doors or the entryway area adjacent to the hoistway doors.
- .8 The size of the secondary protection zone shall vary as the door positions vary during opening and closing. The width of the zone shall be approximately one-

third the size of the separation between the doors (or door and strike plate for single-slide doors) and shall be approximately centered in the door separation. In order to minimize detection of hallway passers-by who are not entering the elevator, the maximum zone penetration into the entryway shall not exceed 20" for any door separation. Normal penetration depth into the entryway from the car doors shall be ~14" for a door separation of 42". The penetration shall reduce proportionally as the doors close. At door separations of 18" or less the secondary protection system may cease its normal operation since the depth of the zone recedes to where it is inside the hoistway doors. The vertical coverage of the secondary protection shall be ~19" (480 mm) above the sill to ~55" (1400 mm) above the sill (mid-thigh to shoulder of a typical adult).

- .9 The secondary protection shall have an anti-nuisance feature which will ignore detection in the secondary zone after continual detection occurs for a significant time period in the secondary zone without corresponding detection in the primary protection zone; i.e. a person/object is in the entryway but does not enter. Normal secondary protection shall be re-enabled whenever detection occurs in the primary zone.
- .10 The reaction time of the door detector sub-system shall not exceed 60 milliseconds when both primary and secondary protection capabilities are active; nor 40 milliseconds when the secondary protection is disabled.
- .11 Door nudging operation to occur if doors are prevented from closing for an adjustable period of time.
- .6 Provide equipment according to Seismic zone: zone 0
- .7 Design and construct elevator in accordance with CAN/CSA-B44, local codes and regulations.

## 1.5 SUBMITTALS

- .1 Product Data: Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Signal and operating fixtures, operating panels and indicators.
  - .2 Cab design, dimensions and layout.
  - .3 Hoistway-door and frame details.
  - .4 Electrical characteristics and connection requirements.
  - .5 Expected heat dissipation of elevator equipment in machine room (BTU).
- .2 Shop Drawings: Submit in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Submit shop drawings to indicate project layout, including details and the following information:
    - .1 Car, guide rails, buffers and other components in hoistway.
    - .2 Maximum rail bracket spacing.
    - .3 Maximum loads imposed on guide rails requiring load transfer to building structure.
    - .4 Loads on hoisting beams.
    - .5 Clearances and travel of car.
    - .6 Clear inside hoistway and pit dimensions.

- .7 Location and sizes of access doors, hoistway entrances and frames.
- .2 Operation and Maintenance Data
  - .1 Provide 4 copies manufacturer's standard operations and maintenance manual.

## **1.6 QUALITY ASSURANCE**

- .1 Manufacturer: Provide elevators manufactured by a firm with a minimum of 10 years experience in fabrication of elevators equivalent to those specified. Elevator manufacturer shall be ISO9002 certified.
- .2 Installer: Elevators shall be installed by the manufacturer.
- .3 Regulatory Requirements: Elevator system design and installation shall comply with the latest versions of CAN/CSA-B44 -00.
  - .1 Elevator shall be designed to meet to Americans with Disabilities Act Accessibility Guidelines (ADAAG)
- .4 Permits and Inspections: Provide licenses and permits and perform required inspections and tests.

## **1.7 DELIVERY, STORAGE AND HANDLING**

- .1 Manufacturer shall issue delivery schedule within 7 days of issuance of purchase order. Manufacturer shall maintain regular contact with the contractor and Consultant regarding expediting shop drawings and delivery.
- .2 At least 3 weeks in advance of delivery, manufacturer's representative shall visit the site to discuss site preparedness. Manufacturer's rep. shall make a second visit one week in advance of the delivery and again liaise with General Contractor and Consultant to ensure site preparation.

## **1.8 WASTE MANAGEMENT AND DISPOSAL**

- .1 Deposit packaging materials in appropriate container on site for recycling or reuse.
- .2 Avoid using landfill waste disposal procedures when recycling facilities are available.
- .3 Collect and separate plastic, paper packaging and corrugated cardboard.
- .4 Dispose of corrugated cardboard, polystyrene and plastic packaging material in appropriate on-site bin.

## **1.9 WARRANTY**

- .1 The elevator warranty shall cover defective functionality, programming, materials and workmanship for a period of One Year from the date of Substantial Completion of the contract. The guarantee includes ordinary wear but excludes improper use, vandalism, abuse, and misuse by the owner.
- .2 Project Warranty: Refer to CCDC 2 for project warranty provisions.

## **1.10 MAINTENANCE SERVICE**

- .1 Included in the Tender price is the maintenance service consisting of regular examinations, adjustments and lubrication of the elevator equipment shall be provided by the elevator contractor for a period of three (3) years after the elevator has been turned over for the customer's use. This service shall not be subcontracted but shall be performed by the elevator contractor. All work shall be performed by competent employees during regular working hours of regular working days and shall include emergency 24-hour callback service. This service shall not cover adjustments, repairs or replacement of parts due to negligence, misuse, abuse or accidents caused by persons other than the elevator contractor. Only genuine parts and supplies as used in the manufacture and installation of the original equipment shall be provided.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Materials: As required to achieve specified performance criteria; functionally compatible with adjacent materials and components.

### **2.2 ACCEPTABLE MANUFACTURERS**

- .1 This specification is based on **Vertech Elevator 2890 lbs (1311 kg) Deep Cab, Front Only** hydraulic elevator.
- .2 NOTE: hoist is required to suit noted floor to floor to roof heights. Custom hoist may be required, depending on supplier, to suit building floor to floor and roof structure height. Pop-up above the roof is not permitted.

### **2.3 EQUIPMENT: MACHINE ROOM COMPONENTS**

- .1 The hydraulic system shall be of compact design suitable for operation under the required pressure. The power component shall be mounted in the hydraulic-fluid storage tank. The control valve shall control flow for up and down directions hydraulically and shall include an integral check valve. A control section including control solenoids shall direct the main valve and control: up and down starting, acceleration, transition from full speed to leveling speed, up and down stops, pressure relief and manual lowering. All of these functions shall be fully adjustable for maximum smoothness and to meet contract conditions. System to be provided with a muffler, low-pressure switch and a shut-off valve.
- .2 A microprocessor-based controller shall be provided, including necessary starting switches together with all relays, switches, solid-state components and hardware required for operation, including door operation, as described herein. A three (3) phase overload device shall be provided to protect the motor against overloading.
- .3 A manual lowering feature shall permit lowering the elevator at slow speed in the event of power failure or for adjusting purposes.
- .4 Pressure Switch

## 2.4 EQUIPMENT: HOISTWAY COMPONENTS

- .1 Plunger(s) and Cylinder(s): Each cylinder shall be constructed of steel pipe of sufficient thickness and suitable for the operating pressure. The top of each cylinder shall be equipped with a cylinder head with a drip ring to collect any oil seepage as well as an internal guide ring and self-adjusting packing. Each plunger shall be constructed of selected steel tubing or pipe of proper diameter machined true and smooth with a fine polished finish. Each plunger shall be provided with a stop ring electrically welded to it to prevent the plunger from leaving the cylinder. Each plunger and cylinder shall be installed plumb and shall operate freely with minimum friction.
- .2 Car Guide Rails: Tee-section steel rails with brackets and fasteners.
- .3 Spring Buffer: Helical coil spring type.
- .4 Wiring: Wiring for hoistway electrical devices included in scope of the elevator system, hall panels, pit emergency stop switch, and the traveling cable for the elevator car, operating telephone handset call system in Cab.
- .5 Hoistway Entrances
  - .1 Frames: Entrance frames shall be of bolted construction for complete one-piece unit assembly. All frames shall be securely fastened to fixing angles mounted in the hoistway and shall be of 14-gauge (2 mm) sheet steel. Additional sill angle support will be provided with 4'0" and 4'6" two speed opening door arrangements (4500 & 5000 lb. cars). Sills shall be extruded aluminum.
  - .2 Doors: Entrance doors shall be of hollow metal construction with vertical internal channel reinforcements.
  - .3 Fire Rating: Entrance and doors shall be UL fire rated for 1-1/2 hour.
  - .4 Entrance Finish: Prime white paint, baked enamel. All doors & frames, suitable for finish painting.
  - .5 Entrance Markings: Entrance jambs shall be marked with 4" x 4" (102 mm x 102 mm) plates having raised floor markings with Braille adjacent. Markings shall be provided on both sides of the entrance.
  - .6 Sight Guards: Black sight guards will be furnished with any metal finish door. Powder paint matching sight guards will be furnished with powder paint doors.

## 2.5 EQUIPMENT: CAR COMPONENTS

- .1 Car Frame: A suitable car frame shall be provided with adequate bracing to support the platform and car enclosure. The buffer striking plate on the underside of the car-frame platform assembly must fully compress the spring buffer mounted in the pit before the plunger reaches its lower limit of travel.
- .2 Platform, Heavy Loading Type: The car platform shall be arranged to accommodate one-piece loads weighing up to 25% of the rated capacity, such as wheeled food carts, stretchers, x-ray equipment, etc. The platform shall be recessed 5/16" for flooring by others.
- .3 Cab walls to have attached vertical non-removable panels, laminated front and back with plastic laminate.



- .4 Car Door Finish: Car front(s) and door finish can be independent elevators. Satin stainless steel
- .5 Car top to be of wood material clad on both sides with a natural finish aluminum panel.
- .6 Ceiling Type:
  - .1 Aluminum Eggcrate [DC22E Ceiling] suspended ceiling shall consist of aluminum eggcrate diffusers set in frame of extruded aluminum with fluorescent lighting fixtures.
- .7 Emergency Car Lighting: An emergency power unit employing a 6 volt, sealed rechargeable battery and totally static circuits shall be provided to illuminate the elevator car and provide current to the emergency siren in the event of building power failure.
- .8 Emergency Pulsating Siren: Siren mounted on top of the car that is activated when the Alarm button in the car operating panel is engaged. Siren shall have a rated sound pressure level of 80 dba at a distance of 3.0 m from the device. Siren shall respond with a delay of not more than 1 second after the switch or push button has been pressed
- .9 Exhaust Fan: An exhaust fan shall be mounted on the car top.
- .10 Utility Outlet: A 125V 15 amperes utility outlet with ground-fault circuit-interrupter protection shall be furnished on top of the cab.
- .11 Handrail:
  - .1 Rectangular Tubular Metal Bar DH50 Handrails 1/2" (13 mm) x 1-1/2" (38 mm) in stainless steel.
- .12 Threshold: aluminum.

## 2.6 **EQUIPMENT: SIGNAL DEVICES AND FIXTURES**

- .1 Car-Operating Panel: A panel shall be provided which contains all push buttons, key switches, and message indicators for elevator operation. Raised markings **Braille** markings shall be provided for each push-button.
- .2 Car Fixture Finish: satin stainless steel.
  - .1 [Series 2 Fixtures] Applied car operating panel shall be furnished. It shall contain a bank of round mechanical illuminated buttons marked to correspond to the landings served, an emergency call button, door open and door close buttons, and switches for lights, inspection and the exhaust fan. The emergency call button shall be connected to a bell that serves as an emergency signal. All buttons to have both raised and Braille markings. LED (red) button illumination with 1/8" projecting target. All buttons to be stain stainless steel.
- .3 Car Position Indicator: A 16-segment, digital, vacuum fluorescent car position indicator shall be integral to the car operating panel.
- .4 An ADA compliant communication device shall be provided which has been designed in response to ADAAG requirements integral with the car operating panel.

- .5 Car Lantern and Chime: A directional lantern visible from the corridor shall be provided in the car entrance. When the car stops and the doors are opening, the lantern shall indicate the direction in which the car is to travel and a chime will sound.
- .6 Hall Fixtures: Hall fixtures shall be provided with necessary push buttons and key switches for elevator operation. Raised markings shall be provided for each push-button. Otis series 5.
- .7 Fixture Finish: **sat in stainless steel.**
- .8 Landing Passing Signal: A chime bell shall sound in the car to tell a passenger that the car is either stopping at or passing a floor served by the elevator.
- .9 Security Lockout Key switches to disable activation of hall buttons.

### **Part 3 Execution**

#### **3.1 MANUFACTURER=S INSTRUCTIONS**

- .1 Compliance: Comply with manufacturer=s written data, including product technical bulletins, product catalog installation instructions, product carton installation instructions, and data sheet.

#### **3.2 PREPARATION**

- .1 Take field dimensions and examine conditions of substrates, supports, and other conditions under which this work is to be performed. Do not proceed with work until unsatisfactory conditions are corrected.

#### **3.3 INSTALLATION**

- .1 Installation of all elevator components except as specifically provided for elsewhere by others.

#### **3.4 SITE TESTS**

- .1 Perform and meet tests required by CAN/CSA-B44.
- .2 Supply instruments and execute specific tests.
- .3 Furnish test and approval certificates issued by jurisdictional authorities.

#### **3.5 CLEANING**

- .1 Remove protective coverings from finished surfaces and components.
- .2 Clean surfaces and components ready for inspection.

**3.6 ADJUSTMENTS**

- .1 The elevator contractor shall make a final check of each elevator operation with the Owner or Owner's representative present prior to turning each elevator over for use. The elevator contractor shall determine that control systems and operating devices are functioning properly.
- .2 Adjust door opening and closing times to suit handicapped users in accordance with Engineer's instructions.
- .3 Adjust control system to cause elevators to answer hall calls during working day within performance criteria specified.
- .4 Adjust for smooth acceleration and deceleration of car as so not to cause passenger discomfort.
- .5 Adjust automatic floor levelling feature at each floor.

**END OF SECTION**

## **Division 20 Common Requirements for Mechanical**

- 20 00 01 Mechanical Specification Index
- Common Contract Requirements for Mechanical**
- 20 02 51 Mechanical Contract Requirements
- Common Work Results for Mechanical**
- 20 05 11 Mechanical Work Requirements
- 20 05 21 Demolition and Renovation
- 20 05 31 Expansion Fittings and Loops
- 20 05 32 Thermometers and Pressure Gauges
- 20 05 34 Bases, Hangers and Supports
- 20 05 49 Vibration Control Measures
- 20 05 53 Identification of Mechanical Services
- Testing, Adjusting, and Balancing**
- 20 06 11 Testing, Adjusting, and Balancing (TAB) of Mechanical Systems

## **Division 22 Plumbing**

- Plumbing Insulation**
- 22 07 19 Plumbing Piping Insulation
- Facility Water Distribution**
- 22 11 16 Domestic Water Piping – Copper
- 22 11 31 Potable Water Auxiliary Equipment
- Facility Sanitary Sewerage**
- 22 13 13 Sanitary Drains
- 22 13 16 Sanitary Waste and Vent Piping – Cast Iron and Copper
- 22 13 17 Sanitary Waste and Vent Piping – Plastic
- 22 13 29 Sanitary Sewage Pumps
- Plumbing Auxiliary Equipment**
- 22 36 13 Plumbing Auxiliary Equipment
- Fire Extinguishers**
- 22 37 13 Portable Fire Extinguishers
- Plumbing Fixtures Combined With Drawing Schedule**
- 22 44 13 Plumbing Fixtures Combined With Drawing Schedule

## **Division 23 Heating, Ventilating, and Air Conditioning (HVAC)**

- Operation and Maintenance of HVAC Systems**
- 23 01 31 HVAC System Cleaning
- HVAC Insulation**
- 23 07 13 Duct Insulation
- 23 07 19 HVAC Piping Insulation

## **Hydronic Piping and Pumps**

- 23 21 11 Hydronic Accessories
- 23 21 13 Hydronic Piping (Welded)

## **Refrigerant Piping**

- 23 23 13 Refrigerant Piping and Specialties

## **HVAC Ducts and Casings**

- 23 31 13 Metal Ducts

## **Air Duct Accessories**

- 23 33 13 Duct Accessories
- 23 33 13.13 Volume-Control Dampers
- 23 33 16 Fire Dampers
- 23 33 17 Smoke Control Dampers
- 23 33 18 Operating Dampers
- 23 33 46 Flexible Ducts
- 23 33 53 Duct Liners

## **HVAC Fans**

- 23 34 23 Packaged Exhausters

## **Air Outlets and Inlets**

- 23 37 13 Diffusers, Registers, and Grilles
- 23 37 23 Louvres and Vents for Intake and Exhaust

## **Decentralized Unitary HVAC Equipment**

- 23 81 26 Split System Air Conditioning

## **Convection Heating and Cooling Units**

- 23 82 23 Hydronic Unit Ventilators
- 23 82 29 Radiators, Convectors, and Cabinet Heaters

# **Division 25 Integrated Automation**

## **Control Systems**

- 25 40 11 Building Control System

**END OF SECTION**

**Part 1            General**

**1.1                GENERAL PROVISIONS**

- .1      This section covers items common to all sections of Mechanical Division.
- .2      Conform to Division 1 General Conditions.
- .3      Furnish labour, materials, and equipment necessary for completion of work as described in contract documents.
- .4      Unless specifically indicated, all materials and equipment provided under this contract shall be new and shall be manufactured in the project year.

**1.2                INTENT**

- .1      Mention herein or indication on Drawings of articles, materials, operations or methods requires: supply of each item mentioned or indicated, of quality, or subject to qualifications noted; installation according to conditions stated: and, performance of each operation prescribed with furnishing of necessary labour, equipment, and incidentals for mechanical work.
- .2      Where used, words “Section” and “Division” shall also include other Subcontractors engaged on site to perform work to make building and site complete in all respects.
- .3      Where used, word “supply” shall mean furnishing to site in location required or directed complete with accessory parts.
- .4      Where used, word “install” shall mean secured in place and connected up for operation as noted or directed.
- .5      Where used, word “provide” shall mean supply and install as each is described above.

**1.3                TENDERS**

- .1      Submit tender based on specified described equipment or Alternates listed.

**1.4                REGULATIONS, PERMITS AND FEES**

- .1      All materials and quality of work shall meet all current and latest Provincial, Municipal and Fire Marshall requirements, regulations, codes and by-laws in force in the area of the project.
- .2      Each contractor shall give all necessary notices, obtain all necessary permits, and pay all fees in order that the work shown or specified may be carried out. Each contractor shall furnish any certificates necessary as evidence that the work installed conforms with the laws and regulations of all authorities having jurisdiction.
- .3      In the event that changes or alterations are required on completed work by authorized inspectors, these changes shall be made at the contractor’s expense.

- .4 Special equipment which does not have a standard CSA label shall be inspected by the local electrical authority having jurisdiction and the Approval Certificate shall be submitted to the Consultant as soon as possible. All costs and fees for inspections shall be borne by this contractor.
- .5 Submit a copy of all final certificates in the maintenance manuals.

## **1.5 DRAWINGS**

- .1 Mechanical Drawings do not show structural and related details. Take information involving accurate measurement of building from building drawings, or at building. Make, without additional charge, any necessary changes or additions to runs of piping, conduits and ducts to accommodate structural conditions. Location of pipes, ducts, conduits and other equipment may be altered by Consultant without extra charge provided change is made before installation and does not necessitate major additional material.
- .2 As work progresses and before installing piping, ductwork, heating units, registers, diffusers, fixtures and any other fittings and equipment which may interfere with interior treatment and use of building, provide detail drawings or obtain directions for exact location of such equipment and fitments.
- .3 Mechanical Drawings indicate general location and route of pipes, ducts and conduits which are to be installed. Where required work is not shown or only shown diagrammatically, install same at maximum height in space to conserve head room (minimum 2200 mm (88") clear) and interfere as little as possible with free use of space through which they can pass. Follow building lines, conceal piping, conduits and ducts in furred spaces, ceilings and walls unless specifically shown otherwise. Install work close to structure so furring will be small as practical.
- .4 Install piping and ductwork to clear structural members and any fireproofing. Locate mechanical work to permit installation of specified insulation. Do not remove or damage structural fireproofing. Leave space to permit fireproofing and insulation to be inspected and repaired.
- .5 Before commencing work, check and verify all sizes, locations, grade and invert elevations, levels and dimensions to ensure proper and correct installation. Verify existing/municipal services.
- .6 Locate all mechanical and electrical equipment in such a manner as to facilitate easy and safe access to and maintenance and replacement of any part.
- .7 In every place where there is indicated space reserved for future or other equipment, leave such space clear, and install piping and other work so that necessary installation and connections can be made for any such apparatus. Obtain instructions whenever necessary for this purpose.
- .8 Relocate equipment and/or material installed but not co-ordinated with work of other Sections and/or installed incorrectly as directed, without extra charge.
- .9 Where drawings are done in metric and product not available in metric, the corresponding imperial trade size shall be utilized.

## **1.6 INTERFERENCE AND CO-ORDINATION DRAWINGS**

- .1 Prepare interference and equipment placing drawings to ensure that all components will be properly accommodated within the constructed spaces provided.
- .2 Prepare drawings to indicate co-ordination and methods of installation of a system with other systems where their relationship is critical. Ensure that all details of equipment apparatus, and connections are co-ordinated.
- .3 Ensure that clearances required by jurisdictional authorities and clearances for proper maintenance are indicated on drawings.
- .4 Upon consultant's request submit copies of interference drawings to consultant.
- .5 Due to the nature of the building and the complexity of the building systems provide the following:
  - .1 Interference drawings, showing coordination of architectural, structural, mechanical and electrical systems for the consultant's review prior to fabrication.
  - .2 Detailed layout drawings, clearly showing fasteners and hangers.
- .6 Provide CAD drawings (minimum release AutoCAD 2007) in addition to hard copies.

## **1.7 QUALITY ASSURANCE**

- .1 Perform work in accordance with applicable provisions of local Plumbing Code, Gas Ordinances, and adoptions thereof for all mechanical systems. Provide materials and labor necessary to comply with rules, regulations, and ordinances.
- .2 In case of differences between building codes, provincial laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern. Promptly notify Consultant in writing of such differences.

## **1.8 ALTERNATES AND SUBSTITUTIONS**

- .1 Throughout Mechanical Division are lists of "Alternate Equipment" manufacturers acceptable to Consultant if their product meets characteristics of specified described equipment. Submitted Bids shall be based on the supply of named articles and or products as specified in the Bid Documents.
- .2 Each bidder may elect to use "Alternate Equipment" from lists of Alternates where listed. Include for any additional costs including all costs for revisions to electrical contract to suit Alternate used. Prices are not required in Tender for Alternates listed except where specifically noted as "Separate Price". Complete the Supplementary Tender Form.



- .3 When two or more suppliers/manufacturers are named in the Bid Documents, only one supplier/manufacturer of the products named will be acceptable; however, it is the responsibility of this Division to ensure “Alternate Equipment” fits space allocated and gives performance specified. If an “Alternate Equipment” nor “equal” specified product unit is proposed and does not fit space allotted in Consultant’s opinion, supply of specified described equipment will be required without change in Contract amount. Should electrical characteristics for “alternate” or “equal” equipment differ from equipment specified it shall be the responsibility of the equipment manufacturer to pay all costs associated with the revisions to the electrical contract. Only manufacturers listed will be accepted for their product listing. All other manufacturers shall be quoted as substitution stating conditions and credit amount.
- .4 If item of material specified is unobtainable, state in Tender proposed substitute and amount added or deducted for its use. Extra monies will not be paid for substitutions after Contract has been awarded.
- .5 If pipe or item, of size or weight indicated, is unobtainable, supply next larger size or heavier weight without additional charge.

## **1.9 EXAMINATION**

- .1 Site Inspection
  - .1 Examine premises to understand conditions, which may affect performance of work of this Division before submitting proposals for this work.
  - .2 No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.
- .2 Drawings:
  - .1 Mechanical Drawings show general arrangement of piping, ductwork, equipment, etc. Follow as closely as actual building construction and work of other trades will permit.
  - .2 Consider Architectural and Structural Drawings part of this work insofar as these drawings furnish information relating to design and construction of building. These drawings take precedence over Plumbing, Mechanical, and Fire Protection Drawings.
  - .3 Because of small scale of Drawings, it is not possible to indicate all offsets, fittings, and accessories, which may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions.
- .3 Ensure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents. If approval is received by Addendum or Change Order to use other than originally specified items, be responsible for specified capacities and for ensuring that items to be furnished will fit space available.

## **1.10 SEQUENCING SCHEDULING AND COORDINATION**

- .1 It is understood that while Drawings are to be followed as closely as circumstances permit, this Division will be held responsible for installation of systems according to the true intent and meaning of Contract Documents. Anything not clear or in conflict will be explained by making application to Consultant. Should conditions arise where certain changes would be advisable, secure Consultant's approval of these changes before proceeding with work.
- .2 Coordinate work of various trades in installing interrelated work. Before installation of mechanical items, make proper provision to avoid interferences in a manner approved by Consultant. Each Contractor shall refer to all sections of the specification for their responsibilities with other trades. Changes required in work specified in Mechanical Division caused by neglect to do so shall be made at no cost to Owner.
- .3 Arrange pipes, ducts, and equipment to permit ready access to valves, unions, traps, starters, motors, control components, and to clear openings of doors and access panels.
- .4 Furnish and install inserts and supports required by Mechanical Division unless otherwise noted. Furnish sleeves, inserts, supports, and equipment that are an integral part of other Divisions of the Work to Sections involved in sufficient time to be built into construction as the Work proceeds. Locate these items and see that they are properly installed. Expense resulting from improper location or installation of items above shall be borne by Mechanical Division.
- .5 Be responsible for required excavation, backfilling, cutting, and patching incident to work of this Division and make required repairs afterwards to satisfaction of Consultant. Cut carefully to minimize necessity for repairs to existing work. Do not cut beams, columns, or trusses.
  - .1 Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown. Surface finishes shall exactly match existing finishes of same materials.
  - .2 Each Section of this Division shall bear expense of cutting, patching, repairing, and replacing of work of other Sections required because of its fault, error, tardiness, or because of damage done by it.
  - .3 Cutting, patching, repairing, and replacing pavements, sidewalks, roads, and curbs to permit installation of work of this Division is responsibility of Section installing work.
- .6 Adjust locations of pipes, ducts, equipment, fixtures, etc., to accommodate work from interferences anticipated and encountered. Determine exact route and location of each pipe and duct prior to fabrication.
  - .1 Make offsets, transitions, and changes in direction of pipes, ducts, and electrical raceways as required to maintain proper head room and pitch of sloping lines whether or not indicated on Drawings.
  - .2 Furnish and install traps, air vents, sanitary vents, pull boxes, etc., as required to effect these offsets, transitions, and changes in direction.

- .7 Slots and openings through floors, walls, ceilings, and roofs shall be provided by this contractor but performed by a trade specializing in this type of work. This Division shall see that they are properly located and do any cutting and patching caused by its neglect to do so.

**1.11 CONTRACT BREAKDOWN**

- .1 Provide breakdown of contract exclusive of HST to acceptance of consultants prior to first draw submission.
- .2 Provide labour and material cost for each item.
- .3 Breakdown shall indicate total contract amount.
- .4 Contract breakdown shall be as follows as a minimum.
  - Mobilization and shop drawings (max. \$2,000.00)
  - Demolition
  - Inside buried plumbing and drainage
  - Above grade rough-in plumbing and drainage
  - Plumbing Fixtures
  - Plumbing Equipment
  - Unit Ventilator
  - Refrigeration Piping
  - Heating Piping
  - Piping Insulation
  - Ductwork
  - Duct Insulation
  - Grilles & Diffusers
  - Fire Stopping
  - Fans & Equipment
  - Building Automation Systems
  - Testing Adjusting and Balancing
  - Mechanical contractor closeout requirements (min. of 3% but not less than \$5,000.00)
- .5 Progress claims, when submitted are to be itemized against each item of the contract breakdown, this shall be done in table form showing contract amount, work complete to date, previous draw, amount this draw and balance.

**1.12 COMMISSIONING CONTRACT BREAKDOWN**

- .1 This contractor shall work with the HVAC system commissioning contractor as specified elsewhere. The following commissioning breakdown shall be indicated on the contract breakdown draw.

**1.13 SHOP DRAWINGS AND PRODUCT DATA**

- .1 **Refer to specification section 23 82 23 ‘Hydronic Unit Ventilators’ for specific unit ventilator shop drawing/delivery requirements.**
- .2 Furnish complete catalog data for manufactured items of equipment to be used in the Work to Consultant for review within 30 days after award of Contract.
- .3 Provide a complete list of shop drawings to be submitted prior to first submission.

- .4 Before submitting to the Consultant, review all shop drawings to verify that the products illustrated therein conform to the Contract Documents. By this review, the Contractor agrees that it has determined and verified all field dimensions, field construction criteria, materials, catalogue numbers, and similar data and that it has checked and coordinated each shop drawing with the requirements of the work and of the Contract Documents. The Contractor's review of each shop drawings shall be indicated by stamp, date and signature of a qualified and responsible person possessing by the appropriate authorization.
- .5 If material or equipment is not as specified or submittal is not complete, it will be rejected by Consultant.
- .6 Additional shop drawings required by the contractor for maintenance manuals, site copies etc., shall be photocopies of the "reviewed" shop drawings. All costs to provide additional copies of shop drawings shall be borne by the contractor.
- .7 Submit all shop drawings for the project as a package. Partial submittals will not be accepted.**
- .8 Catalog data or shop drawings for equipment, which are noted as being reviewed by Consultant or his Engineer shall not supersede Contract Documents.
- .9 Review comments of Consultant shall not relieve this Division from responsibility for deviations from Contract Documents unless Consultant's attention has been called to such deviations in writing at time of submission, nor shall they relieve this Division from responsibility for errors in items submitted.
- .10 Check work described by catalog data with Contract Documents for deviations and errors.
- .11 Shop drawings and product data shall show:
  - .1 Mounting arrangements.
  - .2 Operating and maintenance clearances. e.g. access door swing spaces.
- .12 Shop drawings and product data shall be accompanied by:
  - .1 Detailed drawings of bases, supports, and anchor bolts.
  - .2 Acoustical sound power data, where applicable.
  - .3 Points of operation on performance curves.
  - .4 Manufacturer to certify as to current model production.
  - .5 Certification of compliance to applicable codes.
- .13 State sizes, capacities, brand names, motor HP, accessories, materials, gauges, dimensions, and other pertinent information. List on catalog covers page numbers of submitted items. Underline applicable data.

- .14 Shop drawings shall be submitted electronically as per the following directions:
  - .1 Electronic Submissions:
    - .1 Electronically submitted shop drawings shall be prepared as follows:
      - .1 Use latest software to generate PDF files of submission sheets.
      - .2 Scanned legible PDF sheets are acceptable. Image files are not acceptable.
      - .3 PDF format shall be of sufficient resolution to clearly show the finest detail.
      - .4 PDF page size shall be standardized for printing to letter size (8.5"x11"), portrait with no additional formatting required by the consultant. Submissions requiring larger detail sheets shall not exceed 11"x17".
      - .5 Submissions shall contain multiple files according to section names as they appear in Specification.
      - .6 File names shall include consultant project number and description of shop drawing section submitted.
      - .7 Each submission shall contain an index sheet listing the products submitted, indexed in the same order as they appear in the Specification. Include associated PDF file name for each section.
      - .8 On the shop drawing use an "electronic mark" to indicate what is being provided.
      - .9 **Each file shall bear an electronic representation of the "company stamp" of the contractor. If not stamped the file submission will not be reviewed.**
    - .2 Email submissions shall include subject line to clearly identify the consultants project number and the description of the shop drawings submitted.
    - .3 Electronic attachments via email shall not exceed 10MB. For submissions larger than 10MB, multiple email messages shall be used. Denote related email messages by indicating "1 of 2" and "2 of 2" in email subject line for the case of two messages.
    - .4 Electronic attachments via web links (URL) shall directly reference PDF files. Provide necessary access credentials within link or as username/password clearly identified within body of email message.
    - .5 On site provide one copy of the "reviewed" shop drawings in a binder as noted above.
    - .6 Contractor to print copies of "reviewed" shop drawings and compile into maintenance manuals in accordance with requirements detailed in this section.

**1.14 OPERATION AND MAINTENANCE MANUAL**

- .1 Provide operation and maintenance data for incorporation into manual as in submittals' requirements.
- .2 Operation and maintenance manual to be approved by, and final copies deposited with, Consultant before final inspection.
- .3 Operation data to include:
  - .1 Control schematics for each system including environmental controls.
  - .2 Description of each system and its controls.
  - .3 Description of operation of each system at various loads together with reset schedules and seasonal variances.
  - .4 Operation instruction for each system and each component.
  - .5 Description of actions to be taken in event of equipment failure.
  - .6 Valves schedule and flow diagram.
  - .7 Colour coding chart.
  - .8 Spare parts equipment list.
  - .9 Manufacturers standard or extended warranty information.
- .4 Maintenance data shall include:
  - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
  - .2 Data to include schedules of tasks, frequency, tools required and task time.
- .5 Performance data to include:
  - .1 Equipment manufacturer's performance data sheets with point of operation as left after commissioning is complete.
  - .2 Equipment performance verification test results.
  - .3 Special performance data as specified elsewhere.
  - .4 Testing, adjusting and balancing reports as specified in Testing, Adjusting and Balancing Section.
- .6 Miscellaneous data to include:
  - .1 Letter of contractors warranty and guarantee.
  - .2 Index sheet.
  - .3 Tabbed format for each section.
  - .4 Manufacturers approved shop drawings.
  - .5 Spare parts list and source.
  - .6 List of Manufacturers and suppliers address for each piece of equipment.

- .7 Approvals:
  - .1 Submit 1 copy of Operation and Maintenance Manual to Consultant for approval. Submission of individual data will not be accepted unless so directed by Consultant.
  - .2 Make changes as required and re-submit as directed by Consultant.
  - .3 Provide two (2) copies of final operation maintenance manuals, as well as a PDF file of the entire approved manual on a USB stick. Only one USB stick is to be provided containing both the approved manual and as-built drawings.
- .8 Additional data:
  - .1 Prepare and insert into operation and maintenance manual when need for same becomes apparent during demonstrations and instructions specified above.

### **1.15 AS-BUILT DRAWINGS**

- .1 Site records:
  - .1 Contractor shall provide 2 sets of reproducible mechanical drawings. Provide sets of white prints as required for each phase of the work. Mark thereon all changes as work progresses and as changes occur. This shall include changes to existing mechanical systems, control systems and low voltage control wiring.
  - .2 On a weekly basis, transfer information to reproducibles, revising reproducibles to show all work as actually installed.
  - .3 Use different colour waterproof ink for each service.
  - .4 Make available for reference purposes and inspection at all times.
- .2 As-Built drawings:
  - .1 Prior to start of Testing, Adjusting and Balancing (TAB), finalize production of as-built drawings.
  - .2 Identify each drawing in lower right hand corner in letters at least 3 mm (1/8") high as follows: - "AS-BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (date).
  - .3 TAB to be performed using as-built drawings.
    - .1 Submit hard copy to Consultant for approval. When returned, make corrections as directed.
    - .2 Once approved, submit completed reproducible paper as-built drawings as well as a scanned pdf file copy on USB stick with Operating and Maintenance Manuals.

### **1.16 WARRANTIES**

- .1 In addition to guarantee specified in General Conditions, guarantee heating, cooling, and plumbing systems to be free from noise in operation that may develop from failure to construct system in accordance with Contract Documents.
- .2 Provide certificates of warranty for each piece of equipment made out in favor of Owner. Clearly record "start-up" date of each piece of equipment on certificate. Include certificates as part of Operation & Maintenance Manual.

- .3 If mechanical sub-contractor with offices located more than 80 km (50 miles) from Project site is used, provide service/warranty work agreement for warranty period with local mechanical sub-contractor approved by Consultant. Include copy of service/warranty agreement in warranty section of Operation & Maintenance Manual.
- .4 Warranty period shall start from date of substantial completion.

**1.17 SUBSTANTIAL PERFORMANCE**

- .1 Complete the following to the satisfaction of the consultant prior to request for submission of substantial performance.
  - .1 As-Built Drawings.
  - .2 Maintenance Manuals
  - .3 System Start up
  - .4 TAB Reports
  - .5 HVAC System Commissioning
  - .6 Instructions to Owners
  - .7 Final Certificates (required prior to consultant's release of conformance letter).
    - .1 Potable Water Test (Refer to domestic water piping – Copper section – Part 3)

**1.18 OCCUPANCY REQUIREMENTS**

- .1 The contractor shall provide the following documentation to the consultant prior to receiving occupancy. Failure to provide the proper documentation will result in the occupancy not being granted. List of required documentation:
  - .1 Final Certificates (required prior to consultant's release of conformance letter).
    - .1 Potable Water Test (Refer to domestic water piping – Copper section – Part 3).

**1.19 REVISION TO CONTRACT**

- .1 Provide the following:
  - .1 Itemized list of material with associated costs.
  - .2 Labour rate and itemized list of labour for each item.
  - .3 Copy of manufacturers/supplier's invoice if requested.

**1.20 DELIVERY STORAGE & HANDLING**

- .1 Follow Manufacturer's directions in delivery, storage, and protection, of equipment and materials.
- .2 Deliver equipment and material to site and tightly cover and protect against dirt, water, and chemical or mechanical injury but have readily accessible for inspection. Store items subject to moisture damage (such as controls) in dry, heated space.



**1.21 ASBESTOS**

- .1 If asbestos is suspected or identified cease all work in the immediate area in accordance with OHSA and notify consultant.**
- .2 Each contractor and on site employee of the contractor shall have “asbestos awareness training”.**
- .3 The Contractor shall ensure that employees who may come into contact with asbestos due to the nature of the work that they perform, have received training that enables them to recognize asbestos and that enables them to react in accordance with the Occupational Health and Safety Act and regulations thereto should contact with asbestos occur during the course of their work.**
- .4 It is the responsibility of the contractor to review the asbestos book in the building prior to starting any work.**
- .5 Existing occupied buildings (depending upon their age) may contain asbestos in thermal insulating materials and some manufactured products, such as vinyl asbestos floor tile. Any insulating materials, on pipes, fittings, boilers, tanks, ductwork, etc. may contain asbestos and shall not be disturbed.**
- .6 A survey of each building documenting the location and condition of asbestos-containing materials is available for your mandatory review prior to commencing any work on premises.**

**1.22 TSSA INSPECTION**

- .1 Prior to final completion of the project, this contractor shall make application, arrange, and pay for a TSSA inspection of all piping systems and equipment installations, including, but not limited to medical gasses, refrigeration, fuel piping, compressed air, heating plant, cooling plant, and associated equipment installed under the contract.**
- .2 Provide a copy of the TSSA report in the maintenance manuals for each system.**

**1.23 ENERGY EFFICIENCY**

- .1 The mechanical systems of this building must achieve the energy efficiency levels by conforming to ANSI/ASHRAE/IESNA 90.1 “Energy Standard for Buildings Except Low-Rise Residential Buildings” and Chapter 2 of Division 3 of SB-10 prescriptive method from the Ontario Building Code.**
- .2 All equipment, products, and installations must conform to the Codes and Standards.**

**END OF SECTION**

**Part 1            General**

**1.1                TESTS**

- .1            Give 48 hours written notice of date for tests.
- .2            Insulate or conceal work only after testing and approval by Consultant.
- .3            Conduct tests in presence of Consultant.
- .4            Bear costs including retesting and making good.
- .5            Piping:
  - .1            General: maintain test pressure without loss for 4 h unless otherwise specified.
  - .2            Hydraulically test steam and hydronic piping systems at 1-1/2 times system operating pressure or minimum 860 kPa, whichever is greater.
  - .3            Test drainage, waste and vent piping to Ontario Building Code and authorities having jurisdiction.
  - .4            Test domestic hot, cold and recirculation water piping at 1-1/2 times system operating pressure or minimum 860 kPa (124.8 psi), whichever is greater.
  - .5            Test fire systems in accordance with authorities having jurisdiction and as specified elsewhere.
- .6            Equipment: test as specified in relevant sections.
- .7            Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures or test medium.

**1.2                SYSTEM START UP**

- .1            **Provide adjusting testing and start up of all equipment prior to testing and balancing (TAB) specified elsewhere.**
- .2            **Provide consultant with written notice verifying all equipment operation and installation is complete.**
- .3            **Start up shall be in presence of the following: owner or representative, contractor, building automation systems (BAS) contractor, and manufacturer's representative. Each person shall witness and sign off each piece of equipment. Consultant's attendance will be determined by consultant.**
- .4            Simulate system start up and shut down and verify operation of each piece of equipment.
- .5            Arrange with all parties and provide 72 hours notice for start up procedure.
- .6            Arrange with building automation systems contractor to sequence all components and ensure system operation.

### **1.3 COMMISSIONING**

- .1 Co-ordinate and direct each step of the commissioning process and recommend acceptance or non-acceptance to the Owner/Owner's Representative.**
- .2 Prepare, in writing, documentation of any deficiencies discovered during the commissioning process. Submit to consultant and Owner/Owner's Representative.**
- .3 The Commissioning Process is detailed in *ASHRAE Guideline 1-1996 HVAC Commissioning Process*. The commissioning plan may be modified to reflect the actual construction schedule and design.**
- .4 Provide a pre-functional test of all HVAC mechanical system and sub-system elements, including control devices, shall be checked for the following:**
  - .1 Verify that each element has been properly installed, properly identified, and that all connections (including electrical) have been made correctly.**
  - .2 Verify that each element has been checked for proper lubrication, drive rotation, belt tension, control sequence, flow direction, or other conditions which may cause damage or reduce system performance.**
  - .3 Verify that tests, meter readings, and specific mechanical/electrical performance characteristics agree with those required by equipment or system manufacturer.**
  - .4 Controls calibration to be completed in accordance with the specification.**
  - .5 The TAB shall be done in accordance with the specifications.**
- .5 A functional performance testing shall be done during two separate periods – one during the cooling season and one during the heating season. The first (cooling) testing period shall occur as soon after completion of installation as practical. The heating testing period shall occur as soon as weather conditions make it practical to test warm-up, zone heating and economizer functions. These tests ensure that all equipment and systems operate in accordance with design intent. The tests are dynamic tests, and test the systems through all possible modes of operation.**
- .6 Reports:**
  - .1 The contractor shall be responsible for recording, documenting, and maintaining detailed inspection and testing data on the test documentation reports. The data record shall be comprehensive and concise.**
  - .2 All data must be recorded as soon as possible during the course of the inspection and testing.**
  - .3 All documentation shall have the date, time, and names of persons participating in the inspection and testing.**
  - .4 All test instruments shall be documented for valid calibration.**
  - .5 The recording work sheets, inspection check lists, and Performance Testing plans must all be approved by the Engineer and the owner's representative prior to the start of the testing.**
  - .6 Include all commissioning documentation in the maintenance manuals.**

- .7 Mechanical System Execution:**
- .1 Operate equipment and systems shall be tested in the presence of the owner's representative and the consultant to demonstrate compliance with specified requirements. To minimize the time of Commissioning Team members, testing shall be done in four seasonal single blocks of time insofar as possible.**
  - .2 Notify the consultant, in writing, fourteen (14) days prior to tests scheduled under requirements of this Section.**
  - .3 Testing shall be conducted under specified design operating conditions as recommended or approved by the consultant.**
  - .4 All elements of systems shall be tested to demonstrate that total systems satisfy all requirements of these Specifications. Testing shall be accomplished on hierarchical basis. Test each piece of equipment for proper operation, followed by each sub-system, followed by entire system, followed by any inter-ties of other major systems.**
  - .5 All special testing materials and equipment shall be provided by the appropriate contractor.**
  - .6 Provide three copies of all test reports and records to the consultant.**
- .8 The verification testing procedures shall address all operating characteristics of all mechanical equipment and systems, including:**

**Equipment Checklist**

**Exhaust Fans**

**Controllers/Valves/Dampers**

**Relays/Sensors/Transducers**

**Unit Ventilators**

**System Checklist**

**Unit Ventilators**

**1.4 DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTION**

- .1 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.**
- .2 Mechanical contractor to schedule and coordinate the demonstration all on the same day, starting at a pre-approved time and continuing consequently until complete.**
- .3 Where specified elsewhere in Mechanical Division, qualified manufacturers' representatives who are knowledgeable about the project to provide demonstrations and instructions.**
- .4 Use operation and maintenance manual, as-built drawings, audio visual aids, etc. as part of instruction materials.**
- .5 Instruction duration time requirements as specified in appropriate sections.**
- .6 Where deemed necessary, Consultants may record these demonstrations on video tape for future reference.**

**1.5 TRIAL USAGE**

- .1 Consultant or owner may use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Trial usage to apply to following equipment and systems:
  - .1 HVAC
  - .2 Exhaust air
  - .3 Domestic water
  - .4 Plumbing and drainage.

**1.6 DEFICIENCIES**

- .1 During the course of construction, the consultants will monitor construction and provide written reports of work progress, discussions, and instruction to correct work.
- .2 Instruction to correct work shall be done within the work period before the next review.
- .3 The contractor shall not conceal any work until inspected.
- .4 The contractor shall expedite 100% complete rough-in work and have inspected prior to concealing services and equipment especially above ceiling.
- .5 Upon completion of the project the consultant will do a final review. Upon receiving the final inspection report, the contractor must correct and sign back the inspection report indicating the deficiencies are completed. A re-inspection will only be done once consultant receives this in writing.

**1.7 EQUIPMENT INSTALLATIONS**

- .1 Unions or flanges: provide for ease of maintenance and disassembly.
- .2 Space for servicing, disassembly and removal of equipment and components: provide as recommended by manufacturer or as indicated.
- .3 Equipment drains: pipe to floor drains.
- .4 Install equipment, rectangular cleanouts and similar items parallel to or perpendicular to building lines.

**1.8 MOUNTING HEIGHTS**

- .1 Mounting height of equipment is from finished floor to equipment unless specified or indicated otherwise. Coordinate with block coursing (if applicable).
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

- .3 Install mechanical equipment at following heights unless indicated otherwise.
  - .1 Barrier-free water closets 400 (16") to top of bowl
  - .2 Barrier-free water closets 450 (18") to top of seat lid
  - .3 Barrier-free wall hung lavatory 840 (33") max to top of rim  
737 (29") min underside of rim front  
685 (27") clear at 400 (8") from basin front  
350 (14") min clear under waste trap
  - .4 Fire extinguisher 1350 (4'- 0") to hanger
  - .5 Hydronic heating elements 200 mm (8") to bottom of cabinet**
  - .6 Thermostats: Barrier Free (operable) 1200 mm (47.25")  
Non-Barrier Free 1500 mm (59")

Also follow direction of architectural drawings and where discrepancies occur clarify prior to rough-in.

#### **1.9 ANCHOR BOLTS AND TEMPLATES**

- .1 Supply anchor bolts and templates for installation by other divisions.

#### **1.10 PROTECTION OF OPENINGS**

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

#### **1.11 ELECTRICAL**

- .1 Electrical work to conform to Electrical Division including the following:
  - .1 Supplier and installer responsibility and related mechanical responsibility is indicated in Equipment Schedule on mechanical and/or electrical drawings
  - .2 Power wiring and conduit is specified in Electrical Division except for conduit, wiring and connections below 50 V which are related to control systems specified in Mechanical Division. Follow Electrical Division for quality of materials and workmanship.
  - .3 Electrically operated equipment shall be C.S.A. approved label. Special Inspection Label of Provincial Authority having jurisdiction will be accepted in lieu of C.S.A. approval. Each motor shall have an approved starter. Starter will be supplied and installed by Electrical Division unless otherwise indicated.

#### **1.12 CONTROL WIRING**

- .1 Furnish and install all components, devices, and control wiring for all plumbing, fire protection, HVAC equipment, HVAC systems, lighting, and other electrical loads to make all equipment operable to satisfaction of owner and consultant and to manufacturer's requirements and recommendations.
- .2 All electrical wiring, mechanical wiring and installations shall comply with local and national electrical and mechanical codes.

- .3 Supply and install wiring as required for all devices and systems. Install wiring in EMT conduit and otherwise comply with all requirements of the Electrical Division. Approved plenum wire may be used for sensor and network communication wiring where it complies with appropriate building codes and regulatory authorities.
- .4 All wiring concealed in walls and chases, and all exposed wiring shall be run in conduit.
- .5 Provide recessed conduit and backer boxes where controls are wall mounted. Surface mounted boxes and conduit are acceptable in mechanical or service rooms.
- .6 Free-run plenum rated cable shall be run in cable hangers where provided by electrical division or tied neatly to pipe and duct hangers in the ceiling. Avoid wiring that droops. Follow building lines and do not run wiring “as the crow flies”.

**1.13 PIPING AND EQUIPMENT SUPPORTS**

- .1 Equipment supports supplied by equipment manufacturer: specified elsewhere in Mechanical Division.
- .2 Piping and equipment supports not supplied by equipment manufacturer: fabricate from structural grade steel meeting requirements of - Structural Steel Section. Submit structural calculations with shop drawings.
- .3 Mount base mounted equipment on chamfered edge housekeeping pads, minimum of 100 mm (4") high and 150 mm (6") larger than equipment dimensions all around. Concrete specified elsewhere.
- .4 Where housekeeping pads incorporate existing pads provide 10 mm dowels into existing pads. New pad height shall match existing.

**1.14 ROOF MOUNTED PIPE SUPPORT**

- .1 Provide zero penetration pipe support on roof where indicated.
- .2 Base shall be made of high density polypropylene with UV protection. Maximum loading shall be 50 lb/sq.ft.
- .3 Frames shall be galvanized. All fastenings, rods, nuts, washers, hangers, etc. shall be stainless steel.
- .4 Provide shop drawings as specified. Install to manufacturers recommendations.
- .5 Acceptable material:
  - Portable pipe hanger
  - Bigfoot systems
  - Miro rooftop supports

**1.15 SLEEVES**

- .1 Pipe sleeves: at points where pipes pass through masonry, concrete or fire rated assemblies and as indicated. Grout sleeves in place.
- .2 Schedule 40 steel pipe.

- .3 Sleeves with annular fin continuously welded at midpoint:
  - .1 Through foundation walls.
  - .2 Where sleeve extends above finished floor.
  - .3 Through fire rated walls and floors.
- .4 Sizes: minimum 6 mm (1/4") clearance all around, between sleeve and uninsulated pipe or between sleeve and insulation.
- .5 Terminate sleeves flush with surface of concrete and masonry walls, concrete floors on grade and 25 mm (1") above other floors.
- .6 Fill voids around pipes:
  - .1 Caulk between sleeve and pipe in foundation walls and below grade floors with waterproof fire retardant non-hardening mastic.
  - .2 Where sleeves pass through walls or floors, provide space for firestopping. Where pipes/ducts pass through fire rated walls, floors, and partitions, maintain fire rating integrity.
  - .3 Ensure no contact between copper tube or pipe and ferrous sleeve.
  - .4 Fill future-use sleeves with lime plaster or other easily removable filler.
  - .5 Coat exposed exterior surfaces of ferrous sleeves with heavy application of zinc rich paint to CGSB 1-GP-181M+Amdt-Mar-78.
- .7 Provide minimum 20 gauge duct sleeves where ducts pass through masonry concrete or fire rated assemblies. Maintain minimum 25 mm clearance all around or to the requirements of the authority having jurisdiction. Seal at wall as indicated.

#### **1.16 FIRE STOPPING**

- .1 This contractor shall work with all other contractors on the project in providing one common method of fire stopping all penetrations made in fire rated assemblies.
- .2 Approved fire stopping and smoke seal material in all fire separations and fire ratings within annular space between pipes, ducts, insulation and adjacent fire separation and/or fire rating.
- .3 Do not use cementitious or rigid seals around penetrations for pipe, ductwork, or other mechanical items.
- .4 Insulated pipes and ducts: ensure integrity of insulation and vapour barrier at fire separation.
- .5 Provide materials and systems capable of maintaining effective barrier against flame, smoke and gases. Ensure continuity and integrity of fire separation.
- .6 Comply with the requirements of CAN4-S115-M35, and do not exceed opening sized for which they have been tested.
- .7 Systems to have an F or FT rating (as applicable) not less than the fire protection rating required for closures in a fire separation. Provide "fire wrap" blanket around services penetrating fire walls. Extent of blanket must correspond to ULC recommendations.
- .8 The fire stopping materials are not to shrink, slump or sag and to be free of asbestos, halogens, and volatile solvents.



- .9 Firestopping materials are to consist of a component sealant applied with a conventional caulking gun and trowel.
- .10 Fire stop materials are to be capable of receiving finish materials in those areas which are exposed and scheduled to receive finishes. Exposed surfaces are to be acceptable to consultant prior to application of finish.
- .11 Firestopping shall be inspected and approved by local authority prior to concealment or enclosure.
- .12 Install material and components in accordance with ULC certification, manufacturers instructions and local authority.
- .13 Submit product literature and installation material on fire stopping in shop drawing and product data manual. Maintain copies of these on site for viewing by installers and consultant.
- .14 Manufacturer of product shall provide certification of installation. Submit letter to the consultant.
- .15 Acceptable Manufacturer:  
Minnesota Mining and Manufacturing
- .16 Acceptable Alternate Manufacturers to approval of local authority:  
Fryesleeve Industries Inc.  
General Electric Pensil Firestop Systems  
International Protective Coatings Corp.  
Rectorseal Corporation (Metacaulk)  
Proset Systems  
3M  
AD Systems  
Hilti
- .17 Ensure firestop manufacturer representative performs on site inspections and certifies installation. Submit inspection reports/certification at time of substantial completion.

**1.17 ESCUTCHEONS**

- .1 On pipes and ductwork passing through walls, partitions, floors and ceilings in exposed finished areas and on water and drain pipes inside millwork and cabinets.
- .2 Chrome or nickel plated brass or Type 302 stainless steel, one piece type with set screws.
- .3 Outside diameter to cover opening or sleeve.
- .4 Inside diameter to fit around finished pipe.

**1.18 PAINTING**

- .1 Refer to Section Interior Painting and specified elsewhere.
- .2 Apply at least one coat of corrosion resistant primer paint to ferrous supports and site fabricated work.
- .3 Apply two coats of paint to exposed piping service in mechanical room, base colour as specified in Mechanical Identification Section.

- .4 Prime and touch up marred finished paintwork to match original.
- .5 Restore to new condition, or replace equipment at discretion of consultant, finishes which have been damaged too extensively to be merely primed and touched up.

**1.19 SPARE PARTS**

- .1 Furnish spare parts in accordance with general requirements and as follows:
  - .1 One set of packing for each pump.
  - .2 One casing joint gasket for each size pump.
  - .3 One head gasket set for each heat exchanger.
  - .4 One glass for each gauge glass.
  - .5 One set of belts for each type or each size of machinery.
  - .6 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.
- .2 Provide list of equipment in maintenance manuals indicating corresponding spare parts required. List of spare parts to be signed off by receiving personnel.

**1.20 SPECIAL TOOLS**

- .1 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Maintenance Materials Special Tools and Spare Parts.

**1.21 ACCESS DOORS**

- .1 Provide access doors to concealed mechanical equipment for operating, inspecting, adjusting and servicing.
- .2 Flush mounted 600 x 600 mm (24" x 24") for body entry and 300 x 300 mm (12" x 12") for hand entry unless otherwise noted. Doors to open 180°, have rounded safety corners, concealed hinges, screwdriver latches and anchor straps.
- .3 Material:
  - .1 Special areas such as tiled or marble surfaces: use stainless steel with brushed satin or polished finish as directed by Consultant.
  - .2 Remaining areas: use prime coated steel.
  - .3 Fire rated areas: provide ULC listed access doors.
  - .4 Washrooms or high moisture area ceilings: Aluminum with mill finish suitable for painting.
- .4 Installation:
  - .1 Locate so that concealed items are accessible.
  - .2 Locate so that hand or body entry (as applicable) is achieved.

- .5 Acceptable materials:
  - Le Hage
  - Zurn
  - Acudor
  - Nailor Industries Inc.

#### **1.22 DIELECTRIC COUPLINGS**

- .1 General:
  - .1 To be compatible with and to suit pressure rating of piping system.
  - .2 Where pipes of dissimilar metals are joined.
- .2 Pipes NPS 50 mm (2") and under: isolating unions.
- .3 Pipes NPS 65 mm (2 1/2") and over: isolating flanges.

#### **1.23 DRAIN VALVES**

- .1 Locate at low points and at section isolating valves unless otherwise specified.
- .2 Minimum NPS 20 mm (3/4") unless otherwise specified: bronze, with hose end male thread and complete with cap and chain.
- .3 Drain valves on potable water systems shall be complete with vacuum breaker.

#### **1.24 REPAIRS, CUTTING, AND RESTORATION**

- .1 Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown. Surface finishes shall exactly match existing finishes of same materials.
- .2 Each Section of this Division shall bear expense of cutting, patching, and repairing to install their work and/or replacing of work of other Sections required because of its fault, error, tardiness, or because of damage done by it.
- .3 Cutting, patching, repairing, and replacing pavements, sidewalks, roads, and curbs to permit installation of work of this Division is responsibility of Section installing work.
- .4 All patching, painting and making good of the existing walls, floors, ceilings, partitions and roof will be at the expense of this Contractor, but performed by the Contractor specializing in the type of work involved unless otherwise noted.

#### **1.25 EXISTING SYSTEMS**

- .1 Connections into existing systems to be made at time approved by Consultant. Request written approval of time when connections can be made.
- .2 Be responsible for damage to existing plant by this work.

#### **1.26 CLEANING**

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units prior to turn over to owner.
- .2 In preparation for final acceptance, clean and refurbish all equipment and leave in operating condition including replacement of all filters in all air and piping systems.

**1.27 DISCONNECTION AND REMOVAL**

- .1 Disconnect and/or remove equipment, piping, ductwork, etc. as indicated.
- .2 Cap and conceal all redundant and obsolete connections.
- .3 Provide a list of equipment to be removed to the owner, for his acceptance of same. Remove all equipment from site, which the owner does not retain.
- .4 Store equipment to be retained by owner on site where directed by consultant.

**1.28 OWNER SUPPLIED EQUIPMENT**

- .1 Connect to equipment supplied by the owner and make operable.

**1.29 DEMOLITION**

- .1 The general requirements are indicated on the drawings and on the outline specification in Division 1.**
- .2 The general execution of the demolition is to be carried out in a clean and efficient manner.**
- .3 Demolition of existing ceiling, walls etc., to facilitate removal of existing services or equipment or installation of new to be kept to a minimum and then restored to match existing.**
- .4 All openings or holes created by removal of existing mechanical systems which are not being reused are to be patched with the same material surrounding surfaces.
- .5 All new holes and openings to facilitate mechanical systems are to be patched to match surrounding surfaces.
- .6 Protect all existing furnishings materials and equipment. Any damage occurring as a result of the work of this Division shall be repaired or replaced at the expense of this Division.
- .7 Where work involves breaking into or connecting to existing services, carry out work at times directed by the Owners in an expedient manner with minimum disruption to the facility and systems downtime.
- .8 Where unknown services are encountered, immediately advise Consultant and confirm findings in writing.
- .9 Where the location of any services has been shown on the plans, such information is not guaranteed. It is this Division's responsibility to verify locations, invert elevations, etc., immediately after moving on site. Should for any reason the information obtained necessitates changes in procedure or design, advise the Consultant at once. If verification of existing conditions is not done at the outset and any problems arise, the responsibility for same is entirely this Division's.

**1.30 LOCATION OF EXISTING UNDERGROUND SERVICES**

- .1 **This contractor shall locate existing services prior to starting any work in the affected area.**
- .2 **This contractor shall use a video camera for the existing storm and/or sanitary drainage at the indicated connection point to confirm location, size, and invert of the existing piping.**

**1.31 EXISTING CONCRETE SLAB X-RAY/SCANNING**

- .1 This contractor shall retain the services of a qualified company to provide and X-Ray and/or scan of the existing buried services in wall and/or floors prior to starting any work in the affected area.
- .2 Failure to locate existing piping, conduit rebar etc., shall not relieve this contractor of repair of same prior to installing his service.
- .3 This contractor shall be responsible for all repairs and/or replacement of existing services caused by cutting the existing concrete slabs and/or walls.

**1.32 EXCAVATING AND BACKFILLING**

- .1 Provide all excavating and backfilling inside and outside the building for plumbing pipes, drains and equipment. All backfilling shall be new clean granular 'A' fill brought in specifically for the purpose of backfilling to the underside of floor slab. All backfilling shall be compacted at intervals not more than 150 mm (6") layer to the satisfaction of the Consultant.
- .2 Provide excavating and backfilling outside the building with granular A brought in specifically for backfilling to a minimum of 450 mm (18") over the pipe. Backfilling outside building over and above the 450 mm (18") backfill as previously specified herein shall be by the Mechanical Contractor as specified under Division 2. Where backfilling outside the building is not specified under Division 2 the mechanical contractor shall provide new clean granular 'A' fill to grade level.
- .3 Bottoms of trenches shall be excavated so that the pipe will be supported on a 150 mm (6") compacted bed of clean granular 'A' fill. Provide all necessary pumping to maintain excavation free of water.
- .4 Should water be encountered during excavation, the mechanical contractor shall provide all labour and material, including all equipment required for dewatering the excavation. After the water has been removed, this Contractor shall install a 300 mm (12") base of compacted 50 mm (2") clear stone covered with filter cloth before installing backfill as detailed and/or as specified.
- .5 Be responsible for all weather protection required to install piping and/or equipment to the satisfaction of the Consultant.
- .6 Be responsible for providing all clear stone or granular 'A' material suitable for application to replace existing soil not suitable for backfilling above the 450 mm (18") bedding material.

**1.1 TSSA INSPECTION**

- .1 Prior to final completion of the project, this contractor shall make application, arrange, and pay for a TSSA inspection of all piping systems and equipment installations, including, but not limited to medical gasses, refrigeration, fuel piping, compressed air, heating plant, cooling plant, and associated equipment installed under the contract.
- .2 Provide a copy of the TSSA report in the maintenance manuals for each system.

**END OF SECTION**

**Part 1            General**

**1.1                GENERAL PROVISIONS**

- .1      Conform to the General Provisions of General Requirements Section.
- .2      This project is one of a retrofit nature in part, and which will require some demolition.
- .3      Allow for all remedial work in areas indicated on the drawings and as generally defined in the relevant sections of the specifications.

**1.2                RELATED WORK SPECIFIED ELSEWHERE**

- .1      Electrical Division.

**1.3                SCOPE OF WORK**

- .1      The scope of work is essentially the selected disconnection and/or removal of services and/or equipment, piping ductwork etc. as indicated or required to complete the work.

**Part 2            Products**

**2.1                GENERAL**

- .1      This Division is to liaise with the Owners or Consultant for equipment being removed that may be suitable for reuse to that specified or handed over to the owner.
- .2      This Division to take full responsibility for any special tools or equipment required to disassemble or remove material from building.

**Part 3            Execution**

**3.1                GENERAL**

- .1      The general requirements are indicated on the drawings and on the outline specification in Division 1.
- .2      The general execution of the demolition is to be carried out in a clean and efficient manner.
- .3      Demolition of existing ceiling, walls etc., to facilitate removal of existing services or equipment or installation of new to be kept to a minimum and then restored to match existing.
- .4      All openings or holes created by removal of existing mechanical systems which are not being reused are to be patched with the same material surrounding surfaces.
- .5      All new holes and openings to facilitate mechanical systems are to be patched to match surrounding surfaces.
- .6      Protect all existing furnishings materials and equipment. Any damage occurring as a result of the work of this Division shall be repaired or replaced at the expense of this Division.

- .7 Where work involves breaking into or connecting to existing services, carry out work at times directed by the Owners in an expedient manner with minimum disruption to the facility and systems downtime.
- .8 Where unknown services are encountered, immediately advise Consultant and confirm findings in writing.
- .9 Where the location of any services has been shown on the plans, such information is not guaranteed. It is this Division's responsibility to verify locations, invert elevations, etc., immediately after moving on site. Should for any reason the information obtained necessitates changes in procedure or design, advise the Consultant at once. If verification of existing conditions is not done at the outset and any problems arise, the responsibility for same is entirely this Division's.
- .10 Disconnect and/or remove equipment piping, ductwork, etc. as indicated.
- .11 Cap and conceal all redundant and obsolete connections.
- .12 Provide a list of equipment to be removed to the owner, for his acceptance of same. Remove all equipment from site which the owner does not retain.
- .13 Maintain equipment to be retained by owner on site where directed by consultant.
- .14 Demolition of all parts of the work must be completed within the confines of the work area and in such a way as the dust produced and risk to injury of will not adversely affect the building users.
- .15 Demolished areas of the existing building will remain in their current use in some cases. Demolition in these areas must be kept to the minimum required to complete the work.
- .16 Demolition shall take place within areas isolated from all other areas with appropriate hoarding, scaffolding, netting, fencing or other means of security between building users and the work.
- .17 Co-ordinate making safe electrical devices, capping plumbing and removal of fixtures prior to commencement of demolition.
- .18 All piping and equipment to be removed and/or abandoned shall be drained prior to capping and/or abandoning. Disposal of all liquids shall be to the approval of authority of having jurisdiction and/or provincial regulations.

### **3.2 EXISTING SYSTEM DRAINAGE**

- .1 Drain all existing piping and drainage systems including all related equipment as required to facilitate system renovations.
- .2 Disposal of existing system shall be to the requirements of the local and/or provincial regulations.

**END OF SECTION**



**Part 1            General**

**1.1                REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 American Society for Testing and Materials
  - .1 ASTM A53/A53M, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
  - .2 ASTM A105/A105M, Specification for Carbon Steel Forgings for Piping Applications.

**1.2                PRODUCT DATA**

- .1 Submit product data in accordance with general requirements.
- .2 Indicate for each item as applicable:
  - .1 Manufacturer, model number, line contents, pressure, and temperature rating.
  - .2 Movement handled; axial, lateral, angular and the amounts of each.
  - .3 Nominal size and dimensions including details of construction and assembly.

**1.3                CLOSEOUT SUBMITTALS**

- .1 Submit maintenance data in accordance with general requirements.
- .2 Data to include:
  - .1 Servicing requirements, including any special requirements, stuffing box packing, lubrication, and recommended procedures.

**Part 2            Products**

**2.1                FLEXIBLE CONNECTION**

- .1 Application: to suit motion.
- .2 Minimum length in accordance with manufacturer's recommendations to suit offset.
- .3 Inner hose: stainless steel corrugated.
- .4 Braided wire mesh stainless steel outer jacket.
- .5 Diameter and type of end connection: as indicated.
- .6 Operating conditions:
  - .1 Working pressure: 1034 kPa (150 psi).
  - .2 Working temperature: 250°C (482°F).
  - .3 To match system requirements.

## **2.2 ANCHORS AND GUIDES**

- .1 Anchors:
  - .1 Provide as indicated.
- .2 Alignment guides:
  - .1 Provide as indicated.
  - .2 To accommodate specified thickness of insulation.
  - .3 Vapour barriers, jackets to remain uninterrupted.

## **2.3 EXPANSION COMPENSATORS (EXP)(2"-4")**

- .1 All welded packless guided construction complete with multi ply stainless steel bellows.
- .2 Operating temperature (700°F).
- .3 Provide model HP3 for steel pipe and model HBFF3 for copper pipe.
- .4 Movement capability of 4" axial. Welded ends.
- .5 Material to match piping system.
- .6 Acceptable materials:
  - Metraflex HP
  - Mark David Canada
  - Senior Flexonics

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install expansion joints with cold setting, as indicated as instructed by Consultant. Make record of cold settings.
- .2 Install expansion joints and flexible connections in accordance with manufacturer's instructions.
- .3 Install pipe anchors and guides as indicated. Anchors to withstand 150% of axial thrust.

### **3.2 APPLICATION**

- .1 Provide on all vibration isolated equipment.
- .2 Provide where requested by equipment manufacturers installation manuals.
- .3 Install in accordance with manufacturer's recommendations.
- .4 Provide expansion compensators (exp.) on radiation heating element exceeding 3.6 M (12' – 0") in length. Provide one expansion compensators on each length of return piping in cabinet.

### **3.3 THERMAL EXPANSION**

- .1 Provide in long runs of heating mains exceeding 100 ft. in length.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ANSI/ASME B40.100, Pressure Gauges and Gauge Attachments.
- .3 CAN/CGSB-14.4, Thermometers, Liquid-in-Glass, Self-Indicating, Commercial/Industrial Type.
- .4 CAN/CGSB-14.5, Thermometers, Bimetallic, Self-Indicating, Commercial/Industrial Type.

**1.2                SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings and product data in accordance with general requirements.
- .2 Submit manufacturer's product data for following items:
  - .1 Thermometers.
  - .2 Pressure gauges.
  - .3 Stop cocks.
  - .4 Syphons.
  - .5 Wells.

**Part 2            Products**

**2.1                GENERAL**

- .1 Design point to be at mid point of scale or range.
- .2 Ranges: suitable for application.

**2.2                DIRECT READING THERMOMETERS**

- .1 Industrial, variable angle type, liquid filled, 225 mm (9") scale length: to CAN/CGSB 14.4.
  - .1 Acceptable materials:
    - .1 Terice
    - .2 Winters 91T
    - .3 Wiess

**2.3                THERMOMETER WELLS**

- .1 Copper pipe: copper or bronze.
- .2 Steel pipe: brass or stainless steel.

## **2.4 PRESSURE GAUGES**

- .1 115 mm (4 1/2"), dial type: to ANSI/ASME B40.100, Grade 2A, stainless steel phosphor bronze bourdon tube having 0.5% accuracy full scale unless otherwise specified.
  - .1 Acceptable materials:
    - .1 Winters
    - .2 Trerice
    - .3 Wiess
  - .2 Provide:
    - .1 Siphon for steam service.
    - .2 Snubber for pulsating operation.
    - .3 Diaphragm assembly for corrosive service.
    - .4 Gasketed pressure relief back with solid front.
    - .5 Bronze stop cock.

## **Part 3 Execution**

### **3.1 GENERAL**

- .1 Install so they can be easily read from floor or platform. If this cannot be accomplished, install remote reading units.
- .2 Install between equipment and first fitting or valve.

### **3.2 THERMOMETERS**

- .1 Install in wells on all piping. Provide heat conductive material inside well.
- .2 Install in locations as indicated and on inlet and outlet of:
  - .1 In other locations indicated.
- .3 Install wells as indicated only for balancing purposes.
- .4 Use extensions where thermometers are installed through insulation.

### **3.3 PRESSURE GAUGES**

- .1 Install in following locations:
  - .1 Upstream and downstream of control valves.
  - .2 Inlet and outlet of coils.
  - .3 In other locations as indicated.
- .2 Install gauge cocks for balancing purposes, elsewhere as indicated.
- .3 Use extensions where pressure gauges are installed through insulation.

**3.4 NAMEPLATES**

- .1 Install engraved lamincoid nameplates as specified elsewhere identifying medium.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 American National Standards Institute/ American Society of Mechanical Engineers (ANSI/ASME)
  - .1 ANSI/ASME B31.1, Power Piping, (SI Edition).
- .3 American Society for Testing and Materials (ASTM)
  - .1 ASTM A 125, Specification for Steel Springs, Helical, Heat-Treated.
  - .2 ASTM A 307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - .3 ASTM A 563, Specification for Carbon and Alloy Steel Nuts.
- .4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
  - .1 MSS SP-58, Pipe Hangers and Supports - Materials, Design, Manufacture Selection, Application, and Installation.

**1.2                DESIGN REQUIREMENTS**

- .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
- .2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP-58.
- .3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
- .4 Design hangers and supports to support systems under all conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
- .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment to be in accordance with MSS SP-58.

**1.3                SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings and product data in accordance with general requirements.
- .2 Submit shop drawings and product data for following items:
  - .1 All bases, hangers and supports.
  - .2 Connections to equipment and structure.
  - .3 Structural assemblies.

**1.4                MAINTENANCE DATA**

- .1 Provide maintenance data for incorporation into manual specified in general requirements.

**Part 2**

**Products**

**2.1**

**GENERAL**

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

**2.2**

**PIPE HANGERS**

- .1 Finishes:
  - .1 Pipe hangers and supports: to ANSI & ULC requirements
  - .2 Ensure steel hangers in contact with copper piping are copper plated.
- .2 Upper attachment structural: Suspension from upper flange of I-Beam or joist.
  - .1 Cold piping NPS 50 mm (2") maximum: Ductile iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.
    - .1 Rod: 10 mm (3/8") UL listed
  - .2 Cold piping NPS 65 mm (2 1/2") or greater, all hot piping: Malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed & FM approved.
- .3 Upper attachment structural: Suspension from upper flange of I-Beam.
  - .1 Cold piping NPS 50 mm (2") maximum: Ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed.
  - .2 Cold piping NPS 65 mm (2 1/2") or greater, all hot piping: Malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nuts.
- .4 Upper attachment to concrete.
  - .1 Ceiling: Carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm (1/4") minimum greater than rod diameter.
  - .2 Concrete inserts: wedge shaped body with knockout protector plate ULC listed. Note: Rapidex and Siporex are not considered concrete. Should one of these systems be encountered, piping/ductwork and/or equipment shall be supported from adjacent walls or from supplemental steel provided by this contractor attached to the adjacent walls/structure.
- .5 Shop and field-fabricated assemblies.
  - .1 Trapeze hanger assemblies: ASME B31.1.
  - .2 Steel brackets: ASME B31.1.
- .6 Hanger rods: threaded rod material to MSS SP-58.
  - .1 Ensure that hanger rods are subject to tensile loading only.
  - .2 Provide linkages where lateral or axial movement of pipework is anticipated.

- .7 Pipe attachments: material to MSS SP-58.
  - .1 Attachments for steel piping: carbon steel.
  - .2 Attachments for copper piping: copper plated black steel.
  - .3 Use insulation shields for all piping.
  - .4 Oversize pipe hangers and supports to accommodate thermal insulation. Provide 1.5 mm (16 gauge) saddles.
- .8 Adjustable clevis: material to MSS SP-58 UL listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
  - .1 Ensure "U" has hole in bottom for rivetting to insulation shields.

### **2.3 RISER CLAMPS**

- .1 Steel or cast iron pipe: black carbon steel to MSS-SP-58, type 42, UL listed.
- .2 Copper pipe: carbon steel copper plated to MSS-SP-58, type 42.
- .3 Bolts: to ASTM A 307.
- .4 Nuts: to ASTM A 563.

### **2.4 INSULATION PROTECTION SHIELDS**

- .1 Insulated cold piping:
  - .1 64 kg/m<sup>2</sup> (13.12 lbs/ft<sup>2</sup>) density insulation plus insulation protection shield to: MSS SP-69, galvanized sheet carbon steel. Length designed for maximum 3 m (10') span.
- .2 Insulated hot piping:
  - .1 Curved plate 300 mm (12") long, with edges turned up, welded-in centre plate for pipe sizes NPS 300 mm (12") and over, carbon steel to comply with MSS SP-58.

### **2.5 EQUIPMENT SUPPORTS**

- .1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of miscellaneous metals, specified herein. Submit calculations with shop drawings.

### **2.6 EQUIPMENT ANCHOR BOLTS AND TEMPLATES**

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

### **2.7 ROOF MOUNTED EQUIPMENT**

- .1 Install as per manufacturers' instructions on roof curbs provided by manufacturer as indicated.
- .2 Provide all necessary continuous pressure treated wood blocking and 24 gauge metal liner on all exposed wood as required to install roof curb level.



## **2.8 OTHER EQUIPMENT SUPPORTS**

- .1 From structural grade steel meeting requirements of structural steel section specified herein.
- .2 Submit structural calculations with shop drawings.

## **2.9 MANUFACTURER**

- .1 Acceptable materials:
  - .1 Grinnell
  - .2 Anvil
  - .3 Myatt
  - .4 Taylor

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install in accordance with:
  - .1 Manufacturer's instructions and recommendations.
- .2 Vibration Control Devices:
  - .1 Install on piping systems at pumps, boilers, chillers, cooling towers, elsewhere as indicated.
- .3 Clamps on riser piping:
  - .1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.
  - .2 Bolt-tightening torques to be to industry standards.
  - .3 Steel pipes: Install below coupling or shear lugs welded to pipe.
  - .4 Cast iron pipes: Install below joint.
- .4 Clevis plates:
  - .1 Attach to concrete with 4 minimum concrete inserts at each corner.
- .5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

### **3.2 HANGER SPACING**

- .1 Plumbing piping: most stringent requirements of Canadian Plumbing Code, Provincial Code, or authority having jurisdiction.
- .2 Fire protection: to applicable fire code.
- .3 Gas and fuel oil piping: up to NPS 15 mm (1/2"): every 1.8 m (6').
- .4 Copper piping: up to NPS 15 mm (1/2"): every 1.5 m (5').

.5 **Flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.**

.6 Within 300 mm (12") of each elbow and:

| Maximum<br>Pipe<br>Size: NPS | Spacing<br>Steel | Maximum<br>Spacing<br>Copper |
|------------------------------|------------------|------------------------------|
| up to 32 mm (1 1/4")         | 2.1 m (7')       | 1.8 m (6')                   |
| 40 mm (1 1/2")               | 2.7 m (9')       | 2.4 m (8')                   |
| 50 mm (2")                   | 3.0 m (10')      | 2.7 m (9')                   |
| 65 mm (2 1/2")               | 3.6 m (12')      | 3.0 m (10')                  |
| 80 mm (3")                   | 3.6 m (12')      | 3.0 m (10')                  |
| 90 mm (3 1/2")               | 3.9 m (13')      | 3.3 m (11')                  |
| 100 mm (4")                  | 4.2 m (14')      | 3.6 m (12')                  |
| 125 mm (5")                  | 4.8 m (16')      |                              |
| 150 mm (6")                  | 5.1 m (17')      |                              |
| 200 mm (8")                  | 5.7 m (19')      |                              |
| 250 mm (10")                 | 6.6 m (22')      |                              |
| 300 mm (12")                 | 6.9 m (23')      |                              |

.7 Pipework greater than NPS 300 mm (12"): to MSS SP-69.

### 3.3 HANGER INSTALLATION

- .1 Install hanger so that rod is vertical under operating conditions.
- .2 Adjust hangers to equalize load.
- .3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.
- .4 Do "NOT" support piping, ductwork and equipment from roof deck, on bottom chord of floor and/or roof joist and/or from OWSJ bridging. Provide structural member between joist.

### 3.4 HORIZONTAL MOVEMENT

- .1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4mm (5/32") from vertical.
- .2 Where horizontal pipe movement is less than 15 mm (1/2"), offset pipe hanger and support so that rod hanger is vertical in the hot position.

### 3.5 FINAL ADJUSTMENT

- .1 Adjust hangers and supports:
  - .1 Ensure that rod is vertical under operating conditions.
  - .2 Equalize loads.

- .2 Adjustable clevis:
  - .1 Tighten hanger load nut securely to ensure proper hanger performance.
  - .2 Tighten upper nut after adjustment.
- .3 C-clamps:
  - .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.
- .4 Beam clamps:
  - .1 Hammer jaw firmly against underside of beam.

**END OF SECTION**

**Part 1            General**

**1.1                SHOP DRAWINGS**

- .1        Submit shop drawings in accordance with general requirements.
- .2        Provide separate shop drawings for each isolated system complete with performance and product data.

**Part 2            Products**

**2.1                GENERAL**

- .1        Size and shape of bases type and performance of vibration isolation to be as indicated.
- .2        To be of the same manufacturer for all isolation.
- .3        Acceptable materials:  
          Korfund  
          Vibro-Acoustics  
          Vibron

**2.2                ELASTOMERIC PADS**

- .1        Type EP1 - neoprene waffle or ribbed; 10 mm (3/8") minimum thick; 50 durometer; maximum loading 350 kPa (50.8 psi).
- .2        Type EP2 - rubber waffle or ribbed; 10 mm (3/8") minimum thick; 30 durometer natural rubber; maximum loading 415 kPa (60.2 psi).
- .3        Type EP3 - neoprene-steel-neoprene; 10 mm (3/8") minimum thick neoprene bonded to 1.5 mm (16 gauge) steel plate; 50 durometer neoprene, waffle or ribbed; holes sleeved with isolation washers; maximum loading 350 kPa (50.8 psi).
- .4        Type EP4 - rubber-steel-rubber; 10 mm (3/8") minimum thick rubber bonded to 1.5 mm (16 gauge) steel plate; 30 durometer natural rubber, waffle or ribbed; holes sleeved with isolation washers; maximum loading 415 kPa (60.2 psi).
- .5        Acceptable materials:  
          Korfund  
          IAC Acoustics  
          Vibro-Acoustics  
          Vibron

**Part 3            Execution**

**3.1                INSTALLATION**

- .1        Install vibration isolation equipment in accordance with manufacturers instructions and adjust mountings to level equipment.

- .2 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.
- .3 Unless indicated otherwise, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm (1") minimum static deflection as follows:
  - .1 Up to NPS 100 mm (4"): first 3 points of support. NPS 125 mm (5") to NPS 200 mm (8"): first 4 points of support. NPS 250 mm (10") and Over: first 6 points of support.
  - .2 First point of support shall have a static deflection of twice deflection of isolated equipment, but not more than 50 mm (2").
- .4 Where isolation is bolted to floor use vibration isolation rubber washers.
- .5 Block and shim level bases so that ductwork and piping connections can be made to a rigid system at the operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

### **3.2 SITE VISIT**

- .1 Manufacturer to visit site and provide written certification that installation is in accordance with manufacturer's instructions and submit report to Consultant.
- .2 Provide Consultant with notice 24 h in advance of visit.
- .3 Make adjustments and corrections in accordance with written report.

### **3.3 TESTING**

- .1 Experienced and competent sound and vibration testing professional engineer to take vibration measurement for HVAC systems after start up and TAB of systems to Testing Adjusting and Balancing Section.
- .2 Vibration measurements shall be taken for equipment-listed below:
- .3 Provide Consultant with notice 48 h in advance of commencement of tests.
- .4 Establish adequacy of equipment isolation and acceptability of noise levels in occupied areas and where appropriate, remedial recommendations including sound curves.
- .5 Submit complete report of test results including sound curves.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 Canadian General Standards Board (CGSB).
  - .1 CAN/CGSB-1.60, Interior Alkyd Gloss Enamel.
  - .2 CAN/CGSB-24.3, Identification of Piping Systems.
- .3 Canadian Standards Association (CSA).
  - .1 Natural Gas and Propane Installation Code CSA B149.1.
- .4 National Fire Protection Association
  - .1 NFPA 13, Installation of Sprinkler Systems.
  - .2 NFPA 14, Standpipe and Systems.

**1.2                PRODUCT DATA**

- .1 Submit product data in accordance with General Requirements.
- .2 Product data to include paint colour chips, all other products specified in this section.

**1.3                PRODUCT LITERATURE**

- .1 Submit product literature in accordance with General Requirements.
- .2 Product literature to include nameplates, labels, tags, lists of proposed legends.

**Part 2            Products**

**2.1                MANUFACTURER'S EQUIPMENT NAMEPLATES**

- .1 Metal or plastic lamicoid nameplate mechanically fastened to each piece of equipment by manufacturer.
- .2 Lettering and numbers to be raised or recessed.
- .3 Information to include, as appropriate:
  - .1 Equipment: Manufacturer's name, model, size, serial number, capacity.
  - .2 Motor: voltage, Hz, phase, power factor, duty, frame size.

## 2.2 SYSTEM NAMEPLATES

- .1 Colours:
- .1 Hazardous: red letters, white background.
  - .2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).
- .2 Construction:
- .1 3 mm (1/8") thick laminated plastic, matte finish, with square corners, letters accurately aligned and machine engraved into core.
- .3 Sizes:
- .1 Conform to following table:

| Size | No. of<br>Sizes mm (") | Height of<br>Line mm (") | Letters mm (") |
|------|------------------------|--------------------------|----------------|
| 1    | 10 x 50 (3/8" x 2")    | 1 (3/64")                | 3 (1/8")       |
| 2    | 15 x 75 (1/2" x 3")    | 1 (3/64")                | 6 (1/4")       |
| 3    | 15 x 75 (1/2" x 3")    | 2 (5/64")                | 3 (1/8")       |
| 4    | 20 x 100 (3/4" x 4")   | 1 (3/64")                | 10 (3/8")      |
| 5    | 20 x 100 (3/4" x 4")   | 2 (6/64")                | 6 (1/4")       |
| 6    | 20 x 200 (3/4" x 8")   | 1 (3/64")                | 10 (3/8")      |
| 7    | 25 x 125 (1" x 5")     | 1 (3/64")                | 15 (1/2")      |
| 8    | 25 x 125 (1" x 5")     | 2 (5/64")                | 10 (3/8")      |
| 9    | 32 x 200 (1¼" x 8")    | 1 (3/64")                | 20 (3/4")      |
  - .2 Use maximum of 25 letters/numbers per line.
- .4 Locations:
- .1 Terminal cabinets, control panels: Use size #5.
  - .2 Equipment in Mechanical Rooms: Use size #9.
  - .3 Roof top equipment: use size #9.
  - .4 Equipment above ceiling: use size #1 riveted to ceiling suspension system.

## 2.3 FIRE DAMPER/FIRE STOP FLAP NAMEPLATES

- .1 Colours:
- .1 Black letters, yellow background.
- .2 Construction:
- .1 Self adhesive 50 mm x 25 mm, matte finish, with round corners.
- .3 Locations:
- .1 Install on adjacent ceiling grid. Where fire stop flap is installed in gypsum ceiling install on diffuser/grille frame. Where fire damper is installed above gypsum ceiling install on adjacent wall.

## **2.4 EXISTING IDENTIFICATION SYSTEMS**

- .1 Apply existing identification system to new work.
- .2 Where existing identification system does not cover for new work, use identification system specified in this section.
- .3 Before starting work, obtain written approval of identification system from Consultant.
- .4 Upon completion of this project all references to room names and numbering shall be to the Owner's requirements which may or may not be the numbering system used on the drawings. Each contractor shall verify the proper numbering scheme to be used prior to project completion.
- .5 All equipment shall be identified in sequence from the existing equipment and "NOT" duplicate numbering of equipment.

## **2.5 PIPING SYSTEMS GOVERNED BY CODE**

- .1 Identification:
  - .1 Natural and propane gas: To CSA B149.1-00 and authority having jurisdiction and as indicated elsewhere.
  - .2 Sprinklers: To NFPA 13.
  - .3 Standpipe and hose systems: To NFPA 14.

## **2.6 IDENTIFICATION OF PIPING SYSTEMS**

- .1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.
- .2 Legend:
  - .1 Block capitals to sizes and colours listed in CAN/CGSB-24.3.
- .3 Arrows showing direction of flow:
  - .1 Outside diameter of pipe or insulation less than 75 mm (3"): 100 mm (4") long x 50 mm (2") high.
  - .2 Outside diameter of pipe or insulation 75 mm (3") and greater: 150 mm (6") long x 50 mm (2") high.
  - .3 Use double-headed arrows where flow is reversible.
- .4 Extent of background colour marking:
  - .1 To full circumference of pipe or insulation.
  - .2 Length to accommodate pictogram, full length of legend and arrows.
- .5 Materials for background colour marking, legend, arrows:
  - .1 Pipes and tubing 20 mm (3/4") and smaller: Waterproof and heat-resistant pressure sensitive plastic marker tags.
  - .2 All other pipes: Pressure sensitive vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150°C (300°F) and intermittent temperature of 200°C (395°F).



- .6 Colours and Legends:
- .1 Where not listed, obtain direction from Consultant.
  - .2 Colours for legends, arrows: To following table:  
 Background colour:      Legend:              Arrows:  
 Yellow                      White              Black  
 Green                      White              Black  
 Red                         White              Black
- .7 Background colour marking and legends for piping systems:

| CONTENTS                   | BACKGROUND<br>COLOUR<br>MARKING | LEGEND                   |
|----------------------------|---------------------------------|--------------------------|
| Hot water heating supply   | Yellow                          | HEATING SUPPLY           |
| Hot water heating return   | Yellow                          | HEATING RETURN           |
| Domestic hot water supply  | Green                           | DOM. HW SUPPLY           |
| Dom. HW recirculation      | Green                           | DOM. HW CIRC             |
| Domestic cold water supply | Green                           | DOM. CWS                 |
| Domestic tempered supply   | Green                           | DOM. TEMPERED            |
| Trap Primer                | Green                           | TRAP PRIMER              |
| Sanitary                   | Green                           | SAN                      |
| Plumbing vent              | Green                           | SAN. VENT                |
| Condensate                 | Green                           | CONDENSATE               |
| Refrigeration suction      | Yellow                          | REF. SUCTION             |
| Refrigeration liquid       | Yellow                          | REF. LIQUID              |
| Refrigeration hot gas      | Yellow                          | REF. HOT GAS             |
| Conduit for low voltage    |                                 |                          |
| Control wiring             | White                           | CONTROL WIRING ___ VOLTS |

**2.7 IDENTIFICATION DUCTWORK SYSTEMS**

- .1 50 mm (2") high stencilled letters and directional arrows 150 mm (6") long x 50 mm (2") high.
- .2 Colours: Black, or co-ordinated with base colour to ensure strong contrast.

**2.8 VALVES, CONTROLLERS**

- .1 Brass tags with 15 mm (1/2") stamped identification data filled with black paint.
- .2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

- .3 Provide adhesive coloured tab (max. size 15 mm) indication on ceiling to locate valves/equipment above. Same applies to grid. Colour to be approved by consultant.

## **2.9 CONTROLS COMPONENTS IDENTIFICATION**

- .1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.
- .2 Inscriptions to include function and (where appropriate) fail-safe position.
- .3 Provide equipment identification and/or indication on ceiling to locate devices/equipment above ceiling. Install identification on grid. Colours to be approved by consultant.

## **2.10 LANGUAGE**

- .1 Identification to be in English.

## **Part 3 Execution**

### **3.1 TIMING**

- .1 Provide identification only after all painting specified has been completed.

### **3.2 INSTALLATION**

- .1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.
- .2 Provide ULC and/or CSA registration plates as required by respective agency.

### **3.3 NAMEPLATES**

- .1 Locations:
  - .1 In conspicuous location to facilitate easy reading and identification from operating floor.
- .2 Standoffs:
  - .1 Provide for nameplates on hot and/or insulated surfaces.
- .3 Protection
  - .1 Do not paint, insulate or cover in any way.

### **3.4 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS**

- .1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels not more than 1.7 m (5'-8") intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.
- .2 Adjacent to each change in direction.
- .3 At least once in each small room through which piping or ductwork passes.
- .4 On both sides of visual obstruction or where run is difficult to follow.
- .5 On both sides of separations such as walls, floors, partitions.

- .6 Where system is installed in pipe chases, ceiling spaces, galleries, other confined spaces, at entry and exit points, and at each access opening.
- .7 At beginning and end points of each run and at each piece of equipment in run.
- .8 At point immediately upstream of major manually operated or automatically controlled valves, dampers, etc. Where this is not possible, place identification as close as possible, preferably on upstream side.
- .9 Identification to be easily and accurately readable from usual operating areas and from access points.
  - .1 Position of identification to be approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

### **3.5 VALVES, CONTROLLERS**

- .1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.
- .2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Consultant. Provide one copy (reduced in size if required) in each operating and maintenance manual.
- .3 Number valves in each system consecutively. Where existing numbering system is installed start new numbering system at 100.

**END OF SECTION**

**Part 1            General**

**1.1                GENERAL**

- .1      TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do all other work as specified in this section including all air handling systems and equipment, all plumbing systems and equipment and all temperature controls system, building automation systems and equipment.
- .2      This contractor must co-ordinate their work with that of the TAB contractor.

**1.2                QUALIFICATIONS OF TAB AGENCIES**

- .1      Names of all personnel it is proposed to perform TAB to be submitted to and approved by Consultant within 30 days of start of work.
- .2      Provide documentation confirming qualifications, successful experience.
- .3      Only the following NEBB (National Environmental Balancing Bureau) TAB contractors may quote:
  - .1      Air Audit Inc.  
110 Turnbull Court, Unit 11  
Cambridge, Ontario  
N1T 1K6  
(519) 740-0871
  - .2      Air Velocities Control Ltd.  
100 Premium Way  
Mississauga, Ontario  
L5B 1A2  
(905) 279-4433
  - .3      Flowset Balancing Ltd.  
431 Willis Dr.  
Oakville, Ontario  
L6L 4V6  
(416) 410-9793
  - .4      Air Adjustments & Balancing Inc.  
P.O. Box 176,  
Schomberg, Ontario  
LOG 1T0  
(416) 254-3004

### **1.3 PURPOSE OF TAB**

- .1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average (95% design) and low (75% of design) loads using actual or simulated loads. TAB contractor to perform equipment evaluation upon start up and once during each season in the first year of operation.
- .2 Adjust and regulate equipment and systems so as to meet specified performance requirements and to achieve specified interaction with all other related systems under all normal and emergency loads and operating conditions. Confirm all equipment interlocks and functions of associated systems.
- .3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges and temperatures. Refer to BAS for system operating functions.

### **1.4 EXCEPTIONS**

- .1 TAB of systems and equipment regulated by codes, standards to be to satisfaction of authority having jurisdiction.

### **1.5 CO-ORDINATION**

- .1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule so as to ensure completion before acceptance of project.
- .2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems. Co-ordinate with other trades to ensure all systems are interlocked as indicated elsewhere prior to TAB.

### **1.6 PRE-TAB REVIEW**

- .1 Review contract documents before project construction is started and confirm in writing to Consultant adequacy of provisions for TAB and all other aspects of design and installation pertinent to success of TAB.
- .2 Review specified standards and report to Consultant in writing all proposed procedures which vary from standard.
- .3 During construction, co-ordinate location and installation of all TAB devices, equipment, accessories, measurement ports and fittings.
- .4 During construction indicate all tolerances of piping, ductwork etc conforms to specifications.

### **1.7 START-UP**

- .1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.
- .2 Follow special start-up procedures specified elsewhere in the Mechanical Division.

### **1.8 OPERATION OF SYSTEMS DURING TAB**

- .1 Operate systems for length of time required for TAB and as required by Consultant for verification of TAB reports.

## **1.9 START OF TAB**

- .1 Notify Consultant in writing 3 days prior to start of TAB.
- .2 Start TAB only when building is essentially completed, including:
  - .1 Installation of ceilings, doors, windows, other construction affecting TAB.
  - .2 Application of weather-stripping, sealing, caulking.
  - .3 All pressure, leakage, other tests specified elsewhere in the Mechanical Division.
  - .4 All provisions for TAB installed and operational.
  - .5 Start-up, verification for proper, normal and safe operation of all mechanical and associated electrical and control systems affecting TAB including but not limited to:
    - .1 Proper thermal overload protection in place for electrical equipment.
    - .2 Air systems:
      - .1 Filters in place, clean.
      - .2 Duct systems clean.
      - .3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.
      - .4 Correct fan rotation.
      - .5 Fire, smoke, volume control dampers installed and open.
      - .6 Coil fins combed, clean.
      - .7 Access doors, installed, closed.
      - .8 All outlets installed, volume control dampers open.
    - .3 Liquid systems:
      - .1 Flushed, filled, vented.
      - .2 Correct pump rotation.
      - .3 Strainers in place, baskets clean.
      - .4 Isolating and balancing valves installed, open.
      - .5 Calibrated balancing valves installed, at factory settings.
      - .6 Chemical treatment systems complete, operational.
      - .7 Control valves are properly piped.
      - .8 Coils and radiation are properly piped.
      - .9 BAS in operation.

## **1.10 APPLICATION TOLERANCES**

- .1 Do TAB to following tolerances of design values:
  - .1 HVAC systems: plus 10%, minus 5%.
  - .2 Hydronic systems: plus or minus 10%.

**1.11 ACCURACY TOLERANCES**

- .1 Measured values to be accurate to within plus or minus 2% of actual values.

**1.12 INSTRUMENTS**

- .1 Prior to TAB, submit to Consultant list of instruments to be used together with serial numbers.
- .2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.
- .3 Calibrate within 3 months of TAB. Provide certificate of calibration to Consultant.

**1.13 SUBMITTALS**

- .1 Submit, prior to commencement of TAB:
  - .1 Proposed methodology and procedures for performing TAB if different from referenced standard.

**1.14 PRELIMINARY TAB REPORT**

- .1 Submit for checking and approval of Consultant, prior to submission of formal TAB report, sample of rough TAB sheets. Include:
  - .1 Details of instruments used.
  - .2 Details of TAB procedures employed.
  - .3 Calculations procedures.
  - .4 Summaries.

**1.15 TAB REPORT**

- .1 Format to be in accordance with NEBB, AABC, or SMACNA.
- .2 TAB report to show all results in SI or imperial units as indicated on plans and to include:
  - .1 Project as-built drawings.
  - .2 System schematics.

**1.16 VERIFICATION**

- .1 All reported results subject to verification by Consultant.
- .2 Provide manpower and instrumentation to verify up to 30% of all reported results.
- .3 Number and location of verified results to be at discretion of Consultant.
- .4 Bear costs to repeat TAB as required to satisfaction of Consultant.

**1.17 SETTINGS**

- .1 After TAB is completed to satisfaction of Consultant, replace drive guards, close all access doors, lock all devices in set positions, ensure sensors are at required settings. Replace all ceiling tile etc.
- .2 Permanently mark all settings to allow restoration at any time during life of facility. Markings not to be eradicated or covered in any way.

**1.18 COMPLETION OF TAB**

- .1 TAB to be considered complete only when final TAB Report received and approved by Consultant.

**1.19 AIR SYSTEMS**

- .1 Standard: TAB to be to most stringent of TAB standards of NEBB, AABC, SMACNA, ASHRAE.
- .2 Do TAB of all systems, equipment, components, controls specified in the Mechanical Division including but not limited to following:
  - .1 Air handling systems and equipment
  - .2 Duct testing to SMACNA standards.
- .3 Qualifications: personnel performing TAB to be current member in good standing of NEBB.
- .4 Quality assurance: Perform TAB under direction of qualified supervisor.
- .5 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.
- .6 Locations of equipment measurements: To include, but not be limited to, following as appropriate:
  - .1 Inlet and outlet of each damper, filter, coil, humidifier, fan, and other equipment causing changes in conditions.
  - .2 At each controller, controlled device.
- .7 Locations of systems measurements to include, but not be limited to, following as appropriate: Each main duct, main branch, sub-branch, grille, register or diffuser.

**1.20 HYDRONIC SYSTEMS**

- .1 Definitions: for purposes of this section, to include low pressure hot water heating, chilled water, condenser water, glycol systems.
- .2 Standard: TAB to be the most stringent of TAB standards of NEBB, AABC, SMACNA, ASHRAE.
- .3 Do TAB of all systems, equipment, components, controls specified in Mechanical Division including but not limited to hydronic equipment testing.



- .4 Qualifications: personnel performing TAB to be current member in good standing of NEBB.
- .5 Quality assurance: perform TAB under direction of qualified supervisor.
- .6 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls: Flow rate, static pressure, pressure drop (or loss), temperature, specific gravity, density, RPM, electrical power voltage, noise, vibration.
- .7 Locations of equipment measurement: To include, but not be limited to, following as appropriate:
  - .1 Inlet and outlet of each heat exchanger (primary and secondary sides), boiler, chiller, coil, humidifier, cooling tower, condenser, pump, PRV, control valve, other equipment causing changes in conditions.
  - .2 At each controller, controlled device.
- .8 Locations of systems measurements to include, but not be limited to, following as appropriate: Supply and return of each primary and secondary loop (main, main branch, branch, sub-branch of all hydronic systems, inlet connection of make-up water.

**1.21 DUCT LEAKAGE TESTING**

- .1 Co-ordinate leakage testing with the sheet metal contractor. TAB contractor will be responsible for all duct testing.
- .2 Duct to be tested in accordance with SMACNA HVAC Duct Leakage Test Manual and as indicated.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 Canadian General Standards Board (CGSB)
  - .1 ASTM C553, Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
  - .2 CGSB 51-GP-52Ma, Vapour Barrier Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
  - .3 CAN/CGSB-51.53, Poly (Vinyl Chloride) Jacketing Sheet, for Insulating Pipes, Vessels and Round Ducts.
- .3 Underwriters Laboratories of Canada (ULC)
  - .1 CAN/ULC-S102, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- .4 American Society for Testing and Materials (ASTM)
  - .1 ASTM C 335, Test Method for Steady State Heat Transfer Properties of Pipe Insulation.
  - .2 ASTM C 921, Practice for Determining the Properties Jacketing Materials for Thermal Insulation.
  - .3 ASTM B 209M, Specification for Aluminum and Aluminum Alloy Sheet and Plate.
- .5 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).
  - .1 ASHRAE Standard 90.1.
- .6 Manufacturer's Trade Associations
  - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.

**1.2 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with general requirements.
- .2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for pipe, fittings, valves and jointing recommendations.

**1.3 INSTALLATION INSTRUCTIONS**

- .1 Submit manufacturer's installation instructions in accordance with general requirements.
- .2 Installation instructions to include procedures to be used, installation standards to be achieved.

**1.4 QUALIFICATIONS**

- .1 Installer to be specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Protect from weather, construction traffic.
- .3 Protect against damage from any source.
- .4 Store at temperatures and conditions required by manufacturer.

**1.6 DEFINITIONS**

- .1 For purposes of this section:
  - .1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
  - .2 "EXPOSED" - will mean "not concealed" as defined herein.

**Part 2 Products**

**2.1 FIRE AND SMOKE RATING**

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

**2.2 INSULATION**

- .1 Mineral fibre as specified herein includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C (75°F) mean temperature when tested in accordance with ASTM C 335.
- .3 Type A-1: Rigid moulded mineral fibre with factory applied vapour retarder jacket.
  - .1 Mineral fibre: to ASTM C553.
  - .2 Jacket: to CGSB 51-GP-52 Ma.
  - .3 Maximum "k" factor: to ASTM C553.
- .4 Materials:
  - .1 All materials must be supplied by the same manufacturer.
  - .2 Acceptable Materials:
    - Fibreglass Canada
    - Knauf
    - Manson
    - Pittsburgh Corning

### **2.3 INSULATION SECUREMENT**

- .1 Tape: Self-adhesive, aluminum, reinforced, 50 mm (2") wide minimum.
- .2 Contact adhesive: Quick setting.
- .3 Canvas adhesive: Washable.

### **2.4 CEMENT**

- .1 Thermal insulating and finishing cement:
  - .1 To ASTM C553.
  - .2 Hydraulic setting or Air drying on mineral wool, to ASTM C 449M.

### **2.5 VAPOUR RETARDER LAP ADHESIVE**

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

### **2.6 INDOOR VAPOUR RETARDER FINISH**

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

### **2.7 JACKETS**

- .1 Polyvinyl Chloride (PVC):
  - .1 One-piece moulded type [and sheet] to CAN/CGSB-51.53 with pre-formed shapes as required.
  - .2 Colours: white.
  - .3 Minimum service temperatures: -20°C (-4°F).
  - .4 Maximum service temperature: 65°C (150°F).
  - .5 Moisture vapour transmission: 0.02 perm.
  - .6 Fastenings:
    - .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
    - .2 Tacks.
    - .3 Pressure sensitive vinyl tape of matching colour.
- .2 Aluminum:
  - .1 To ASTM B 209M.
  - .2 Thickness: 0.50 mm (26 gauge) sheet.
  - .3 Finish: Smooth.
  - .4 Joining: Longitudinal and circumferential slip joints with 50 mm (2") laps.
  - .5 Fittings: 0.50 mm (26 gauge) thick die-shaped fitting covers with factory-attached protective liner.
  - .6 Metal jacket banding and mechanical seals: stainless steel, 20 mm (3/4") wide, 0.50 mm (26 gauge) thick at 300 mm (12") spacing.

**2.8 CAULKING FOR JACKETS**

- .1 Caulking: Silicone clear caulking.

**Part 3 Execution**

**3.1 PRE-INSTALLATION REQUIREMENT**

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

**3.2 INSTALLATION**

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturers' instructions and this specification.
- .3 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
  - .1 Hangers, supports to be outside vapour retarder jacket.
- .4 Supports, Hangers:
  - .1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

**3.3 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES**

- .1 Application: At expansion joints, valves, primary flow measuring elements, flanges, and unions at equipment.
- .2 Design: To permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.
- .3 Insulation:
  - .1 Insulation, fastenings and finishes: same as system.
  - .2 Jacket: As per adjacent insulation.

**3.4 INSTALLATION OF ELASTOMERIC INSULATION**

- .1 Insulation to remain dry at all times. Overlaps to manufacturers instructions. Ensure tight joints.
- .2 Provide vapour retarder as recommended by manufacturer.

**3.5 PIPING INSULATION SCHEDULES**

- .1 Includes valves, valve bonnets, strainers, flanges, and fittings unless otherwise specified.
- .2 Install insulator and jackets to applicable TIAC codes.
- .3 Insulate ends of capped piping with type and thickness indicated for capped service.
- .4 Thickness of insulation to be as listed in following table.
  - .1 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.
  - .2 All storm piping including all vertical and horizontal piping shall be insulated.

| Application           | Type | Pipe sizes through (NPS) and insulation thickness mm (") |                      |                    |                      |                    |
|-----------------------|------|--|----------------------|--------------------|----------------------|--------------------|
|                       |      | to<br>25 (1")  | 32 (1¼")<br>40 (1½") | 50 (2")<br>80 (3") | 105 (4")<br>150 (6") | 200 (8")<br>& over |
| Domestic Water Piping | A-1  | 25 (1")  | 25 (1")              | 40 (1½")           | 40 (1½")             | 40 (1½")           |
| Horizontal Cast Iron  | A-1  | N/A  | N/A                  | 25 (1")            | 25 (1")              | 25 (1")            |
| Sanitary Piping       |      |  |                      |                    |                      |                    |
| Trap Primer Piping    | A-1  | 15 (½")  | 15 (½")              | 25 (1")            |                      |                    |

- .5 Finishes: Conform to the following table:

| <u>Application</u>     | <u>Piping</u> | <u>Valves &amp; Fittings</u> |
|------------------------|---------------|------------------------------|
| Exposed indoors        | PVC           | PVC                          |
| Exposed in mech. rooms | PVC           | PVC                          |
| Concealed indoors      | N/A           | PVC                          |
| Outdoors               | Aluminum      | Aluminum                     |

- .6 Connection: To appropriate TIAC code.
- .7 Finish attachments: SS bands, @ 150 mm (6") oc. seals: closed.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ANSI/ASME B16.15, Cast Copper Alloy Threaded Fittings, Classes 125 and 250.
- .3 ANSI B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
- .4 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
- .5 ANSI B16.24, Cast Copper Alloy, Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500, and 2500.
- .6 ASTM B88M, Specification for Seamless Copper Water Tube (Metric).
- .7 MSS-SP-70, Cast Iron Gate Valves, Flanged and Threaded Ends.
- .8 MSS-SP-71, Cast Iron Swing Check Valves, Flanged and Threaded Ends.
- .9 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.

**1.2                SHOP DRAWINGS**

- .1 Submit shop drawing data in accordance with general requirements.

**1.3                MAINTENANCE DATA**

- .1 Provide maintenance data for incorporation into manual specified in general requirements.

**Part 2            Products**

**2.1                PIPING**

- .1 Domestic hot, cold and recirculation systems, within building.
  - .1 Above ground: copper tube, hard drawn, type L: to ASTM B88M.

**2.2                FITTINGS**

- .1 Bronze pipe flanges and flanged fittings, Class 150 and 300: to ANSI B16.24.
- .2 Cast bronze threaded fittings, Class 125 and 250: to ANSI/ASME B16.15.
- .3 Cast copper, solder type: to ANSI B16.18.
- .4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.
- .5 Tee drill NPS 25 mm (1") and larger.

### **2.3 JOINTS**

- .1 Solder: 95/5.
- .2 Teflon tape: for threaded joints.
- .3 Dielectric connections between dissimilar metals: dielectric fitting to ASTM F1545, complete with thermoplastic liner.
- .4 Tee drill fittings shall be brazed with silver solder, 45% Ag - 15% Cu or copper phosphorous, 95% Cu, 5% P and non-corrosive flux.

### **2.4 VALVES**

- .1 All valves shall be of commercial grade and of same manufacturer, Lead-Free.
- .2 Acceptable materials:  
Milwaukee  
Crane  
Kitz

### **2.5 BALL VALVES**

- .1 All valves shall be of commercial grade and of same manufacturer.
- .2 NPS 80 mm (3") and under, soldered:
  - .1 To ANSI B16.18, Class 150.
  - .2 Bronze body, full port stainless steel ball, PTFE Teflon adjustable packing, brass gland and PTFE Teflon seat, steel lever handle, with NPT to copper adaptors.

### **2.6 SWING CHECK VALVES**

- .1 NPS 50 mm (2") and under, soldered:
  - .1 To MSS SP-80, Class 125, 860 kPa (125 psi), bronze body, bronze swing disc, screw in cap, regrindable seat.
- .2 NPS 50 mm (2") and under, screwed:
  - .1 To MSS SP-80, Class 125, 860 kPa (125 psi), bronze body, bronze swing disc, screw in cap, regrindable seat.
- .3 NPS 65 mm (2 1/2") and over, flanged:
  - .1 To MSS SP-71, Class 125, 860 kPa (125 psi), cast iron body, flat flange faces, [regrind] [renewable] seat, bronze disc, bolted cap.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install in accordance with Provincial Plumbing Code and local authority having jurisdiction.
- .2 Cut square, ream and clean tubing and tube ends, clean recesses of fittings and assemble without binding.



- .3 Assemble all piping using fittings manufactured to ANSI standards.
- .4 Install tubing close to building structure to minimize furring, conserve headroom and space. Group exposed piping and run parallel to walls.
- .5 Install CWS piping below and away from HWS and HWC and all other hot piping so as to maintain temperature of cold water as low as possible.
- .6 Connect to fixtures and equipment in accordance with manufacturers instructions unless otherwise indicated.
- .7 Bent tubing is not acceptable.

### **3.2 VALVES**

- .1 Isolate equipment, fixtures and branches with ball valves.
- .2 Balance recirculation system using lockshield globe valves. Mark settings and record on as-built drawings on completion.

### **3.3 PRESSURE TESTS**

- .1 Conform to requirements of general requirements.
- .2 Test pressure: greater of 1½ times maximum system operating pressure or 860 kPa (125 psi).

### **3.4 FLUSHING AND DISINFECTING**

- .1 Maintain testable RP backflow preventor between municipal water and new plumbing system.
- .2 Ensure a minimum of 90% of plumbing fixtures are installed.
- .3 Flush water mains through available outlets with a sufficient flow of potable water to produce a velocity of 1.5 m/s, within pipe for 10 min, or until foreign materials have been removed and flushed water is clear with backflow protection.
- .4 Provide connections and pumps for flushing as required.
- .5 Open and close valves, and operate fixtures to ensure thorough flushing.
- .6 When flushing has been complete to satisfaction of Consultant introduce a strong solution of Chlorine into water system and ensure that it is distributed throughout entire system.
- .7 Rate of chlorine application to be proportional to rate of water entering pipe.
- .8 Chlorine injection to be close to point of filling water main or at building water service and to occur simultaneously.
- .9 Confirm adequate chlorine residual not less than 50 ppm has been obtained, leave system charged with chlorine solution for 24 h. After 24 h, further samples shall be taken to ensure that there is still not less than 10 ppm of chlorine residual remaining throughout system.
- .10 Upon 10 ppm confirmation and 24 hr elapsed time flush line to remove chlorine solution.

- .11 Measure chlorine residuals at extreme end of pipeline being tested.
- .12 Perform bacteriological tests on water main, after chlorine solution has been flushed out. Take samples daily for minimum of two days. Should contamination remain or reoccur during this period, repeat disinfecting procedure. Specialist contractor shall submit certified copy of test results.
- .13 Take water samples at remote fixtures and service connections.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ASTM A126, Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
- .3 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.
- .4 PDI-WH201, Water Hammer Arresters.
- .5 CAN/CSA-B64 Series, Backflow Preventers and Vacuum Breakers.

**1.2                SUBMITTALS**

- .1 Submit shop drawings and product data in accordance with general requirements.
- .2 For shop drawings, indicate dimensions, construction details and materials.
- .3 For product data, indicate dimensions, construction details and materials for all items specified herein.

**1.3                MAINTENANCE DATA**

- .1 Provide maintenance data for incorporation into manual specified in general requirements.
- .2 Data to include:
  - .1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.
  - .2 Details of operation, servicing and maintenance.
  - .3 Recommended spare parts list.

**Part 2            Products**

**2.1                VACUUM BREAKERS**

- .1 To CAN/CSA-B64 Series.
- .2 Atmospheric vacuum breaker (A-VB):
  - .1 Acceptable materials:  
Watts 288A  
Conbraco 38-103 Series  
Wilkins 35
- .3 Hose connection vacuum breaker (HCVB):
  - .1 Acceptable materials:  
Watts Series 8  
Conbraco 38-304-AS  
Wilkins BFP-8

- .4 Laboratory faucet intermediate vacuum breaker (LFVB):
  - .1 Acceptable materials:
    - Watts N-LF9
    - Conbraco 38-502-01

## **2.2 PRESSURE REGULATORS**

- .1 Capacity: as indicated.
  - .1 Inlet pressure: 1034 kPa (150 psi).
  - .2 Outlet pressure: 41 kPa (5.9 psi).
- .2 Up to NPS 40 mm (1 1/2") bronze bodies, screwed: to ASTM B62.
  - .1 Acceptable material:
    - Watts Series 25AUB (1/2" - 2")
- .3 NPS 50 mm (2") and over, semi-steel bodies, Class 125, flanged: to ASTM A126, Class [B].
  - .1 Acceptable materials:
    - Watts PV-10
    - Conbraco 36 Series
- .4 Semi-steel spring chambers with bronze trim.
  - .1 Acceptable materials:
    - Watts PV-10
    - Conbraco 36 Series

## **2.3 STRAINERS**

- .1 860 kPa (125 psi), Y type with 20 mm (3/4") mesh, bronze or stainless steel removable screen.
- .2 NPS 50 mm (2") and under, bronze body, screwed ends, with brass cap.
  - .1 Acceptable materials:
    - Watts Series 777SI
    - Crane/Powers
    - Colton 125 YTB
    - Wilkins S Series
- .3 NPS 65 mm (2½") and over, cast iron body, flanged ends, with bolted cap.
  - .1 Acceptable materials:
    - Watts 77F-D (77F-D-FDA for water service)
    - Crane/Powers
    - Colton 125 YTB
    - Wilkins FS Series

**2.4 SOLENOID VALVES**

- .1 Two (2) way normally closed all bronze construction.
- .2 Voltage shall be suitable for controlling function.
- .3 Acceptable material:  
Asco

**2.5 OWNER SUPPLIED EQUIPMENT**

- .1 The mechanical contractor shall supply and install all water, gas, condensate and sanitary piping to the owner supplied equipment. Connection to equipment shall be by this contractor.
- .2 Provide flexible riser stops to all sinks and ball valves to all other equipment.
- .3 Provide backflow preventors on equipment required by the local plumbing inspector.
- .4 Provide flexible gas piping to all gas equipment.
- .5 All equipment in store equipment schedule will be supplied and set in place by Mechanical Contractor unless otherwise noted.
- .6 Coordinate all rough-ins and connection with the supplier on site.
- .7 Owner supplied equipment includes existing relocated equipment.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install in accordance with provincial codes, and local authority having jurisdiction.
- .2 Install in accordance with manufacturer's instructions and as specified.

**3.2 STRAINERS**

- .1 Install with sufficient room to remove basket.
- .2 Strainer size to match pipe size.

**3.3 COMMISSIONING**

- .1 In context of this paragraph, "verify" to include "demonstrate" to Consultant.
- .2 Timing: commission only after start-up deficiencies rectified.
- .3 Access doors: verify size and location relative to items to be services.
- .4 Adjust to suit site conditions, including, but not necessarily limited to, following:
  - .1 Non-freeze wall, ground hydrants:
    - .1 Verify complete drainage.
    - .2 Verify operation of vacuum breaker.
  - .2 Water hammer arrestors:
    - .1 Verify accessibility.

- .3 Backflow preventors, vacuum breakers:
  - .1 Verify installation of correct type to suit application.
  - .2 Adjust as necessary to ensure proper operation.
  - .3 Verify visibility of discharge.
- .4 Pressure regulators:
  - .1 Adjust settings to suit installed locations, required flow rates.
- .5 Hose bibbs, sediment faucets:
  - .1 Verify operation.
- .6 Water make-up assembly:
  - .1 Verify operation.
- .7 Water meters:
  - .1 Verify operation.
- .8 Pipeline strainers:
  - .1 Verify accessibility of basket.
  - .2 Clean out during commissioning until system clean.
- .5 Commissioning reports:
  - .1 Record all results on approved report forms.
  - .2 Include signature of tester and supervisor.
  - .3 To be countersigned by Consultant.
- .6 Verification:
  - .1 Notify Consultant 48 h before commencing tests.
  - .2 All tests and procedures to be witnessed by Consultant.
  - .3 All reported results subject to verification by consultant.
- .7 Training:
  - .1 Train O&M personnel in start-up, operation, monitoring, servicing, maintenance, and shut-down procedures.
- .8 Demonstrations:
  - .1 Demonstrate full compliance with Design Criteria.
  - .2 Demonstrations also to show completeness of O&M personnel training.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ASTM A126, Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
- .3 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.
- .4 CAN/CSA-B79, Commercial and Residential Drains and Cleanouts.

**1.2                SUBMITTALS**

- .1 Submit shop drawings and product data in accordance with general requirements.
- .2 For shop drawings, indicate dimensions, construction details and materials.
- .3 For product data, indicate dimensions, construction details and materials for all items specified herein.

**1.3                MAINTENANCE DATA**

- .1 Provide maintenance data for incorporation into manual specified in general requirements.
- .2 Data to include:
  - .1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.
  - .2 Details of operation, servicing and maintenance.
  - .3 Recommended spare parts list.

**Part 2            Products**

**2.1                FLOOR DRAINS**

- .1 Floor drains and trench drains: to CAN/CSA-B79.
- .2 Refer to schedule on drawing.

**2.2                CLEANOUTS**

- .1 Cleanout plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.
- .2 Wall access: face or wall type, stainless steel round cover with flush head securing screws, bevelled edge frame complete with anchoring lugs.
  - .1 Acceptable material:  
Zurn ZSS-1469  
Mifab C1400-RD  
Watts CO-480-RD-3  
Jay R. Smith 4710

- .3 Floor access: rectangular, round, as indicated, cast iron body and frame with adjustable secured 15 mm (½") thick flush mounted heavy duty nickel bronze top and:  
Plugs: bolted bronze with neoprene gasket.
  - .1 Cover for unfinished concrete floors: nickel bronze round, gasket, vandal-proof screws.
    - .1 Acceptable material:  
Zurn ZN-1400 – HD or Zurn ZZN-1612  
Mifab C1100-XR-6  
Watts CO-200-RX-1-6  
Jay R. Smith SQ-4-1753-XNBCO-SP-U
  - .2 Cover for terrazzo finish: round polished nickel bronze with recessed cover for filling with terrazzo, vandal-proof locking screws.
    - .1 Acceptable materials:  
Zurn ZN-1400-Z  
Mifab C1100-UR-6  
Watts CO-200-U-1-6  
Jay R. Smith SQ-4-1753-NBRT-SP-U
  - .3 Cover for VCT tile and linoleum floors: square polished nickel bronze with 15 mm (1/2") thick flush mounted heavy duty nickel bronze cover, complete with vandal-proof locking screws.
    - .1 Acceptable materials:  
Zurn ZN-1400-T – HD  
Mifab C1100-TS-6  
Watts CO-200-TS-1-6  
Jay R. Smith 4200-U
  - .4 Cover for ceramic tile floors: 15 mm (½") thick heavy duty nickel bronze square, cover complete with gasket, vandal-proof screws, for flush finish.
    - .1 Acceptable material:  
Zurn ZN-1400 – T-HD or Zurn ZZN-1612  
Mifab C1100-S-6  
Watts CO-200-S-1-6  
Jay R. Smith SQ-4-1753-NBCO-SP-U-Y
  - .5 Cover for carpeted floors: round polished nickel bronze with flush cover, complete with stainless steel carpet marker, vandal-proof locking screws.
    - .1 Acceptable materials:  
Zurn ZN-1400-HD-CM or ZN-1612-CM  
Mifab C1100C-S-1-6  
Ancon CO-200-RC-1-6  
Smith  
Contour C3000RMNB



## **2.3 BACKWATER VALVES**

- .1 Coated extra heavy cast iron body with bronze seat, revolving bronze flapper and threaded cover.
  - .1 Acceptable materials:  
Zurn Z-1090  
Mifab BV1200-R  
Watts BV200  
Jay R. Smith 7012
- .2 Access: Surface access.  
Access pipe with cover: maximum 300 mm (12") depth.  
Steel housing with gasketed steel cover.  
Concrete access pit with cover, as indicated.
  - .1 Acceptable material:  
Watts BV-230-R  
Jay R. Smith SQ-7-4680-420-LXH420

## **2.4 TRAP SEAL PRIMERS**

- .1 All brass, with integral vacuum breaker, NPS 15 mm (1/2") solder ends, NPS 15 mm (1/2") drip line connection.
- .2 Acceptable materials:  
Zurn Z-1022  
Mifab  
Watts MS-810  
Jay R. Smith 2699

## **2.5 SOLENOID VALVES (HEADER TRAP SEAL PRIMER)**

- .1 Two (2) way normal closed all bronze construction.
- .2 With integral adjustable cycle time clock control. Timer control to have two dial functions, time between cycles and time held in "open position".
- .3 Suitable for 120V.
- .4 Acceptable material:  
Asco

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install in accordance with provincial codes, and local authority having jurisdiction.
- .2 Install in accordance with manufacturer's instructions and as specified.

### **3.2 CLEANOUTS**

- .1 In addition to those required by code, and as indicated, install at base of all soil and waste stacks.
- .2 Bring cleanouts to wall or finished floor unless serviceable from below floor.
- .3 Building drain cleanout and stack base cleanouts: line size to maximum NPS 100 mm (4").

### **3.3 BACKWATER VALVES**

- .1 Install where indicated.

### **3.4 TRAP SEAL PRIMERS**

- .1 Install for all floor, hub and trench drains and elsewhere, as indicated.
- .2 Install on cold water supply to nearest frequently used plumbing fixture, in concealed space, to approval of Consultant.
- .3 Install soft copper tubing to floor drains above grade and polyethylene piping to floor drains below grade.

### **3.5 COMMISSIONING**

- .1 In context of this paragraph, "verify" to include "demonstrate" to Consultant.
- .2 Timing: commission only after start-up deficiencies rectified.
- .3 Access doors: verify size and location relative to items to be services.
- .4 Adjust to suit site conditions, including, but not necessarily limited to, following:
  - .1 Floor, hub, and trench drains:
    - .1 Verify proper operation of trap primer, flushing features.
    - .2 Verify security and removability of strainers.
  - .2 Cleanouts:
    - .1 Verify covers are gastight, secure, and easily removable.
    - .2 Verify that cleanout rods can probe as far as next cleanout.
  - .3 Backwater valves:
    - .1 Verify accessibility of cover, valve.
  - .4 Trap seal primers:
    - .1 Verify operation.
    - .2 Adjust flow rate to suit site conditions.
  - .5 Acid dilution devices:
    - .1 Verify operation.
- .5 Commissioning reports:
  - .1 Record all results on approved report forms.
  - .2 Include signature of tester and supervisor.
  - .3 To be countersigned by Consultant.

- .6 Verification:
  - .1 Notify Consultant 48 h before commencing tests.
  - .2 All tests and procedures to be witnessed by Consultant.
  - .3 All reported results subject to verification by consultant.
- .7 Training:
  - .1 Train O&M personnel in start-up, operation, monitoring, servicing, maintenance, and shut-down procedures.
- .8 Demonstrations:
  - .1 Demonstrate full compliance with Design Criteria.
  - .2 Demonstrations also to show completeness of O&M personnel training.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ASTM B32, Specification for Solder Metal.
- .3 ASTM B306, Specification for Copper Drainage Tube (DWV).
- .4 ASTM C564, Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- .5 CAN/CSA-B70, Cast Iron Soil Pipe, Fittings and Means of Joining.
- .6 CAN/CSA-B125.3, Plumbing Fittings.

**Part 2 Products**

**2.1 COPPER TUBE AND FITTINGS**

- .1 Above ground sanitary, and vent, maximum 65 mm (2½") Type DWV copper to: ASTM B306.
  - .1 Fittings.
    - .1 Cast brass: to CAN/CSA B125.3.
    - .2 Wrought copper: to CAN/CSA B125.3.
  - .2 Solder: tin-lead, 50:50, to ASTM B32, type 50A.

**2.2 CAST IRON PIPING AND FITTINGS**

- .1 Above ground sanitary, and vent, minimum NPS 80 mm (3"), cast iron to: CAN/CSA-B70.
  - .1 Mechanical joints (vents)
    - .1 Neoprene or butyl rubber compression gaskets: to ASTM C564 or CAN/CSA-B70.
    - .2 Stainless steel clamps (2 band).
  - .2 Mechanical joints (sanitary)
    - .1 Heavy duty neoprene or butyl rubber compression gaskets to: ASTM C1540.
    - .2 Stainless steel clamps (4 band min).

**2.3 VENT FLASHINGS**

- .1 Thaler or equal spun aluminum complete with insulation, cap, and rubber gasket.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install in accordance with Provincial Plumbing Code and local authority having jurisdiction.
- .2 Install above ground piping parallel and close to walls and ceilings to conserve headroom and space, and to grade as indicated.
- .3 Place Cleanouts
  - .1 Where shown on Drawings and near bottom of each stack and riser.
  - .2 At every 90 degree change of direction for horizontal lines.
  - .3 Every 15 m (50') of horizontal run.
  - .4 Extend clean out to accessible surface. Do not place cleanouts in carpeted floors. In such locations, use wall type cleanouts.
- .4 Each fixture and appliance discharging water into sanitary sewer or building sewer lines shall have a seal trap in connection with a complete venting system so gases pass freely to atmosphere with no pressure or syphon condition on water seal.
- .5 Vent entire waste system to atmosphere.
  - .1 Discharge 500 mm (20") above roof. Join lines together in fewest practicable number before projecting above roof.
  - .2 Set back vent lines so they will not pierce roof near an edge or valley.
  - .3 Do not terminate vents within 3600 mm of any building intake and/or exhaust opening.
  - .4 Provide copper vent piping through roof as per detail.
- .6 Use torque wrench to obtain proper tension in cinch bands when using hubless cast iron pipe. Butt ends of pipe against centering flange of coupling.
- .7 Flash pipes passing through roof with 453 g (16 oz) sheet copper flashing fitted snugly around pipes and caulk between flashing and pipe with flexible waterproof compound.
  - .1 Flashing base shall be at least 600 mm (24") square.
  - .2 Flashing may be a 24 kg/m<sup>2</sup> (5 lb/ft<sup>2</sup>) lead flashing fitted around pipes and turned down into pipe 15 mm (½") with turned edge hammered against pipe wall.
- .8 Before piping is covered, conduct tests in presence of Consultant and correct leaks or defective work. Conduct test prior to placing floor slab but after backfill is placed.
  - .1 Do not caulk threaded work.
  - .2 Fill waste and vent system to roof level [a minimum of 3,100 mm - (10')] with water and show no leaks for 2 hours.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ASTM D2235, Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
- .3 ASTM D2564, Specification for Solvent Cements for Poly(Vinyl-Chloride) (PVC) Plastic Piping Systems.
- .4 CAN/CSA-B181.1, ABS Drain, Waste and Vent Pipe and Pipe Fittings.
- .5 CAN/CSA-B181.2, PVC and CPVC Drain, Waste and Vent Pipe and Pipe Fittings.
- .6 CAN/CSA-B182.1, Plastic Drain and Sewer Pipe and Pipe Fittings.

**Part 2 Products**

**2.1 PIPING AND FITTINGS**

- .1 Buried sanitary, and vent piping to:
  - .1 80 mm (3") and smaller: ABS drain waste and vent pipe to CAN/CSA-B181.1.
  - .2 100 mm (4") and larger: SDR-35 PVC drain waste and vent pipe to CAN/CSA-B181.2.
  - .3 Vent piping: any size, PVC-DWV plastic drain and sewer pipe and fittings CAN/CSA-B181.2.
- .2 Above grade sanitary and vent piping:
  - .1 80 mm (3") and smaller: IPEX: PVC-XFR drain waste and vent pipe to CAN/CSA-B181.2.
  - .2 100 mm (4") and larger: IPEX: PVC-XFR drain waste and vent pipe to CAN/CSA-B181.2.
  - .3 Vent piping: any size, IPEX: PVC-XFR plastic drain and sewer pipe and fittings CAN/CSA-B181.2.
- .3 Use plastic XFR – DWV in pipe chase for urinal piping to 1.5 M (5' –0") above finished floor.
- .4 Where piping pierces a fire separation an approved fire stop system to the approval of authority having jurisdiction shall be used.

**2.2 JOINTS**

- .1 Solvent weld for PVC: to ASTM D2564.
- .2 Solvent weld for ABS: to ASTM D2235.

## **2.3 VENT FLASHINGS**

- .1 Thaler Stack Jack spun aluminum complete with insulation, cap, and rubber gasket.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install in accordance with Provincial Plumbing Code and local authority having jurisdiction. Install in accordance with manufacturer's instructions.
- .2 Installation of underground pipe
  - .1 Provide all excavation, bedding, backfill, and compaction.
  - .2 Install materials in accordance with Manufacturer's instructions.
  - .3 Use jacks to make-up gasketed joints.
  - .4 Stabilize unstable trench bottoms.
  - .5 Bed pipe true to line and grade with continuous support from firm base.
    - .1 Bedding depth - 100 mm to 150 mm (4" to 6").
    - .2 Material and compaction to meet ASTM standard noted above.
  - .6 Excavate bell holes into bedding material so pipe is uniformly supported along its entire length. Blocking to grade pipe is forbidden.
  - .7 Trench width at top of pipe -
    - .1 Minimum 450 mm (18") or diameter of pipe plus 300 mm (12"), whichever is greater.
    - .2 Maximum - Outside diameter of pipe plus 600 mm (24").
  - .8 Piping and joints shall be clean and installed according to manufacturer's recommendations. Break down contaminated joints, clean seats and gaskets and reinstall.
  - .9 Do not use back hoe or power equipment to assemble pipe.
  - .10 Initial backfill shall be 300 mm (12") above top of pipe with material specified in referenced ASTM standard.
- .3 Place Cleanouts
  - .1 Where shown on Drawings and near bottom of each stack and riser.
  - .2 At every 90 degree change of direction for horizontal lines.
  - .3 Every 15 m (50 ft) of horizontal run.
  - .4 Extend clean out to accessible surface. Do not place cleanouts in carpeted floors. In such locations, use wall type cleanouts
- .4 Each fixture and appliance discharging water into sanitary sewer or building sewer lines shall have a seal trap in connection with a complete venting system so gases pass freely to atmosphere with no pressure or syphon condition on water seal.

- .5 Before piping is covered, conduct tests in presence of Consultant and correct leaks or defective work. Conduct test prior to placing floor slab but after backfill is placed.
  - .1 Fill waste and vent system a minimum of 1.8 m (6 ft) above finished floor with water and show no leaks for 2 hours.
  - .2 Conduct ball test in presence of consultant to ensure proper grade and clear of obstructions.
- .6 Install solvent welded expansion joints as per manufacturer's recommendation. Care is to taken to accommodate ambient temperatures at time of install.
- .7 Vent entire waste system to atmosphere.
  - .1 Discharge 350 mm (14") above roof. Join lines together in fewest practicable number before projecting above roof.
  - .2 Set back vent lines so they will not pierce roof near an edge or valley.
- .8 Install above ground piping parallel and close to walls and ceilings to conserve headroom and space, and to grade as indicated.

**END OF SECTION**



**Part 1            General**

**1.1                REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.

**1.2                SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with general requirements.
- .2 Indicate:
  - .1 Equipment, including connections, fittings, control assemblies and ancillaries, identifying factory and field assembled.
  - .2 Wiring and schematic diagrams.
  - .3 Dimensions and recommended installation.
  - .4 Pump performance and efficiency curves.

**1.3                CLOSEOUT SUBMITTALS**

- .1 Provide maintenance and engineering data for incorporation into manual specified in general requirements
- .2 Data to include:
  - .1 Manufacturer's name, type, model year, capacity, and serial number.
  - .2 Details of operation, servicing, and maintenance.
  - .3 Recommended spare parts list with names and addresses.

**Part 2            Products**

**2.1                ELEVATOR SUMP AND SIMPLEX PUMP**

- .1 Pump shall be of the centrifugal type and submersible type motor. The unit shall be capable of 2" solid capacity for normal grey water and 2" discharge pipe.
- .2 Pump shall have a capacity of 50 GPM at a total head of 27 feet.
- .3 Pump Motor:
  - .1 Pump motor shall be of the submersible type rated 1/2 horsepower at 3450 RPM. Motor shall be for 60 Hz., three phase, 208 volts (208/3/60). Motor shall be capacitor start, capacitor run type for high starting torque. Motors rated for VFD/continuous duty operation.
  - .2 Starter winding shall be of the open type with Class F insulation, good for 155°C (311°F) maximum operating temperature. Winding housing shall be filled with a clean, high dielectric oil that lubricates bearings and seals and transfers heat from windings and rotor to outer shell. Air-filled motors which do not have the superior heat dissipating capabilities of oil-filled motors shall not be considered equal.

- .3 Motor shall have two heavy-duty ball bearings to support pump shaft and take radial and thrust loads. Ball bearings shall be designed for 50,000 hours B-10 life. Stator shall be bolted to seal plate for easy motor replacement.
- .4 The motor shall have a heat sensor thermostat and overload attached to the top end of the motor windings to stop the motor if the motor winding temperature reaches 200°F. The high temperature shutoff will cause the pump to cease operation, should a control failure cause the pump to run in a dry wet well. The thermostat shall reset automatically when the motor cools to a safe operating temperature.
- .5 The common motor pump shall be of #416 stainless steel threaded to take pump impeller and impeller.
- .6 Motor shall be protected by one rotary mechanical seal. Seal face shall be carbon and ceramic and lapped to a flatness of one light band.
- .4 The pump impeller shall be of the recessed type to provide an open unobstructed passage through the volute for the solids. Impeller shall be engineered thermoplastic (MC/MGF) or ductile iron (MGH) and shall be threaded onto stainless steel shaft.
- .5 All iron castings shall be pre-treated with phosphate and chromic rinse and to be painted before machining, and all machined surfaces exposed to the sewage water to be re-painted. All fasteners to be 302 stainless steel.
- .6 The motor power cord shall be 14 GA SJOW/SJOWA or SOOW. The cable jacket shall be sealed at the motor entrance by means of a rubber compression washer and compression nut. A heat shrink tube filled with epoxy shall seal the outer cable jacket and the individual leads to prevent water from entering the motor housing.
- .7 The pump shall be complete with integral float and power cord.
- .8 High level alarm system with audible signal and test button suited for 120/1/60 with plug. Supply sufficient cord length to nearest plug.
- .9 Sump System
  - .1 Factory assembled 750 mm (30") diameter basin.
  - .2 Packaged basin units with basin and cover designed for off-set mounting.
  - .3 System includes fiberglass basin with anti-floatation ring, epoxy coated steel cover with separate cover for access to each pump and controls, control panel mounting sleeve, galvanized lifting chain and 100 mm (4") inlet.
  - .4 Depth of sump to be as indicated on drawings but not less than 750 mm (30") below inlet pipe.
- .10 Acceptable manufacturers:  
Myers  
Barnes  
Grundfos

**Part 3 Execution**

**3.1 SEWAGE SUMPS AND PUMPS**

- .1 Install in accordance with manufacturers recommendations.
- .2 Clean sump upon completion.
- .3 Confirm operation of pumps, controls, and high level alarms.

**3.2 FIELD QUALITY CONTROL**

- .1 Check power supply.
- .2 Check starter protective devices.
- .3 Start up, check for proper and safe operation.
- .4 Check settings and operation of all hand-off-auto selector switch, operating, safety and limit controls, audible and visual alarms, over-temperature and other protective devices.
- .5 Adjust flow from water-cooled bearings.
- .6 Adjust impeller shaft stuffing boxes, packing glands.
- .7 Demonstrate equipment operation as directed by consultant.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code.

**1.2                SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with general requirements.
- .2 Indicate:
  - .1 Equipment, including connections, fittings, control assemblies and ancillaries, identifying factory and field assembled.
  - .2 Wiring and schematic diagrams.
  - .3 Dimensions and recommended installation.
  - .4 Pump performance and efficiency curves.

**1.3                CLOSEOUT SUBMITTALS**

- .1 Provide maintenance and engineering data for incorporation into manual specified in general requirements
- .2 Data to include:
  - .1 Manufacturer’s name, type, model year, capacity, and serial number.
  - .2 Details of operation, servicing, and maintenance.
- .3 Recommended spare parts list with names and addresses.

**Part 2            Products**

**2.1                AUTOMATIC URINAL FLUSHING SYSTEM**

- .1 Passive Infrared Motion Sensor
  - .1 First of all it can be flush mounted on the ceiling or behind a ceiling grate and still give optimum performance.
  - .2 Sensor shall activate only when the urinals are used. Designed to offer coverage of 360°. Sensor shall “only” pick up someone directly in front of urinals.
  - .3 Sensor also has an activation light to show it has picked up motion. This light can either remain visible or be covered by the plastic slide located on the sensor. This light is useful when setting up the field of activation, however it is normally covered after installation so that it does not attract attention. This sensor has a 16 volt DC @ 50mA rating.

- .2 Solenoid Valve and Assembly
  - .1 The solenoid valve shall be installed in the main supply line.
  - .2 The solenoid valve shall have a 6 watt rating and operates on 24 volts DC. This solenoid valve is a “normally closed” valve so that should the power be interrupted the valve will remain closed. It is also to be a “slow actuating” valve, meaning that it is designed to open and close slowly.
- .3 Programmable Control Unit
  - .1 The control unit shall plug into a 110 volt outlet. The output is 24 volts DC/60Hz/1.2 Amps and shall be CSA approved.
  - .2 Stage 1 is the “inactivity” timer. This stage is programmable from 1 hour to 99 hours. The function of this stage is to flush the urinals within a certain period of time, even if the system is not activated by the motion sensor, when so desired.
  - .3 Stage 2 is a programmable delay time initiated from the activation of the motion sensor. This delay can be programmed from 1 minute to 99 minutes. The purpose of this delay is to prevent the urinals from being flushed after each and every person.
  - .4 Stage 3 is also programmable from 1 to 99 minutes and determines how long the solenoid valve is open to flush the urinals (determines flush volume).
  - .5 Test button shall allow the on site person to test the system to ensure it flushes, in a reduced delay time.
  - .6 The control unit shall also monitor the number of flushes.
- .4 Mounting of all devices and all wiring shall be by this contractor to the standards of Division 16.
- .5 Flow rate: each flush flow rate shall not exceed 1.9 liters (0.5 gallons).
- .6 Acceptable materials:
  - .1 Water Matrix UTC Sentinel (1-800-668-4420)

### **Part 3 Execution**

#### **3.1 FIELD QUALITY CONTROL**

- .1 Manufacturer's factory trained, certified Engineer to start up and commission DHW heaters.
- .2 Check power supply.
- .3 Check starter protective devices.
- .4 Start up, check for proper and safe operation.
- .5 Check settings and operation of all hand-off-auto selector switch, operating, safety and limit controls, audible and visual alarms, over-temperature, and other protective devices.
- .6 Adjust flow from water-cooled bearings.
- .7 Adjust impeller shaft stuffing boxes, packing glands.

- .8 Demonstrate equipment operation as directed by consultant.
- .9 Demonstrate water softener regeneration controls.

**END OF SECTION**

**Part 1            General**

**1.1            GENERAL REQUIREMENTS**

- .1            Conform to Sections of Division 1 and to General Mechanical Requirements Section.

**1.2            REFERENCES**

- .1            All codes, standards, etc. as referenced shall be the latest edition.
- .2            Perform work in accordance with the recommendations of and the requirements of:
  - .1            Local and district bylaws and regulations.
  - .2            N.F.P.A.14 "Installation of Standpipe and Hose Systems".
  - .3            The Ontario Building Code.
  - .4            U.L.C. or Factory Mutual approval for hose, valve, and extinguisher requirements.
  - .5            N.F.P.A.10 "Standard for Portable Fire Extinguishers".
  - .6            The Ontario Fire Code.

**1.3            SUBMITTALS**

- .1            Submit shop drawings and maintenance data in accordance with general requirements.

**1.4            COORDINATION**

- .1            Confirm fire extinguisher cabinet locations and quantities from both architectural and mechanical drawings and report any discrepancies to consultant prior to bid close.
- .2            Coordinate location of cabinet with other trades and provide protection against damage during construction.

**Part 2            Products**

**2.1            MULTI-PURPOSE DRY CHEMICAL EXTINGUISHERS (CLASS ABC)**

- .1            Stored pressure rechargeable type with hose and shut off nozzle, ULC labelled for A, B and C class protection as indicated. Size of extinguishers shall be as follows:
  - .1            Mechanical Rooms      10 lb ABC rating
  - .2            Storage Rooms 10 lb ABC rating
  - .3            Acceptable materials:
    - .1            Wilson & Cousins
    - .2            National

**2.2 IDENTIFICATION**

- .1 Identify extinguishers in accordance with recommendations of NFPA 10.
- .2 Attach tag or label to extinguishers indicating month and year of installation and provide space for the addition of recording service dates.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Provide portable fire extinguisher cabinets and mount in wall during construction. Cabinet to be surface or recessed mounted as indicated on the drawings. Install cabinets so that the door will not obstruct normal traffic when open.
- .2 Hang extinguishers in cabinets with wall mounting bracket.
- .3 Prior to installing the extinguisher cabinets, confirm the mounting height and exact location with the Consultant. Mount extinguisher so top of unit is not more than 1.5 m (5').
- .4 Install wall mounted fire extinguishers complete with wall mounting bracket where indicated and/or directed on site by consultant.
- .5 Caulk perimeter of fire extinguisher cabinets after acceptance.

**3.2 TESTS**

- .1 Fire protection equipment shall be tested to the requirements of NFPA10, NFPA13, NFPA14 and comply with the requirements of the authorities having jurisdiction.

**END OF SECTION**



**Part 1            General**

**1.1                REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 CAN/CSA B45S1, Supplement #1 to CAN/CSA B-45 Series Plumbing Fixtures.
- .3 CAN/CSA-B45 Series, CSA Standards on Plumbing Fixtures.
- .4 CAN/CSA-B125.3, Plumbing Fittings.
- .5 CAN/CSA-B651, Accessible Design for the Built Environment.

**1.2                SHOP DRAWINGS**

- .1 Submit shop drawings and product data in accordance with general requirements.
- .2 Indicate, for all fixtures and trim:
  - .1 Dimensions, construction details, roughing-in dimensions.
  - .2 Factory-set water consumption per flush at recommended pressure.
  - .3 For water closets, urinals: minimum pressure required for flushing.

**1.3                CLOSEOUT SUBMITTALS**

- .1 Provide maintenance data including monitoring requirements for incorporation into manual specified in general requirements.
- .2 Include:
  - .1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.
  - .2 Details of operation, servicing, maintenance.
  - .3 List of recommended spare parts.

**1.4                PRODUCTS INSTALLED BUT NOT SUPPLIED UNDER THIS SECTION**

- .1 Install rough-in for equipment supplied by others, complete with valves on hot and cold water supplies, waste and vent.
- .2 Equipment installed by others.
  - .1 Connect with unions.
- .3 Equipment not installed.
  - .1 Capped with valves for future connection by others.

**Part 2 Products**

**2.1 MANUFACTURED UNITS**

- .1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.
- .2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.3.
- .3 Exposed plumbing brass to be chrome plated.
- .4 Number, locations: Architectural drawings to govern.
- .5 Fixtures in any one location to be product of one manufacturer and of same type.
- .6 Trim in any one location to be product of one manufacturer and of same type.

**2.2 FIXTURE CARRIERS**

- .1 Provide factory manufactured floor-mounted carrier systems for all wall-mounted fixtures.
- .2 Acceptable materials:
  - .1 Zurn
  - .2 Smith
  - .3 Ancon

**2.3 PLUMBING FIXTURES**

- .1 Refer to plumbing fixture schedule on the drawings for fixture type, manufacturer, trim, drainage supply, and accessories.

**2.4 FIXTURE PIPING**

- .1 Hot and cold water supplies to each fixture/faucet:

Chrome plated flexible supply pipes each with screwdriver stop, reducers, escutcheon and chrome plated nipple.

  - .1 Acceptable materials:
    - .1 Delta 47T900 Series
    - .2 McGuire
  - .2 Waste:

Open grid strainer, or pop up as indicated, offset open grid strainer on Barrier-Free fixtures, cast brass fittings with tubular piping, chrome plated, rubber gasket compression fitting, and overflow flange.

    - .1 Acceptable materials:
      - .1 Delta 33T200 Series
      - .2 McGuire

- .3 'P' Traps:
  - Cast brass P trap with cleanout on each fixture not having integral trap.
  - Chrome plated in all exposed places.
  - .1 Acceptable materials:
    - .1 Delta 33T300 Series
    - .2 McQuire

### **Part 3 Execution**

#### **3.1 INSTALLATION**

- .1 Mounting heights:
  - .1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified. Confirm mounting height(s) with consultant prior to rough-in.
  - .2 Wall-hung fixtures: measured from finished floor.
  - .3 Physically Barrier-Free: to comply with most stringent of either NBCC or CAN/CSA B651.
- .2 Drinking fountains:
  - .1 In accordance with CAN/CSA B45S1.

#### **3.2 ADJUSTING**

- .1 Conform to water conservation requirements specified this section.
- .2 Adjustments.
  - .1 Adjust water flow rate to design flow rates.
  - .2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.
  - .3 Adjust flush valves to suit actual site conditions.
  - .4 Adjust urinal flush timing mechanisms.
  - .5 Adjust water cooler, drinking fountain flow stream to ensure no spillage.
  - .6 Automatic flush valves for water closets and urinals: set controls to prevent unnecessary flush cycles during silent hours.
- .3 Checks.
  - .1 Water closets, urinals: flushing action.
  - .2 Aerators: operation, cleanliness.
  - .3 Vacuum breakers, backflow preventors: operation under all conditions.
  - .4 Wash fountains: operation of flow-actuating devices.
  - .5 Refrigerated water coolers: operation, temperature settings.

- .4 Thermostatic controls.
  - .1 Verify temperature settings, operation of control, limit and safety controls.
- .5 Floor and wall mounted fixtures: caulk to floor or wall using silicone caulking to make water tight, colour to match fixture.
- .6 Counter mounted fixtures: lay fixtures into bead of caulking to ensure excess moisture does not reach the cut edge of the countertop. Clean excess caulking off outside the sink.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCE**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 National Air Duct Cleaners Association (NADCA): “Assessment, Cleaning & Restoration of HVAC Systems (ACR).
- .3 National Air Duct Cleaners Association (NADCA): “Understanding Microbial Contamination in HVAC Systems”.
- .4 National Air Duct Cleaners Association (NADCA): “Introduction to HVAC System Cleaning Services”.
- .5 National Air Duct Cleaners Association (NADCA): Standard 05 “Requirements for the Installation of Service Openings in HVAC Systems”.
- .6 Underwriters’ Laboratories (UL): UL Standard 181.
- .7 American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE): Standard 62, "Ventilation for Acceptable Indoor Air Quality".
- .8 Environmental Protection Agency (EPA): "Building Air Quality".
- .9 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA): “HVAC Duct Construction Standards - Metal and Flexible”.
- .10 North American Insulation Manufacturers Association (NAIMA): "Cleaning Fibrous Glass Insulated Air Duct Systems".

**1.2                SPECIAL PROVISIONS**

- .1 Qualification of the HVAC System Cleaning Contractor
  - .1 Membership: The HVAC system cleaning contractor shall be a certified member of the National Air Duct Cleaners Association (NADCA), or shall maintain membership in a nationally recognized non-profit industry organization dedicated to the cleaning of HVAC systems.
  - .2 Certification: The HVAC system cleaning contractor shall have a minimum of one (1) Air System Cleaning Specialist (ASCS) certified by NADCA on a full time basis, or shall have staff certified by a nationally recognized certification program and organization dedicated to the cleaning of HVAC systems.
  - .3 Supervisor Qualifications: A person certified as an ASCS by NADCA, or maintaining an equivalent certification by a nationally recognized program and organization, shall be responsible for the total work herein specified.
  - .4 Experience: The HVAC system cleaning contractor shall submit records of experience in the field of HVAC system cleaning as requested by the owner. Bids shall only be considered from firms, which are regularly engaged in HVAC system maintenance with an emphasis on HVAC system cleaning and decontamination.

- .5 Equipment, Materials and Labor: The HVAC system cleaning contractor shall possess and furnish all necessary equipment, materials and labour to adequately perform the specified services.
  - .1 The contractor shall assure that its employees have received safety equipment training, medical surveillance programs, individual health protection measures, and manufacturer's product and material safety data sheets (MSDS) as required for the work by the U.S. Occupational Safety and Health Administration, and as described by this specification. For work performed in countries outside of the U.S.A., contractors should comply with applicable national safety codes and standards.
  - .2 The contractor shall maintain a copy of all current MSDS documentation and safety certifications at the site at all times, as well as comply with all other site documentation requirements of applicable OSHA programs and this specification
  - .3 Contractor shall submit to the owner all Material Safety Data Sheets (MSDS) for all chemical products proposed to be used in the cleaning process.
- .6 Licensing: The HVAC system cleaning contractor shall provide proof of maintaining the proper license(s), if any, as required to do work in this state. Contractor shall comply with all Federal, state and local rules, regulations, and licensing requirements.

### **1.3 STANDARDS**

- .1 NADCA Standards: The HVAC system cleaning contractor shall perform the services specified here in accordance with the current published standards of the National Air Duct Cleaners Association (NADCA).
  - .1 All terms in this specification shall have their meaning defined as stated in the NADCA Standards.
  - .2 NADCA Standards must be followed with no modifications or deviations being allowed.

### **1.4 DOCUMENTS**

- .1 Mechanical Drawings: The owner shall provide the HVAC system cleaning contractor with one copy of the following documents:
  - .1 Project drawings and specifications.
  - .2 Approved construction revisions pertaining to the HVAC system.
  - .3 Any existing indoor air quality (IAQ) assessments or environmental reports prepared for the facility.

**Part 2 Products**

**2.1 SCOPE OF WORK**

- .1 This section defines the minimum requirements necessary to render HVAC components clean, and to verify the cleanliness through inspection and/or testing in accordance with items specified herein and applicable NADCA Standards.
- .2 The Contractor shall be responsible for the removal of visible surface contaminants and deposits from within the HVAC system in strict accordance with these specifications.
- .3 The HVAC system includes any interior surface of the facility's existing air distribution system associated with unit ventilators. This includes the entire heating, air-conditioning and ventilation system from the points where the air enters the system to the points where the air is discharged from the system. The supply air ducts, fans, fan housing, fan blades, turning vanes, filters, filter housings, reheat coils, and supply diffusers are all considered part of the HVAC system. The HVAC system may also include other components such as dedicated exhaust and ventilation components and make-up air systems.

**2.2 HVAC SYSTEM COMPONENT INSPECTIONS AND SITE PREPARATIONS**

- .1 HVAC System Component Inspections: Prior to the commencement of any cleaning work, the HVAC system cleaning contractor shall perform a visual inspection of the HVAC system to determine appropriate methods, tools, and equipment required to satisfactorily complete this project. The cleanliness inspection should include air handling units and representative areas of the HVAC system components and ductwork. In HVAC systems that include multiple air-handling units, a representative sample of the units should be inspected.
- .2 The cleanliness inspection shall be conducted without negatively impacting the indoor environment through excessive disruption of settled dust, microbial amplification or other debris. In cases where contamination is suspected, and/or in sensitive environments where even small amounts of contaminant may be of concern, environmental engineering control measures should be implemented
  - .1 Damaged system components found during the inspection shall be documented and brought to the attention of the consultant.
- .3 Site Evaluation and Preparations: Contractor shall conduct a site evaluation, and establish a specific, coordinated plan which details how each area of the building will be protected during the various phases of the project.
- .4 Inspector Qualifications: Qualified personnel should perform the HVAC cleanliness inspection to determine the need for cleaning. At minimum, such personnel should have an understanding of HVAC system design, and experience in utilizing accepted indoor environmental sampling practices, current industry HVAC cleaning procedures, and applicable industry standards.

### **2.3 GENERAL HVAC SYSTEM CLEANING REQUIREMENTS**

- .1 Containment: Debris removed during cleaning shall be collected and precautions must be taken to ensure that Debris is not otherwise dispersed outside the HVAC system during the cleaning process.
- .2 Particulate Collection: Where the Particulate Collection Equipment is exhausting inside the building, HEPA filtration with 99.97% collection efficiency for 0.3-micron size (or greater) particles shall be used. When the Particulate Collection Equipment is exhausting outside the building, Mechanical Cleaning operations shall be undertaken only with Particulate Collection Equipment in place, including adequate filtration to contain Debris removed from the HVAC system. When the Particulate Collection Equipment is exhausting outside the building, precautions shall be taken to locate the equipment down wind and away from all air intakes and other points of entry into the building.
- .3 Controlling Odors: Measures shall be employed to control odors and/or mist vapors during the cleaning process.
- .4 Component Cleaning: Cleaning methods shall be employed such that all HVAC system components must be Visibly Clean as defined in applicable standards (see NADCA Standards). Upon completion, all components must be returned to those settings recorded just prior to cleaning operations.
- .5 Air-Volume Control Devices: Dampers and any air-directional mechanical devices inside the HVAC system must have their position marked prior to cleaning and, upon completion, must be restored to their marked position.
- .6 Service Openings: The contractor shall utilize service openings, as required for proper cleaning, at various points of the HVAC system for physical and mechanical entry, and inspection.
  - .1 Contractor shall utilize the existing service openings already installed in the HVAC system where possible.
  - .2 Other openings shall be created by this contractor where needed and they must be created so they can be sealed by this contractor in accordance with industry codes and standards.
  - .3 Closures must not significantly hinder, restrict, or alter the airflow within the system.
  - .4 Closures must be properly insulated to prevent heat loss/gain or condensation on surfaces within the system.
  - .5 Openings must not compromise the structural integrity of the system.
  - .6 Construction techniques used in the creation of openings should conform to requirements of applicable building and fire codes, and applicable NFPA, SMACNA and NADCA Standards.
  - .7 Cutting service openings into flexible duct is not permitted. Flexible duct shall be disconnected at the ends as needed for proper cleaning and inspection.
  - .8 Rigid fiberglass duct systems shall be resealed in accordance with NAIMA recommended practices. Only closure techniques that comply with UL Standard 181 or UL Standard 181a are suitable for fiberglass duct system closures.



- .9 All service openings capable of being re-opened for future inspection or remediation shall be clearly marked and shall have their location reported to the consultant in project report documents.
- .7 Ceiling sections (tile): The contractor may remove and reinstall ceiling sections to gain access to HVAC systems during the cleaning process.
- .8 Air distribution devices (registers, grilles & diffusers): The contractor shall clean all air distribution devices.
- .9 Air handling units, terminal units (VAV, Dual duct boxes, etc.), blowers and exhaust fan: The contractor shall ensure that supply, return, and exhaust fans and blowers are thoroughly cleaned. Areas to be cleaned include blowers, fan housings, plenums (except ceiling supply and return plenums), scrolls, blades, or vanes, shafts, baffles, dampers and drive assemblies. All visible surface contamination deposits shall be removed in accordance with NADCA Standards. Contractor shall:
  - .1 Clean all air handling units (AHU) internal surfaces, components and condensate collectors and drains.
  - .2 Assume that a suitable operative drainage system is in place prior to beginning wash down procedures.
  - .3 Clean all coils and related components, including evaporator fins.
- .10 Duct Systems: This Contractor shall:
  - .1 Create service openings in the system as necessary in order to accommodate cleaning of otherwise inaccessible areas. Provide access doors specified in duct accessories to replace openings.
  - .2 Mechanically clean all duct systems to remove all visible contaminants, such that the systems are capable of passing Cleaning Verification Tests (see NADCA Standards).

## **2.4 HEALTH AND SAFETY**

- .1 Safety Standards: Cleaning contractors shall comply with applicable federal, state, and local requirements for protecting the safety of the contractor's employees, building occupants, and the environment. In particular, all applicable standards of the Occupational Safety and Health Administration (OSHA) shall be followed when working in accordance with this specification.
- .2 Occupant Safety: No processes or materials shall be employed in such a manner that they will introduce additional hazards into occupied spaces.
- .3 Disposal of Debris: All Debris removed from the HVAC System shall be disposed of in accordance with applicable federal, state and local requirements.

## 2.5 MECHANICAL CLEANING METHODOLOGY

- .1 Source Removal Cleaning Methods:
  - .1 The HVAC system shall be cleaned using Source Removal mechanical cleaning methods designed to extract contaminants from within the HVAC system and safely remove contaminants from the facility. It is the contractor's responsibility to select Source Removal methods that will render the HVAC system Visibly Clean and capable of passing cleaning verification methods (See applicable NADCA Standards) and other specified tests, in accordance with all general requirements. No cleaning method, or combination of methods, shall be used which could potentially damage components of the HVAC system or negatively alter the integrity of the system.
    - .1 All methods used shall incorporate the use of vacuum collection devices that are operated continuously during cleaning. A vacuum device shall be connected to the downstream end of the section being cleaned through a predetermined opening. The vacuum collection device must be of sufficient power to render all areas being cleaned under negative pressure, such that containment of debris and the protection of the indoor environment are assured.
    - .2 All vacuum devices exhausting air inside the building shall be equipped with HEPA filters (minimum efficiency), including hand-held vacuums and wet-vacuums.
    - .3 All vacuum devices exhausting air outside the facility shall be equipped with Particulate Collection including adequate filtration to contain Debris removed from the HVAC system. Such devices shall exhaust in a manner that will not allow contaminants to re-enter the facility. Release of debris outdoors must not violate any outdoor environmental standards, codes or regulations.
    - .4 All methods require mechanical agitation devices to dislodge debris adhered to interior HVAC system surfaces, such that debris may be safely conveyed to vacuum collection devices. Acceptable methods will include those, which will not potentially damage the integrity of the ductwork, nor damage porous surface materials such as liners inside the ductwork or system components.
- .2 Methods of Cleaning Fibrous Glass Insulated Components:
  - .1 Fibrous glass thermal or acoustical insulation elements present in any equipment or ductwork shall be thoroughly cleaned with HEPA vacuuming equipment, while the HVAC system is under constant negative pressure, and not permitted to get wet in accordance with applicable NADCA and NAIMA standards and recommendations.
  - .2 Cleaning methods used shall not cause damage to fibrous glass components and will render the system capable of passing Cleaning Verification Tests (see NADCA Standards)

- .3 Damaged Fibrous Glass Material:
  - .1 Evidence of damage: If there is any evidence of damage, deterioration, delaminating, friable material, mold or fungus growth, or moisture such that fibrous glass materials cannot be restored by cleaning or resurfacing with an acceptable insulation repair coating, they shall be identified for replacement.
  - .2 Replacement: When requested or specified, Contractor must be capable of remediating exposed damaged insulation in air handlers and/or ductwork requiring replacement.
  - .3 Replacement material: In the event fiber glass materials must be replaced, all materials shall conform to applicable industry codes and standards, including those of UL and SMACNA.
  - .4 Replacement of damaged insulation is not covered by this specification.
- .4 Cleaning of Coils:
  - .1 Any cleaning method may be used which will render the Coil Visibly Clean and capable of passing Coil Cleaning Verification (see applicable NADCA Standards). Coil drain pans shall be subject to Non-Porous Surfaces Cleaning Verification. The drain for the condensate drain pan shall be operational. Cleaning methods shall not cause any appreciable damage to, displacement of, inhibit heat transfer, or erosion of the coil surface or fins, and shall conform to coil manufacturer recommendations when available. Coils shall be thoroughly rinsed with clean water to remove any latent residues.
- .5 Antimicrobial Agents and Coatings:
  - .1 Antimicrobial agents shall only be applied if active fungal growth is reasonably suspected, or where unacceptable levels of fungal contamination have been verified through testing.
  - .2 Application of any antimicrobial agents used to control the growth of fungal or bacteriological contaminants shall be performed after the removal of surface deposits and debris.
  - .3 When used, antimicrobial treatments and coatings shall be applied in strict accordance with the manufacturer's written recommendations and EPA registration listing.
  - .4 Antimicrobial coatings shall be applied according to the manufacturer's written instructions. Coatings shall be sprayed directly onto interior ductwork surfaces, rather than "fogged" downstream onto surfaces.

## 2.6 CLEANLINESS VERIFICATION

- .1 General:
  - .1 Verification of HVAC System cleanliness will be determined after mechanical cleaning and before the application of any treatment or introduction of any treatment-related substance to the HVAC system, including biocidal agents and coatings.

- .2 Visual Inspection:
  - .1 The HVAC system shall be inspected visually to ensure that no visible contaminants are present.
    - .1 If no contaminants are evident through visual inspection, the HVAC system shall be considered clean; however, the consultant reserves the right to further verify system cleanliness through Surface Comparison Testing or the NADCA vacuum test specified in the NADCA standards.
    - .2 If visible contaminants are evident through visual inspection, those portions of the system where contaminants are visible shall be re-cleaned and subjected to re-inspection for cleanliness.
    - .3 NADCA vacuum test analysis shall be performed by a qualified third party experienced in testing of this nature through the HVAC commissioning contract.
- .3 Verification of Coil Cleaning:
  - .1 Cleaning must restore the coil pressure drop to within 10 percent of the pressure drop measured when the coil was first installed. If the original pressure drop is not known, the coil will be considered clean only if the coil is free of foreign matter and chemical residue, based on a thorough visual inspection (see NADCA Standards).

**2.7 PRE-EXISTING SYSTEM DAMAGE**

- .1 Contractor is not responsible for problems resulting from prior inappropriate or careless cleaning techniques of others.

**2.8 POST-PROJECT REPORT**

- .1 At the conclusion of the project, the Contractor shall provide a report to the consultant indicating the following:
  - .1 Success of the cleaning project, as verified through visual inspection and/or gravimetric analysis.
  - .2 Areas of the system found to be damaged and/or in need of repair.

**Part 3 Execution**

- .1 Not Applicable

**END OF SECTION**

**Part 1**

**General**

**1.1**

**REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 Canadian General Standards Board (CGSB)
  - .1 ASTM C553, Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
  - .2 CAN/ULC-S702, Mineral Fiber Thermal Insulation for Buildings.
  - .3 ASTM C612, Mineral Fiber Block and Board Thermal Insulation.
  - .4 CGSB 51-GP-52Ma- [89], Vapour Barrier Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
- .3 Underwriters Laboratories of Canada (ULC).
  - .1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.
- .4 American Society for Testing and Materials (ASTM).
  - .1 ASTM C 335, Test Method for Steady State Heat Transfer Properties of Pipe Insulation.
  - .2 ASTM C 449M, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
  - .3 ASTM B 209M, Specification for Aluminum and Aluminum Alloy Sheet and Plate.
- .5 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).
  - .1 ASHRAE Standard 90.1.
- .6 Manufacturer's Trade Associations.
  - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.

**1.2**

**SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with general requirements.
- .2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for duct jointing recommendations.

**1.3**

**INSTALLATION INSTRUCTIONS**

- .1 Submit manufacturer's installation instructions in accordance with general requirements.
- .2 Installation instructions to include procedures to be used, installation standards to be achieved.

**1.4**

**QUALIFICATIONS**

- .1 Installer to be specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver materials to site in original factory packaging, labeled with manufacturer's name, address.
- .2 Protect from weather and construction traffic.
- .3 Protect against damage from any source.
- .4 Store at temperatures and conditions required by manufacturer.

**1.6 DEFINITIONS**

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

**Part 2 Products**

**2.1 FIRE AND SMOKE RATING**

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

**2.2 INSULATION**

- .1 Mineral fibre as specified herein includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C (75°F) mean temperature when tested in accordance with ASTM C 335.
- .3 Type C-1: Rigid mineral fibre board to ASTM C612, with factory applied vapour retarder jacket to CGSB 51-GP-52Ma:
  - .1 Mineral fibre: to ASTM C553.
  - .2 Jacket: to CGSB 51-GP-52 Ma.
  - .3 Maximum "k" factor: to ASTM C553.
- .4 Type C-2: Mineral fibre blanket to ASTM C553 faced with factory applied vapour retarder jacket to CGSB 51-GP-52Ma:
  - .1 Mineral fibre: to ASTM C553.
  - .2 Jacket: to CGSB 51-GP-52 Ma.
  - .3 Maximum "k" factor: to ASTM C553.

- .5 Manufacturers:
  - .1 All materials must be supplied by the same manufacturer.
  - .2 Acceptable Materials:
    - .1 Johns Manville
    - .2 Fibreglass Canada
    - .3 Knauf
    - .4 Manson
    - .5 Roxul

### **2.3 ACCESSORIES**

- .1 Vapour retarder lap adhesive:
  - .1 Water based, fire retardant type, compatible with insulation.
- .2 Indoor Vapour Retarder Finish:
  - .1 Vinyl emulsion type acrylic, compatible with insulation.
- .3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C 449.
- .4 ULC Listed Canvas Jacket:
  - .1 220 g/m<sup>2</sup> (0.0451 lb/ft<sup>2</sup>) cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C 921.
- .5 Tape: self-adhesive, aluminum, reinforced, 75 mm (3") wide minimum.
- .6 Contact adhesive: quick-setting Duro Dyne 1A-22 or equal.
- .7 Canvas adhesive: washable.
- .8 Tie wire: 1.5 mm (16 gauge) stainless steel.
- .9 Facing: 25 mm (1") stainless steel hexagonal wire mesh stitched on one face of insulation
- .10 Fasteners: weld pins, length to suit insulation, with 40 mm (1½") diameter clips.

## **Part 3 Execution**

### **3.1 PRE-INSTALLATION REQUIREMENTS**

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

### **3.2 INSTALLATION**

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturers instructions and this specification.
- .3 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
  - .1 Hangers, supports to be outside vapour retarder jacket.

- .4 Supports, Hangers in accordance with general requirements.
  - .1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.
- .5 Fasteners: At 300 mm (12") oc. in horizontal and vertical directions, minimum two rows each side.
- .6 Provide rigid insulation for exposed ductwork.

**3.3 DUCTWORK INSULATION SCHEDULE**

- .1 Insulation types and thickness' conform to following table:

| <u>Application</u>   | <u>Type</u> | <u>Thickness</u> |
|--|-------------|------------------|
| Rectangular supply air ducts   | C-1         | 25 mm (1")       |
| Round supply air ducts   | C-2         | 25 mm (1")       |
| Supply, return and exhaust ducts exposed (visible) in space being served | none        |                  |
| Outdoor air intake ductwork and plenums                                  | C-1         | 50 mm (2")       |
| Exhaust plenums dampers and louvres                                      | C-1         | 25 mm (1")       |
| Interior acoustically lined ducts  | none        |                  |
| Last 1.5m of Exhaust duct  | C-1         | 25 mm (1")       |

- .2 Exposed round ducts 600 mm (24") and larger, smaller sizes where subject to abuse:
  - .1 Use TIAC code C-1 insulation, scored to suit diameter of duct.
- .3 Finishes: Conform to following table:

| <u>Application</u>                | <u>Rectangular</u> | <u>Round</u> |
|-----------------------------------|--------------------|--------------|
| Indoor, concealed                 | none               | none         |
| Indoor, exposed                   | Canvas             | Canvas       |
| Outdoor, exposed to Precipitation | Aluminum           | Aluminum     |

**END OF SECTION**



**Part 1            General**

**1.1                REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 Canadian General Standards Board (CGSB)
  - .1 ASTM C553, Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
  - .2 CGSB 51-GP-52Ma, Vapour Barrier Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
  - .3 CAN/CGSB-51.53, Poly (Vinyl Chloride) Jacketing Sheet, for Insulating Pipes, Vessels and Round Ducts.
- .3 Underwriters Laboratories of Canada (ULC)
  - .1 CAN/ULC-S102, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- .4 American Society for Testing and Materials (ASTM)
  - .1 ASTM C 335, Test Method for Steady State Heat Transfer Properties of Pipe Insulation.
  - .2 ASTM C 921, Practice for Determining the Properties Jacketing Materials for Thermal Insulation.
  - .3 ASTM B 209M, Specification for Aluminum and Aluminum Alloy Sheet and Plate.
- .5 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).
  - .1 ASHRAE Standard 90.1.
- .6 Manufacturer's Trade Associations
  - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.

**1.2                SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with general requirements.
- .2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for pipe, fittings, valves and jointing recommendations.

**1.3                INSTALLATION INSTRUCTIONS**

- .1 Submit manufacturer's installation instructions in accordance with general requirements.
- .2 Installation instructions to include procedures to be used, installation standards to be achieved.

**1.4                QUALIFICATIONS**

- .1 Installer to be specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Protect from weather, construction traffic.
- .3 Protect against damage from any source.
- .4 Store at temperatures and conditions required by manufacturer.

**1.6 DEFINITIONS**

- .1 For purposes of this section:
  - .1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
  - .2 "EXPOSED" - will mean "not concealed" as defined herein.

**Part 2 Products**

**2.1 FIRE AND SMOKE RATING**

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

**2.2 INSULATION**

- .1 Mineral fibre as specified herein includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C (75°F) mean temperature when tested in accordance with ASTM C 335.
- .3 Type A-1: Rigid moulded mineral fibre with factory applied vapour retarder jacket.
  - .1 Mineral fibre: to ASTM C553.
  - .2 Jacket: to CGSB 51-GP-52 Ma.
  - .3 Maximum "k" factor: to ASTM C553.
- .4 Type A-3: Flexible unicellular tubular elastomer.
  - .1 Insulation to ASTM C553 with vapour retarder jacket.
  - .2 Jacket: to CGSB 51-GP-52 Ma.
  - .3 Maximum "k" factor: to ASTM C553.
  - .4 To be certified by manufacturer to be free of potential stress corrosion cracking corrodants.

.5 Materials:

- .1 All materials must be supplied by the same manufacturer.
- .2 Acceptable Materials:
  - Fibreglass Canada
  - Knauf
  - Manson
  - Pittsburg Corning

**2.3 INSULATION SECUREMENT**

- .1 Tape: Self-adhesive, aluminum, reinforced, 50 mm (2") wide minimum.
- .2 Contact adhesive: Quick setting.
- .3 Canvas adhesive: Washable.

**2.4 CEMENT**

- .1 Thermal insulating and finishing cement:
  - .1 To ASTM C553.
  - .2 Hydraulic setting or Air drying on mineral wool, to ASTM C 449M.

**2.5 VAPOUR RETARDER LAP ADHESIVE**

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

**2.6 INDOOR VAPOUR RETARDER FINISH**

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

**2.7 OUTDOOR VAPOUR RETARDER FINISH**

- .1 Vinyl emulsion type acrylic, compatible with insulation.
- .2 Reinforcing fabric: Fibrous glass, untreated 305 g/m<sup>2</sup> (0.062 lb/ft<sup>2</sup>).

**2.8 JACKETS**

- .1 Polyvinyl Chloride (PVC):
  - .1 One-piece moulded type [and sheet] to CAN/CGSB-51.53 with pre-formed shapes as required.
  - .2 Colours: white.
  - .3 Minimum service temperatures: -20°C (-4°F).
  - .4 Maximum service temperature: 65°C (150°F).
  - .5 Moisture vapour transmission: 0.02 perm.
  - .6 Fastenings:
    - .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
    - .2 Tacks.
    - .3 Pressure sensitive vinyl tape of matching colour.

**2.9 CAULKING FOR JACKETS**

- .1 Caulking: Silicone clear caulking.

**Part 3 Execution**

**3.1 PRE-INSTALLATION REQUIREMENT**

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

**3.2 INSTALLATION**

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturers' instructions and this specification.
- .3 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
  - .1 Hangers, supports to be outside vapour retarder jacket.
- .4 Supports, Hangers:
  - .1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

**3.3 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES**

- .1 Application: At expansion joints, valves, primary flow measuring elements, flanges, and unions at equipment.
- .2 Design: To permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.
- .3 Insulation:
  - .1 Insulation, fastenings, and finishes: same as system.
  - .2 Jacket: As per adjacent insulation.

**3.4 PIPING INSULATION SCHEDULES**

- .1 Includes valves, valve bonnets, strainers, flanges, and fittings unless otherwise specified.
- .2 Install insulator and jackets to applicable TIAC codes.
- .3 Insulate ends of capped piping with type and thickness indicated for capped service.

.4 Thickness of insulation to be as listed in following table.

.1 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

| Application              | Type | Pipe sizes through (NPS) and insulation thickness mm (") |                      |                    |                      |                    |
|--------------------------|------|--|----------------------|--------------------|----------------------|--------------------|
|                          |      | to<br>25 (1")  | 32 (1¼")<br>40 (1½") | 50 (2")<br>80 (3") | 105 (4")<br>150 (6") | 200 (8")<br>& over |
| Hot Water Heating        | A-1  | 40 (1½")   | 50 (2")              | 50 (2")            | 50 (2")              | 50 (2")            |
| Refrigerant piping       | A-3  | 25 (1")  | 25 (1")              | 25 (1")            | 25 (1")              | 25 (1")            |
| Cooling Coil cond. Drain | A-1  | 25 (1")  | 25(1")               | 25 (1")            | 25 (1")              | 25 (1")            |

.5 Finishes: Conform to the following table:

| Application            | Piping | Valves & Fittings |
|------------------------|--------|-------------------|
| Exposed indoors        | PVC    | PVC               |
| Exposed in mech. rooms | PVC    | PVC               |
| Concealed indoors      | N/A    | PVC               |

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 Canadian Standards Association (CSA).
  - .1 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code.
- .3 American Society for Testing and Materials (ASTM).
  - .1 ASTM A47/A47M, Specification for Ferritic Malleable Iron Castings.
  - .2 ASTM A278/A278M, Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures up to 650°F (350°C).
  - .3 ASTM A516/A516M, Specification for Pressure Vessel Plates, Carbon Steel, for Moderate - and Lower - Temperature Service.
  - .4 ASTM A536, Specification for Ductile Iron Castings.
  - .5 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.
- .4 American Society of Mechanical Engineers (ASME).
  - .1 ANSI/ASME, Boiler and Pressure Vessels Code (BPVC).

**1.2                SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings and product data in accordance with general requirements.
- .2 Indicate on product data expansion tanks, air vents, separators, valves, strainers.

**1.3                CLOSEOUT SUBMITTALS**

- .1 Submit maintenance data in accordance with general requirements.

**Part 2            Products**

**2.1                PIPE LINE STRAINER**

- .1 NPS 15 mm to 50 mm (1/2" to 2"): bronze body to ASTM B62, screwed connections.
- .2 NPS 65 mm to 300 mm (2 1/2" to 12"): cast steel body to ASTM A278M, Class 30, flanged connections.
- .3 NPS 50 mm to 300 mm (2" to 12"): T type with malleable iron body to ASTM A47M, grooved ends.
- .4 Blowdown connection: NPS 25 mm (1").
- .5 Screen: stainless steel with 1.19 mm (50 mil) perforations.
- .6 Working pressure: 860 kPa (125 psi).

**Part 3 Execution**

**3.1 GENERAL**

- .1 Install as indicated and to manufacturer's recommendations.
- .2 Run drain lines (and blow off connections) to terminate above nearest drain.
- .3 Maintain proper clearance to permit service and maintenance.
- .4 Should deviations beyond allowable clearances arise, request and follow Consultant's directive.
- .5 Check shop drawings for conformance of all tappings for ancillaries and for equipment operating weights.

**3.2 STRAINERS**

- .1 Install in horizontal or down flow lines.
- .2 Ensure clearance for removal of basket.
- .3 Install ahead of each pump.
- .4 Install ahead of each automatic control valve and as indicated.
- .5 Strainer size to match pipe size.

**END OF SECTION**

**Part 1            General**

**1.1            RELATED SECTIONS**

- .1            HVAC Water Treatment Section.

**1.2            REFERENCES**

- .1            All codes, standards, etc. as referenced shall be the latest edition.
- .2            Canadian Standards Association (CSA).
  - .1            CSA W47.1, Certification of Companies for Fusion Welding of Steel.
- .3            American National Standards Institute (ANSI).
  - .1            ANSI/ASME B16.1, Gray Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800.
  - .2            ANSI/ASME B16.3, Malleable-Iron Threaded Fittings, Classes 150 and 300.
  - .3            ANSI/ASME B16.5, Pipe Flanges and Flanged Fittings: NPS½ through NPS24 Metric/Inch.
  - .4            ANSI/ASME B16.9, Factory-Made Wrought Steel Buttwelding Fittings.
  - .5            ANSI B18.2.1, Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series).
  - .6            ANSI/ASME B18.2.2, Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series).
  - .7            ANSI/AWWA C111/A21.11, Rubber Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- .4            American Society for Testing and Materials (ASTM).
  - .1            ASTM A47/A47M, Specification for Ferritic Malleable Iron Castings.
  - .2            ASTM A53/A53M, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
  - .3            ASTM A536, Specification for Ductile Iron Castings.
  - .4            ASTM B61, Specification for Steam or Valve Bronze Castings.
  - .5            ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.
- .5            Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).
  - .1            MSS-SP-67, Butterfly Valves.
  - .2            MSS-SP-70, Cast Iron Gate Valves, Flanged and Threaded Ends.
  - .3            MSS-SP-71, Cast Iron Swing Check Valves, Flanged and Threaded Ends.
  - .4            MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.
  - .5            MSS-SP-85, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.



### **1.3 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with general requirements.
- .2 Indicate on manufacturers catalogue literature the following:
  - .1 Piping
  - .2 Valves
  - .3 Accessories

### **1.4 CLOSEOUT SUBMITTALS**

- .1 Provide maintenance data for incorporation into manual specified in general requirements.

## **Part 2 Products**

### **2.1 PIPE**

- .1 Steel pipe: to ASTM A53/A53M, Grade B, as follows:
  - .1 NPS 150 mm (6") and smaller: Schedule 40.
- .2 Final connection to copper heating elements.
  - .1 Type "L" copper with 95/5 solder joints and dielectric couplings. Maximum length 600 mm (24").

### **2.2 PIPE JOINTS**

- .1 NPS 50 mm (2") and under: screwed fittings with pulverized lead paste.
- .2 NPS 65 mm (2½") and over: welding fittings and flanges to CSA W47.1.
- .3 Flanges: plain or raised face, slip-on.
- .4 Flange gaskets: suitable for hydronic heating up to 110°C (220°F).
- .5 Pipe thread: taper.
- .6 Bolts and nuts: to ANSI B18.2.1 and ANSI/ASME B18.2.2.

### **2.3 FITTINGS**

- .1 Screwed fittings: malleable iron, to ANSI/ASME B16.3, Class 150.
- .2 Pipe flanges and flanged fittings:
  - .1 Cast iron: to ANSI/ASME B16.1, Class 125.
  - .2 Steel: to ANSI/ASME B16.5.
- .3 Butt-welding fittings: steel, to ANSI/ASME B16.9.
- .4 Unions: malleable iron, to ASTM A47/A47M and ANSI/ASME B16.3.

## 2.4 VALVES MANUFACTURERS

- .1 All valves shall be of commercial grade and of same manufacturer.
- .2 Acceptable Manufacturers:
  - .1 Newman Hattersley Canada Ltd.
  - .2 Jenkins/Crane
  - .3 Milwaukee
  - .4 Toyo
  - .5 Kitz

## 2.5 VALVES

- .1 Connections:
  - .1 NPS 50 mm (2") and smaller: screwed ends.
  - .2 NPS 65 mm (2 ½") and larger: flanged ends.
- .2 Gate valves: Application: Isolating equipment, control valves, pipelines:
  - .1 NPS 50 mm (2") and under:
    - .1 Mechanical Rooms: Class 125, rising stem, solid wedge disc.
    - .2 Elsewhere: Class 125, non-rising stem, solid wedge disc.
  - .2 NPS 65 mm (2 1/2") and over:
    - .1 Mechanical Rooms:
      - .1 Rising stem, solid wedge disc, bronze trim.
        - .1 Operators: handwheel.
      - .2 Non-rising stem, solid wedge disc, bronze trim.
        - .1 Operators: handwheel.
- .3 Butterfly valves: Application: Isolating each cell or section of multiple component equipment and where indicated.
  - .1 NPS 65 mm (2 1/2") and over: Flanged ends.
- .4 Globe valves: Application: Throttling, flow control, emergency bypass:
  - .1 NPS 50 mm (2") and under:
    - .1 With PTFE disc, as specified. Bronze.
  - .2 NPS 65 mm (2 1/2") and over:
    - .1 With solid bronze disc, bronze trim, cast iron body.
- .5 Drain valves: Gate, Class 125, non-rising stem, solid wedge disc, with chain and cap.
- .6 Swing check valves:
  - .1 NPS 50 mm (2") and under:
    - .1 Class 150, swing, with PTFE disc, as specified. Bronze. Jenkins 4475TJ.
  - .2 NPS 65 mm (2 1/2") and over:
    - .1 Flanged or Grooved ends, Bronze trim, Cast Iron: Gate, Globe, Check.

- .7 Ball valves:
  - .1 NPS 80 mm (3") and under:
    - .1 Body and cap: cast high tensile bronze to ASTM B62.
    - .2 Pressure rating: Class 125, 860 kPa (125 psi) steam, WP = 1.4 MPa (203 psi) WOG.
    - .3 Connections:
      - .1 NPS 50 mm (2") and under screwed ends to ANSI B1.20.1 and with hex. shoulders.
      - .2 NPS 65 mm (2½") and over flanged ends.
    - .4 Stem: stainless steel tamperproof ball drive.
    - .5 Ball and seat: replaceable stainless steel solid ball and teflon seats.
    - .6 Operator: removable lever handle.
    - .7 Extended handles on chilled water valves.
    - .8 Full port.

## 2.6 BALANCING VALVES

- .1 Size 15 mm (1/2") to 50mm (2"): Bronze body, brass ball, NPT connections and variable orifice.
- .2 Size 65 mm (2 1/2") to larger: Cast iron body, raised flange connections, glove style with brass plug.
- .3 Differential pressure readout ports with internal EPT inserts and check valves, 6 mm (¼")NPT tapped drain/purge ports, memory stop and calibrated nameplate.
- .4 Acceptable materials:
  - .1 Bell & Gossett Circuit Setters
  - .2 Armstrong
  - .3 Taco
  - .4 Tour & Anderson
  - .5 Oventrop

## 2.7 AUTOMATIC AIR VENT

- .1 Industrial float vent: cast iron body and NPS 15 mm (1/2") connection and rated at 860 kpa (125 psi) working pressure.
- .2 Float: solid material suitable for 115°C (240°F) working temperature.
- .3 Plastic vents are not acceptable.
- .4 Acceptable materials:
  - .1 Maid-O-Mist No. 67
  - .2 Spirax Sarco

**Part 3 Execution**

**3.1 PIPING INSTALLATION**

- .1 Installation shall be by a licensed pipe fitter.
- .2 Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.
- .3 Install concealed pipes close to building structure to keep furring space to minimum. Install to conserve headroom and space. Run exposed piping parallel to walls. Group piping wherever practical.
- .4 Slope piping in direction of drainage and for positive venting.
- .5 Use eccentric reducers at pipe size change installed to provide positive drainage or positive venting.
- .6 Provide clearance for installation of insulation and access for maintenance of equipment, valves and fittings.
- .7 Ream pipes, clean scale and dirt, inside and outside, before and after assembly.
- .8 Assemble piping using fittings manufactured to ANSI standards.
- .9 Saddle type branch fittings may be used on mains if branch line is no larger than half the size of main. Hole saw or drill and ream main to maintain full inside diameter of branch line prior to welding saddle.

**3.2 VALVE INSTALLATION**

- .1 Install rising stem valves in upright position with stem above horizontal.
- .2 Install butterfly valves on chilled water and condenser water lines only.
- .3 Install gate or ball valves at branch take-offs and to isolate each piece of equipment, and as indicated.
- .4 Install globe valves for balancing and in by-pass around control valves as indicated.
- .5 Provide silent check valves on discharge of pumps and in vertical pipes with downward flow and as indicated.
- .6 Provide swing check valves in horizontal lines as indicated.
- .7 Install chain operators on valves NPS 65 mm (2 1/2") and over where installed more than 2400 mm (96") above floor in Boiler Rooms and Mechanical Equipment Rooms.

**3.3 AIR VENTS**

- .1 Install at high points of systems.
- .2 Install ball valve on automatic air vent inlet.
- .3 Extend vent lines in Mechanical Room with screwdriver stop at 1.8 m AFF.

### **3.4 CIRCUIT BALANCING VALVES**

- .1 Install flow measuring stations and flow balancing valves as indicated and as follows:
  - .1 On return side of all heating devices (convectors, panels, force flows, radiation, coils, etc).
  - .2 On return side of all water or glycol cooling coils.
  - .3 On return side of all reverse return piping loops and/or branch circuits.
- .2 Install to manufacturers requirements.
- .3 Valve size shall be one trade size smaller than piping.
- .4 Refer to Testing Adjusting and Balancing Section for applicable procedures.

### **3.5 FILLING OF SYSTEM**

- .1 Refill system with clean water adding water treatment as specified.
- .2 Co-ordinate filling of system with HVAC water treatment contractor.
- .3 Drain and vent all new and existing piping, radiation, etc. for a complete operable system.

### **3.6 TESTING**

- .1 Test system in accordance with Mechanical General Requirements Section.
- .2 For glycol systems, retest with propylene glycol to ASTM E202, inhibited, for use in building system after cleaning. Repair any leaking joints, fittings, or valves.

### **3.7 FLUSHING AND CLEANING**

- .1 Scope:
  - .1 **Flush new piping only.**
- .2 Procedure:
  - .1 Flushing and cleaning should only take place after successful piping pressure testing.
  - .2 Terminal device (reheat coils, heat pumps, perimeter radiation, etc.), air handling unit coils and their associated control and balancing valves should be bypassed during the preliminary flushing and cleaning process.
  - .3 Instruments such as flow meters, flow metering valves and orifice plates should only be installed after flushing and cleaning.
- .3 Timing:
  - .1 The overall construction schedule identifies piping flushing and cleaning with realistic time allotments.
  - .2 The mechanical contractor is required to provide a detailed report outlining the processes and procedures for flushing and cleaning per piping system at least 4 to 6 weeks in advance of work.
  - .3 As a minimum, at least one piping flushing and cleaning procedure shall be witnessed, by the consultant and/or commissioning agent.

- .4 The mechanical contractor shall to utilize a qualified water treatment specialist to supervise the flushing and cleaning process and provide the certified water analysis report certifying that the piping systems are clean.
- .5 Coordinate flushing and cleaning of mechanical systems with HVAC water treatment contractor and HVAC systems commissioning contractor.
- .6 Flush and clean new piping system in presence of Consultant.
- .7 Flush after pressure test for a minimum of 4 hrs.
- .8 Fill system with solution of water and non-foaming, phosphate-free detergent 3% solution by weight. Circulate for minimum of 8 hrs.
- .9 Thoroughly flush all new mechanical systems and equipment with approved cleaning chemicals designed to remove deposition from construction such as pipe dope, oils, loose mill scale and other extraneous materials. Chemicals to inhibit corrosion of various system materials and be safe to handle and use.
- .10 During circulation of cleaning solution, periodically examine and clean filters and screens and monitor changes in pressure drop across equipment.
- .11 Refill system with clean water. Circulate for at least 2 hours. Clean out strainer screens/baskets regularly. Then drain.
- .12 Drainage to include drain valves, dirt pockets, strainers, every low point in system.
- .13 Drain and flush systems until alkalinity of rinse water is equal to make-up water. Refill with clean water treated to prevent scale and corrosion during system operation.
- .14 Re-install strainer screens/baskets only after obtaining Consultant's approval and approval from HVAC water treatment contractor.
- .15 Repeat system drain and flush as often as necessary to have a clean system.
- .16 Disposal of cleaning solutions to be approved by authority having jurisdiction.
- .17 Isolate new piping system from existing system as required for system cleaning.
- .18 **After hydronic system is cleaned, refill with clean water and chemical as per chemical supplier treatment.**

### **3.8 EXISTING SYSTEM DISPOSAL**

- .1 Disposal of existing system shall be to the requirements of the local and/or provincial regulations.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ANSI/ASME B16.22, Wrought Copper Alloy and Copper Alloy Solder - Joint Pressure Fittings: Classes 150, 300, 600, 900, 1500, and 2500.
- .3 ANSI/ASME B16.24, Cast Copper Pipe Flanges and Flanged Fittings.
- .4 ANSI/ASME B16.26, Cast Copper Alloy Fittings for Flared Copper Tubes.
- .5 ANSI/ASME B31.5, Refrigeration Piping and Heating Transfer Components.
- .6 ASTM A307, Specification for Carbon Steel Bolts and Studs, 413.5 mPa (60,000 psi) Tensile Strength.
- .7 ASTM B280, Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
- .8 CSA B52, Mechanical Refrigeration Code.
- .9 EPS 1/RA/2, Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.

**Part 2            Products**

**2.1                TUBING**

- .1 Processed for refrigeration installations, deoxidized, dehydrated and sealed.
  - .1 Hard copper: to ASTM B280, type ACR-B.

**2.2                FITTINGS**

- .1 Service: design pressure 2070 kPa (300 psi) and temperature 121°C (250°F).
- .2 Brazed:
  - .1 Fittings: wrought copper to ANSI/ASME B16.22.
  - .2 Joints: silver solder, 45% Ag-15% Cu or copper-phosphorous, 95% Cu-5%P and non-corrosive flux.
- .3 Flanged:
  - .1 Bronze or brass, to ANSI/ASME B16.24, Class 150 and Class 300.
  - .2 Gaskets: suitable for service.
  - .3 Bolts, nuts and washers: to ASTM A307, heavy series.
- .4 Flared:
  - .1 Bronze or brass, for refrigeration, to ANSI/ASME 16.26.

### **2.3 PIPE SLEEVES**

- .1 Hard copper or steel, sized to provide 6 mm (1/4") clearance all around between sleeve and uninsulated pipe or between sleeve and insulation.

### **2.4 VALVES**

- .1 22 mm (7/8") and under: Class 500, 3.5 MPa (500 psi), globe or angle non-directional type, diaphragm, packless type, with forged brass body and bonnet, moisture proof seal for below freezing applications, brazed connections.
- .2 Over 22 mm (7/8"): Class 375, 2.5 MPa (375 psi), globe or angle type, diaphragm, packless type, back-seating, cap seal, with cast bronze body and bonnet, moisture proof seal for below freezing applications, brazed connections.

### **2.5 FILTER-DRIER**

- .1 On lines 20 mm (3/4") outside diameter and larger, filter-drier shall be replaceable core type with Schraeder type valve.
- .2 On lines smaller than 20 mm (3/4") outside diameter, filter-drier shall be sealed type using flared copper fittings.
- .3 Size shall be full line size.
- .4 Approved manufacturers:
  - .1 Mueller
  - .2 Parker
  - .3 Sporlan
  - .4 Virginia

### **2.6 SIGHT GLASS**

- .1 Combination moisture and liquid indicator with protection cap.
- .2 Sight glass shall be full line size.
- .3 Sight glass connections shall be solid copper or brass, no copper-coated steel sight glasses allowed.
- .4 Approved manufacturers:
  - .1 Mueller
  - .2 Henry
  - .3 Parker
  - .4 Superior

### **2.7 SUCTION LINE TRAP**

- .1 Manufactured standard one-piece traps.



## **2.8 EXPANSION VALVES**

- .1 For pressure type distributors, externally equalized with stainless steel diaphragm, and same refrigerant in thermostatic elements as in system.
- .2 Size valves to provide full rated capacity of cooling coil served. Co-ordinate selection with evaporator coil and condensing unit.
- .3 Approved manufacturers:
  - .1 Henry
  - .2 Mueller
  - .3 Parker
  - .4 Sporlan

## **2.9 FLEXIBLE CONNECTORS**

- .1 Designed for refrigerant service with bronze seamless corrugated hose and bronze braiding.
- .2 Approved manufacturers:
  - .1 Anaconda "Vibration Eliminators" by Anamet
  - .2 Vibration Absorber Model VAF by Packless Industries
  - .3 Vibration Absorbers by Superior Valve Co
  - .4 Style "BF" Spring-flex freon connectors by Vibration Mountings.

## **2.10 ROOF FLASHING**

- .1 Thaler or equal spun aluminum complete with insulation, cap, and rubber gasket.

## **2.11 PREFABRICATED PIPE ENTRY DOGHOUSE**

- .1 Dog House and cover shall be fabricated from 2mm thick aluminum with UV protected powder coated finish is also acceptable.
- .2 Cover shall be gasketed to ensure air and water tightness.
- .3 Mount in curb shall be full insulated and supplied with Doghouse.
- .4 Curb shall be 610 mm (24") high with 89 mm (3.5") wide flange pre-punched for securement to roof deck.
- .5 Curb shall be insulated with 50 mm (2") thick glass fibre insulation.
- .6 Pipe entry openings shall be provided by the pipe entry chase manufacturer and be specifically made for the application. Minimum acceptable standard:
  - .1 Sigrist Exit Seal
  - .2 Vault Exit Seal
- .7 Cover shall be removable and be fastened to the curb/body with vandal resistant fasteners. Hardware shall be zinc plated or stainless steel.
- .8 Size: To suite required penetrations.

- .9 Acceptable Manufacturers
  - .1 Sigrist Alta Pipe Chase Housing
  - .2 Vault Roof Penetration Housing
  - .3 Other Acceptable Manufacturers if approved by Consultant prior to tender close.

**2.12 PIPING SUPPORT ASSEMBLY**

- .1 All channel members shall be fabricated from structural grade steel conforming to one of the following ASTM specifications: A1011/A1011M, A653/A653M.
- .2 All fittings shall be fabricated from steel conforming to one of the following ASTM specifications: A575, A36/A36M or A635/A635M.
- .3 Electro galvanized cush clamps with shoulder bolt and molded thermoplastic cushion, size to suit pipe.
- .4 Acceptable materials:
  - .1 Unistrut
  - .2 Or equal

**Part 3 Execution**

**3.1 GENERAL**

- .1 Hard copper to be used. Throughout the project, the use of annealed copper shall not be used without approval of the consultant.
- .2 Install in accordance with CSA B52, EPS 1/RA/2 and ANSI/ASME B31.5.
- .3 Connect to equipment with isolating valves and unions.
- .4 Provide space for servicing, disassemble, and removal of equipment and components all as recommended by manufacturer.
- .5 Protect all openings in piping against entry of foreign material.
- .6 Provide all necessary equipment including thermal expansion valve, sight glass, solenoid valve, filter dryer, etc., for a complete installed system. Pipe system as per manufacturer's recommendation and requirements.
- .7 Provide number of refrigerant circuits and appropriate corresponding piping as per manufacturer's recommendations and requirements.

**3.2 BRAZING PROCEDURES**

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

### **3.3 PIPING INSTALLATION**

- .1 General:
  - .1 Hard drawn copper tubing: do not bend. Minimize use of fittings.
  - .2 Pitch at least 1:240 down in direction of flow to prevent oil return to compressor during operation.
  - .3 Provide trap at base of risers greater than 2.4m (8') high and at each 7.6m (25'-0") thereafter.
  - .4 Provide inverted deep trap at top of each riser.
  - .5 Provide double risers for compressors having capacity modulation.
    - .1 Large riser: install traps as specified above.
    - .2 Small riser: size for 5.1 m/s (1000 ft/min) at minimum load. Connect upstream of traps on large riser.

### **3.4 PRESSURE AND LEAK TESTING**

- .1 Close valves on factory charged equipment and other equipment not designed for test pressures.
- .2 Leak test to CSA B52 before evacuation to 2 MPa (290 psi) and 1 MPa (145 psi) on high and low sides respectively.
- .3 Test Procedure: Build pressure up to 35 kPa (5 psi) with refrigerant gas on high and low sides. Supplement with nitrogen to required test pressure. Test for leaks with electronic or halide detector. Repair leaks and repeat tests.

### **3.5 DEHYDRATION AND CHARGING**

- .1 Close service valves on factory charged equipment.
- .2 Ambient temperatures to be at least 13°C (55°F) for at least 12 h before and during dehydration.
- .3 Use copper lines of largest practical size to reduce evacuation time.
- .4 Use 2-stage vacuum pump with gas ballast on 2nd stage capable of pulling 5 Pa (0.02" WC) absolute and filled with dehydrated oil.
- .5 Measure system pressure with vacuum gauge. Take readings with valve between vacuum pump and system closed.
- .6 Triple evacuate all system components containing gases other than correct refrigerant or having lost holding charge as follows:
  - .1 Twice to 14 Pa (0.056" WC) absolute and hold for 4 h.
  - .2 Break vacuum with refrigerant to 14 kPa (0.056" WC).
  - .3 Final to 5 Pa (0.02" WC) absolute and hold for at least 12 h.
  - .4 Isolate pump from system, record vacuum and time readings until stabilization of vacuum.
  - .5 Submit all test results to Consultant.

- .7 Charging:
  - .1 Charge system through filter-drier and charging valve on high side. Low side charging not permitted.
  - .2 With compressors off, charge only amount necessary for proper operation of system. If system pressures equalize before system is fully charged, close charging valve and start up. With unit operating, add remainder of charge to system.
  - .3 Re-purge charging line if refrigerant container is changed during charging process.
- .8 Checks:
  - .1 Make all checks and measurements as per manufacturer's operation and maintenance instructions.
  - .2 Record and report all measurements to Consultant.

### **3.6 INSTRUCTIONS**

- .1 Post instructions in frame with glass cover in accordance with Operation and Maintenance Manual Section and CSA B52.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1      All codes, standards, etc. as referenced shall be the latest edition.
- .2      SMACNA HVAC Duct Construction Standards, Metal and Flexible.
- .3      SMACNA HVAC Duct Leakage Test Manual.
- .4      ASTM A480/A480M, Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
- .5      ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process. (Metric).
- .6      ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.
- .7      ANSI/NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.

**1.2                SHOP DRAWINGS AND PRODUCT DATA**

- .1      Submit shop drawings and product data in accordance with Section general requirements.
- .2      Indicate following:
  - .1      Sealants
  - .2      Tape
  - .3      Proprietary Joints
  - .4      Fittings

**1.3                CERTIFICATION OF RATINGS**

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

**Part 2            Products**

**2.1                DUCTWORK**

- .1      Galvanized Steel:
  - .1      Galvanized steel with Z90 designation zinc coating lock forming quality: to ASTM A653/A653M.

.2 Thickness:

| Size Type                       | Class A Gauge | Class B Gauge | Class C Gauge |
|---------------------------------|---------------|---------------|---------------|
| <b>Square and Rectangular</b>   |               |               |               |
| Up to 600 mm (24")              | 22            | 24            | 24            |
| 625 mm to 1000 mm (25" to 40")  | 20            | 22            | 24            |
| 1025 mm to 1800 mm (41" to 72") | 18            | 20            | 22            |
| 1825 mm to 2400 mm (73" to 96") | 16            | 18            | 20            |
| 2450 mm and over (97")          | 16            | 16            | 16            |
|                                 |               |               |               |
| <b>Round and Oval</b>           |               |               |               |
| Up to 300 mm (12")              | 24            | 24            | 24            |
| 325 mm to 600 mm (13" to 24")   | 22            | 24            | 24            |
| 625 mm to 900 mm (25" to 36")   | 20            | 22            | 24            |
| 925 mm to 1200 mm (37" to 48")  | 18            | 20            | 22            |
| 1225 mm (49") and over          | 18            | 18            | 20            |

.3 All ductwork between HVAC unit connections and 3.0 m (10'-0") downstream or to silencers shall be 1.4 mm (18 gauge).

.2 Stainless Steel

- .1 To ASTM A480/A480M, Type 304.
- .2 Thickness, fabrication and reinforcement: to ASHRAE and SMACNA or as indicated.
- .3 Joints: to ASHRAE and SMACNA.
  - .1 Acceptable material:  
Ductmate Canada Ltd.

**2.2 DUCT CONSTRUCTION**

.1 Round and oval:

- .1 Ducts: factory fabricated, spiral wound, with matching fittings and specials to SMACNA.
- .2 Transverse joints up to 900 mm (36"): slip type with tape and sealants.
- .3 Transverse joints over 900 mm (36"): Ductmate or Exanno Nexus Duct System.

.2 Square and rectangular:

- .1 Ducts: to SMACNA.
- .2 Transverse joints, longest side:  
up to and including 750 mm (30"): SMACNA proprietary duct joints.

- .3 Ducts with sides over 750 mm (30") to 1200 mm (48"), transverse duct joint system by Ductmate/25, Nexus, or WDCI (Lite) (SMACNA "E" or "G" Type connection). Weld all corners.
  - .1 Acceptable materials:
    - .1 Ductmate Canada Ltd.
    - .2 Nexus, Exanno Corp.
    - .3 WDCI
- .4 Ducts 1200 mm (48") and larger, Ductmate/35, Nexus, or WDCI (heavy) (SMACNA "J" Type connection). Weld all corners.
  - .1 Acceptable materials:
    - .1 Ductmate Canada Ltd.
    - .2 Nexus, Exanno Corp.
    - .3 WDCII.

## **2.3 FITTINGS**

- .1 Fabrication: to SMACNA.
- .2 Radiused elbows:
  - .1 Rectangular: standard radius and or short radius with single thickness turning vanes Centreline radius: 1.5 times width of duct.
  - .2 Round:
    - .1 In exposed areas one-piece smooth radius, 1.5 times diameter.
    - .2 In concealed areas 3-piece adjustable, 1.5 times diameter.
- .3 Mitred elbows, rectangular:
  - .1 To 400 mm (16"): with double thickness turning vanes.
  - .2 Over 400 mm (16"): with double thickness turning vanes.
- .4 Branches:
  - .1 Rectangular main and branch: with 45° entry on branch.
  - .2 Round main and branch: enter main duct at 45° with conical connection.
  - .3 Provide volume control damper in branch duct near connection to main duct.
  - .4 Main duct branches: with splitter damper.
- .5 Diffuser connection to main:
  - .1 90° round spin in collars with balancing damper and locking quadrant.
- .6 Transitions:
  - .1 Diverging: 20° maximum included angle.
  - .2 Converging: 30° maximum included angle.
- .7 Offsets:
  - .1 Full short radiused elbows.
- .8 Obstruction deflectors: maintain full cross-sectional area.

## 2.4 SEAL CLASSIFICATION

- .1 Classification as follows:

| Maximum Pressure Pa (" w.c.) | SMACNA Seal Class |
|------------------------------|-------------------|
| 2500 (10")                   | A                 |
| 1500 (6")                    | A                 |
| 1000 (4")                    | A                 |
| 750 (3")                     | A                 |
| 500 (2")                     | B                 |
| 250 (1")                     | B                 |
| 125 (0.5")                   | C                 |

- .2 Seal classification:

- .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.
- .2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant.
- .3 Class C: transverse joints and connections made air tight with gaskets, or sealant or combination thereof. Longitudinal seams sealed with foil tape or sealant.

## 2.5 SEALANT

- .1 Sealant: oil resistant, polymer type flame resistant duct sealant. Temperature range of -30°C (-22°F) to plus 93°C (199°F).
- .1 Acceptable materials:
- .1 Duro Dyne S-2
- .2 Foster

## 2.6 TAPE

- .1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm (2") wide.
- .1 Acceptable material:
- .1 Duro Dyne FT-2

## 2.7 DUCT LEAKAGE

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

## 2.8 FIRESTOPPING

- .1 40 mm x 40 mm x 3 mm (1½" x 1½" x 16ga) retaining angles all around duct, on both sides of fire separation.
- .2 Firestopping material and installation must not distort duct.
- .3 All ductwork passing through partition walls shall be firestopped.



**2.9 HANGERS AND SUPPORTS**

- .1 Band hangers: use on round and oval ducts only up to 500 mm (20") diameter, of same material as duct but next sheet metal thickness heavier than duct.
- .2 Trapeze hangers: ducts over 500 mm (20") diameter or longest side, to ASHRAE and SMACNA.
- .3 Hangers: galvanized steel angle with black steel rods to ASHRAE and SMACNA following table:

| Duct Size<br>mm (")       | Angle Size<br>mm (")        | Rod Size<br>mm (") |
|---------------------------|-----------------------------|--------------------|
| up to 750 (30)            | 25 x 25 x 3 (1 x 1 x 1/8)   | 6 (1/4)            |
| >750 to 1050 (>30 to 42)  | 40 x 40 x 3 (1½ x 1½ x 1/8) | 6 (1/4)            |
| >1050 to 1500 (>42 to 60) | 40 x 40 x 3 (1½ x 1½ x 1/8) | 10 (3/8)           |
| >1500 to 2100 (>60 x 84)  | 50 x 50 x 3 (2 x 2 x 1/8)   | 10 (3/8)           |
| >2100 to 2400 (>84 x 96)  | 50 x 50 x 5 (2 x 2 x 1/8)   | 10 (3/8)           |
| >2400 (96) and over       | 50 x 50 x 6 (2 x 2 x ¼)     | 10 (3/8)           |

- .4 Upper hanger attachments:
  - .1 For concrete: manufactured concrete inserts.
    - .1 Acceptable material:
      - .1 Myatt fig. 485
  - .2 For steel joist: manufactured joist clamp or steel plate washer.
    - .1 Acceptable material:
      - .1 Grinnell fig. 61 or 60
  - .3 For steel beams: manufactured beam clamps:
    - .1 Acceptable material:
      - .1 Grinnell Fig. 60

**Part 3 Execution**

**3.1 GENERAL**

- .1 The following systems shall conform to these requirements:

| System                 | Class | Material         |
|------------------------|-------|------------------|
| HVAC Supply and Return | B     | Galvanized steel |
| General Exhaust        | B     | Galvanized steel |
| Ventilation Plenum     | B     | Galvanized steel |
| Exhaust Plenum         | B     | Galvanized steel |
| Individual Exhaust     | C     | Galvanized steel |

- .2 Do work in accordance with ASHRAE and SMACNA.

- .3 Do not break continuity of insulation vapour barrier with hangers or rods.
- .4 Support risers in accordance with ASHRAE and SMACNA.
- .5 Install breakaway joints in ductwork on each side of fire separation.
- .6 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.
- .7 Manufacture duct in lengths to accommodate installation of acoustic duct lining.

### 3.2 HANGERS

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

| Duct Size       | Spacing     |
|-----------------|-------------|
| mm (")          | mm (")      |
| to 1500 (60")   | 3000 (120") |
| over 1500 (60") | 2500 (100") |

- .4 Do not support ductwork over 250 mm x 250 mm (10" x 10") from roof deck.

### 3.3 SEALING

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

### 3.4 LEAKAGE TESTS

- .1 Co-ordinate leakage testing with TAB contractor TAB contractor will be responsible for all duct testing.
- .2 Duct to be tested in accordance with SMACNA HVAC Duct Leakage Test Manual.
- .3 Leakage tests to be done in sections.
- .4 Trial leakage tests to be performed as instructed to demonstrate workmanship.
- .5 Install no additional ductwork until trial test has been passed.
- .6 Test section to be minimum of 15 m (50'-0") long with not less than 3 branch takeoffs and two 90° elbows. Maximum test length and area to be determined by BAS testing equipment. Allow for twelve (12) tests.
- .7 Complete test before insulation or concealment.
- .8 Provide all necessary end caps and fittings as required for the TAB contractor. Remove same after successful completion of duct test.
- .9 Pressure test ductwork to 1½ times operating pressure (minimum pressure 500 Pa (2" wc) all systems).

**3.5 CLEANING**

- .1 Keep ducts clear from dust and debris
- .2 Keep duct liner clean from dust, debris, and moisture.
- .3 At completion of project vacuum ducts if dirt or dust is present.
- .4 Where new systems connect into existing systems the existing systems shall be cleaned and vacuumed prior to reconnection.
- .5 Ensure all systems are clean prior to start up.

**3.6 INSTALLATION REQUIREMENTS**

- .1 All ductwork is to be protected from the weather and precipitation. The top and sides of all ductwork are to be completely covered with 6mil poly to the satisfaction of the consultant. Maintain protection of the ductwork until the building is made watertight and hollow cores drained. Tape all joints.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 SMACNA HVAC Duct Construction Standards, Metal and Flexible.
- .3 ANSI/NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.
- .4 ANSI/NFPA 96, Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .5 CSA B228.1, Pipes, Ducts and Fittings for Residential Type Air Conditioning.

**1.2                PRODUCT DATA**

- .1 Submit product data in accordance with general requirements.
- .2 Indicate the following:
  - .1 Flexible connections.
  - .2 Duct access doors.
  - .3 Turning vanes.
  - .4 Instrument test ports.

**1.3                CERTIFICATION OF RATINGS**

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

**Part 2            Products**

**2.1                GENERAL**

- .1 Manufacture in accordance with CSA B228.1.

**2.2                FLEXIBLE CONNECTIONS**

- .1 Frame: galvanized sheet metal frame with fabric clenched by means of double locked seams.
- .2 Material:
  - .1 Fire resistant, self-extinguishing, neoprene coated glass fabric, temperature rated at -40°C (-40°F) to plus 90°C (194°F), density of 1.3 kg/m.

**2.3                ACCESS DOORS IN DUCTS**

- .1 Non-insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm (25 gauge) thick complete with sheet metal angle frame.

- .2 Insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm (24 gauge) thick complete with sheet metal angle frame and 25 mm (1") thick rigid glass fibre insulation.
- .3 Gaskets: neoprene
- .4 Hardware:
  - .1 Up to 300 mm (12"): 2 sash locks
  - .2 301 mm to 450 mm (13" to 18"): 4 sash locks Complete with safety chain.
  - .3 451 mm to 1000 mm (19" to 40"): piano hinge and minimum 2 sash locks.
  - .4 Doors over 1000 mm (40"): piano hinge and 2 handles operable from both sides.
  - .5 Hold open devices.
- .5 Acceptable materials:
  - Nailor
  - E. H. Price
  - Titus

## **2.4 INSTRUMENT TEST PORTS**

- .1 1.6 mm (16 gauge) thick steel zinc plated after manufacture.
- .2 Cam lock handles with neoprene expansion plug and handle chain.
- .3 28 mm (1 1/8") minimum inside diameter. Length to suit insulation thickness.
- .4 Neoprene mounting gasket.
- .5 Acceptable material:
  - Duro Dyne IP1 or IP2
  - Duct mate

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Flexible connections:
  - .1 Install in following locations:
    - .1 Inlets and outlets to supply air units and fans. (Unless internally isolated)
    - .2 Inlets and outlets of exhaust and return air fans.
    - .3 As indicated.
  - .2 Length of connection: 100 mm (4").
  - .3 Minimum distance between metal parts when system in operation: 75 mm (3").
  - .4 Install in accordance with recommendations of SMACNA.
  - .5 When fan is running:
    - .1 Ducting on each side of flexible connection to be in alignment.
    - .2 Ensure slack material in flexible connection.

- .2 Access doors and viewing panels:
  - .1 Size:
    - .1 600 mm x 600 mm (24" x 24") for person size entry.
    - .2 600 mm x 1000 mm (24" x 40") for servicing entry.
    - .3 300 mm x 300 mm (12" x 12") for viewing.
    - .4 As indicated.
  - .2 Location:
    - .1 At fire and smoke dampers.
    - .2 At control dampers.
    - .3 At devices requiring maintenance.
    - .4 At locations required by code.
    - .5 At inlet and outlet of reheat coils.
    - .6 Elsewhere as indicated.
    - .7 Inlet and outlet of duct mounted coils.
- .3 Instrument test ports.
  - .1 General:
    - .1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
  - .2 Locate to permit easy manipulation of instruments
  - .3 Install insulation port extensions as required.
  - .4 Locations.
    - .1 For traverse readings:
      - .1 At ducted inlets to roof and wall exhausters.
      - .2 At inlets and outlets of other fan systems.
      - .3 At main and sub-main ducts.
      - .4 And as indicated.
    - .2 For temperature readings:
      - .1 At outside air intakes.
      - .2 In mixed air applications in locations as approved by Consultant.
      - .3 At inlet and outlet of coils.
      - .4 Downstream of junctions of two converging air streams of different temperatures.
      - .5 And as indicated.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 SMACNA HVAC Duct Construction Standards, Metal and Flexible.

**1.2                PRODUCT DATA**

- .1 Submit product data in accordance with general requirements
- .2 Indicate the following: performance data.

**Part 2            Products**

**2.1                GENERAL**

- .1 Manufacture to SMACNA standards.

**2.2                SINGLE BLADE DAMPERS**

- .1 Of same material as duct, but one sheet metal thickness heavier. V-groove stiffened, minimum 1.6 mm (16 gauge).
- .2 Size and configuration to recommendations of SMACNA, except maximum height 100 mm (4").
- .3 Shaft extension to accommodate insulation thickness and locking quadrant.
- .4 Inside and outside nylon end bearings.
- .5 Channel frame of same material as adjacent duct, complete with angle stop.

**2.3                MULTI-BLADED DAMPERS**

- .1 Factory manufactured of material compatible with duct.
- .2 Opposed blade: configuration, metal thickness and construction to recommendations of SMACNA.
- .3 Maximum blade height:
  - .1 50 mm (2") up to 375 mm (15") high duct.
  - .2 100 mm (4") max 400 mm (16") high duct and over.
- .4 Bearings: self-lubricating nylon.
- .5 Linkage: shaft extension with locking quadrant.
- .6 Channel frame of same material as adjacent duct, complete with angle stop.
- .7 Shaft extension to accommodate insulation thickness and locking quadrants.**

- .8 Acceptable materials:
  - .1 Duro Dyne
  - .2 E.H. Price
  - .3 Nailor
  - .4 T.A. Morrison
  - .5 Tamco
  - .6 Ruskin
  - .7 Ventex/Alumavent
  - .8 United Enertech

## 2.4 LOCKING QUADRANTS

- .1 6 mm (1/4") dial regulator with square bearing shaft.
  - .1 18 gauge oval frame, cadmium plated, clearly shows damper position.
  - .2 18 gauge formed handle for easy adjustment.
  - .3 Bolt and wing nut lock damper securely.
  - .4 Offset mounting holes avoid interference with damper movement and mechanical fastening to duct.
- .2 9 mm (3/8") and larger: clamp quadrant with square bearing shaft.
  - .1 Accommodates and securely locks square rod, bearing fitting and adaptor pins.
  - .2 Heavily ribbed 16 gauge steel frame, 3 mm (1/8") thick formed steel handle, cadmium-plated.
  - .3 By tightening nut, bearing is securely locked in handle, preventing slippage and rattle.
  - .4 Neoprene and steel washer assembly seals bearing opening to eliminate air-leakage.
  - .5 Screw holes for mechanically fastening to ductwork.
- .3 High pressure system locking quadrant:
  - .1 Airtight, rattle-proof regulator, designed for ZERO leakage at high pressure. Use for applications up to 500°F constant temperature.
  - .2 Handle design for easy recognition of damper position.
  - .3 Heavy-gauge, zinc-plated steel, 2 high temperature rubber seals and washers, end bearing support, and 2 end bearings. Pressure loss and damper rattle in ductwork has been a constant annoyance for as long as HVAC ductwork has been installed. Now, a truly air-tight, rattle-proof regulator is available. The SPEC-SEAL regulator utilizes a special high-temperature rubber seal to eliminate leakage and rattle even at many times the pressure found in high pressure.
  - .4 Soft, comfortable grip handle with a highly visible, plastic cover which indicates the damper position.
  - .5 Handle to accommodate 9 mm (3/8") or 12 mm (1/2") to match damper shaft size, square and round bearing shafts.



- .4 Acceptable manufacturers:  
Duro Dyne  
Ductmate

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install where indicated.
- .2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
- .3 For supply, return and exhaust systems, locate balancing dampers in each branch duct.
  - .1 Single blade dampers up to 200 mm (8").
  - .2 Multi-blade dampers over 200 mm (8").
- .4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.
- .5 All dampers to be vibration free.
- .6 Leave all dampers in open position for T.A.B.
- .7 Fasten locking quadrants to ductwork and shaft.
- .8 Place locking quadrants on standoffs where ductwork insulated.
- .9 Lock down quadrant arm in the open position.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.
- .3 CAN/ULC-S112, Standard Method of Fire Test of Fire Damper Assemblies.
- .4 CAN/ULC-S112.1, Standard Method of Fire Test of Ceiling Firestop Flap Assemblies.
- .5 ULC-S505, Fusible Links for Fire Protection Service.

**1.2                PRODUCT DATA**

- .1 Submit product data in accordance with general requirements.
- .2 Indicate the following:
  - .1 Fire dampers.
  - .2 Operators.
  - .3 Firestop flaps.
  - .4 Fusible links.

**1.3                MAINTENANCE DATA**

- .1 Provide maintenance data for incorporation into manual specified in general requirements.

**1.4                MAINTENANCE MATERIALS**

- .1 Provide following:
  - .1 6 fusible links of each type.

**1.5                CERTIFICATION OF RATINGS**

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

**Part 2            Products**

**2.1                FIRE DAMPERS (STATIC)**

- .1 Fire dampers: arrangement as indicated, listed and bear label of ULC, meet requirements of provincial fire authority and authorities having jurisdiction. Fire damper assemblies to be fire tested in accordance with CAN/ULC-S112.
- .2 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.

- .3 Top hinged: offset single damper, round or square; multi-blade hinged or interlocking type; guillotine type; sized to maintain full duct cross section.
- .4 Fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type or roll door type in horizontal position with vertical air flow.
- .5 40 mm x 40 mm x 3 mm (1½" x 1½" x 16ga) retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.
- .6 Acceptable materials:
  - .1 Ruskin
  - .2 Nailor
  - .3 E.H. Price
  - .4 T.A. Morrison
  - .5 Tamco
  - .6 Ventex/Alumavent
  - .7 United Enertech
  - .8 Safeair-Dowco (stainless steel)
  - .9 Greenheck

## **2.2 FIRE DAMPERS (DYNAMIC)**

- .1 Multi blade or roll type, fire damper suitable for HVAC system velocities up to 2000 fpm (610 m/mm), dual direction air flow, max 4" wg pressure.
- .2 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.
- .3 Top hinged: offset single damper, round or square; multi-blade hinged or interlocking type; guillotine type; sized to maintain full duct cross section.
- .4 Stainless closure spring to positively close damper upon fusible link release, for horizontal or vertical orientations.
- .5 Linkage concealed in frame.
- .6 40 mm x 40 mm x 3 mm (1½" x 1½" x 16ga) retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.
- .7 Fire damper assemblies and type to meet requirements of provincial fire authority and authority having jurisdiction.

- .8 Acceptable materials:
  - .1 Ruskin
  - .2 Nailor
  - .3 E.H. Price
  - .4 T.A. Morrison
  - .5 Tamco
  - .6 Greenheck
  - .7 Ventex/Alumavent

### **2.3 FIRE STOP FLAPS**

- .1 To be ULC listed and labelled and fire tested in accordance with CAN/ULC-S112.1.
- .2 Construct of minimum 1.5 mm (16 gauge) thick sheet steel with 1.5 mm (16 gauge) thick non-asbestos ULC listed insulation and corrosion-resistant pins and hinges.
- .3 Flaps to be held open with fusible link conforming to ULC-S505 and close at 74°C (165°F).

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Provide where indicated and at all fire rated partitions indicated, on architectural drawing.
- .2 Install in accordance with ANSI/NFPA 90A and in accordance with conditions of ULC listing.
- .3 Maintain integrity of fire separation.
- .4 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.
- .5 Install access door adjacent to each damper.
- .6 Coordinate with installer of firestopping.
- .7 Static fire dampers: Only on transfer air ducts where ductwork is not connected to a fan/blower.
- .8 Dynamic fire dampers: In all duct work where air is moved by a fan/blower.

**END OF SECTION**

**Part 1            General**

**1.1                CODES AND STANDARDS**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.
- .3 CAN/ULC-S112, Standard Method of Fire Test of Fire Damper Assemblies.
- .4 CAN/ULC-S112.1, Standard Method of Fire Test of Ceiling Firestop Flap Assemblies.
- .5 ULC-S505, Fusible Links for Fire Protection Service.
- .6 CAN/ULC-S524, Installation of Fire Alarm Systems
- .7 CAN/ULC-S1001.11, Integrated Systems Testing of Fire Protection and Life Safety Systems.

**1.2                PRODUCT DATA**

- .1 Submit product data in accordance with general requirements indicating the following:
  - .1 Damper type
  - .2 Operators
  - .3 Fusible links
  - .4 Smoke detectors
  - .5 Power requirements
  - .6 Size, orientation, construction

**1.3                MAINTENANCE DATA**

- .1 Provide maintenance data for incorporation into manual specified in general requirements.

**1.4                MAINTENANCE MATERIALS**

- .1 Provide following:
  - .1 6 fusible links of each type.

**1.5                CERTIFICATION OF RATINGS**

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

**Part 2 Products**

**2.1 COMBINATION FIRE AND SMOKE DAMPERS**

- .1 Provide a complete system, consisting of the damper, damper actuator, smoke detector with duct sampling tube, sleeve, and all other components necessary for a complete and operable system. The assembly shall be factory assembled as a single unit. Field assembly shall be permitted at contractor discretion provided all listings are maintained and the installation follows all manufacturer installation guidelines.
- .2 Damper
  - .1 Damper shall be ULC listed and labelled
  - .2 Both damper and damper actuator to be ULC listed and labelled.
  - .3 Normally closed smoke/seal: folding blade type. Blade edge seals of flexible stainless steel shall provide required constant sealing pressure. Stainless steel negator springs with locking devices shall ensure positive closure for units.
  - .4 Damper shall have Class I leakage rating.
  - .5 Suitable for horizontal or vertical installations.
- .3 Actuator/Link
  - .1 Actuator shall be ULC listed and labelled
  - .2 Motorized actuator: 2-position, spring return, normally open with power on. When power is interrupted damper shall close automatically. Upon return of power, damper shall automatically reset open. Actuators are to be located outside of airstream, unless otherwise specified or shown on drawings.
  - .3 Exterior visualization of damper position.
  - .4 Damper actuator end switches for monitoring damper position by the BAS.
  - .5 Combined actuator: electrical control system actuated from smoke sensor or smoke detection system and from fusible link.
  - .6 Fusible link, or electric re-settable link (ERL).
  - .7 Electric fire sensor capable of remote openable control is to be provided in place of fusible link where specifically indicated in project documents.
  - .8 Where ERL or electric fire sensor is used in place of fusible link, this device shall fail closed upon power failure.
  - .9 Actuator may be mounted in duct in areas of renovation work when ductwork is over 450mm (18") wide.
- .4 Factory sleeve.
  - .1 Type and style: matching application.
- .5 Operating Temperature: 0° Celsius to 99° Celsius ambient temperature rating for 300 fpm to 4000 fpm air velocity.

- .6 Smoke Detector:
  - .1 ULC approved photoelectric duct smoke detector;
  - .2 operates from 100 to 4000 ft/min air velocity, -4 to 158°F temperature, and 0 to 95% non-condensing humidity;
  - .3 test/reset button with LED display;
  - .4 The detector housing shall be ULC listed specifically for use in air handling systems; capable of local testing via magnetic switch and test button; duct mounted smoke detector with sampling tube, housing
  - .5 6. The detector shall incorporate separate 2.0A 30VDC Alarm and Supervisory contacts. Alarm contacts shall be normally open (N.O.) in which closed contacts will indicate an alarm condition to the fire alarm panel. Supervisory contacts shall be normally closed (N.C.) in which open contacts will indicate a trouble condition to the fire alarm panel.
  - .6 Sensor may be mounted in duct in areas of renovation work when ductwork is over 450mm (18") wide.
- .7 Damper assembly to operate at 120V with single point power connection.
- .8 Large damper sizes can be provided in multiple sections. Field assembly is acceptable following manufacturer's installation guidelines.
- .9 Fire rating to match wall assembly i.e. 1 hour/1 ½ hour/2 hour/ 3 hour.
- .10 Size: as indicated on drawings.
- .11 Acceptable materials:
  - E H Price
  - NCA Ltd.
  - Nailor Industries Inc.
  - Ruskin
  - Alumavent
  - United Enertech
  - Safeair-Dowco (stainless steel)

## 2.2 NUMBER OF AIR TYPE SMOKE DETECTORS

- .1 Where air velocities are greater than 1.5 m/s (300 feet per second), one air duct type detector shall be installed for every 1.5 meters square (16 square feet) of cross-sectional duct area.
- .2 Where air velocities are less than 1.5 m/s (300 feet per second), one duct type smoke detector shall be installed for every 0.5 meters square (5.3 square feet) or cross-sectional duct area.

## 2.3 PRESSURE RELIEF DOORS

- .1 Frames shall be Z-shape, 12 gage (2.8) galvanized steel.
- .2 Door shall be 12 gage (2.8) galvanized steel, hinged on one side.
- .3 Seal shall be around the door perimeter allowing no more than 7 cfm/ft<sup>2</sup> at 1.0 inch w.g.

- .4 Door shall include stainless steel springs to close door upon pressure relief and system shutdown.
- .5 All release mechanisms, springs and parts shall be completely out of airstream.
- .6 Pressure relief settings available from 2" (0.5 kPa) to 10" (2.49 kPa) increments of 1" w.g. (0.25 kPa). Supplier shall examine plans to provide appropriate pressure relief based on associated air handling system.
- .7 Pressure relief mechanism shall be factory calibrated in an AMCA Registered Laboratory.
- .8 Pressure Relief Doors shall be provided as indicated in the execution section.

### **Part 3 Execution**

#### **3.1 INSTALLATION**

- .1 Provide smoke dampers where indicated and at all duct penetrations through smoke barrier partitions indicated on architectural drawings.
- .2 Provide combination fire and smoke dampers where indicated and at all duct penetrations through fire rated smoke barrier partitions indicated on architectural drawings. To provide separated fire dampers and smoke dampers, obtain approval from the consultant for the alternate arrangement.
- .3 Provide pressure relief doors (both positive and negative as applicable) as follows:
  - .1 For all systems with a combination fire smoke or smoke damper in the duct main of the system when:
    - .1 The system operates at static pressure of 1.0 inches w.g. or higher; and
    - .2 More than 50% of the system airflow passes through the combination fire/smoke or smoke damper.
  - .2 Where/as indicated on the plans.
- .4 Install in accordance with ANSI/NFPA 90A, in accordance with conditions of ULC listing and manufacturer's recommendation.
- .5 Maintain integrity of smoke separation and fire rating.
- .6 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.
- .7 Install access door adjacent to each damper and smoke detector.
- .8 Front grille access for through wall dampers that terminate in a grille is acceptable.
- .9 Provide proper firestopping and duct seal to fire barrier wall.
- .10 Confirm proper operation and test sheets.
- .11 Should contractor provide separated devices mount smoke detector downstream of damper and within 1.5 m (5 ft) of damper.
- .12 Ensure access doors/panels, fusible links, damper actuators, and sensors are easily observed and accessible.



**3.2 WIRING**

- .1 All fire alarm wiring shall be 1 hour rated and in conduit or as per electrical fire alarm wiring requirement.

**3.3 CLEANING**

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

**3.4 INTEGRATED LIFE SAFETY SYSTEMS TESTING**

- .1 Prior to the building Integrated Life Safety Systems Testing the mechanical contractor shall commission/verify the operation of all installed smoke dampers.
- .2 Participate in the Integrated Life Safety Systems Testing to confirm proper operation of all operating smoke dampers and associated Life Safety Systems (i.e. fire alarm).
- .3 This contractor shall work with the Integrated Life Safety Contractor and reset all systems back into proper operation.
- .4 Include all costs associated with participation Integrated Life Safety System Testing in the tender value.

**END OF SECTION**

**Part 1 General**

**1.1 GENERAL**

- .1 This section applies to operating dampers not specified in Controls Section.

**1.2 REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

**1.3 PRODUCT DATA**

- .1 Submit product data in accordance with general requirements.
- .2 Indicate the following:
  - .1 Performance data.

**1.4 MAINTENANCE DATA**

- .1 Provide maintenance data for incorporation into manual specified in general requirements.

**1.5 CERTIFICATION OF RATINGS**

- .1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency.

**Part 2 Products**

**2.1 MOTORIZED DAMPERS**

- .1 Opposed blade type.
- .2 Extruded aluminum, interlocking blades, complete with extruded vinyl seals, spring stainless steel side seals, extruded aluminum frame.
- .3 Pressure fit self-lubricated bronze bearings.
- .4 Linkage: plated steel tie rods, brass pivots and plated steel brackets, complete with plated steel control rod.
- .5 Operator: Refer to BAS Section.
- .6 Performance:
  - .1 Leakage: in closed position to be less than 2% of rated air flow at 250 Pa (1" w.c.) differential across damper.
  - .2 Pressure drop: at full open position to be less than 10 Pa (0.04" w.c.) differential across damper.

- .7 Insulated aluminum dampers:
  - .1 Frames: insulated with extruded polystyrene foam with R factor of 5.0.
  - .2 Blades: constructed from aluminum extrusions with internal hollows insulated with polyurethane or polystyrene foam, R factor of 5.0.
  - .3 Use on services to the exterior.
- .8 Acceptable materials:
  - Honeywell
  - Johnson
  - T. A. Morrison
  - E.H. Price
  - Tamco
  - Ruskin
  - Nailor
  - Henderson Industrial
  - Ventex/Alumavent

## **2.2 BACK DRAFT DAMPERS**

- .1 Automatic gravity operated, multi leaf, aluminum construction with nylon bearings, centre pivoted or counterweighted, as indicated.
- .2 Acceptable materials:
  - T.A. Morrison
  - Tamco Series 7000
  - Ruskin
  - Nailor
  - E.H. Price
  - Henderson Industrial
  - Ventex/Alumavent

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install where indicated.
- .2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.
- .3 Seal multiple damper modules with silicon sealant.
- .4 Install access door adjacent to each damper. See Duct Accessories Section.
- .5 Insulated dampers on all outside air intake and exhaust damper.
- .6 Non-insulated dampers on all interior motorized dampers not exposed to outside air.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 CAN/ULC-S110, Standard Methods of Test for Air Ducts.
- .3 UL 181, Factory Made Air Ducts and Air Connectors.
- .4 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.
- .5 ANSI/NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.
- .6 SMACNA HVAC Duct Construction Standards - Metal and Flexible.

**1.2                PRODUCT DATA**

- .1 Submit product data in accordance with general requirements.
- .2 Indicate the following:
  - .1 Thermal properties.
  - .2 Friction loss.
  - .3 Acoustical loss.
  - .4 Leakage.
  - .5 Fire rating.

**1.3                CERTIFICATION OF RATINGS**

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

**Part 2            Products**

**2.1                GENERAL**

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

**2.2                METALLIC – UNINSULATED**

- .1 Spiral wound flexible aluminum, Class 1 duct material.
- .2 Performance:
  - .1 Factory tested to 2.5 kPa (10" w.c.) without leakage.
  - .2 Maximum relative pressure drop coefficient: 3.
  - .3 Operating pressure: 300 mm (12").

- .3 Acceptable materials:
  - .1 Flexmaster T/L
  - .2 Ductmate

**Part 3 Execution**

**3.1 DUCT INSTALLATION**

- .1 Install in accordance with: SMACNA.
- .2 Maximum length of flexible duct: 1.8 m (6' 0").
- .3 Minimum length of acoustical ductwork; 1.5 m (5' 0") with minimum of 1 bend.
- .4 Provide support at centre of flexible duct with 25 mm (1") wide galvanized hanger.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 SMACNA HVAC Duct Construction Standards, Metal and Flexible.
- .3 ASTM C553, Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
- .4 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.
- .5 ANSI/NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.

**1.2 PRODUCT DATA**

- .1 Submit product data in accordance with general requirements.

**Part 2 Products**

**2.1 DUCT LINER**

- .1 General:
  - .1 Rigid fibrous glass duct liner: air stream side faced with mat facing.
  - .2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50 when tested in accordance with CAN/ULC-S102.
  - .3 Acceptable material:
    - .1 Johns Manville, Permacote Linacoustic R-300
    - .2 Owen Corning
- .2 Rigid:
  - .1 Use on flat surfaces.
  - .2 25 mm (1") thick, to CGSB 51-GP-10M, fibrous glass rigid board duct liner.
  - .3 Density: 36 kg/m<sup>2</sup> (7.4 lb/ft<sup>2</sup>).
  - .4 Thermal resistance to be minimum 750 mm (30") C/W for 25 mm (1") thickness  
1150 mm (45") C/W for 40 mm (1½") thickness when tested in accordance with ASTM C177, at 24°C (75°F) mean temperature.

**2.2 ADHESIVE**

- .1 Meet requirements of ANSI/NFPA 90A and ANSI/NFPA 90B.
- .2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range -29°C (-20°F) to 93°C (200°F).
- .3 Acceptable material:
  - .1 Duro Dyne 1A-22
  - .2 Ductmate

### **2.3 FASTENERS**

- .1 Weld pins 2.0 mm (14 gauge) diameter, length to suit thickness of insulation. Metal retaining clips, 32 mm (1¼") square.
- .2 Acceptable material:
  - .1 Duro Dyne
  - .2 Ductmate

### **2.4 JOINT TAPE**

- .1 Poly-Vinyl treated open weave fiberglass membrane 50 mm (2") wide.
- .2 Acceptable materials:
  - .1 Duro Dyne FT2
  - .2 Ductmate

### **2.5 SEALER**

- .1 Meet requirements of ANSI/NFPA 90A and ANSI/NFPA 90B.
- .2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range -68°C (-90F) to 93°C (200°F).
- .3 Acceptable materials:
  - .1 Duro Dyne 1A-94
  - .2 Ductmate

## **Part 3 Execution**

### **3.1 GENERAL**

- .1 Do work in accordance with recommendations of SMACNA duct liner standards as indicated in SMACNA HVAC Duct Construction Standards, Metal and Flexible, except as specified otherwise.
- .2 Line inside of ducts where indicated.
- .3 Duct dimensions, as indicated, are clear inside duct lining.
- .4 Provide an interior of ductwork from fans from minimum distance of 3 m (10'-0").

### **3.2 DUCT LINER**

- .1 Install in accordance with manufacturer's recommendations, and as follows:
  - .1 Fasten to interior sheet metal surface with 100% coverage of adhesive.
  - .2 In addition to adhesive, install weld pins not less than 2 rows per surface and not more than 300 mm (12") on centres.
- .2 Weld pins are to have cupped or beveled heads to prevent damage to lining surface.
- .3 Store foam liners away from sunlight.

**3.3 JOINTS**

- .1 Seal all butt joints, exposed edges, weld pin and clip penetrations and all damaged areas of liner with joint tape and sealer. Install joint tape in accordance with manufacturer's recommendations, and as follows:
  - .1 Bed tape in sealer.
  - .2 Apply 2 coats of sealer over tape.
- .2 Replace damaged areas of liner at discretion of Consultant.
- .3 Protect leading and trailing edges of each duct section with sheet metal nosing having 15 mm (1/2") overlap and fastened to duct.

**END OF SECTION**



**Part 1            General**

**1.1                REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 AMCA 99, Standards Handbook.
- .3 ANSI/AMCA 210, Laboratory Methods of Testing Fans for Certified Aerodynamics Performance Rating.
- .4 AMCA 300, Revised 1987, Reverberant Room Method for Sound Testing of Fans.
- .5 AMCA 301, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
- .6 ANSI/ASHRAE 51, Laboratory Methods of Testing Fans for Certified Aerodynamics Performance Rating.
- .7 ANSI/NFPA 96 – Ventilation Control and Fire Protection of Commercial Cooking Operations.

**1.2                SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings and product data in accordance with general requirements.
- .2 Product data to include fan curves and sound rating data.

**1.3                OPERATION AND MAINTENANCE DATA**

- .1 Provide operation and maintenance data for incorporation into manual specified in general requirements.

**1.4                CERTIFICATION OF RATINGS**

- .1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered from independent testing agency signifying adherence to codes and standards in force.
- .2 Provide confirmation of testing.

**Part 2            Products**

**2.1                FANS GENERAL**

- .1 Capacity: flow rate, total static pressure Pa, r/min, W (" w.c., r/min, bhp) model and size and sound ratings as indicated on schedule.
- .2 Statically and dynamically balanced. Constructed in conformity with AMCA 99.
- .3 Sound ratings: comply with AMCA 301, tested to AMCA 300.
- .4 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210, and ANSI/ASHRAE 51.

- .5 Bearings: sealed lifetime of self aligning type with oil retaining, dust excluding seals and a certified minimum rated life of 80,000 100,000 h in accordance with AFBMA L10 life standard. Bearings to be rated and selected in accordance with AFBMA 9 and AFBMA 11.
- .6 Acceptable materials: As indicated on drawings.
- .7 Provide factory mounted speed control for all direct drive motors.

## **2.2 CEILING DISCHARGE FANS**

- .1 Centrifugal direct drive, with plug in type electric motor suitable for ceiling installation, zinc coated rectangular metal housing.
- .2 Sizes and capacity: as indicated.
- .3 Toggle switch operated complete with integral electrical outlet box with plug-in type receptacle.
- .4 Side duct outlet with integral backdraft damper, size as indicated.
- .5 Wall cap complete with spring loaded backdraft damper with neoprene gasket.
- .6 Silver anodized aluminum grille paint finish.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install in accordance with manufacturer's instructions.
- .2 Provide flexible duct connection at roofline.
- .3 Provide backdraft damper at building exterior penetration.

**END OF SECTION**

**Part 1**

**General**

**1.1**

**PRODUCT DATA**

- .1 Submit product data in accordance with general requirements.
- .2 Indicate the following:
  - .1 Capacity.
  - .2 Throw and terminal velocity.
  - .3 Noise criteria.
  - .4 Pressure drop.
  - .5 Neck velocity.

**1.2**

**MAINTENANCE MATERIALS**

- .1 Include:
  - .1 Keys for volume control adjustment.
  - .2 Keys for air flow pattern adjustment.

**1.3**

**MANUFACTURED ITEMS**

- .1 Grilles, registers, and diffusers of same generic type to be product of one manufacturer.

**1.4**

**CERTIFICATION OF RATINGS**

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

**Part 2**

**Products**

**2.1**

**GENERAL**

- .1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.
- .2 Frames:
  - .1 Full perimeter gaskets.
  - .2 Plaster frames where set into plaster or gypsum board and as specified.
  - .3 Concealed fasteners.
- .3 Concealed operators.
- .4 Colour and Finish: standard as directed by Consultant.
- .5 Acceptable materials:
  - .1 Refer to schedule on drawings.

## **2.2 RETURN AND EXHAUST GRILLES**

- .1 General: with opposed blade dampers as indicated, concealed manual operator and gaskets
- .2 Type, size, and capacity: as indicated.
  - .1 Refer to schedule on drawings.

## **2.3 OPEN MESH SCREEN**

- .1 15 mm x 15 mm (½" x ½") open mesh screen fastened on 25 mm (1") border, screw fasten.
- .2 On all open ends of ductwork and where indicated.
- .3 Size: To match ductwork size.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install in accordance with manufacturer's instructions.
- .2 Install with flat head screws in countersunk holes where fastenings are visible.
- .3 Bolt grilles, registers and diffusers, in place
- .4 Provide concealed safety chain on each grille, register and diffuser in gymnasium, similar game rooms, and on exposed diffusers, and elsewhere as indicated.
- .5 Clean grilles upon completion.
- .6 Paint ductwork beyond grilles, matte black where visible.
- .7 Ensure all grilles, diffusers, etc. match opening sizes as indicated on the drawings and as fabricated on site by the contractor.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ASTM E90, Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions, and Elements.

**1.2 PRODUCT DATA**

- .1 Submit product data in accordance with general requirements.
- .2 Indicate the following:
  - .1 Pressure drop.
  - .2 Face area.
  - .3 Free area.
  - .4 Colour and finish.

**1.3 CERTIFICATION OF RATINGS**

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

**1.4 TEST REPORTS**

- .1 Submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E90.

**Part 2 Products**

**2.1 BRICK VENTS (FLANGE FRAME)**

- .1 Construction: welded with exposed joints ground flush and smooth.
- .2 Material: extruded aluminum alloy 6063-T5.
- .3 Blade: stormproof pattern.
- .4 Perimeter flange frame, head, sill, and jamb: 40 mm (1½") deep one piece extruded aluminum, minimum 3 mm (1/8") thick with approved caulking slot, integral to unit.
- .5 Fastenings: stainless steel (Society of Automotive Engineers) SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.
- .6 Screen: 15 mm (1/2") exhaust 20 mm (3/4") exhaust mesh, 2 mm (5/64") diameter wire aluminum birdscreen on inside face of louvres in formed U-frame.
- .7 Finish: Kynar 500  
Colour: to Consultant's approval.

- .8 Options:
  - .1 Straight duct extension.
  - .2 Perimeter flange frame.
- .9 Acceptable materials:
  - Greenheck Model BVF
  - Construction Specialties
  - E.H. Price
  - Krueger
  - Ruskin
  - Ventmaster
  - Ventex
  - Nailor

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 In accordance with manufacturers and SMACNA recommendations.
- .2 Reinforce and brace air vents, intakes and goosenecks as indicated.
- .3 Anchor securely into opening.
- .4 Seal with caulking all around to ensure weather tightness.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ASTM C553, Mineral Fiber Blanket, Thermal Insulation for Commercial and Industrial Applications.
- .3 CSA B52, Mechanical Refrigeration Code.
- .4 EPS 1/RA/2, Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.

**1.2                SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings and product data in accordance with general conditions.
- .2 Indicate major components and accessories including sound power levels of units.
- .3 Type of refrigerant used.

**1.3                OPERATION AND MAINTENANCE DATA**

- .1 Provide operation and maintenance data for incorporation into manual specified in general conditions.

**1.4                WARRANTY**

- .1 Contractor hereby warrants refrigeration compressors for 5 years.

**Part 2            Products**

**2.1                GENERAL**

- .1 System type:
  - .1 Air flow arrangement: horizontal
  - .2 Cooling: direct expansion
  - .3 Condensing: air cooled

**2.2                OUTDOOR CONDENSING UNITS**

- .1 General: Factory-assembled, single piece, air-cooled condensing unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, compressor, refrigerant holding charge, and special features required prior to field start-up. Unit shall be rated in accordance with ARI Standard and be CSA approved.

- .2 Unit Cabinet:
  - .1 Unit cabinet shall be constructed of galvanized steel, bonderized and coated with a prepainted baked enamel finish.
  - .2 A heavy gage roll-formed perimeter base rail with forklift slots and lifting holes shall be provided to facilitate rigging.
- .3 Fans:
  - .1 Condenser fans shall be direct driven, propeller-type, discharging air horizontally.
  - .2 Fan blades shall be balanced.
  - .3 Condenser fan discharge openings shall be equipped with PVC coated steel wire safety guards.
  - .4 Condenser fan and motor shaft shall be corrosion resistant.
- .4 Compressor:
  - .1 Compressor shall be mounted on vibration isolators.
  - .2 Compressors shall include overload protection.
- .5 Condenser Coil:
  - .1 Condenser coil shall be air-cooled and circuited for integral subcooler.
  - .2 Coil shall be constructed of aluminum fins (copper fins optional) mechanically bonded to internally grooved seamless copper tubes which are then cleaned, dehydrated, and sealed.
- .6 Refrigeration Components:
  - .1 Refrigeration circuit components shall include liquid line service valve, suction line service valve, liquid filter drier, a full charge of compressor oil, and a holding charge of refrigerant.
- .7 Controls and Safeties:
  - .1 Minimum control functions shall include:
    - .1 Control wire terminal blocks.
    - .2 Five-minute recycle protection to prevent compressor short-cycling.
    - .3 Compressor lockout on auto-reset safety until reset from thermostat.
  - .2 Minimum Safety devices which are equipped with automatic reset (after resetting first at thermostat), shall include:
    - .1 High discharge pressure cutout.
    - .2 Loss-of-charge cutout.
- .8 Electrical Requirements:
  - .1 208/1/60, 19.6 MCA.
  - .2 Unit electrical power shall be single-point connection.
  - .3 Unit control circuit shall contain a 24-v transformer for unit control.
- .9 Capacity: 3.5 kW (12 MBH) @ 31°C db (88°F db)



- .10 Provide the following:
  - .1 Hail Guard Package.
  - .2 Winter Start Package.
- .11 Acceptable materials:
  - .1 Owner supplied

### **2.3 4 WAY CEILING CASSETTE UNIT**

- .1 shall be designed for installation into the ceiling cavity and shall be equipped with a white panel.
  - .2 Unit shall provide up to four-way air distribution via motorized louvers which can be horizontally and vertically adjusted from 0° to 90°.
  - .3 Cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation. Units sound pressure shall range from 28 dB (A) to 33 dB(A) at low speed measured at 5 feet below the unit.
  - .4 Return air shall be through the concentric panel, which shall include a washable, resin net mold resistant filter. Return air thermistor shall be mounted inside concentric opening.
  - .5 Units shall be provided with condensate drain pumps suitable for 21 inches of lift. Pump shall be located below the coil in the condensate pan with a built in safety alarm.
  - .6 Units shall be provided with (MERV 8) high efficiency air filters.
- .2 Acceptable materials:
- .1 Owner Supplied

### **2.4 REFRIGERANT**

- .1 Holding charge of refrigerant applied at factory.

## **Part 3 Execution**

### **3.1 GENERAL**

- .1 Install as indicated, to manufacturers' recommendations.
- .2 Manufacturer to certify installation.
- .3 Run drain line from cooling coil condensate drain pan to terminate over nearest floor drain.
- .4 Provide concrete pad complete with 100 mm x 100 mm x 20 mm (4" x 4" x 3/4") neoprene type vibration isolation.

**3.2 EQUIPMENT**

.1 Preparation and Start-Up

- .1 Provide services of manufacturer's authorized factory trained mechanic to set and adjust equipment for operation as specified.
- .2 Provide results in operation and maintenance manuals

**END OF SECTION**

**Part 1 General**

**1.1 GENERAL**

- .1 Conform to general provisions for mechanical division in General Requirements section.

**1.2 SUBMITTAL**

- .1 Submit shop drawings and product data in accordance with general requirements,
- .2 Indicate the following: complete specifications, wiring diagrams (showing all interconnections); weight; performance details.
- .3 Provide data for inclusion in the Operating and Maintenance manuals in accordance with general requirements

**1.3 SHOP DRAWING SUBMISSION/UNIT DELIVERY REQUIREMENTS**

- .1 Shop drawings shall be submitted to the Consultant within two (2) weeks of Award of Contract.
- .2 Shop drawings shall be reviewed/returned by the Consultant within one (1) week of submission.
- .3 Contractor to order equipment from manufacturer immediately upon returned/approved shop drawings.
- .4 This Contractor shall co-ordinate with the manufacturer to ensure unit ventilator equipment is delivered to site and installed by January 2024. Include in tender price for premium costs associated with manufacturer's rush/accelerated delivery.

**Part 2 Products**

**2.1 HORIZONTAL UNIT VENTILATOR**

- .1 Exterior cabinet panels shall be constructed of heavy gauge steel. Units supplied as "heating only" shall be suitable for the future addition of a cooling coil and related components. Units shall be constructed such that testing and trouble-shooting can be accomplished in the end pockets of the unit without affecting the normal airflow pattern through the unit.

- .2 Floor mounted units shall have an integral pipe tunnel for convenient crossover of piping or electrical wiring in accordance with local and National Electric Codes (NEC). The front surface shall consist of three separate, removable panels. Control compartment must be accessible without removing the entire front panel. Unit discharge grille shall be welded continuous bar type with round edged steel bars placed for a 10° vertical deflection. Adjustable side deflection vanes shall be located beneath the continuous bar grille for easy adjustment by maintenance personnel]. A 6 mm (1/4") painted galvanized mesh screen shall be furnished and located beneath the discharge grille. Unit top surface shall be supplied with a textured paint surface that resists scuffing and hides fingerprints.  
  
Overall unit depth shall be 550 mm (21 7/8").
- .3 Motors shall be direct drive electronically commutated motors (ECM) and be mounted on rubber isolation. Blowers shall be designed specifically for unit ventilator operation. ECM motors shall be programmed to meet the scheduled airflow at the specified external static pressure with additional speed taps for manual adjustment on site during balancing. Motors shall consist of a brushless, permanently lubricated ball bearing construction for maintenance free operation.
- .4 Hydronic coils are to be constructed with copper tubes and mechanically bonded aluminum corrugated plate fins. Water coils shall be furnished with a threaded drain plug at the lowest point. A manual air vent shall be provided at the high point of the coil on all floor mounted units. An auto air vent shall be provided at the high point of the coil on all ceiling mounted units.
- .5 Unit manufacturer shall provide and install a capillary type auto reset freeze stat across the leaving side of the hot water coil. When tripped, the freeze stat shall be wired to shut the outdoor air dampers.
- .6 Microprocessor-based control for each unit ventilator that must be adaptable to future network system. This control must be pre-engineered, preprogrammed and pretested and shall be factory installed before shipment. The microprocessor-based control shall monitor room conditions and automatically adjust unit operations to maintain these requirements. The control sequence shall be on the basis of ASHRAE Cycle II or ASHRAE Cycle III as selected by owner. The manufacturer shall provide this DDC controller in each unit ventilator.
- .7 Separate room air and outdoor air dampers. The room air damper shall be constructed of aluminum and shall be counterbalanced against back pressure. Outdoor air damper shall be two-piece double wall construction with 15 mm (1/2") thick, 1.5 lb. density fiberglass insulation sandwiched between welded 1.0 mm (20 Ga.) galvanized steel blades for rigidity and to inhibit corrosion. Dampers shall be fitted with neoprene seals along all the sealing edges. Damper bearings shall be made of nylon or other material which does not require lubrication. Dampers shall be factory mounted complete with modulating spring return damper actuator for proportional damper control.
- .8 Integral factory installed face and bypass damper. The face and bypass damper shall be constructed of aluminum and have a dead air space to minimize pickup in the bypass position. The long sealing edges of the damper shall be fitted with silicone rubber impregnated glass cloth seals with blended mohair seals on the ends for long life and positive sealing

- .9 Filters shall be MERV-13.
- .10 Unit manufacturer shall provide an external wall louvre for the outdoor air intake. The louvre and frame shall be of heavy gauge aluminum with 45 deg. blades. The blade profile shall be designed to prevent water penetration. The louvre shall have ½” birdscreen attached to the inner face and shall have a minimum free area of 1.1 sq. ft. The finish on the louver shall be a custom color as selected by the consultant.
- .11 Unit manufacturer shall provide a wall sleeve and shall be custom sized to suit the wall depth. The wall sleeve shall include air flow separators to prevent mixing of fresh air, condenser air intake and condenser air exhaust.
- .12 Unit manufacturer shall provide a decorative exterior aluminum wall grille constructed of heavy gauge aluminum with rectangular holes to match louvre blade spacing to maximize the air opening. Grille to be secured to wall louvre/ exterior wall. The grille finish shall match the louvre above.
- .13 All internal line voltage wiring shall be by the unit manufacturer.
  - .1 A suitably rated unfused disconnect switch shall be factory installed within the unit.
- .14 Control Components
  - .1 Provide terminal strip (“digital-ready”) for standard electric/mechanical controls per Energy Controls.
- .15 Unit Selection and capacity: As per schedule on drawings.
- .16 Acceptable manufacturers:
  - .1 Daikin
  - .2 Trane
  - .3 Engineered Air

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install in accordance with manufacturer’s instructions.
- .2 Install equipment exposed to finished areas after walls and ceiling are finished and painted. Avoid damage.
- .3 Protection: Provide finished cabinet units with protective covers during balance of construction.
- .4 Unit Ventilators: Locate as indicated, level and shim units, and anchor to structure. Coordinate with existing wall louvre and radiation cabinet. Adjust existing adjacent surfaces as required for a complete finished installation.

- .5 Hydronic Units: Install with shut-off valve on supply and lockshield balancing valve on return piping. If not easily accessible, extend vent to exterior surface of cabinet for easy servicing.
- .6 The mechanical contractor shall charge the refrigeration system after installation and ensure that the cooling system is operating correctly.

**END OF SECTION**

**Part 1            General**

**1.1                SHOP DRAWINGS**

- .1      Submit shop drawings in accordance with general requirements.
- .2      Indicate:
  - .1      Equipment, capacity, piping, and connections.
  - .2      Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, sizes and location of mounting bolt holes.
  - .3      Special enclosures.
- .3      Primer coat to be off white.
- .4      All hydronic heating shall be by a single manufacturer.

**1.2                MAINTENANCE DATA**

- .1      Provide maintenance data for incorporation into manual specified in general requirements.

**Part 2            Products**

**2.1                DAMPERS**

- .1      Factory built, internal damper, complete with operator, at enclosure air outlet grille for each convection type heating unit not thermostatically controlled. Refer to schedules on drawings.

**2.2                CAPACITY**

- .1      As indicated.

**2.3                EXISTING WALL FIN AND CABINET RADIATION (H-EX)**

- .1      Remove existing cover, vacuum existing fin and components.
- .2      Replace damaged components including but not limited to hangers, wall mounting brackets.
- .3      Replace existing control valve where installed and ensure operation.
- .4      Replace isolating valves as indicated.
- .5      Replace existing cabinet. Provide new filler pieces etc., to match existing cabinet.

**2.4                FINNED TUBE RADIATION H-2**

- .1      Heating elements: NPS 32 mm (1 1/4") seamless copper tubing, 1.2 mm (18 gauge) minimum wall thickness, mechanically expanded into flanged collars of evenly spaced aluminum fins, 100 mm x 100 mm (4" x 4") nominal, 164 fins per meter (50 fins/ft) suitable for sweat fittings.

- .2 Element hangers: cradle type providing unrestricted longitudinal movement on enclosure brackets. Space brackets 900 mm (36") centres maximum.
- .3 Standard enclosures: 450 mm (18") high, 1.6 mm (16 gauge) thick steel complete with stamped grille, components for wall-to-wall or complete with die formed end caps having no knock-outs, with inside corners, outside corners, as indicated. Provide full length channel and sealer strip at top of wall edge. Height as indicated. Joints and filler pieces to be flush with cabinet. Support rigidly top and bottom, on wall mounted brackets. Joints and filler pieces to be clear of grilles located to provide easy access to valves and vents. Provide access doors for valves. Finish cabinet with factory applied baked primer coat. Enclosure height as indicated. Sloping top, sloping bottom.
- .4 Special enclosures: as indicated.
- .5 Dimensions for enclosures: measure site conditions. Do not scale from drawing.
- .6 Provide for noiseless expansion of all components.
- .7 Expansion compensators: Flexonics at each section by mechanical contractor as specified elsewhere.
- .8 Acceptable materials: As indicated on drawings.

## **2.5 CABINET CONVECTORS**

- .1 Heating element: seamless copper tubing mechanically expanded into flanged collars of evenly spaced aluminum fins and cast iron headers, steel side plates and supports.
- .2 Cabinet: type as indicated, 1.6 mm (16 gauge) thick steel back and ends, manual damper, exposed corners rounded, secured removable front panel, braced and reinforced for stiffness. Provide stamped grill in sloping top, open bottom. Provide damper and operator and access doors for valves. Finish cabinet with factory applied baked primer coat.
- .3 Catalogue rating: certified IBR ratings.
- .4 Capacity: as indicated.
- .5 Acceptable materials: As indicated on drawings.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install in accordance with manufacturer's instructions.
- .2 Install in accordance with piping layout and reviewed shop drawings.
- .3 Provide for pipe movement during normal operation.
- .4 Maintain sufficient clearance to permit performance of service maintenance.
- .5 Check final location with Consultant if different from that indicated prior to installation. Should deviations beyond allowable clearances arise, request and follow Consultant's directive.



- .6 Valves
  - .1 Install valves with stems upright or horizontal unless approved otherwise.
  - .2 Install isolating gate valves on inlet and balancing valves on outlet of each unit.
- .7 Venting:
  - .1 Install screwdriver vent on cabinet convector, terminating flush with surface of cabinet.
  - .2 Install standard air vent with cock on continuous finned tube radiation.
- .8 Clean finned tubes and comb straight.
- .9 Install flexible expansion compensators as indicated.
- .10 Mount wall mounted convectors at 200 mm (8") above finish floor.
- .11 Mount wall mounted radiation at 200 mm (8") above finish floor unless otherwise indicated.
- .12 On units fed from below floor provide factory manufactured piping shrouds on the exposed piping between base of the radiation cabinet and finished floor. Shroud shall be manufactured by the radiation manufacturer. Shroud shall match finish of the radiation cabinet.

**END OF SECTION**

**Part 1            General**

**1.1                GENERAL REQUIREMENTS**

- .1 Conform to General Conditions for Mechanical Trades.
- .2 Related Work Specified Elsewhere.
  - .1 General Conditions for Mechanical Trades
  - .2 Plumbing & Drainage
  - .3 Heating, Ventilation & Air Conditioning
  - .4 Heating, Ventilation & Air Conditioning Equipment
  - .5 Electrical

**1.2                DESCRIPTION OF SYSTEM**

- .1 Furnish and install all components, devices and control wiring for a fully integrated Energy Management and Environmental Control System incorporating Direct Digital Control (DDC), and equipment monitoring. The system shall control/monitor HVAC and plumbing equipment and systems as specified in this section. The work shall include but is not limited to the following:
  - .1 All necessary hardware, software, control panels, control wiring, field devices, installation, documentation and owner training as specified.
  - .2 The installed system shall incorporate electronic and digital control devices to perform the control sequences and monitoring outlined herein. Specific control sequence requirements are as detailed elsewhere in this Section of the specification.
  - .3 Control and monitoring of the equipment and systems shown on the drawings (refer also to 'Sequence of Operation' for additional details).
  - .4 Control valves shall be supplied by this Trade but installed in the piping system by the Mechanical Trade complete with transitions and unions as required.
  - .5 Testing, debugging, calibrating, adjustment, programming and confirmation of total system operation.

**1.3                MANUFACTURER AND INSTALLING CONTRACTOR**

- .1 The temperature control manufacturer shall be Energy Controls.
- .2 The local Energy Controls contractor is available at phone 519-893-2638.
- .3 Any new building must be a seamless extension of the current Energy Management and Building Control System.
  - .1 The existing Energy Controls Vista software is, and shall continue to be, the only head-end BAS server for the entire School Board.
  - .2 The head-end server contains the secure Energy Management Settings (i.e. Master Setpoints & Schedules) that are sent to all schools in real-time. The control system must be an extension of the head-end server and be able to be managed exclusively through the Vista head-end server.

- .3 Monitoring of all school board control systems are done in real-time and must be presented at the exclusive Vista head-end server as first-priority data.
- .4 The Vista head-end server has all the required controller databases and software to be able to centrally maintain and modify network configuration and controller software for the entire School Board. The Vista head-end server is the only system that can access the LacNet programming variables inside the controllers for real-time configuration of setpoint and time scheduling parameters.
- .5 The graphics and controller database must be presented inside the Vista head-end server in its native format in order to preserve the real-time speed, integrity and multi-site administration of the entire system.

#### **1.4 SCOPE OF WORK**

- .1 Refer to drawings and specification for complete scope.
- .2 Unit ventilator control (heating, cooling, free cooling, outdoor air ventilation).

#### **1.5 QUALITY OF ASSURANCE**

- .1 The system components shall be listed by Underwriters Laboratories Inc. and Canadian Standards Association.
- .2 The system control products shall be stored and handled according to manufacturer' recommendations.
- .3 The work shall be performed by skilled technicians all of whom shall be properly trained and qualified for this work.

#### **1.6 SUBMITTALS**

- .1 Prior to the installation of any equipment, the Contractor shall provide the Consultant with shop drawings and specifications for all devices and equipment used for the complete system installation. Shop drawings shall include the following:
  - .1 Identified schematic control diagrams for all systems, each diagram indicating or referencing input / output connection points, control components, component catalogue numbers, operation sequence, interlocking and RPU's to which they are connected.
  - .2 Complete network schematic indicating all programmable controllers and data connections.
  - .3 Detailed listing of inputs and outputs of each programmable controller.
  - .4 Control damper schedule indicating damper size, required torque and blade type.
  - .5 Technical data sheets / manufacturer application manuals of each system component.

- .2 Upon completion of the installation and prior to acceptance and Owner training, the Contractor shall furnish the Consultant with three copies of installation and operation manuals for the system. Each manual shall include:
  - .1 Record drawings, including plan layout indicating major device locations and wiring diagrams as finally installed.
  - .2 All shop drawings, incorporating all required revisions to reflect as-built conditions.
  - .3 The Contractor shall also keep one copy of backup programs for the system archived in a software storage vault at their business location.

## **Part 2 Products**

### **2.1 GENERAL**

- .1 The control system shall be a Tour Andover (TAC) Xenta/Distech building automation system (BAS).
- .2 The system shall integrate the operation of intelligent building management controllers distributed into the network.
- .3 The DDC System shall be generally comprised of the following devices to achieve the control functions described in this section:
  - .1 Xenta/Distech programmable controllers
  - .2 Distech input/ output programmable I/O modules.
  - .3 Control relays.
  - .4 Control dampers and valves.
  - .5 Sensors, actuators and other input/output devices.
- .4 Controllers shall execute the application programs, calculations, and commands to provide the control function specified for that unit. Each controller shall include its own micro-computer controller, power supply, input/output modules, termination modules and real time clock.
- .5 Controllers shall be capable of full control functionality and alarm reporting independently or as a part of the DDC network.
- .6 The system shall be stored in flash ram so no batteries are required.
- .7 Each control device shall be modular and expandable to provide additional inputs and outputs and control functionality for that device
- .8 Each controller shall be able to transfer and receive data via the network for performance of control functions.
- .9 The system shall be modular, permitting expansion by adding hardware and software without changes in communication or processing equipment.
- .10 The complete system shall be capable of communication over a LonWorks network.
- .11 The controllers shall monitor the status of all overrides and include this information in logs and summaries to inform the operator that automatic control has been inhibited.

- .12 Controllers shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all subsidiary equipment and provide both local and remote annunciation of any component failures.
- .13 Controllers shall activate an orderly shutdown of their operation in the event of loss of normal electrical power. Non-volatile memory shall be incorporated for all controller configuration data. The controllers shall automatically resume full operation without manual intervention.
- .14 The controllers shall have sufficient memory to support their own operating system and data bases including:
  - .1 control processes
  - .2 energy management applications
  - .3 alarm management
  - .4 trend data
  - .5 operator input/output
  - .6 remote communications
  - .7 manual override monitoring
- .15 Controllers shall incorporate the following software features:
  - .1 Energy management:
    - .1 Time of Day Scheduling
    - .2 Calendar Based Scheduling
    - .3 Holiday Scheduling
    - .4 Optimal Start and Stop
    - .5 Demand Limiting
    - .6 Heating/Cooling Interlock
  - .2 Alarm Management:
    - .1 Alarm Management shall be provided to monitor, buffer and direct alarm reports to operator devices and memory files. The controllers shall perform alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic and prevent alarms from being lost.
    - .2 All alarm or point change report shall include the points English language description and the time and date of occurrence.
    - .3 The user shall be able to define the specific reaction for each point, the priority level (3 in total) and ability to inhibit alarm reporting for each point.
    - .4 The user shall be able to define conditions under which point changes need to be acknowledged by an operator and logged for analysis at a later date.
    - .5 The user shall be able to print, display or store a unique 60 character alarm message to more fully describe the alarm condition or direct operator response. The message shall be customizable to describe each individual alarm.

- .6 In web access applications only critical alarms shall initiate a call to a remote operator device, otherwise call activity shall be minimized by time stamping and saving reports until a manual request is received or until the buffer space (minimum 50 alarms) is full.
- .3 Trend Logs:
  - .1 Controllers shall provide an automatic roll-over trend log, which stores records up to an operator-selected number at an operator-selected sampling rate and then overwrites the oldest record with each new record.
  - .2 Sample intervals shall be from 1 minute to 24 hours.
  - .3 Provide graphical and tabular displays
- .4 Runtime Totalization:
  - .1 The controllers shall automatically accumulate and store runtime hours for binary points with a sampling resolution of 1 minute. The user shall have the ability to define a warning limit to trigger maintenance or user-defined messages.
- .5 Custom Programming:
  - .1 The controllers shall permit user defined custom control processes based on:
    - .1 any system measured data or status
    - .2 any calculated data
    - .3 any results from other processes
    - .4 Boolean logic
  - .2 The custom processes may be triggered by:
    - .1 Time-of-day
    - .2 calendar date
    - .3 events (point alarm etc.)
- .16 The control strategy for each control loop shall be performed by software within the controller. The sequence of events required for each control loop is described for each system in the control sequence.
- .17 Outdoor air temperature indication shall be available at each controller as an integral part of the control strategies for that controller. Should the network transmission of the common outdoor air temperature (or any other common value) fail, then each controller shall use the last good value received.
- .18 Controls and Requirements for VVT Systems
  - .1 Where VVT controls are specified, units are to operate as part of a Variable Volume/Variable Temperature System complete with all necessary controls including zone dampers, temperature sensors, static pressure sensor probes and bypass damper.

## **2.2 NETWORK ARCHITECTURE**

- .1 The controllers on the local network shall communicate via a two wire LonTalk TP/FT-10 network.

## **2.3 CONTROL PANELS**

- .1 Control panels shall be fully enclosed cabinets with all steel construction. Cabinets shall have a hinged door with locking latch or bolt-on cover plate. All cabinet locks shall be common keyed. Cabinets shall be finished with two coats of paint.

## **2.4 TEMPERATURE SENSORS**

- .1 Provide thermistor temperature sensors, not requiring transmitters, to measure temperature.
- .2 Accuracy shall be +/-0.2°C from 0 to 70°C.
- .3 Temperature sensors shall be Greystone EC200 series.
- .4 Space sensors in occupied areas shall be type AE or equal having an integral push button for unoccupied override and an integral slider to adjust set point (LED display not required).
- .5 In corridors and where noted on the drawings, provide stainless steel plate type sensors (push button override and LED display not required), type AS.
- .6 Duct temperature sensors shall be type B having a stainless steel probe length to suit application and ABS enclosure. Duct averaging temperature sensors shall be type FD having an element length to suit application, copper probe and ABS enclosure.
- .7 Immersion temperature sensors shall be type C having a ¼" OD stainless steel probe, 4" long and ABS enclosure. Immersion sensors shall be complete with thermowells. Thermal conductive compound shall be added inside the thermowell to provide optimum thermal transfer from the fluid to sensor. Stainless steel thermowells shall be used for steel pipe and brass thermowells shall be used in copper pipe.

## **2.5 CARBON DIOXIDE SENSORS**

- .1 Sensors shall Greystone CDD series or equal having the following features:
  - .1 0-2000 ppm factory default detection range, field adjustable.
  - .2 Non-dispersive infrared sensing element with self-calibration algorithm.
  - .3 Guaranteed 5 year calibration interval.
  - .4 Powered by either AC or DC source.
  - .5 Accuracy: within 50 ppm or 3% of reading (whichever is greater).
  - .6 Operating humidity range: 0-95% RH.
  - .7 Operating temperature range: 0 to 50°C or greater.
  - .8 Stability: less than 2% full scale in 15 years
  - .9 Response time: less than 2 minutes for 90% step change.

- .2 Duct mounted sensors shall be complete with ABS enclosure complete with sampling tube.
- .3 Space mounted sensors shall be executive space type without LCD display.

## **2.6 MOTORIZED CONTROL DAMPERS**

- .1 Control dampers shall be the parallel or opposed blade type as below or as scheduled on drawings.
  - .1 Outdoor and/or return air mixing dampers and face and bypass (F & BP) dampers shall be parallel blade, arranged to direct air-streams toward each other.
  - .2 Other modulating dampers shall be the opposed blade type.
  - .3 Two-position shutoff dampers may be parallel or opposed blade type with blade and side seals.
- .2 Damper frames shall be 13 gauge galvanized steel channel or 1/8 in. extruded aluminum with reinforced corner bracing.
- .3 Damper blades shall not exceed 20 cm (8 in.) in width or 125 cm (48 in.) in length. Blades are to be suitable for medium velocity performance (10 m/s [2000 fpm]). Blades shall be not less than 16 gauge.
- .4 Damper shaft bearings shall be as recommended by manufacturer for application, oil impregnated sintered bronze or better.
- .5 All blade edges and top and bottom of the frame shall be provided with replaceable butyl rubber or neoprene seals. Side seals shall be spring-loaded stainless steel. The blade seals shall provide for a maximum leakage rate of 50 L/s m<sup>2</sup> (10 cfm per ft<sup>2</sup>) at 1000 Pa (4 in. w.g.) differential pressure. Provide air foil blades suitable for a wide-open face velocity of 7.5 m/s (1500 fpm).
- .6 Individual damper sections shall not be larger than 125 cm x 150 cm (48 in. x 60 in.). Provide a minimum of one damper actuator per section.
- .7 Modulating dampers shall provide a linear flow characteristic where possible.
- .8 Dampers shall have exposed linkages.

## **2.7 WATER CONTROL VALVES**

- .1 Heating and cooling control valves shall be Belimo CCV series characterized ball valves, complete with chrome plated brass trim and NPT female pipe connections. Radiation valves shall be complete with non-spring return modulating actuators. Control valves for coils heating a portion of outdoor air shall have spring return modulating actuators.
- .2 Control valves shall be sized to provide approximately one half the circuit branch pressure drop to obtain good modulation control but they shall be no smaller than two pipe sizes less than the pipe they are installed in.



**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Installation
  - .1 All controllers and components in the system and on the network shall be installed according to manufacturer recommendations, general installation standards for digital controls and in accordance with the approved shop drawings.
  - .2 Locate room sensors in the locations shown on the mechanical drawings. All sensors shall be mounted at barrier free height (3'-11" (1175 mm) above finished floor).
  - .3 All control components for off site system access shall be located where noted on the drawings. The Electrical Contractor shall provide all required connections / cabling for off site access to the web access components.
  - .4 All programmable controllers, web access components, relays and other control components shall be located within control panels. Control Panels shall be wall mounted and shall be located within suspended ceiling spaces or other locations approved by the Consultant.
  - .5 The Electrical Contractor will provide hand-off-auto switches in all starters controlled by the BAS.
- .2 Generally duct mount carbon dioxide sensors shall be used where specified for air handling units; but, for gyms and single zone libraries, a wall mount carbon dioxide sensor shall be mounted next to the room temperature sensor.
- .3 All carbon dioxide levels which are measured by the carbon dioxide sensors shall be made available to the Owner in the form of trend logs. Record readings at 10 minute intervals and keep them for at least 30 days.
- .4 Freeze-stats shall be installed so that their sensing element runs horizontally across the coil face (not diagonally) with no more than 12" vertical drops at the outside coil frame. The full face of the coil shall be covered with no horizontal runs being more than 12" apart. The top and bottom horizontal run shall be within 6" of the coil frame. If more than one freezestat is required they shall be wired in series in order to detect a low temperature in portion of the coil. The sensing elements shall be firmly secured in place to avoid vibration without added air restriction.

**3.2 SYSTEM START-UP AND ACCEPTANCE**

- .1 Upon completion of installation, test, adjust and calibrate controls provided under this Section.
- .2 On system completion, a demonstration of complete system operation shall be made to the Owner's authorized representative and Consultant.
- .3 The Consultant shall verify through the Owners representatives that the entire system is complete and operating to the satisfaction of the Owner before final acceptance is approved.

### **3.3 TRAINING**

- .1 The Contractor shall provide competent instructors to give full instruction to designated personnel in the adjustment, operation and maintenance of the system installed rather than a general training course. Instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach. All training shall be held during normal work hours of 8:00 a.m. to 4:30 p.m. weekdays as follows:
- .2 Provide 4 hours of training for Owner’s operating personnel. Training shall include:
  - .1 Explanation of drawings, operations and maintenance manuals
  - .2 Explanation of web access program
  - .3 Explanation of adjustment procedures
  - .4 Trend Analysis

### **3.4 WARRANTY**

- .1 Equipment, material and software shall be unconditionally guaranteed for a period of two years from the date of substantial completion.
- .2 Provide warranty service at no cost to the Owner for the guarantee period, which shall include but not be limited to the following:
  - .1 Emergency repair service on regular working hour basis during warranty.
  - .2 Replacing defective parts and components as required.
  - .3 System software support.

### **3.5 IDENTIFICATION**

- .1 Provide system identification and provide nameplates identifying the following (nameplates shall be keyed to the wiring diagrams):
  - .1 Duct mounted sensors.
  - .2 Control panels (identify as to equipment / systems controlled). Each panel shall include an as-built drawing showing all the connected control points.

### **3.6 TESTING AND BALANCING**

- .1 During the system testing and balancing by the Testing and Balancing Agency, demonstrate the operation of all controls. During balancing procedures, set controls to a fixed mode (bypass damper locked fully closed and all zone dampers locked fully open) to prevent any changes during the balancing procedure.

### **3.7 ELECTRICAL WIRING**

- .1 All wiring shall be installed to the standards specified in the Electrical Division.
- .2 Use Echelon recommended orange jacket cable for all network wiring.
- .3 Run all wiring in EMT conduit where exposed, where running within concrete block walls and where required by the Ontario Electrical Code. Plenum rated cable shall be used in return air ceiling plenums.

- .4 Control relays necessary for BAS operation shall be provided by the Temperature Control Contractor but all contactors and their power supplies handling power wiring to the equipment shall be by the Electrical Contractor.

#### **Part 4 Sequence of Operation**

##### **4.1 GENERAL**

- .1 All setpoints shall be adjustable.
- .2 Outdoor air temperature shall be broadcasted to all controllers.
- .3 Heating mode: Heating is enabled between October 15 and April 15 or if the outdoor air temperature is below 10°C. This heating mode is used in all controllers for the building.
- .4 Cooling Mode: Mechanical cooling is enabled if the outdoor air temperature is above 18°C.
- .5 Occupancy mode shall be determined by a weekly schedule with an annual holiday schedule. Each system shall have this schedule but there shall be provision for operating under a general (to the building) schedule as well. An adjustable parameter shall be available to select the local or general schedule for each system.
- .6 Lead/lag: Devices designed for lead lag operation shall operate in automatic lead/lag mode to equalize run time. If the lead unit fails the lag shall automatically start and an alarm shall be generated. The lead unit shall be advanced through the series of devices in sequence every Tuesday at noon.

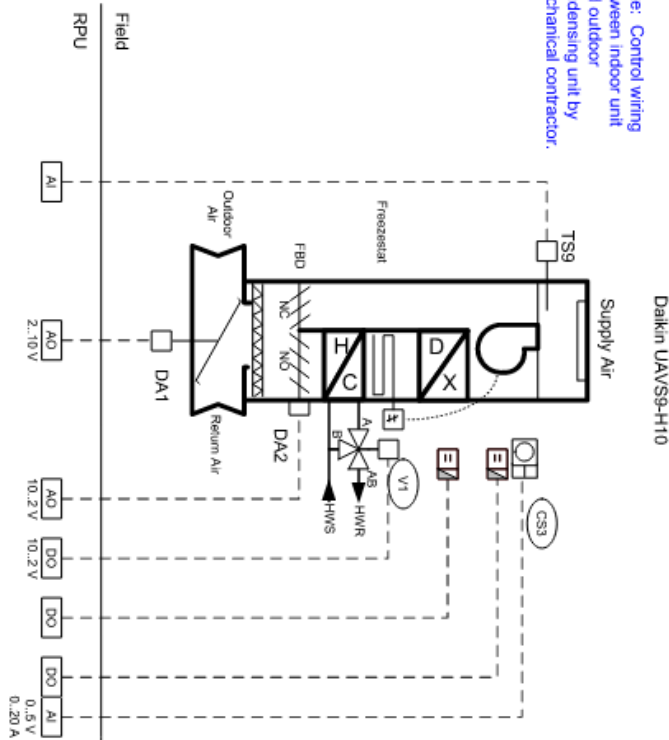
##### **4.2 EQUIPMENT SERVICES**

- .1 Graphical sequence of operations will be provided by BAS contractor.

**END OF SECTION**

- Notes:
- 1) 120V power for controls is provided by Div. 16.
  - 2) Freezestat is factory wired to shut down fan, open heating valve and close outside air damper.
  - 3) DA1: Bellmo actuator supplied with unit (SR) "A1", 2 V = OA closed
  - 4) DA2: Bellmo actuator supplied with unit (NSR) "AZ", 2 V = bypass, 10 V = open to coil.
  - 5) TS9: Supply air sensor supplied with unit (10 k).
  - 6) 3-speed ECM fan motor set to medium speed.

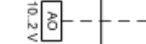
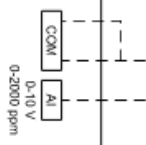
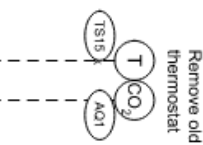
Note: Control wiring between indoor unit and outdoor condensing unit by mechanical contractor.



Note:  
 UV2-7 : Daikin UAVS9H10  
 UV8-10: Daikin UAVS9H07  
 UV-11: Daikin UAVS9H15

| UV    | Room            | Supply (cfm) | DX (tons) | Hq (MBH) | Hq Vlv (MBH) | Rad (MBH) | Rad (Vx) | Notes        |
|-------|-----------------|--------------|-----------|----------|--------------|-----------|----------|--------------|
| UV-1  | Class 10 (101A) | 800          | 2         | 60.3     | V1           | 35        |          |              |
| UV-3  | Class 11 (101C) | 800          | 2         | 60.3     | V1           | 35        |          |              |
| UV-4  | Class 12 (102A) | 800          | 2         | 60.3     | V1           | 35        | V2       | 25.2 MBH rad |
| UV-6  | Class 9 (201A)  | 800          | 2         | 60.3     | V1           | 35        |          |              |
| UV-8  | Class 8 (201C)  | 800          | 2         | 60.3     | V1           | 35        |          |              |
| UV-9  | Class 7 (202A)  | 800          | 2         | 60.3     | V1           | 46        |          |              |
| UV-11 | Class 6 (202C)  | 800          | 2         | 60.3     | V1           | 46        |          |              |
| UV-12 | Class 5 (203A)  | 800          | 2         | 60.3     | V1           | 46        |          |              |
| UV-14 | Class 4 (203C)  | 800          | 2         | 60.3     | V1           | 46        |          |              |

9 Systems As Shown

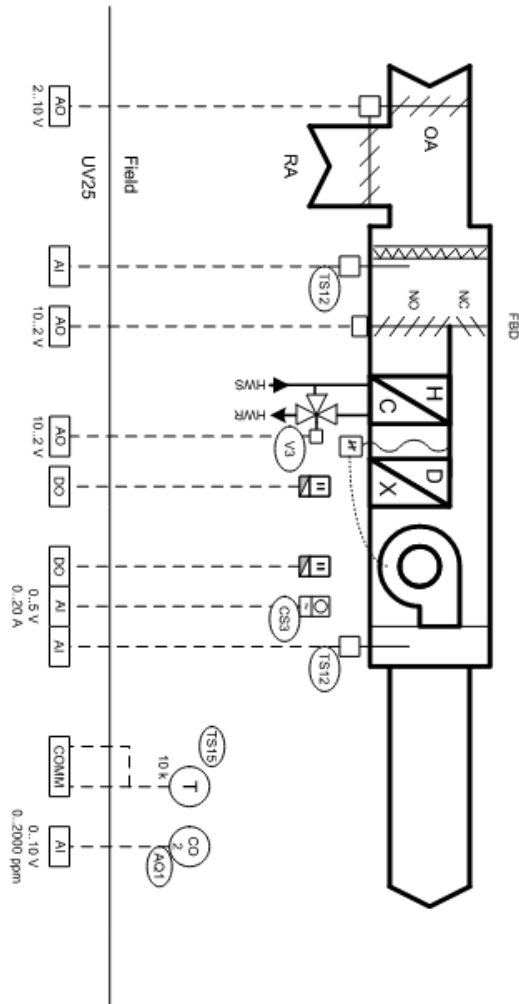


|        |  |  |           |                                 |                             |   |
|--------|--|--|-----------|---------------------------------|-----------------------------|---|
| Job #: | Job Name: Central PS Accessibility Upgrade | Owner: Waterloo Region District School Board | Drawn By: | Revision Date: November 8, 2022 | Title: New Unit Ventilators | 1 |
|--------|--|--|-----------|---------------------------------|-----------------------------|---|

- Notes:
- 1) 120V power for controls is provided by Div. 16.
  - 2) Freezestat is factory wired to shut down fan, open heating valve and close outside air damper.
  - 3) DA1: Bellimo actuator supplied with unit (SR) "A1", 2 V = OA closed
  - 4) DA2: Bellimo actuator supplied with unit (NSR) "AZ", 2 V = bypass, 10 V = open to coil.
  - 5) TS9: Supply air sensor supplied with unit (10 K).
  - 6) 3-speed ECM fan motor set to medium speed.

| 5 Systems As Showed |            |           |              |           |            |               |       |
|---------------------|------------|-----------|--------------|-----------|------------|---------------|-------|
| UV                  | Room       | Room Slat | Supply (cfm) | DX (tons) | Htg (MBtu) | Htg VAV (VAV) | Notes |
| UV-2                | Acove 101E | 101B      | 1000         | 3         | 73.7       | V3            |       |
| UV-5                | Class 13   | 13        | 1000         | 3         | 73.7       | V3            |       |
| UV-7                | Acove 201E | 201B      | 1000         | 3         | 73.7       | V3            |       |
| UV-10               | Acove 202E | 202B      | 1000         | 3         | 73.7       | V3            |       |
| UV-13               | Acove 203E | 203B      | 1000         | 3         | 73.7       | V3            |       |

Note: Control wiring between indoor unit and outdoor condensing unit by mechanical contractor.



|           |                                       |                |                                       |           |  |   |
|-----------|---------------------------------------|----------------|---------------------------------------|-----------|--|---|
| Job #:    | Waterloo Region District School Board | Owner:         | Waterloo Region District School Board | Drawn By: | Title: <b>New Ceiling Unit Ventilators</b> |   |
| Job Name: | Central PS Accessibility Upgrade      | Revision Date: | November 8, 2022                      |           |  |   |
|           |                                       |                |                                       |           |  | 2 |

### DUCTLESS SPLIT

1 System as Shown

| Room              | Unit | DX Clg (tons) | Rad (MBh) | Rad Vw (VA) | Notes |
|-------------------|------|---------------|-----------|-------------|-------|
| Seminar Room A131 | DS-1 | 2             | 11.05     | V4          |       |

**SEQUENCE OF OPERATION**

The room temperature sensor cycles the fan coil to maintain the occupied cooling setpoint and modulates the rad valve to maintain the heating setpoint. The cooling setpoint is 2°C higher than the heating setpoint with a minimum of 23.5°C. The outdoor air damper opens when occupied. The ductless split is disabled when unoccupied or when the outside air temperature is below the global mechanical cooling disable setpoint (initially 12/14°C). A minimum off-time of 5 minutes is provided.

An alarm is generated if the room temperature is too cold (14/16°C) or too hot (38/36°C).

Job #:

Job Name: Central PS  
Accessibility Upgrade

Owner:  
Waterloo Region  
District School Board

Drawn By:

Revision Date:  
November 8, 2022

Title: **Ductless Split Controls**

3

|   | Job #:<br>Job Name: Central PS<br>Accessibility Upgrade | Owner:<br>Waterloo Region<br>District School Board | Drawn By:<br>Revision Date:<br>November 8, 2022 | Title: <b>Perimeter Heating Controls</b> | 4 |                    |  |  |  |  |      |           |           |        |       |             |  |  |  |  |          |      |       |     |  |            |      |       |     |  |              |  |  |  |  |          |      |      |     |  |          |      |      |     |  |
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| <div style="display: flex; justify-content: space-between;"> <div> </div> <div> <table border="1"> <thead> <tr> <th colspan="5">5 Systems as Shown</th> </tr> <tr> <th>Room</th> <th>Htg (MBh)</th> <th>Htg (gpm)</th> <th>Htg Cv</th> <th>Notes</th> </tr> </thead> <tbody> <tr> <td>First Floor</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Vest 806</td> <td>60.4</td> <td>6.214</td> <td>3.6</td> <td></td> </tr> <tr> <td>EI Mach Rm</td> <td>3.56</td> <td>0.366</td> <td>0.2</td> <td></td> </tr> <tr> <td>Second Floor</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Corr 814</td> <td>13.9</td> <td>1.43</td> <td>0.8</td> <td></td> </tr> <tr> <td>Corr 815</td> <td>13.9</td> <td>1.43</td> <td>0.8</td> <td></td> </tr> </tbody> </table> </div> </div> |   |  |   |  |   | 5 Systems as Shown |  |  |  |  | Room | Htg (MBh) | Htg (gpm) | Htg Cv | Notes | First Floor |  |  |  |  | Vest 806 | 60.4 | 6.214 | 3.6 |  | EI Mach Rm | 3.56 | 0.366 | 0.2 |  | Second Floor |  |  |  |  | Corr 814 | 13.9 | 1.43 | 0.8 |  | Corr 815 | 13.9 | 1.43 | 0.8 |  |
| 5 Systems as Shown  |   |  |   |  |   |                    |  |  |  |  |      |           |           |        |       |             |  |  |  |  |          |      |       |     |  |            |      |       |     |  |              |  |  |  |  |          |      |      |     |  |          |      |      |     |  |
| Room  | Htg (MBh)   | Htg (gpm)  | Htg Cv  | Notes                                    |   |                    |  |  |  |  |      |           |           |        |       |             |  |  |  |  |          |      |       |     |  |            |      |       |     |  |              |  |  |  |  |          |      |      |     |  |          |      |      |     |  |
| First Floor   |   |  |   |  |   |                    |  |  |  |  |      |           |           |        |       |             |  |  |  |  |          |      |       |     |  |            |      |       |     |  |              |  |  |  |  |          |      |      |     |  |          |      |      |     |  |
| Vest 806  | 60.4  | 6.214  | 3.6   |  |   |                    |  |  |  |  |      |           |           |        |       |             |  |  |  |  |          |      |       |     |  |            |      |       |     |  |              |  |  |  |  |          |      |      |     |  |          |      |      |     |  |
| EI Mach Rm  | 3.56  | 0.366  | 0.2   |  |   |                    |  |  |  |  |      |           |           |        |       |             |  |  |  |  |          |      |       |     |  |            |      |       |     |  |              |  |  |  |  |          |      |      |     |  |          |      |      |     |  |
| Second Floor  |   |  |   |  |   |                    |  |  |  |  |      |           |           |        |       |             |  |  |  |  |          |      |       |     |  |            |      |       |     |  |              |  |  |  |  |          |      |      |     |  |          |      |      |     |  |
| Corr 814  | 13.9  | 1.43   | 0.8   |  |   |                    |  |  |  |  |      |           |           |        |       |             |  |  |  |  |          |      |       |     |  |            |      |       |     |  |              |  |  |  |  |          |      |      |     |  |          |      |      |     |  |
| Corr 815  | 13.9  | 1.43   | 0.8   |  |   |                    |  |  |  |  |      |           |           |        |       |             |  |  |  |  |          |      |       |     |  |            |      |       |     |  |              |  |  |  |  |          |      |      |     |  |          |      |      |     |  |

## **Division 26 Common Requirements for Electrical**

|          |  |
|----------|--|
| 26 00 11 | Electrical Specification Index   |
|          | <b>Common Contract Requirements for Electrical</b>                             |
| 26 01 15 | Allowances and Fees  |
| 26 01 16 | Electrical General Requirements  |
| 26 01 17 | Demolition and Renovation  |
| 26 01 20 | Commissioning and Integrated Testing of Life Safety and Fire Protection System |
|          | <b>Common Work Results for Electrical</b>                                      |
| 26 05 19 | Wires and Cables   |
| 26 05 20 | Splitters, Junction, and Pull Boxes  |
| 26 05 21 | Outlet Boxes, Conduit Boxes and Fittings                                       |
| 26 05 22 | Wire and Box Connectors – 0 –1000 V  |
| 26 05 26 | Grounding Secondary  |
| 26 05 33 | Conduits, Conduit Fastenings and Conduit Fittings                              |
| 26 05 74 | Short Circuit Coordination Study Arc Flash Hazard Analysis                     |
| 26 05 75 | Auxiliary Systems  |
|          | <b>Switchboard and Panelboards</b>   |
| 26 24 13 | Service Entrance Board   |
| 26 24 16 | Panelboards  |
| 26 24 17 | Moulded Case Circuit Breakers  |
|          | <b>Low-Voltage Distribution Equipment</b>                                      |
| 26 27 26 | Wiring Devices   |
|          | <b>Low-Voltage Circuit Protective Devices</b>                                  |
| 26 28 13 | Fuses – Low Voltage  |
| 26 28 16 | Disconnect Switches  |
|          | <b>Interior Lighting</b>   |
| 26 51 13 | Lighting Equipment   |

## **Division 28 Electronic Safety and Security**

|          |                                  |
|----------|----------------------------------|
|          | <b>Fire Detection and Alarm</b>  |
| 28 31 24 | Fire Alarm System (Conventional) |

**END OF SECTION**



**Part 1            General**

**1.1                GENERAL INSTRUCTIONS**

- .1            Comply with the General Conditions, Supplementary Conditions, and all of General Requirements, Mechanical and Electrical Divisions.

**1.2                CASH ALLOWANCES (HST EXCLUDED)**

- .1            Local Utility Cash Allowances (HST Excluded)
  - .1            This contractor shall be responsible to co-ordinate shutdowns of existing service with the local utility, as well as adjustments required to the existing metering.
  - .2            The cost of the work being performed by the local utility will be paid via cash allowance.
  - .3            The work being performed by the local utility shall be as noted on design drawings.
- .2            Cash Allowances
  - .1            Cash allowances as stated in Division 1 specification shall not be included the electrical tender price. Electrical contractor shall include for all work to coordinate cash allowances related to electrical items. Coordinate with Division 1.

**1.3                FEES**

- .1            The contractor is to determine general inspection fees with Electrical Safety Authority and include as part of tender.
- .2            A submission has been made (if required by this scope of project) by the consultant to the Electrical Safety Authority for review of this project. The payment of the required review costs will be coordinated by the consultant. A copy of the Electrical Safety Authority review report will be forwarded to the successful contractor for information and action. Contractor will not be responsible for these review costs.

**END OF SECTION**

**Part 1**

**General**

**1.1**

**GENERAL**

- .1 This Section covers items common to Electrical Divisions.**
- .2 This section supplements requirements of Division 1.
- .3 Furnish labour, materials, and equipment necessary for completion of work as described in contract documents.

**1.2**

**INTENT**

- .1 Mention herein or indication on Drawings of articles, materials, operations, or methods requires: supply of each item mentioned or indicated, of quality, or subject to qualifications noted; installation according to conditions stated: and, performance of each operation prescribed with furnishing of necessary labour, equipment, and incidentals for electrical work.
- .2 Where used, words “Section” and “Division” shall also include other Subcontractors engaged on site to perform work to make building and site complete in all respects.
- .3 Where used, word “supply” shall mean furnishing to site in location required or directed complete with accessory parts.
- .4 Where used, word “install” shall mean secured in place and connected up for operation as noted or directed.
- .5 Where used, word “provide” shall mean supply and install as each is described above.

**1.3**

**TENDERS**

- .1 Submit tender based on specified described equipment or Alternates listed.
- .2 State in Tender, names of all Subcontractors proposed for work under this Division.

**1.4**

**LIABILITY INSURANCE**

- .1 This contractor must maintain and produce at the request of the consultant proof of proper insurance to fully protect the Owner, the Consultant and the Contractor from any and all claims due to accidents, misfortunes, acts of God, etc.

**1.5**

**DRAWINGS**

- .1 Electrical Drawings do not show structural and related details. Take information involving accurate measurement of building from building drawings, or at building. Make, without additional charge, any necessary changes or additions to runs of conduits and ducts to accommodate structural conditions. Location of conduits and other equipment may be altered by Consultant without extra charge provided change is made before installation and does not necessitate major additional material.
- .2 As work progresses and before installing fixtures and other fittings and equipment which may interfere with interior treatment and use of building, provide detail drawings or obtain directions for exact location of such equipment and fitments.

- .3 Electrical drawings are diagrammatic. Where required work is not shown or only shown diagrammatically, install same at maximum height in space to conserve head room (minimum 2200 mm (88") clear) and interfere as little as possible with free use of space through which they can pass. Conceal wiring, conduits and ducts in furred spaces, ceilings and walls unless specifically shown otherwise. Install work close to structure so furring will be small as practical.
- .4 Before commencing work, check and verify all sizes, locations, grades, elevations, levels and dimensions to ensure proper and correct installation. Verify existing/municipal services.
- .5 Locate all electrical equipment in such a manner as to facilitate easy and safe access to and maintenance and replacement of any part.
- .6 In every place where there is indicated space reserved for future or other equipment, leave such space clear, and install services so that necessary installation and connections can be made for any such apparatus. Obtain instructions whenever necessary for this purpose.
- .7 Relocate equipment and/or material installed but not co-ordinated with work of other Sections as directed, without extra charge.
- .8 Where drawings are done in metric and product not available in metric, the corresponding imperial trade size shall be utilized.

#### **1.6 INTERFERENCE AND CO-ORDINATION DRAWINGS**

- .1 Prepare interference and equipment placing drawings to ensure that all components will be properly accommodated within the constructed spaces provided.
- .2 Prepare drawings to indicate co-ordination and methods of installation of a system with other systems where their relationship is critical. Ensure that all details of equipment apparatus, and connections are co-ordinated.
- .3 Ensure that clearances required by jurisdictional authorities and clearances for proper maintenance are indicated on drawings.
- .4 Upon consultant's request submit copies of interference drawings to consultant.

#### **1.7 QUALITY ASSURANCE**

- .1 The installations of the division must conform to the latest edition of the Electrical Safety Code as well as its supplemental bulletins and instructions. Provide materials and labour necessary to comply with rules, regulations, and ordinances.
- .2 Complete underground systems in accordance with CSA C22.3 No. 7-94 except where specified otherwise.
- .3 Abbreviations for electrical terms: to CSA Z85-1983.
- .4 In case of differences between building codes, provincial laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern. Promptly notify Consultant in writing of such differences.

## **1.8 ALTERNATES AND SUBSTITUTIONS**

- .1 Throughout these sections are lists of “Alternate Equipment” manufacturers acceptable to Consultant if their product meets characteristics of specified described equipment.
- .2 Each bidder may elect to use “Alternate Equipment” from lists of Alternates where listed. Include for any additional costs to suit Alternated used. Prices are not required in Tender for Alternates listed except where specifically noted as “Separate Price”.
- .3 It is responsibility of this Division to ensure “Alternate Equipment” fits space allocated and gives performance specified. If an “Alternate Equipment” unit is proposed and does not fit space allotted nor equal specified product in Consultant’s opinion, supply of specified described equipment will be required without change in Contract amount. Only manufacturers listed will be accepted for their product listing. All other manufacturers shall be quoted as substitution stating conditions and credit amount.
- .4 If item of material specified is unobtainable, state in Tender proposed substitute and amount added or deducted for its use. Extra monies will not be paid for substitutions after Contract has been awarded.

## **1.9 EXAMINATION**

- .1 Site Inspection
  - .1 Examine premises to understand conditions, which may affect performance of work of this Division before submitting proposals for this work.
  - .2 No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.
- .2 Drawings:
  - .1 Electrical Drawings show general arrangement of fixtures, power devices, equipment, etc. Follow as closely as actual building construction and work of other trades will permit.
  - .2 Consider Architectural, Mechanical, and Structural Drawings part of this work insofar as these drawings furnish information relating to design and construction of building. These drawings take precedence over Electrical Drawings.
  - .3 Because of small scale of Drawings, it is not possible to indicate all offsets, fittings, and accessories, which may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions.
- .3 Ensure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents. If approval is received by Addendum or Change Order to use other than originally specified items, be responsible for specified capacities and for ensuring that items to be furnished will fit space available.

### 1.10 SEQUENCING AND SCHEDULING

- .1 It is understood that while Drawings are to be followed as closely as circumstances permit, this Division will be held responsible for installation of systems according to the true intent and meaning of Contract Documents. Anything not clear or in conflict will be explained by making application to Consultant. Should conditions arise where certain changes would be advisable, secure Consultant's approval of these changes before proceeding with work.
- .2 Coordinate work of various trades in installing interrelated work. Before installation of electrical items, make proper provision to avoid interferences in a manner approved by Consultant. Changes required in work specified in these sections caused by neglect to do so shall be made at no cost to Owner.
- .3 Arrange fixtures, conduit, ducts, and equipment to permit ready access to junction boxes, starters, motors, control components, and to clear openings of doors and access panels.
- .4 Furnish and install inserts and supports required by these sections unless otherwise noted. Furnish sleeves, inserts, supports, and equipment that are an integral part of other Divisions of the Work to Sections involved in sufficient time to be built into construction as the Work proceeds. Locate these items and see that they are properly installed. Expense resulting from improper location or installation of items above shall be borne by the electrical trade.
- .5 Adjust locations of ducts, conduits, equipment, fixtures, etc, to accommodate work from interferences anticipated and encountered. Determine exact route and location of each conduit and duct prior to installation.
  - .1 Make offsets, transitions, and changes in direction of ducts, and electrical raceways as required to maintain proper head room and pitch of sloping lines whether or not indicated on Drawings.
  - .2 Supply and install pull boxes, etc, as required to effect these offsets, transitions, and changes in direction.

### 1.11 DRAW BREAKDOWN

- .1 This Contractor **MUST** submit a breakdown of the tender price into classifications to the satisfaction of the Consultant, with the aggregate of the breakdown totaling the total contract amount. **Each item must be broken out into material and labour costs.** Progress claims, when submitted are to be itemized against each item of the draw breakdown. This shall be done in table form showing contract amount, amount this draw, total to date, % complete and balance.
- .2 Breakdown shall be as follows:
  - .1 Permits and fees
  - .2 Mobilization (maximum 1%)
  - .3 Demolition
  - .4 Switchboard
  - .5 Panelboards and miscellaneous distribution equipment
  - .6 Rental generator

- .7 Feeder conduits
- .8 Branch conduits
- .9 Feeder cables
- .10 Branch wiring
- .11 Lighting fixtures
- .12 Emergency lighting
- .13 Fire alarm system
- .14 Voice/Data system
- .15 Starters, contactors and control devices
- .16 Wiring for mechanical equipment
- .17 Commissioning and Integrated System Testing**
- .18 Commissioning (minimum 3%)
  
- .3 The breakdown must be approved by the Consultant prior to submission of the first draw.
- .4 Breakdowns not complying to the above will not be approved.
- .5 Breakdown must indicate total contract amount.
- .6 Mobilization amount may only be drawn when all required shop drawings have been reviewed by the consultant.**

#### **1.12 SHOP DRAWINGS AND PRODUCT DATA**

- .1 General
  - .1 Furnish complete catalog data for manufactured items of equipment to be used in the Work to Consultant for review within 30 days after award of Contract.
  - .2 Provide a complete list of shop drawings to be submitted prior to first submission.
  - .3 Before submitting to the Consultant, review all shop drawings to verify that the products illustrated therein conform to the Contract Documents. By this review, the Contractor agrees that it has determined and verified all field dimensions, field construction criteria, materials, catalogue numbers, and similar data and that it has checked and coordinated each shop drawing with the requirements of the work and of the Contract Documents. The Contractor's review of each shop drawings shall be indicated by stamp, date and signature of a qualified and responsible person possessing by the appropriate authorization.
  - .4 If material or equipment is not as specified or submittal is not complete, it will be rejected by Consultant.
  - .5 Additional shop drawings required by the contractor for maintenance manuals, site copies etc., shall be photocopies of the "reviewed" shop drawings. All costs to provide additional copies of shop drawings shall be borne by the contractor.
  - .6 Submit all shop drawings for the project as a package. Partial submittals will not be accepted.**

- .7 Catalog data or shop drawings for equipment, which are noted as being reviewed by Consultant or his Engineer shall not supersede Contract Documents.
- .8 Review comments of Consultant shall not relieve this Division from responsibility for deviations from Contract Documents unless Consultant's attention has been called to such deviations in writing at time of submission, nor shall they relieve this Division from responsibility for errors in items submitted.
- .9 Check work described by catalog data with Contract Documents for deviations and errors.
- .10 Shop drawings and product data shall show:
  - .1 Mounting arrangements.
  - .2 Operating and maintenance clearances. e.g. access door swing spaces.
- .11 Shop drawings and product data shall be accompanied by:
  - .1 Detailed drawings of bases, supports, and anchor bolts.
  - .2 Manufacturer test data where requested.
  - .3 Manufacturer to certify as to current model production.
  - .4 Certification of compliance to applicable codes.
- .12 State sizes, capacities, brand names, motor HP, accessories, materials, gauges, dimensions, and other pertinent information. List on catalog covers page numbers of submitted items. Underline applicable data.
- .13 Once these shop drawings are returned “reviewed” or “reviewed as noted” fabrication, production, and installation may commence. **NOTE: If a shop drawing is returned “reviewed as noted” this Contractor must provide written indication that the comments have been complied with.**

A partial list of shop drawings includes:

  - .1 Switchboards, panelboards, and miscellaneous distribution equipment
  - .2 Fire alarm system components
  - .3 Luminaires and drivers
  - .4 Emergency battery units and fixtures
  - .5 Starters, contactors and control devices
  - .6 Firestopping materials
  - .7 Surface raceways
  - .8 Wiring devices
  - .9 Occupancy sensors
  - .10 Co-ordination and Arc Flash Hazard study
  - .11 Integrated Life Safety System Testing Plan (ITP)

- .2 Submissions shall be submitted electronically as per the following directions:
  - .1 Electronic Submissions:
    - .1 Electronically submitted shop drawings shall be prepared as follows:
      - .1 Use latest software to generate PDF files of submission sheets.
      - .2 Scanned legible PDF sheets are acceptable. Image files are not acceptable.
      - .3 PDF format shall be of sufficient resolution to clearly show the finest detail.
      - .4 PDF page size shall be standardized for printing to letter size (8.5"x11"), portrait with no additional formatting required by the consultant. Submissions requiring larger detail sheets shall not exceed 11"x17".
      - .5 Submissions shall contain multiple files according to section names as they appear in Specification.
      - .6 File names shall include consultant project number and description of shop drawing section submitted.
      - .7 Each submission shall contain an index sheet listing the products submitted, indexed in the same order as they appear in the Specification. Include associated PDF file name for each section.
      - .8 On the shop drawing use an "electronic mark" to indicate what is being provided.
      - .9 **Each file shall bear an electronic representation of the "company stamp" of the contractor. If not stamped the file submission will not be reviewed.**
    - .2 Email submissions shall include subject line to clearly identify the consultants' project number and the description of the shop drawings submitted.
    - .3 Electronic attachments via email shall not exceed 10MB. For submissions larger than 10MB, multiple email messages shall be used. Denote related email messages by indicating "1 of 2" and "2 of 2" in email subject line for the case of two messages.
    - .4 Electronic attachments via web links (URL) shall directly reference PDF files. Provide necessary access credentials within link or as username/password clearly identified within body of email message.
    - .5 On site provide one copy of the "reviewed" shop drawings in a binder as noted above.
    - .6 Contractor to print copies of "reviewed" shop drawings and compile into maintenance manuals in accordance with requirements detailed in this section.



**1.13 CARE, OPERATION AND START-UP**

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

**1.14 VOLTAGE RATINGS**

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

**1.15 PERMITS, FEES AND INSPECTION**

- .1 A submission has been made (if required by this scope of project) by the consultant to the Electrical Safety Authority for review of this project. The payment of the required review costs will be co-ordinated by the consultant. A copy of the Electrical Safety Authority review report will be forwarded to the successful contractor for information and action.
- .2 The contractor is required to include in his tender all required inspection costs by the Electrical Safety Authority. Permit application is the responsibility of the contractor.
- .3 Reproduce drawings and specifications required by Electrical Safety Authority at no cost.
- .4 Notify Consultant of changes required by Electrical Safety Authority prior to making changes.
- .5 Furnish Certificates of Acceptance to Engineer from Electrical Safety Authority and other authorities having jurisdiction upon completion of work.
- .6 This contractor must furnish any certificates required to indicate that the work completed conforms with laws and regulations of authorities having jurisdiction.

**1.16 MATERIALS AND EQUIPMENT**

- .1 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Safety Authority.
- .2 Factory assemble control panels and component assemblies.

**1.17 ELECTRIC MOTORS, EQUIPMENT, AND CONTROLS**

- .1 Supplier and installer responsibility is indicated in the Equipment Wiring Schedule on electrical drawings.
- .2 Control wiring and conduit is specified in the Electrical specifications except for conduit, wiring and connections below 50 V, which are related to control systems specified in the Mechanical specifications.

**1.18 FINISHES**

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
  - .1 Paint outdoor electrical equipment "equipment green" finish.
  - .2 Paint indoor switchgear and distribution enclosures light grey.
- .2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .3 Clean and prime exposed non-galvanized hangers, racks, fastenings, and conduits etc. to prevent rusting.

**1.19 EQUIPMENT IDENTIFICATION**

- .1 Identify electrical equipment with nameplates as follows:
- .2 Nameplates:
  - .1 Lamicoid 3 mm (1/8") thick plastic engraving sheet, black face, white core, mechanically attached with self tapping screws.

**NAMEPLATE SIZES**

|        |                               |         |                           |
|--------|-------------------------------|---------|---------------------------|
| Size 1 | 9 mm x 50 mm (3/8" x 2")      | 1 line  | 3 mm (1/8") high letters  |
| Size 2 | 12 mm x 70 mm (1/2" x 2 1/2") | 1 line  | 5 mm (3/16") high letters |
| Size 3 | 12 mm x 70 mm (1/2" x 2 1/2") | 2 lines | 3 mm (1/8") high letters  |
| Size 4 | 20 mm x 90 mm (3/4" x 3 1/2") | 1 line  | 9 mm (3/8") high letters  |
| Size 5 | 20 mm x 90 mm (3/4" x 3 1/2") | 2 lines | 5 mm (3/16") high letters |
| Size 6 | 25 mm x 100 mm (1" x 4")      | 1 line  | 12 mm (1/2") high letters |
| Size 7 | 25 mm x 100 mm (1" x 4")      | 2 lines | 6 mm (1/4") high letters  |

- .3 Wording on nameplates labels to be approved by Consultant prior to manufacture.
- .4 Allow for average of twenty-five (25) letters per nameplate.
- .5 Identification to be English.
- .6 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .7 Nameplates for disconnects, starters and contactors must indicate equipment being controlled and voltage.

**1.20 WIRING IDENTIFICATION**

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

**1.21 CONDUIT AND CABLE IDENTIFICATION**

- .1 Colour code conduits, boxes and metallic sheathed cables.
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m (45') intervals.
- .3 Colour bands must be 25 mm (1") wide.

|                    |              |
|--------------------|--------------|
|                    | <u>Prime</u> |
| up to 208 V        | yellow       |
| Voice/Data system  | green        |
| Security           | brown        |
| Public address     | black        |
| Fire alarm         | red          |
| Emergency lighting | pink         |
- .4 This contractor must paint all system junction boxes and covers in conformance with the above schedule.

**1.22 PROTECTION OF OPENINGS**

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

**1.23 WIRING TERMINATIONS**

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

**1.24 MANUFACTURERS AND CSA LABELS**

- .1 All labels must be visible and legible after equipment is installed.

**1.25 WARNING SIGNS**

- .1 To meet requirements of Electrical Safety Authority and Consultant.
- .2 Provide porcelain enamel signs, with a minimum size of 175 mm x 250 mm (7" x 10").

**1.26 LOCATION OF OUTLETS**

- .1 Do not install outlets back-to-back in wall; allow minimum 150 mm (6") horizontal clearance between boxes.
- .2 Change location of outlets at no extra cost or credit, providing distance does not exceed 3 m (10'), and information is given before installation.

- .3 Locate light switches on latch side of doors. Locate disconnect devices in mechanical and elevator machine rooms on latch side of door.

### **1.27 MOUNTING HEIGHTS**

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise. Coordinate with block coursing (if applicable).
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Install electrical equipment at following heights unless indicated otherwise.
  - .1 Local switches: 1100 mm (43.3").
  - .2 Wall receptacles:
    - .1 General: 400 mm (16").
    - .2 Above top of continuous baseboard heater: 200 mm (8").
    - .3 Above top of counters or counter splash backs: 100 mm (4").
    - .4 In mechanical rooms: 1200 mm (48").
  - .3 Panelboards: as required by Code or 1400 mm (56").
  - .4 Voice/Data outlets: At height of adjacent outlet or at 400 mm (16").
  - .5 Fire alarm stations: 1200 mm (3' - 11").
  - .6 Fire alarm visual and signal devices: 2250 mm (88 ½").
  - .7 Television outlets: 400 mm (16").
  - .8 Thermostat: 1200 mm (3'-11").
  - .9 Clocks: 2100 mm (84").
  - .10 Heaters: 200 mm (8" AFF) to bottom of heater.
  - .11 Emergency call switches and/or pushbuttons: 900 mm (36").

### **1.28 LOAD BALANCE**

- .1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
- .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
- .3 Submit, at completion of work, report listing phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

### **1.29 CONDUIT AND CABLE INSTALLATION**

- .1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete shall be schedule 40 steel pipe, sized for free passage of conduit, and protruding 50 mm (2") beyond either side.

- .2 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

### **1.30 FIELD QUALITY CONTROL**

- .1 Conduct and pay for following tests:
  - .1 Power distribution system including phasing, voltage, grounding, and load balancing.
  - .2 Circuits originating from branch distribution panels.
  - .3 Lighting and its control.
  - .4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
  - .5 Systems: fire alarm system, communications, security.
- .2 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.
- .3 Insulation resistance testing.
  - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
  - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
  - .3 Check resistance to ground before energizing.
- .4 Carry out tests in presence of Consultant.
- .5 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .6 Submit test results for Consultant's review.

### **1.31 CO-ORDINATION OF PROTECTIVE DEVICES**

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings as indicated on drawings or as determined from co-ordination study.

### **1.32 GUARANTEE AND WARRANTY**

- .1 At the substantial completion stage of this project this Contractor must provide a written guarantee indicating that any defects, not due to ordinary wear and tear or improper use which occur within the first 2 years from the date of substantial completion will be corrected at the contractors expense.
- .2 **If the electrical sub-contractor's office is 50 kilometers (30 miles) or more from the project site, the sub-contractor is to provide a service/warranty work agreement for warranty period with a local electrical sub-contractor approved by Consultant. Include copy of service/warranty agreement in warranty section of operation and maintenance manual.**
- .3 Warranty period shall start from date of substantial completion.
- .4 Refer to individual specification sections for information on any special manufacturer's equipment warranties.

**1.33 SYSTEM START UP**

- .1 Provide consultant with written notice verifying all equipment operation and installation is complete prior to scheduled start-up period.
- .2 Start up shall be in presence of the following: owner or representative, contractor, and manufacturer's representative. Each person shall witness and sign off each piece of equipment. Consultant's attendance will be determined by consultant.
- .3 Arrange with all parties and provide 72 hours notice for start up procedure.
- .4 Simulate system start up and shut down and verify operation of each piece of equipment.
- .5 These tests are to demonstrate that the systems and equipment installed are operational as specified.
- .6 The contractor must describe during the start up session the required maintenance for each piece of equipment according to the manufacturer.
- .7 The contractor must provide all necessary tools (including a digital multimeter) to successfully complete the start up procedure.

**1.34 OPERATION AND MAINTENANCE MANUAL**

- .1 Provide operation and maintenance data for incorporation into manual as specified in other Sections of this Division.
- .2 Operation and maintenance manual to be approved by, and final copies deposited with, Consultant before final inspection. Make changes as requested and re-submit as directed by Consultant.
- .3 Submit one manual for approval. Three (3) manuals will be required at project completion. Each of which shall be in a three ring binder (minimum 50 mm (2") ring) labelled:
  - .1 Operation and Maintenance Manual.
  - .2 Project Name.
  - .3 Location.
- .4 Each manual must include (in "tabbed" sections) the following:
  - .1 Index
  - .2 List of General, Mechanical, Electrical Contractors and all associated sub-contractor names, addresses and contact numbers.
  - .3 List of suppliers and equipment wholesalers local to the project.
  - .4 Two year warranty letter for all parts, equipment and workmanship.
  - .5 List of manufacturers, spare parts list and source.
  - .6 Copy of typewritten schedules for all new and renovated panels.
  - .7 Receipt of spare fuses from owner's representative.
  - .8 Receipt of turned over keys for electrical panels.
  - .9 Final certificate from the Electrical Safety Authority.
  - .10 Certificate of exit/emergency lighting testing as per the specification.

- .11 Copy of electrical shop drawings which have been stamped and reviewed by Consultant.
  - .12 Electrical As-built drawings including contractor company's as built stamp.
  - .13 Coordination study/Arc flash hazard study shop drawings.
  - .14 Any special warranties on equipment required (i.e. LED lighting, digital lighting control, SPDs, power generation).
  - .15 Certificate of completion from all associated sub-contractors.
  - .16 System commissioning certificate and report.
- .5 Upon acceptance of Operation and Maintenance Manual by the consultant, a pdf file of the entire manual is to be provided on a USB stick. Only one USB stick is to be provided containing both the approved manuals and as-built drawings.

**1.35 AS-BUILT DRAWINGS**

- .1 Site records:
- .1 Contractor shall provide 2 sets of reproducible electrical drawings. Provide sets of white prints as required for each phase of the work. Mark thereon all changes as work progresses and as changes occur. This shall include field and contract changes to electrical systems.
  - .2 On a weekly basis, transfer information to reproducibles, revising reproducibles to show all work as actually installed.
  - .3 Use different colour waterproof ink for each service.
  - .4 Make available for reference purposes and inspection at all times.
- .2 As-built drawings:
- .1 Identify each drawing in lower right hand corner in letters at least 3 mm (1/8") high as follows: - "AS-BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW ELECTRICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (date).
  - .2 Submit hard copy to Consultant for approval. When returned, make corrections (if any) as directed.
  - .3 Once approved, submit completed reproducible paper as-built drawings as well as a scanned pdf file copy on USB stick with Operating and Maintenance Manuals.

**1.36 DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTIONS**

- .1 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .2 Manufacturers or their representatives are to provide demonstrations and instructions.
- .3 Use operation and maintenance manual, As-built drawings, audio visual aids, etc. as part of instruction materials.
- .4 Instruction duration time requirements as specified in appropriate sections.
- .5 Where deemed necessary, Consultants may record these demonstrations on video tape for future reference.

**1.37 SUBSTANTIAL PERFORMANCE**

- .1 Complete the following to the satisfaction of the consultant prior to submission of substantial performance.
  - .1 As-built Drawings.
  - .2 Maintenance Manuals.
  - .3 System Start up.
  - .4 Instructions to Owners.
  - .5 Final Certificates (Electrical Safety Authority, Fire Alarm, Emergency Lighting, Integrated Life Safety Systems Commissioning).

**1.38 TRIAL USAGE**

- .1 Consultant or owner may use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

**1.39 REVISION TO CONTRACT**

- .1 Provide the following for each item in a given change notice:
  - .1 Itemized list of material with associated costs.
  - .2 Labour rate and itemized list of labour for each item.
  - .3 Copy of manufacturers/suppliers invoice if requested.

**1.40 EQUIPMENT SUPPORTS**

- .1 Equipment supports supplied by equipment manufacturer: shall be installed by the electrical contractor.
- .2 Equipment supports not supplied by equipment manufacturer: fabricate from structural grade steel meeting requirements of - Structural Steel Section. Submit structural calculations with shop drawings if necessary.
- .3 Mount base mounted equipment on chamfered edge housekeeping pads, minimum of 100 mm (4") high and 150 mm (6") larger than equipment dimensions all around. This installation of this pad shall be the responsibility of the electrical contractor.
- .4 This contractor shall be responsible for providing all anchor bolts and associated formed concrete bases for lighting standards as detailed.

**1.41 SLEEVES**

- .1 Pipe sleeves: at points where pipes pass through masonry, concrete, or fire rated assemblies and as indicated.
- .2 Schedule 40 steel pipe.
- .3 Sleeves with annular fin continuously welded at midpoint:
  - .1 Through foundation walls.
  - .2 Where sleeve extends above finished floor.
- .4 Sizes: minimum 6 mm (1/4") clearance all around, between sleeve and conduit.



- .5 Terminate sleeves flush with surface of concrete and masonry walls, concrete floors on grade and 25 mm (1") above other floors.
- .6 Through foundation walls PVC sleeves are acceptable.
- .7 Fill voids around pipes:
  - .1 Caulk between sleeve and pipe in foundation walls and below grade floors with waterproof fire retardant non-hardening mastic.
  - .2 Where sleeves pass through walls or floors, provide space for firestopping. Where pipes/ducts pass through fire rated walls, floors and partitions, maintain fire rating integrity.
  - .3 Fill future-use sleeves with easily removable filler.

#### **1.42 FIRESTOPPING**

- .1 Firestopping material and installation within annular space between conduits, ducts, and adjacent fire separation.
- .2 Provide materials and systems capable of maintaining effective barrier against flame, smoke, and gases.
- .3 Comply with the requirements of CAN4-S115-M35, and do not exceed opening sized for which they have been tested.
- .4 Systems to have an F or FT rating (as applicable) not less than the fire protection rating required for closures in a fire separation.
- .5 Provide "firewrap" blanket around services penetrating firewalls. Extent of blanket must correspond to ULC recommendations. In general wrap individual conduits with approved firewrap materials on each side of firewall. Refer to architectural drawings for FT ratings. Provide 1 and/or 2 layers of firewrap with transverse and longitudinal seams overlapped and/or butted (second layer offset from first layer). Cut edges are to be sealed with aluminum foil tape. Provide 50 mm stainless steel banding at 200 mm intervals. Install firewrap to manufacturers' recommendations for proper FT rating. Acceptable manufacturers are 3M Firemaster ductwrap or approved equal.
- .6 The firestopping materials are not to shrink, slump or sag and be free of asbestos, halogens and volatile solvents.
- .7 Firestopping materials are to consist of a component sealant applied with a conventional caulking gun and trowel.
- .8 Firestop materials are to be capable of receiving finish materials in those areas, which are exposed and scheduled to receive finishes.
- .9 Firestopping shall be inspected and approved by local authority prior to concealment or enclosure.
- .10 Install material and components in accordance with ULC certification, manufacturers instructions and local authority.
- .11 **Submit product literature and installation material on firestopping in shop drawing and product data manual.**

- .12 Acceptable manufacturers:
  - .1 Fyresleeve Industries Inc.
  - .2 General Electric Pensil Firestop Systems
  - .3 International Protective Coatings Corp.
  - .4 Rectorseal Corporation (Metacaulk)
  - .5 Proset Systems
  - .6 3M
  - .7 AD Systems
  - .8 Hilti
  - .9 Royal

**Note: Fire stop material must conform to requirements of local authorities having jurisdiction. Contractor to confirm prior to application and ensure material used is compatible with that used by other trades on site.**

- .13 Ensure firestop manufacturer representative performs on site inspections and certifies installation. Submit inspection reports/certification at time of substantial completion.

#### **1.43 PAINTING**

- .1 Refer to Section Interior Painting and specified elsewhere.
- .2 Apply at least one coat of corrosion resistant primer paint to ferrous supports and site fabricated work.
- .3 Prime and touch up marred finished paintwork to match original.
- .4 Restore to new condition, or replace equipment at discretion of consultant, finishes which have been damaged too extensively to be merely primed and touched up.

#### **1.44 ACCESS DOORS**

- .1 Supply access doors to concealed electrical equipment for operating, inspecting, adjusting and servicing.
- .2 Flush mounted 600 mm x 600 mm (24" x 24") for body entry and 300 mm x 300 mm (12" x 12") for hand entry unless otherwise noted. Doors to open 180°, have rounded safety corners, concealed hinges, screwdriver latches and anchor straps.
- .3 Material:
  - .1 Special areas such as tiled or marble surfaces: use stainless steel with brushed satin or polished finish as directed by Consultant.
  - .2 Remaining areas: use prime coated steel.
  - .3 Fire rated areas: provide ULC listed access doors
- .4 Installation:
  - .1 Locate so that concealed items are accessible.
  - .2 Locate so that hand or body entry (as applicable) is achieved.
  - .3 Installation is specified in applicable sections.

- .5 Acceptable materials:
  - .1 Le Hage
  - .2 Zurn
  - .3 Acudor
  - .4 Nailor Industries Inc.

**1.45 DELIVERY STORAGE & HANDLING**

- .1 Follow Manufacturer's directions in delivery, storage, and protection, of equipment and materials.
- .2 Deliver equipment and material to site and tightly cover and protect against dirt, water, and chemical or mechanical injury, but have readily accessible for inspection. Store items subject to moisture damage (such as controls) in dry, heated space.

**1.46 REPAIR, CUTTING, CORING AND RESTORATION**

- .1 Be responsible for required digging, cutting, and patching incident to work of this Division and make required repairs afterwards to satisfaction of Consultant. Cut carefully to minimize necessity for repairs to existing work. Do not cut beams, columns, or trusses.
- .2 Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown. Surface finishes shall exactly match existing finishes of same materials.
- .3 Each Section of this Division shall bear expense of cutting, patching, repairing, and replacing of work of other Sections required because of its fault, error, tardiness, or because of damage done by it.
- .4 Cutting, patching, repairing, and replacing pavements, sidewalks, roads, and curbs to permit installation of work of this Division is responsibility of Section installing work.
- .5 Slots, cores and openings through floors, walls, ceilings, and roofs shall be provided by this contractor but performed by a trade specializing in this type of work. This Division shall see that they are properly located and do any cutting and patching caused by its neglect to do so.

**1.47 EXISTING SYSTEMS**

- .1 Connections into existing systems to be made at time approved by Consultant. Request written approval of time when connections can be made.
- .2 Be responsible for damage to existing plant by this work.

**1.48 CLEANING**

- .1 Clean interior and exterior of all electrical equipment provided including light fixture lenses.
- .2 In preparation for final acceptance, clean and refurbish all equipment and leave in operating condition.

**1.49 DISCONNECTION AND REMOVAL**

- .1 Disconnect and/or remove equipment as indicated.
- .2 Cap and conceal all redundant and obsolete connections.
- .3 Provide a list of equipment to be removed to the owner, for his acceptance of same. Remove all equipment from site, which the owner does not retain.
- .4 Store equipment to be retained by owner on site where directed by consultant.

**1.50 OWNER SUPPLIED EQUIPMENT**

- .1 Connect to equipment supplied by the owner and make operable.

**1.51 ENCLOSURES**

- .1 This contractor must ensure that all electrical equipment mounted in sprinklered areas is provided with an enclosure in conformance with the Electrical Safety Code.

**1.52 EXISTING CONCRETE SLAB X-RAY/SCANNING**

- .1 This contractor shall retain the services of a qualified company to provide and X-Ray and/or scan of the existing buried services in walls and/or floors prior to starting any work in the affected area.
- .2 Failure to locate existing piping, conduit, rebar etc., shall not relieve this contractor of repair of same prior to installing his service.
- .3 This contractor shall be responsible for all repairs and/or replacement of existing services caused by cutting the existing concrete slabs and/or walls.

**1.53 SECURITY AND FIRE PROTECTION**

- .1 Power interruptions for main switchboard replacement shall be limited to anticipated shutdown period as coordinated with School Board. To allow operation of existing school fire alarm system, security system, and temporary lighting (interior corridors and exterior), contractor to provide temporary rental generator. Rental generator shall include all fuel, power cable sets, grounding plate, protective fencing, temporary output distribution panel and connections to distribution system points for services noted. Contractor to allow for up to 2 weeks (or longer if anticipated) of generator rental time. Refer to site plan for suggested placement of rental generator. Refer to distribution diagram for proposed breakdown of temporary generator branch circuit required configurations and locations of equipment serving loads to be backed up by rental generator.

**END OF SECTION**

**Part 1            General**

**1.1            GENERAL PROVISIONS**

- .1 Conform to the General Provisions of Division 1 and Electrical General Requirements Section.
- .2 This project is one of a retrofit nature in part, and which will require extensive demolition.
- .3 Allow for all remedial work in areas indicated on the drawings and as generally defined in the relevant sections of the specifications.

**1.2            SCOPE OF WORK**

- .1 The scope of work is essentially the selected disconnection and/or removal of services and/or equipment, devices etc. as indicated or required to complete the work.
- .2 The reference drawings indicate some of the services which shall remain and some may have to be retained through construction i.e. fire alarm system, phone service, interior/exterior lighting. This co-ordination remains the responsibility of the contractors.

**Part 2            Products**

**2.1            GENERAL**

- .1 This Division is to liaise with the Owners or Consultant for equipment being removed that may be suitable for reuse to that specified or handed over to the owner.
- .2 This Division to take full responsibility for any special tools or equipment required to disassemble or remove material from building.

**Part 3            Execution**

**3.1            GENERAL**

- .1 The general requirements are indicated on the drawings and on the outline specification in Division 1.
- .2 The general execution of the demolition is to be carried out in a clean and efficient manner.
- .3 Demolition of existing ceiling, walls etc., to facilitate removal of existing services or equipment or installation of new to be kept to a minimum and then restored to match existing.
- .4 All openings or holes created by removal of existing electrical systems which are not being reused are to be patched with the same material surrounding surfaces.
- .5 All new holes and openings to facilitate electrical systems are to be patched to match surrounding surfaces.

- .6 Protect all existing furnishings materials and equipment. Any damage occurring as a result of the work of this Division shall be repaired or replaced at the expense of this Division.
- .7 Where work involves breaking into or connecting to existing services, carry out work at times directed by the Owners in an expedient manner with minimum disruption to the facility and systems downtime.
- .8 Where unknown services are encountered immediately advise Consultant and confirm findings in writing.
- .9 Where the location of any services has been shown on the plans, such information is not guaranteed. It is this Division's responsibility to verify locations, etc., immediately after moving on site. Should for any reason the information obtained necessitates changes in procedure or design, advise the Consultant at once. If verification of existing conditions is not done at the outset and any problems arise, the responsibility for same is entirely this Division's.
- .10 Disconnect and/or remove equipment, devices, cabling, services, etc. as indicated.
- .11 Remove all redundant and obsolete systems, connections, and wiring.
- .12 Provide a list of equipment to be removed to the owner, for their acceptance of same. Remove all equipment from site that the owner does not retain.
- .13 Maintain equipment to be retained by owner on site where directed by consultant.
- .14 Demolition of all parts of the work must be completed within the confines of the work area and in such a way as the dust produced and risk to injury of will not adversely affect the building users.

**END OF SECTION**

**Part 1            General**

**1.1                INTENT**

- .1      Life safety and fire protection systems are to be installed to comply with the provisions of the current Ontario Building and Fire Codes. As a result, testing of these integrated systems must be performed as a whole to ensure the proper operation and inter-relationship between systems (functional testing).
- .2      The testing is to provide functional verification and documented confirmation that these building systems satisfy the intent of the Building Code.
- .3      These systems as applicable to any given project include but are not limited to fire alarm, door hold open devices, elevator recalls, and smoke fire dampers.

**1.2                GENERAL**

- .1      This testing process is the responsibility of the Integrated Testing Firm as a sub-contractor to the electrical trade. Electrical trade to include all costs associated with the Integrated Testing Coordinator in contract.
- .2      This process must be co-ordinated with suppliers and sub-contractors associated with these systems (mechanical and/or electrical).
- .3      This process must be co-ordinated with the project construction schedule and be completed, including all associated documentation, prior to the consultant's certification of the project for occupancy.
- .4      All applicable contractors, sub-contractors, and suppliers are to include all required costs in their respective tender costs.
- .5      All work is to be performed in accordance with CAN/ULC S1001-2011. Special consideration is to be given to the Sample Integrated Testing Plan (ITP), the review of life safety system design documents, and the provision of test plans and reports.
- .6      The work to be performed by this contractor is also described in CAN/ULC S1001-2011.
- .7      Refer to CAN/ULC S1001-11 Rev1-2019 Informative Annex (C) for Sample Integrated Testing Plan (ITP).

**1.3                QUALITY ASSURANCE**

- .1      The following criteria must be met in order to be considered an acceptable Integrated Testing Coordinator for this project:
  - .1      Manufacturers: Firms regularly engaged in functional testing and implementation of life safety and fire protection systems for not less than five years.
  - .2      Qualifications: Firms with at least five years of successful experience in facility construction, inspection, acceptance testing or commissioning as it relates to fire protection and life safety and equipment similar to that required for this project.

- .3 The Contractor shall be an established commissioning contractor that has had and currently maintains a locally run and operated business for at least five years.
  - .4 The Contractor shall show satisfactory evidence, upon request, that he maintains a fully equipped service organization capable of furnishing adequate inspection and service to the systems.
- .2 Pre-qualified Life Safety Systems Testing Firms include these listed below or local branches of the companies noted in the vicinity of this project:

- .1 Georgian Bay Fire and Safety Ltd.  
1700 20th Street East  
Owen Sound, Ontario
- .2 Vintage Fire and Life Safety Ltd.  
25 Coverdale Cres.  
Kitchener, Ontario N2M 4X1
- .3 Troy Life and Fire Safety  
805 Boxwood Dr., Unit #201  
Cambridge, Ontario N3E 1A4
- .4 Control Tech Systems  
31 Regal Road  
Guelph, Ontario N1K 1B6
- .5 Lonergan Engineering  
4 Industrial Parkway South  
Aurora, Ontario L4G 3W1

**NOTE: This agent must be a third party firm NOT associated with this project in any way and be under contract with the electrical sub-contractor not the fire alarm supplier.**

- .3 Other firms to these listed above, who feel they are capable, must submit in writing, to the Consultant's office confirmation of the items listed in the criteria above, a minimum of one week prior to tender close in order to be considered as a bidder.

#### **1.4 GENERAL REQUIREMENTS**

- .1 The Commissioning Process shall generally encompass and co-ordinate the following key areas:
  - .1 Integrated systems testing planning.
  - .2 Integrated systems testing implementation (functional testing).
  - .3 Integrated systems testing documentation



## 1.5 RESPONSIBILITIES

### .1 General Contractor:

- .1 The general contractor shall verify completeness of the building envelope, perimeter and interior items which affect proper operation of the noted systems.
- .2 The general contractor will assure participation and co-operation of Sub-Contractors and Specialty Contractors (mechanical, electrical, building management, etc.) under the General Contractor's jurisdiction as required for the commissioning process.

### .2 Mechanical Contractor:

- .1 Verify Functional performance of associated mechanical systems for compliance with design intent as specified in the appropriate Specification sections.
- .2 Provide the documentation with standard Functional performance reports on completion of the testing.
- .3 Verify submissions for system operation and maintenance manuals, as-built documents, spare parts listing, special tools listing, and other items as may be specified.

### .3 Electrical Contractor:

- .1 The Integrated Life Safety Systems Testing Coordinator (ITC) is being retained by the electrical contractor, however; this contractor's work to satisfy the ITC requirements shall be included in the tender price.
- .2 Verify Functional performance of electrical systems for compliance with design intent as specified in the appropriate Specification sections.
- .3 Provide the documentation with standard Functional performance reports on completion of the testing.
- .4 Verify submissions for electrical system operation and maintenance manuals, as-built documents, spare parts listing, special tools listing, and other items as may be specified.
- .5 As a minimum this contractor must include for:
  - .1 Providing the ITC with documentation of design and shop drawings.
  - .2 Provide documents for sequence of operation and maintenance of system.
  - .3 Testing of all components and accessories to confirm Alarm/Supervisory/Trouble at the fire panel.
  - .4 Testing and operation of any generator (s) as applicable to the project.
  - .5 Other items that may be requested by the ITC.
  - .6 Re-commissioning of any items that may have failed.
  - .7 Re-setting of the system to proper operation after tests are completed.
  - .8 Provide written confirmation that life safety systems are installed in accordance with applicable codes and standards, as well as the scope of the project engineering documents.

- .4 Equipment Manufacturers:
  - .1 The equipment manufacturers shall be responsible for providing labour, material, equipment, etc., required within the scope of the respective equipment to facilitate the commissioning process.
  - .2 The equipment manufacturers will perform Pre-Functional and Functional Performance Tests required by the commissioning process.
- .5 Design Engineer:
  - .1 The design engineer shall review and provide written confirmation of acceptance of the Integrated Testing Plan (ITP).
  - .2 The design engineer shall observe Functional Performance Testing, at his discretion.
  - .3 The design engineer shall provide technical capabilities for resolution of deficiencies, where required.
  - .4 The design engineer shall provide necessary information to assist Integrated Test Coordinator including written confirmation of life safety systems installation in accordance with project engineering documents and are ready for integrated testing.

## **Part 2 Commissioning Process**

### **2.1 OPERATIONS AND MAINTENANCE MANUALS**

- .1 Furnish Final, reviewed Operation and Maintenance Manuals to the Consultant fourteen (14) days prior to scheduled Functional Performance Tests.

### **2.2 FUNCTIONAL PERFORMANCE TEST**

- .1 The contractor shall be responsible for the Functional Performance Tests. These tests ensure that all equipment and systems are installed in accordance with the Specifications, Drawings and manufacturers' requirements.
- .2 The contractor shall be responsible for co-ordinating schedule for Functional tests of various equipment and systems.
- .3 In the Functional Test, all noted systems and sub-systems shall be checked for the following:
  - .1 Verify that each element has been properly installed, properly identified, and that all connections have been made correctly.
  - .2 Verify that tests, meter readings, and specific mechanical/electrical performance characteristics agree with those required by equipment or system manufacturer.
  - .3 Re-commission any item(s) that may have failed.
  - .4 Notify the consultant in writing, at least fourteen (14) days prior to the date of Functional Performance Testing. Schedule the Functional performance tests over a period of consecutive business days.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 CSA C22.2 No.0.3-92, Test Methods for Electrical Wires and Cables.
- .2 CAN/CSA-C22.2 No.131-M89(R1994), Type TECK 90 Cable.

**1.2 PRODUCT DATA**

- .1 Submit product data in accordance with Electrical General Requirements Section.

**Part 2 Products**

**2.1 BUILDING WIRES**

- .1 Conductors: stranded for 10 AWG and larger.
- .2 Minimum size: 12 AWG.
- .3 Copper conductors: size as indicated, with 600 V insulation of chemically cross-linked thermosetting polyethylene material 90°C (194°F) rated T90 for indoor above grade installations and RW90 for below grade installations.

**2.2 ARMoured CABLES**

- .1 Conductors: insulated, copper minimum size as indicated above.
- .2 Type: AC90 (minimum size 12 AWG).
- .3 Armour: interlocking type fabricated from aluminum strip.
- .4 Connectors must be suitable for installed environment and approved for use with armoured cable.

**Part 3 Execution**

**3.1 INSTALLATION OF BUILDING WIRES**

- .1 Install wiring from source to load through raceways as specified.
- .2 Provide separate neutral conductors for all lighting circuits and circuits originating from surge protected panels. Size raceways accordingly.

**3.2 INSTALLATION OF ARMoured CABLES**

- .1 Group cables wherever possible.
- .2 Terminate cables in accordance with Wire and Box Connectors - 0 - 1000 V Section.

- .3 These cables are to be installed in concealed locations only. These concealed locations are considered to be stud walls and “drops” to stud walls, lighting fixtures, and ceiling mounted devices.
- .4 **These “drops” shall not be permitted to exceed 2.4 m (8'-0"). To limit these “drops” to lengths noted above provide additional branch wiring in conduit.**

**END OF SECTION**

**Part 1            General**

**1.1                SHOP DRAWINGS AND PRODUCT DATA**

- .1        Submit shop drawings and product data for cabinets in accordance with Electrical General Requirements Section.

**Part 2            Products**

**2.1                MATERIALS**

- .1        Splitters must conform to CSA C22.2 No. 76 (latest edition).
- .2        Junction and pull boxes must conform to CSA C22.2 No. 40 (latest edition)

**2.2                SPLITTERS**

- .1        Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
- .2        Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.
- .3        At least three spare terminals on each set of lugs in splitters less than 400 A.
- .4        Splitter length must match arrangement of equipment unless indicated otherwise.

**2.3                JUNCTION AND PULL BOXES**

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

**Part 3            Execution**

**3.1                SPLITTER INSTALLATION**

- .1        Install splitters and mount plumb, true and square to the building lines on 19 mm (3/4") painted plywood backboards.

**3.2                JUNCTION AND PULL BOXES INSTALLATION**

- .1        Install pull boxes in inconspicuous but accessible locations.
- .2        Install junction and pull boxes so as not to exceed 30 m (100') of conduit run between pull boxes and in conformance with the Electrical Safety Code.

**3.3 IDENTIFICATION**

- .1 Provide equipment identification in accordance with General Electrical Requirements Section.
- .2 Install size 2 identification labels indicating system name, voltage and phase.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1        Outlet boxes, conduit boxes, and fittings must conform to CSA C22.2 No. 18 (latest edition).

**Part 2            Products**

**2.1                OUTLET AND CONDUIT BOXES GENERAL**

- .1        Size boxes in accordance with CSA C22.1.
- .2        102 mm (4") square or larger outlet boxes as required for special devices.
- .3        Gang boxes where wiring devices are grouped.
- .4        Blank cover plates for boxes without wiring devices.
- .5        347 V outlet boxes for 347 V switching devices.
- .6        Combination boxes with barriers where outlets for more than one system are grouped.

**2.2                SHEET STEEL OUTLET BOXES**

- .1        Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76 mm x 50 mm x 64 mm (3" x 2" x 2½") or as indicated. 102 mm (4") square outlet boxes when more than one conduit enters one side with extension and plaster rings as required. Iberville 1104 Series.
- .2        Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit **in utility rooms**, minimum size 102 mm x 57 mm x 38 mm (4" x 2¼" x 1½"). Iberville 1110 Series.
- .3        102 mm (4") square or octagonal outlet boxes for lighting fixture outlets.
- .4        102 mm (4") square outlet boxes with extension and plaster rings for flush mounting devices in finished tile walls.

**2.3                MASONRY BOXES**

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

**2.4                CONCRETE BOXES**

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

## 2.5 FLOOR BOXES

.1 Flush floor boxes where indicated shall be complete with the following features:

- .1 Four (4) independent wiring compartments.
- .2 Flexible activation cover.
- .3 Fully adjustable.
- .4 Sixteen (16) Kos 12.7 mm ( $\frac{1}{2}$ " ) – 32 mm ( $1\frac{1}{4}$ " ).
- .5 Stamped steel construction (concrete-tight).

.2 Manufacturers:

- .1 Wiremold Cat# RFB4-DTB-2-2T-RAKM11- flush floor box complete with two duplex receptacle brackets, 2 dual RJ brackets, and recessed activation with carpet trim plate.

Approved alternates:

- .1 Hubbell Cat. #LCFBSS complete with LCFB XX (colour by architect), flush cover and internal faceplate to suit devices noted on the drawings.
- .2 Wellmark Electric Inc. Cat. #400B-1-YY-XX-CRL.

## 2.6 CONDUIT BOXES

.1 Cast FS or FD ferrous boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle **in areas (other than utility rooms) where surface conduit is used.**

## 2.7 OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE

.1 Electro-galvanized, sectional, screw ganging steel boxes, minimum size 76 mm 50 mm x 63 mm ( $3'' \times 2'' \times 2\text{-}1/2''$ ) with two double clamps to take non-metallic sheathed cables.

## 2.8 FITTINGS- GENERAL

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to 32 mm ( $1\text{-}1/4''$ ) and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

## Part 3 Execution

### 3.1 INSTALLATION

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm ( $1/4''$ ) of opening.



- .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.
- .5 Outlets if unwired are to be provided with blank coverplates to suit related sections of this specification.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1        CSA C22.2 No.65-1956(R1965) Wire Connectors.

**Part 2            Products**

**2.1                MATERIALS**

- .1        Pressure type wire connectors: with current carrying parts of copper sized to fit copper conductors as indicated.
- .2        Fixture type splicing connectors: with current carrying parts of copper sized to fit copper conductors 10 AWG or less.
- .3        Clamps or connectors for armoured cable, and flexible conduit, as required.

**Part 3            Execution**

**3.1                INSTALLATION**

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

**END OF SECTION**

**Part 1**            **General**  
**Not Applicable.**

**Part 2**            **Products**

**2.1**                **MATERIALS**

- .1            Grounding equipment must conform to CSA C22.2 No 41 (latest edition).

**2.2**                **EQUIPMENT**

- .1            Insulated grounding conductors: green with insulation type that matches specified phase conductors. Gauge shall be in conformance with the latest edition of the Electrical Safety Code to suit required installation conditions.
- .2            Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
  - .1            Grounding and bonding bushings.
  - .2            Protective type clamps.
  - .3            Bolted type conductor connectors.
  - .4            Bonding jumpers, straps.
  - .5            Pressure wire connectors.

**Part 3**            **Execution**

**3.1**                **INSTALLATION GENERAL**

- .1            Install complete permanent, continuous grounding system including, conductors, connectors, accessories. **Where EMT is used, run ground wire in conduit.**
- .2            Install connectors in accordance with manufacturer's instructions.
- .3            Protect exposed grounding conductors from mechanical injury.
- .4            Use mechanical connectors for grounding connections to equipment provided with lugs.
- .5            Soldered joints not permitted.
- .6            Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

**3.2**                **EQUIPMENT GROUNDING**

- .1            Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, frames of motors, escalators, and distribution panels.

**3.3 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Electrical General Requirements Section.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault indicator during tests.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Canadian Standards Association (CSA)
  - .1 CAN/CSA C22.2 No.18-92, Outlet Boxes, Conduit Boxes, and Fittings.
  - .2 CSA C22.2 No.56-1977(R1977), Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
  - .3 CSA C22.2 No.83-M1985(R1992), Electrical Metallic Tubing.
  - .4 CSA C22.2 No.211.2-M1984(R1992), Rigid PVC (Unplasticized) Conduit.
  - .5 CAN/CSA C22.2 No.227.3-M91, Flexible Nonmetallic Tubing.

**Part 2 Products**

**2.1 CONDUITS**

- .1 Epoxy coated conduit: to CSA C22.2 No.45, with zinc coating and corrosion resistant epoxy finish inside and outside.
- .2 Electrical metallic tubing (EMT) with couplings: to CSA C22.2 No.83.
- .3 Rigid PVC conduit: to CSA C22.2 No.211.2.
- .4 Flexible metal conduit: to CSA C22.2 No.56, aluminum and liquid-tight flexible metal.
- .5 Flexible PVC conduit: to CAN/CSA C22.2 No.227.3, ENT.

**2.2 CONDUIT FASTENINGS**

- .1 One hole steel straps to secure surface conduits 53 mm (2") and smaller. Two hole steel straps for conduits larger than 53 mm (2").
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 1.5 m (5'0") oc.
- .4 Threaded rods, 6 mm (1/4") diameter, to support suspended channels.

**2.3 CONDUIT FITTINGS**

- .1 EMT fittings shall be set screw style (zinc alloy).
- .2 Flexible metal conduit fittings shall be screw-in type.
- .3 Liquid type flexible metal conduit fittings shall be sealtite type.
- .4 PVC fittings shall be PVC type complete with PVC adaptors at all boxes.
- .5 Coating: same as conduit.
- .6 Factory "ells" where 90° bends are required for 27 mm (1") and larger conduits.
- .7 Where bushings are noted to be provided they must be "screwed" type fastened to a conduit connector. Push-fit or glued in place bushings will NOT be accepted.

## 2.4 FISH CORD

- .1 Nylon twine.

## Part 3 Execution

### 3.1 INSTALLATION

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Conceal conduits except in mechanical/ electrical service rooms and in unfinished areas. Where devices are to be installed on existing walls in finished area, which cannot be “fished”, install feeds in a surface metal raceway equal to Wiremold V700 or V500 series as noted. Co-ordinate surface installations with consultant prior to rough-in.
- .3 **Use electrical metallic tubing (EMT) for all branch circuits unless specified otherwise.**
- .4 Use rigid PVC conduit underground and in kitchen areas.
- .5 Use flexible metal conduit for connection to motors in dry areas, connection to recessed fixtures without a prewired outlet box, connection to surface or recessed fixtures, work in movable metal partitions.
- .6 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations and for connections to kitchen equipment.
- .7 Conduits terminating at electrical equipment in sprinklered areas are to be provided with insulated compression style connectors equal to Thomas & Betts Cat. #TC8XXSC or approved equal.
- .8 **Minimum conduit size for branch circuits shall be 21 mm (3/4”).** Single drops from ceiling mounted junction boxes down to a light switch or duplex receptacle may be reduced to 16 mm (1/2”).
- .9 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .10 Mechanically bend steel conduit over 27 mm (1”) diameter.
- .11 Install fish cord in empty conduits.
- .12 Run 2- 27 mm (1”) spare conduits up to accessible ceiling space from each flush panel. Terminate these conduits in 152 mm x 152 mm x 102 mm (6” x 6” x 4”) junction boxes in ceiling space.
- .13 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- .14 Dry conduits out before installing wire.

### 3.2 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m (5') clearance.
- .3 Run conduits in flanged portion of structural steel.

- .4 Group conduits wherever possible on suspended or surface channels.
- .5 Do not pass conduits through structural members except as indicated.
- .6 Do not locate conduits less than 75 mm (3") parallel to steam or hot water lines with minimum of 25 mm (1") at crossovers.
- .7 Do not fasten surface conduit larger than 25 mm (1") to roof deck. Provide standoffs or supports as manufactured by Caddy or use unistrut trapeze fastened to structure.**

### **3.3 CONCEALED CONDUITS**

- .1 Do not install horizontal runs in masonry walls.
- .2 Do not install conduits in terrazzo or concrete toppings.

### **3.4 CONDUITS IN CAST-IN-PLACE CONCRETE**

- .1 Locate to suit reinforcing steel. Install in centre one third of slab.
- .2 Protect conduits from damage where they stub out of concrete.
- .3 Install sleeves where conduits pass through slab or wall.
- .4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.
- .5 Do not place conduits in slabs in which slab thickness is less than 4 times conduit diameter.
- .6 Encase conduits completely in concrete with minimum 27 mm (1") concrete cover.
- .7 Organize conduits in slab to minimize cross-overs.

### **3.5 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE**

- .1 Run conduits 27 mm (1") and larger 300 mm (12") below slab (measured from top of slab to bottom of conduit) and encased in 78 mm (3") sand envelope.

### **3.6 CONDUITS UNDERGROUND**

- .1 Slope conduits to provide drainage.

**END OF SECTION**

**Part 1            General**

**1.1                GENERAL REQUIREMENTS**

- .1        The studies must be submitted to the Consultant prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment for manufacturing. If formal completion of the studies may cause delay in equipment manufacturing, approval from the Consultant may be obtained for a preliminary submittal of sufficient study data to ensure that the selection of device ratings and characteristics will be satisfactory.
- .2        The studies shall include all portions of the electrical distribution system from the normal power source or sources down to and including the smallest adjustable trip circuit breaker in the distribution system. Normal system connections and those, which result in maximum fault conditions, shall be adequately covered in the study.
- .3        The firm should be currently involved in high- and low-voltage power system evaluation. The study must be performed, stamped and signed by a registered professional engineer in the Province of Ontario. Credentials of the individual(s) performing the study and background of the firm shall be submitted to the Consultant for approval prior to start of the work. A minimum of five (5) years experience in power system analysis is required for the individual in charge of the project.
- .4        The firm performing the study should demonstrate capability and experience to provide assistance during start up as required.

**1.2                DATA COLLECTION FOR THE STUDY**

- .1        The Contractor shall provide the required data for preparation of the studies. The Consultant performing the system studies shall furnish the Contractor with a listing of the required data immediately after award of the contract.
- .2        The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to release of the equipment for manufacturing.
- .3        Data collected for the study, including correspondence with local utility, shall be included with study report.

**Part 2            Products**

**2.1                SHORT CIRCUIT AND PROTECTIVE DEVICE EVALUATION AND COORDINATION STUDY**

- .1        The short-circuit study shall be performed with the aid of a digital computer program and shall be in accordance with the latest applicable IEEE and ANSI standards.



- .2 In the short-circuit study, provide calculation methods and assumptions, the base per unit quantities selected, one-line diagrams, source impedance data including power company system characteristics, typical calculations, tabulations of calculation quantities and results, conclusions, and recommendations. Calculate short-circuit interrupting and momentary (when applicable) duties for an assumed 3-phase bolted fault at each supply switchgear lineup, unit substation primary and secondary terminals, low-voltage switchgear lineup, switchboard, motor control center, distribution panelboard, pertinent branch circuit panelboard, and other significant overcurrent protective device locations throughout the system. Provide a ground fault current study for the same system areas, including the associated zero sequence impedance data. Include in tabulations fault impedance, X to R ratios, asymmetry factors, motor fault contribution, short circuit kVA, and symmetrical and asymmetrical fault currents.
- .3 In the protective device coordination study, provide time-current curves graphically indicating the coordination proposed for the system, centered on conventional, full-size, log-log forms. Include with each curve sheet a complete title and one-line diagram with legend identifying the specific portion of the system covered by that particular curve sheet. Include a detailed description of each protective device identifying its type, function, manufacturer, and time-current characteristics. Tabulate recommended device tap, time dial, pickup, instantaneous, and time delay settings.
- .4 Include on the curve sheets power company relay and fuse characteristics, medium-voltage equipment protective relay and fuse characteristics, low-voltage equipment circuit breaker trip device characteristics, pertinent transformer characteristics, pertinent motor and generator characteristics, and characteristics of other system load protective devices. In addition, include all devices down to the largest branch circuit and largest feeder circuit breaker in each motor control center, and main breaker in branch panelboards.  
  
Include all adjustable settings for ground fault protective devices. Include manufacturing tolerance and damage bands in plotted fuse characteristics. Show transformer full load currents, transformer magnetizing inrush, ANSI transformer withstand parameters, and significant symmetrical fault currents. Terminate device characteristic curves at a point reflecting the maximum symmetrical fault current to which the device is exposed.
- .5 Select each primary protective device required for a delta-wye connected transformer so that its characteristic or operating band is within the transformer characteristics, including a point equal to 58 percent of the ANSI withstand point to provide secondary line-to-ground fault protection. Separate transformer primary protective device characteristic curves from associated secondary device characteristics by a 16 percent current margin to provide proper coordination and protection in the event of secondary line-to-line faults. Separate medium-voltage relay characteristic curves from curves for other devices by at least a 0.4-second time margin.
- .6 Include complete fault calculations as specified herein based on contract documents.
- .7 Submit qualifications of individual(s) who will perform the work for approval prior to commencement of the studies. Provide studies in conjunction with equipment submittals to verify equipment ratings required. Submit the study to Consultant for review prior to delivery of the study to the Owner. Make all additions or changes as required by the reviewer.

- .8 Utilize equipment load data for the study obtained by the Contractor from contract documents, including contract addendum's issued prior to bid openings.
- .9 Include fault contribution of all motors in the study. Notify the Consultant in writing of circuit protective devices not properly rated for fault conditions.
- .10 When emergency generator is provided, include phase and ground coordination of the generator protective devices. Show the generator decrement curve and damage curve along with the operating characteristic of the protective devices. Contractor shall obtain the information from the generator manufacturer and include the generator actual impedance value, time constants and current boost data in the study. Do not use typical values for the generator.
- .11 Evaluate proper operation of the ground relays in 4-wire distributions with more than one main service circuit breaker, or when generators are provided, and discuss the neutral grounds and ground fault current flows during a neutral to ground fault.
- .12 For motor control circuits, show the MCC full-load current plus symmetrical and asymmetrical of the largest motor starting current and time to ensure protective devices will not trip during major or group start operation.

## **2.2 ARC FLASH HAZARD ANALYSIS**

- .1 The contractor shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E – Standard for Electrical Safety in the Workplace, reference Article 130.3 and Annex D and CSA Z462-(latest edition).
- .2 The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2004, Annex D.
- .3 When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Alternative methods shall be presented in the proposal.
- .4 The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.
- .5 The Arc-Flash Hazard Analysis shall include all significant locations in 240 volt and 208 volt systems fed from transformers equal to or greater than 125 kVA.
- .6 Safe working distances shall be specified for calculated fault locations based upon the calculated arc flash boundary considering an incident energy of 1.2 cal/cm<sup>2</sup>.
- .7 The Arc Flash Hazard analysis shall include calculations for maximum and minimum contributions of fault current magnitude. The minimum calculation shall assume that the utility contribution is at a minimum and shall assume a minimum motor load. Conversely, the maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.
- .8 Arc flash computation shall include both line and load side of main breaker calculations, where necessary.

- .9 Arc Flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584-latest edition section B.1.2.

### **2.3 STUDY REPORT**

- .1 The results of the power system study shall be summarized in a final report. Submit report in accordance with Electrical General Requirements Section as a shop drawing.
- .2 The report shall include the following sections:
  - .1 Descriptions, purpose, basis, and scope of the study.
  - .2 Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short-circuit duties, and commentary regarding same.
  - .3 Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same.
  - .4 Fault current calculations including a definition of terms and guide for interpretation of computer printout.
  - .5 Incident energy and flash protection boundary calculations
    - .1 Arcing fault magnitude
    - .2 Device clearing time
    - .3 Duration of arc
    - .4 Arc flash boundary
    - .5 Working distance
    - .6 Incident energy
    - .7 Hazard Risk Category
    - .8 Recommendations for arc flash energy reduction
    - .9 **Recommendations for Personal Protection Equipment (PPE) level.**

## **Part 3 Execution**

### **3.1 POWER COMPANY APPROVAL**

- .1 Copies of the final report must be submitted to the power company for their review and approval. Approved copies of the report shall be submitted to the Consultant.

### **3.2 FIELD SETTINGS**

- .1 The Contractor shall perform field adjustments of the protective devices as required to place the equipment in final operating condition. The settings shall be in accordance with the approved short-circuit study, protective device evaluation study, and protective device coordination study.
- .2 Necessary field settings of devices and adjustments and minor modifications to equipment to accomplish conformance with the approved short-circuit and protective device coordination study shall be carried out by the Contractor at no additional cost to the Owner.

### **3.3 ARC FLASH WARNING LABELS**

- .1 The vendor shall provide a 3.5 in. x 5 in. thermal transfer type label of high adhesion polyester for each work location analyzed.
- .2 The label shall have an orange header with the wording, “WARNING, ARC FLASH HAZARD”, and shall include the following information:
  - .1 Location designation
  - .2 Nominal voltage
  - .3 Flash protection boundary
  - .4 Hazard risk category
  - .5 Incident energy
  - .6 Working distance
  - .7 Personal Protection Equipment (PPE) level
  - .8 Engineering report number, revision number and issue date.
- .3 Labels shall be machine printed, with no field markings.
- .4 Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings.
  - .1 For each 600, 480 and applicable 208 volt panelboards, one arc flash label shall be provided.
  - .2 For each motor control center, one arc flash label shall be provided.
  - .3 For each low voltage switchboard, one arc flash label shall be provided.
  - .4 For each switchgear, one flash label shall be provided.
  - .5 For medium voltage switches one arc flash label shall be provided
- .5 **Labels shall be field installed by the firm providing the Arc Flashing Hazard Analysis.**

### **3.4 ACCEPTABLE TESTING FIRMS**

- .1 MVA Engineering (519) 668-4698
- .2 GT Woods (905) 272-1696
- .3 Brosz & Associates (905) 472-6660
- .4 K-Tek Electro-services Ltd. (905) 640-0660 ext. 228

**END OF SECTION**

**Part 1            General**

**1.1                SHOP DRAWINGS**

- .1        Submit shop drawings for each system in Conformance with The Electrical General Requirements Section.

**1.2                PRODUCT/MAINTENANCE DATA**

- .1        Submit product/maintenance data for each system for inclusion in maintenance manual conforming to The General Electrical Requirements Section.

**1.3                SCOPE**

- .1        The scope of this Section will include the following systems.
  - .1        Telecommunication network system rough-in.
  - .2        Occupancy sensors.
  - .3        Classroom Assistive Listening System rough-in.

**Part 2            Products**

**2.1                TELECOMMUNICATION NETWORK SYSTEM ROUGH-IN**

- .1        Outlets where noted shall be single gang flush mounted in wall or surface raceways.
- .2        Outlets if unwired are to be provided with blank coverplates to suit related sections of this specification.

**2.2                OCCUPANCY SENSORS**

- .1        Where noted on drawings the wall mounted (passive technology) occupancy sensor used in storage and service rooms shall be either:
  - .1        Cooper Controls Cat. #ONW-P-1001-VOLT-X (colour by Architect).
  - .2        Wattstopper Cat. #PW-100-VOLT-X (colour by Architect).
  - .3        Sensor switch Cat. #WSX-VOLT-X (colour by architect).

- .2 Where noted on the drawings, the wall mounted switch style occupancy sensor used in Administrative Offices and Seminar/Meeting Rooms shall be a dual technology switch with either single or double relay (circuit) as noted on the drawings. Colour to suit architect.

Note: For dual relay switches, program the sensor for 15 minute off delay, enabled walk-thru, audible alert enabled, relay 1 on mode: auto on, relay 2 on mode: manual on.

- .1 Single relay (circuit): Wattstopper Cat. #DW-100
- .2 Dual relay (circuit): Wattstopper Cat. #DW-200
- .3 Approved equal:
  - .1 Cooper Controls.  
Sensor switch.
- .3 Provide other occupancy sensors to suit the detail on the drawings.  
All sensors shall be set to 15 minutes “delay to off” unless otherwise directed.

### **2.3 CLASSROOM ASSISTIVE LISTENING SYSTEM ROUGH-IN**

- .1 Provide and install back boxes and conduit network for assistive listening system between wall outlets to ceiling outlets and equipment as detailed on design drawings.
- .2 Assistive listening system components, cabling, fire rated covers, connections, setup and commissioning to be part of cash allowance as noted in Division 1. System is based on Lightspeed Cat. #TopCat series.

## **Part 3 Execution**

### **3.1 TELECOMMUNICATION NETWORK SYSTEM ROUGH-IN**

- .1 Provide conduits terminated into ceiling spaces must be within 3m (10') of zone conduits (if applicable).
- .2 Ensure specified zone conduits are installed back to service backboard.
- .3 Outlets are to be installed complete with 25 mm (1") conduit to corridor ceiling space or nearest zone conduit (if applicable).
- .4 Provide insulated bushings on all conduits terminated in ceiling space.

### **3.2 OCCUPANCY SENSORS**

- .1 Install power packs in accessible maintenance areas.
- .2 Provide access doors if power packs are installed above drywall ceilings.
- .3 It shall be the contractor’s responsibility to locate and aim sensory in the correct location required for complete and proper coverage within the range of coverage as per the manufacturer’s recommendations. The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective rooms.

- .4 It is the contractor's responsibility to arrange a pre-installation meeting with the manufacturer's factory authorized representative, at the facility, to verify placement to sensors and installation criteria.
- .5 The contractor shall also provide the on-site training necessary to familiarize the owner's personnel with the operation, use, adjustment and problem solving diagnosis of the occupancy sensing devices systems.
- .6 Upon completion of the installation, the system shall be completely commissioned by the manufacturer's factory authorized technician who will verify all adjustments and sensor placement to ensure a trouble-free occupancy-based lighting control. Submit commissioning report with closeout documents.

### **3.3 CLASSROOM ASSISTIVE LISTENING SYSTEM ROUGH-IN**

- .1 Final device locations, conduit runs, outlets, etc. for assistive listening system to be coordinated with owner's assistive listening vendor (Duplicom Business Products Ltd – contact: Jim Osborn, 519-725-0791).

**END OF SECTION**

**Part 1            General**

**1.1                SHOP DRAWINGS AND PRODUCT DATA**

- .1     Submit shop drawings and product data in accordance with Electrical General Requirements Section.
- .2     Indicate on shop drawings.
  - .1     Floor anchoring method and foundation template.
  - .2     Dimensioned cable entry and exit locations.
  - .3     Dimensioned positions and size of bus.
  - .4     Overall length, height and depth.
  - .5     Dimensioned layout of internal and front panel mounted components.

**1.2                MAINTENANCE DATA**

- .1     Provide maintenance data for service entrance board for incorporation into manual specified in the Electrical General Requirements Section.
- .2     Submit 5 copies of maintenance data for complete assembly including components.

**1.3                MAINTENANCE MATERIALS**

- .1     Include:
  - .1     One can of touch-up paint.

**1.4                SOURCE QUALITY CONTROL**

- .1     Consultant to witness final factory tests if requested.
- .2     Notify Consultant in writing 5 days in advance that service entrance board is ready for testing.
- .3     Submit 5 copies of certified test results.

**Part 2            Products**

**2.1                SERVICE ENTRANCE BOARD**

- .1     Service entrance board must conform to CSA C222 No. 31 (latest edition).
- .2     Rating: 208V, 3 phase, 4 wire, 600A, short circuit current (kA rms symmetrical as noted on distribution riser).
- .3     Cubicles: free standing, dead front, size as indicated, hinged access panels with captive knurled thumbscrews (front access only), EEMAC2 rating (sprinkler hood).
- .4     Distribution section to contain breakers as noted complete with kA interrupting capacity to match mains.

NOTE: Refer to Moulded Case Circuit Breakers section for specifications regarding the required breakers.



- .5 Bus bars and main connections: Copper.
- .6 Bus bars are to have identified colour coded phases.

## **2.2 GROUNDING**

- .1 Aluminum ground bus extending full width of cubicles and located at bottom.
- .2 Lugs at each end for grounding cable. Contractor to size lug.

## **2.3 POWER SUPPLY AUTHORITY METERING**

- .1 Separate compartment and rigid metal raceway for exclusive use of power supply authority metering.

## **2.4 FINISHES**

- .1 Apply finishes in accordance with the Electrical General Requirements Section.
  - .1 Service entrance board exterior: grey.

## **2.5 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Electrical General Requirements Section.
- .2 Nameplates:
  - .1 Black plate, white letters, and size 7.
  - .2 Complete board labeled: 120/208V.
  - .3 Incoming Wireway to match existing and suit existing service connection.
  - .4 Branch disconnects labeled: as indicated.

## **2.6 ACCEPTABLE PRODUCTS**

- .1 Basis of design for equipment spacing per existing service room layout:
  - .1 Schneider Electric Cat# MDS

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Locate service entrance board and fasten to housekeeping pad. Enlarge housekeeping pad to suit size of replacement switchboard.
- .2 Connect main secondary service to line terminals of main device.
- .3 Connect load terminals of distribution devices to feeders.
- .4 Check factory made connections for mechanical security and electrical continuity.

- .5 Run grounding conductors from ground bus to building ground to suit the Electrical Safety Code.
- .6 Check trip unit settings against co-ordination study to ensure proper working and protection of components.

**END OF SECTION**

**Part 1            General**

**1.1                PRODUCT DATA**

- .1        Submit product data in accordance with Electrical General Requirements Section.
- .2        Drawings to include electrical detail of panel, branch breaker or switch type, quantity, ampacity and enclosure dimension.

**Part 2            Products**

**2.1                PANELBOARDS**

- .1        Panel boards must conform to CSA C22.2 No. 29 (latest edition).
- .2        Panelboards: product of one manufacturer.
- .3        Install circuit breakers in panelboards before shipment.
- .4        In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand. **Series rating is acceptable – submit information with shop drawings.**
- .5        Bus and breakers must be rated for 10,000 A (symmetrical) interrupting capacity or as indicated.
- .6        Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
- .7        Panelboard mains, number of circuits, and number and size of branch circuit breakers as indicated.
- .8        Two keys for each panelboard and key panelboards alike.
- .9        Copper bus with neutral of same ampere rating as mains.
- .10       Mains must be suitable for bolt-on breakers. Provide main (if applicable) and branch breakers as bolt-on style.
- .11       Trim with concealed front bolts and hinges.
- .12       Trim and door finish must be baked grey enamel.
- .13       All panels regardless of voltage and amperage must be provided with a lockable door.
- .14       Branch circuit panelboards (250 AMP or smaller) must be one of the following:
  - .1        Schneider Electric Cat # NQ Series

**2.2                BREAKERS**

- .1        Breakers: to Moulded Case Circuit Breakers Section.
- .2        Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

- .3 Lock-on devices for fire alarm, stairway, exit and night light circuits.

### **2.3 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Electrical General Requirements Section.
- .2 Nameplate for each panelboard size 4 engraved description as indicated. In finished areas install label on inside of panel, and in service areas install label on exterior of panel.
- .3 Nameplate for each circuit in distribution panelboards size 2 engraved “name of load” as indicated.
- .4 Complete circuit directory with typewritten legend showing location of each circuit.  
**Include a copy of the directories in the maintenance manuals.**

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- .2 Install surface mounted panelboards on plywood backboards. Where practical, group panelboards on common backboard. Plywood shall be 21mm (3/4”) fire rated or painted with intumescent fire block paint having a minimum of 1h rating, unless noted otherwise.
- .3 Mount panelboards to height specified in Electrical General Requirements Section or as indicated.
- .4 Connect loads to circuits.
- .5 Connect neutral conductors to common neutral bus.

**END OF SECTION**

**Part 1            General**

**1.1                PRODUCT DATA**

- .1            Submit product data in accordance with Electrical General Requirements Section.

**Part 2            Products**

**2.1                BREAKERS GENERAL**

- .1            Moulded case circuit breakers must conform to CSA C22.1 No.5.1-M91 (latest edition.)
- .2            Bolt-on moulded case circuit breaker quick-make, quick-break type, for manual and automatic operation.
- .3            Common-trip breakers: with single handle for multi-pole applications.
- .4            Unless otherwise indicated moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.
- .5            Moulded case circuit breakers 250 Amps and above are to operate by means of a solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, and long time, short time, instantaneous tripping for phase and ground fault short circuit protection (if indicated or applicable by the Electrical Safety Code versus the breaker amperage). Unless otherwise specified, complete system selective co-ordination shall be provided by the individually adjustable time/current curve shaping elements as following:
  - .1            Breakers shall have fixed rating plug determining breaker continuous current rating.
  - .2            All breakers shall have adjustable long delay pickup and time, L.
  - .3            All breakers shall have individual adjustments for short delay pickup and time, S; including I2t settings in time adjustment.
  - .4            Breakers shall have adjustable instantaneous pickup, I; that if required by co-ordination study can be turned off, (I).
  - .5            If required by Electrical Safety Code breakers shall have individually adjustable ground fault current pick-up and time, G; including I2t settings in time adjustment.
  - .6            Unless otherwise specified, for the low voltage systems provide an electronic trip unit as specified above for the following moulded case circuit breakers:
    - .1            Mains or ties in main switchboard: LS trip unit with fixed instantaneous over-ride exceeding maximum value of fault at the point of installation.
    - .2            Transformer feeder for the units 225kVA and above: LSI or LS trip unit with fixed instantaneous over-ride, where instantaneous trip setting or instantaneous over-ride allows for transformer inrush of 12xFLA at 0.1s and exceeds maximum value of fault at the transformer secondary.

- .3 Feeders exceeding 250A trip setting: LS trip unit with fixed instantaneous over-ride exceeding maximum value of fault at downstream panelboard.
- .4 Branch circuits or feeders for MCCs with fusible combination starters: LSI trip unit where instantaneous trip setting allows for maximum size downstream fuse total clearing time.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install circuit breakers as indicated complete with all necessary mounting hardware and filler panels if necessary.

**END OF SECTION**

**Part 1 General**

**1.1 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings and product data in accordance with Electrical General Requirements Section.

**Part 2 Products**

**2.1 SWITCHES**

- .1 General purpose AC switches must conform to CSA C22.2 No. 111 (latest edition).
- .2 15 or 20 A, 120 V, single pole, double pole, three-way, four-way, keyed, or motor rated switches complete with pilot light.
- .3 Manually-operated general purpose ac switches with following features:
  - .1 Terminal holes approved for No. 10 AWG wire.
  - .2 Silver alloy contacts.
  - .3 Urea or melamine molding for parts subject to carbon tracking.
  - .4 Suitable for back and side wiring.
  - .5 Toggle style (Rocker style) (architect to select colour).
- .4 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.
- .5 Switches of one manufacturer throughout project.
- .6 Acceptable materials:
  - single pole: Hubbell Cat # HBL1201 Series
  - three way: Hubbell Cat # HBL1203 Series
  - four way: Hubbell Cat # HBL1204 Series
  - Keyed: Hubbell Cat. #HBL1221 Series complete with 2 keys per switch
  - (Keys): Hubbell Cat. #HBL1209
  - Motor rated: Hubbell Cat. #HBL1221PL c/w pilot light (20 A):
- .7 Acceptable alternate manufacturers include:
  - .1 Pass & Seymour
  - .2 Leviton.

## 2.2 RECEPTACLES

- .1 Receptacles, plugs, and other similar wiring devices must conform to CSA 22.2 No 42 (latest edition).
- .2 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, with following features (20A where noted):
  - .1 Urea molded housing (Colour by architect).
  - .2 Suitable for No. 10 AWG for back and side wiring.
  - .3 Break-off links for use as split receptacles.
  - .4 Eight back wired entrances, four side wiring screws.
  - .5 Triple wipe contacts and rivetted grounding contacts.
- .3 Other receptacles with ampacity and voltage as indicated.
- .4 Receptacles of one manufacturer throughout project.
- .5 Acceptable materials:

|   |  |
|---|--|
| Tamper resistant ground fault protected receptacle              | Hubbell Cat. #GFTR15   |
| Tamper resistant ground fault protected T-slot receptacle       | Hubbell Cat. #GFTR20 complete with Decora style coverplate to suit specification below |
| Tamper resistant duplex receptacle complete with dual USB ports | Hubbell Cat. #USB15XXX   |

- .6 Acceptable alternate manufacturers include:
  - .1 Pass & Seymour
  - .2 Leviton

## 2.3 COVER PLATES

- .1 Cover plates from one manufacturer throughout project.
- .2 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.
- .3 Stainless steel, brushed, 1 mm (1/32") thick cover plates for wiring devices mounted in flush-mounted outlet box.
- .4 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

## 2.4 DIMMER CONTROL

- .1 Dimmers are to be provided complete with the following features:
  - .1 Rating of 15 A 120 V.
  - .2 Wattage to suit load as indicated on drawings (minimum 1000W).
  - .3 Thin profile linear slide control only. (Rotary controls will not be accepted).
  - .4 Dimmer must provide full range of illumination from zero to full intensity.
  - .5 Integral on/off switch.
  - .6 Devices must mount in single gang box or multi-ganged where noted.



- .7 Device and faceplate colour must match other wiring devices.
- .8 Acceptable manufacturers:
  - .1 Leviton Renoir Series
  - .2 Lutron Lumea 2 Series
  - .3 Hubbell AS103 Series

### **Part 3 Execution**

#### **3.1 INSTALLATION**

- .1 Switches:
  - .1 Install single throw switches with handle in "UP" position when switch closed.
  - .2 Install switches in gang type outlet box when more than one switch is required in one location.
  - .3 Mount toggle switches at height specified in Electrical General Requirements Section or as indicated.
- .2 Receptacles:
  - .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
  - .2 Mount receptacles at height specified in Electrical General Requirements Section or as indicated.
  - .3 Where split receptacle has one portion switched mount vertically and switch upper portion.
- .3 Cover plates:
  - .1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
  - .2 Install suitable common cover plates where wiring devices are grouped.
  - .3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.
- .4 Dimmer:
  - .1 Mount devices at height as specified in Electrical General Requirements Section.
  - .2 Dimmer switches must be installed with the "most downward" position of slider corresponding to zero light intensity and the "highest" position of slider corresponding to full light intensity.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Canadian Standards Association (CSA)
  - .1 CSA C22.2 No.248.12/94, Low Voltage Fuses Part 12: Class R (Bi-National Standard with, UL 248-12 (1st Edition).
  - .2 CSA C22.2 No. 106-M92 (latest edition).

**1.2 MAINTENANCE MATERIAL**

- .1 Three spare fuses of each type and size installed.

**1.3 DELIVERY AND STORAGE**

- .1 Ship fuses in original containers.
- .2 Store fuses in original containers in moisture free location.

**Part 2 Products**

**2.1 FUSES GENERAL**

- .1 Fuses: product of one manufacturer for entire project .
- .2 Fuses specified below must conform to CSA C22.2 No. 106 (latest edition). Fuses conforming to standard C22.2 No. 106-1953 will be rejected.
- .3 Fuses must provide a fully co-ordinated system for both overload and fault conditions.

**2.2 FUSE TYPES**

- .1 Class J fuses (formerly HRCI- J).
  - .1 Time delay, capable of carrying 500% of its rated current for 10 s minimum.
  - .2 Fast acting as noted.
- .2 Class R fuses (formerly HRCI- R). For UL Class RK1 fuses, peak let-through current and  $I^2t$  values not to exceed limits of UL 198E-1982, table 10.2.

**2.3 ACCEPTABLE PRODUCTS**

- .1 Motor Protection:
  - 1-600 A: Mersen Type AJT
- .2 Other acceptable manufacturers:
  - .1 GEC
  - .2 Little Fuse

**Part 3            Execution**

**3.1                INSTALLATION**

- .1            Install fuses in mounting devices immediately before energizing circuit.
- .2            Ensure correct fuses fitted to physically matched mounting devices.
  - .1            Install Class R rejection clips for HRCI-R fuses.
- .3            Ensure correct fuses fitted to assigned electrical circuit.

**END OF SECTION**

**Part 1            General**

**1.1                PRODUCT DATA**

- .1        Submit product data in accordance with Electrical General Requirements Section.

**Part 2            Products**

**2.1                DISCONNECT SWITCHES**

- .1        Enclosed manual air break switches must conform to CSA C22.1 No.4 (latest edition).
- .2        Fuseholder assemblies must conform to CSA C22.2 No.39 (latest edition).
- .3        Fusible, and/or non-fusible, horsepower rated disconnect switches, size as indicated.
- .4        Provision for padlocking in off switch position by three locks.
- .5        Mechanically interlocked door to prevent opening when handle in ON position.
- .6        Fuses: size as indicated, to Fuses - Low Voltage Section.
- .7        Fuseholders: relocatable and suitable without adaptors, for type and size of fuse indicated.
- .8        Quick-make, quick-break action.
- .9        ON-OFF switch position indication on switch enclosure cover.
- .10      Disconnects feeding elevator controllers must be equipped with two auxiliary contacts approved by the elevator supplier.

**2.2                EQUIPMENT IDENTIFICATION**

- .1        Provide equipment identification in accordance with Electrical General Requirements Section.
- .2        Indicate name of load controlled on size 4 nameplate.

**2.3                ACCEPTABLE MANUFACTURERS**

| <u>Manufacturer</u> | <u>General Purpose</u> | <u>Weather Proof</u> |
|---------------------|------------------------|----------------------|
| Eaton               | IHD Series             | 3HD Series           |
| Schneider Electric  | Type A Series          | Type R Series        |
| Siemens             | ID Series              | NFR/FR Series        |

**Part 3            Execution**

**3.1                INSTALLATION**

- .1            Install disconnect switches complete with fuses if applicable.
- .2            Connect auxiliary contacts to elevator controller using conduit, wire and route approved by the elevator supplier.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)
  - .1 ANSI/IEEE C62.41- 1991, Recommended Practices for Surge Voltages in Low-Voltage AC Power Circuits.
- .2 American Society for Testing and Materials (ASTM)
  - .1 ASTM F1137- 88 (1993), Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.
- .3 United States of America, Federal Communications Commission (FCC)
  - .1 FCC (CFR47) EM and RF Interference Suppression.
- .4 IESNA LM-79-08, IES Electrical Method for the Electrical and Photometric Measurements of Solid State Lighting Products.

**1.2 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings in accordance with Electrical General Requirements Section for all light fixtures supplied under this contract.
- .2 Submit complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by Consultant.
- .3 Photometric data to include: VCP Table spacing criterion.

**1.3 SCOPE**

- .1 This contractor is responsible to supply and install all lighting fixtures as scheduled and/or indicated including lamp and those accessories required for a complete lighting system. This contractor must coordinate lighting installations with all other Divisions of this project.
- .2 All fixtures must be CSA approved or approved at this contractor's expense by the Special Inspection Division of the Electrical Safety Authority.

**1.4 GUARANTEE**

- .1 Guarantees for materials replacement shall be as follows from date of substantial completion.
  - .1 LED fixtures, and driver: 5 years.
- .2 The labour required to replace these ballasts, lamps or drivers must be included in the above guarantee, however only for the extent of the contract guarantee and warranty period as noted in Electrical General Requirements.

## **Part 2 Products**

### **2.1 FIXTURE CONSTRUCTION**

- .1 Fixtures must be constructed of 20 gauge (minimum) cold rolled steel. All metal edges require smooth finish.
- .2 Light leaks must be prevented by providing gasketting, stops, and barriers.
- .3 Fixtures must be finished in high reflective baked white enamel. This surface must have a reflectance of not less than 85%.

### **2.2 FIXTURE LENS**

- .1 Unless otherwise noted fixture lenses shall be as follows:
  - .1 Lens thickness: 3.2 mm (1/8")
  - .2 Material: injection moulded clear prismatic virgin acrylic
  - .3 Frame: hinged, latched, steel.

### **2.3 LED FIXTURES**

- .1 Fixture LED's must be tested in conformance with IESNA LM80 standard.
- .2 LED's must be selected using a binning algorithm to ensure colour and lumen output of a given fixture are consistent, as well as meet or surpass ANSI C78.377 specification for the rated lifetime of the fixture. Colour accuracy between products must be within a 2-step MacAdam ellipse.
- .3 Luminaires must be tested to IESNA LM79 by an independent approved laboratory.
- .4 Luminaires must be tested prior to shipping.
- .5 Luminaires must be ULC certified and approved for use in Canada.
- .6 Fixtures must maintain a minimum of 90% of their initial light output for 60,000 hours. Submit test results upon request.
- .7 Lumen values indicated for fixtures in the project documents are to be considered as "absolute" or "delivered" values.
- .8 Other than for specialty fixtures, and unless otherwise indicated, the maximum driver current is to be 750 mA.

### **2.4 STANDARD EXIT LIGHTING UNITS**

- .1 Exit lighting units must conform to CSA C860, CSA 22.2 No. 141 (latest edition).
- .2 Housing: extruded aluminum housing, white finish.
- .3 Face and back plates: extruded aluminum.
- .4 Lamps: 2W LED.
- .5 Operation: 25 year.

- .6 Units are to be provided with three (3) pictogram legends indicating “left from here”, “straight from here”, and “right from here”.
- .7 Face plate to remain captive for relamping.

## **2.5 EMERGENCY LIGHTING UNITS (self contained)**

- .1 Emergency lighting units must conform to CSA C22.2 No 141 (latest edition).
- .2 Supply voltage: as noted on drawings.
- .3 Battery: sealed, maintenance free, 10 year life.  
  
Note: Battery units must be capable of supplying the wattage indicated for a minimum of 90 minutes or as specified.
- .4 Charger: solid state, multi rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01 V for plus or minus 10% input variations.
- .5 Solid state transfer circuit. EM backup AC fail operation.
- .6 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.
- .7 Signal lights: “AC Power ON” condition and “charging” condition.
- .8 Lamp type: integral high output LED, 100,000 hours at L70.
- .9 Ceiling mount brackets and recessed mounting kit as required to suit installation.
- .10 Auxiliary equipment:
  - .1 Test switch.

## **2.6 SELF-POWERED COMBINATION EXIT/EMERGENCY LIGHTING UNITS**

- .1 Exit lighting units must conform to CSA C860, CSA 22.2 No. 141 (latest edition).
- .2 Housing: extruded aluminum housing. White Finish.
- .3 Face and back plates: extruded aluminum.
- .4 Lamps 2W LED (EXIT).
- .5 Operation: 25 year life.
- .6 Units are to be provided with three (3) pictogram legends indicating “left from here”, “straight from here”, and “right from here”.
- .7 Face plate to remain captive for relamping.
- .8 Supply voltage: as noted on drawings.
- .9 Output voltage: 12 V DC.
- .10 Battery: sealed maintenance free 10 year life.  
  
Note: Battery must be capable of supplying the wattage indicated for a minimum of 90 minutes.



- .11 Charger: solid state, voltage/current regulated, inverse temperature compensated, short circuit protected, with regulated output of plus or minus 0.01 V for plus or minus 10% V input variation.
- .12 Solid state transfer circuit.
- .13 Signal lights: “AC Power On” condition and “charging” condition.
- .14 Lamp heads: integral on unit, 345° horizontal and 180° vertical adjustment. Lamp type: minimum 4 watt LED.
- .15 Mounting: suitable for universal mounting directly on junction box and complete with knockouts for conduit. Removable or hinged front panel for easy access to batteries.
- .16 Cabinet: finish: white.
- .17 Auxiliary equipment:
  - .1 Test switch.

## **2.7 ACCEPTABLE LIGHTING MANUFACTURERS**

- .1 Refer to the light fixture schedule as indicated on drawings.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Locate and install luminaires as indicated. Luminaires are not to be supported from the roof deck. Provide additional unistrut support channel and/or support from structure. Co-ordinate with consultant on site.
- .2 Ball align hangers must be provided for rod suspended fixtures.
- .3 Fixtures surface mounted to suspended ceilings must be secured through ceiling assembly to cross member supports. These supports are to be steel channels or angles independently secured **to structure** using # 12 “jack” chain. Each chain must be secured so no fixture weight is added to the ceiling assembly.
- .4 Plaster frames/flange kits must be provided by this Division for fixtures recessed in plaster and/or drywall ceilings.
- .5 Where specified, fixtures to be chain hung shall be hung using “jack” chain with a capacity to suit the fixture weight. Branch circuit wiring feeding these fixtures shall be AC90 cable “ty-wrapped” at 900mm (36”) intervals along length of drop. Final appearance must be neat and professional.
- .6 Install exit lighting units with illuminated faces and chevrons/arrows indicating path(s) of exit as indicated. Unless otherwise noted install exit fixtures at 2400 mm (8’ 0”) above finished floor.
- .7 Install emergency lighting units in locations as indicated.

- .8 **Special installation: Secure fixtures to structure to conform to the Electrical Safety Code using “jack chain” NOT ceiling suspension wire. Where coreslab is used, suspension point must be independent of the one used for suspension of the ceiling assembly. As an alternate to jack chain the contractor may use a pre-manufactured aircraft cable suspension and fastening system as manufactured by Gripple (Gripple Cat. #HF02-10F2). Provide minimum 2 per fixture.**
- .9 All battery units are to be provided with a visible lamicaid label indicating the unit number as per drawings.

### **3.2 WIRING**

- .1 Connect luminaires to lighting circuits as indicated.
- .2 Connect exit fixtures to exit lighting circuits and unit equipment (if applicable).
- .3 Connect unit equipment to circuits as indicated.
- .4 All wiring of remote emergency fixtures shall be minimum #10 T90 for each circuit and run in conduit. Wiring must be sized in conformance with manufacturer’s recommendations for distances required.

### **3.3 LUMINAIRE ALIGNMENT**

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

### **3.4 DELIVERIES**

- .1 Fixtures are to be completely assembled at the manufacturer’s plant and delivered to the project site in original unitized containers. Ensure that a dry, protected and secure space is available for proper storage before scheduling delivery of fixtures.

### **3.5 TESTING/CERTIFICATION**

- .1 At the completion of the project and in the presence of the consultant, test all exit and emergency fixtures. On company letterhead, the contractor is to prepare a chart indicating:
  - .1 project
  - .2 date
  - .3 equipment type
  - .4 certification of correct connection
  - .5 certification of correct operation
  - .6 duration of test in minutes (minimum 30)
  - .7 actual period of testing (time of day)

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1        CAN/ULC-S524 (latest edition), Installation of Fire Alarm Systems.
- .2        ULC-S525-1978, Audible Signal Appliances for Fire Alarm Systems.
- .3        CAN/ULC-S526-M87, Visual Signal Appliances, Fire Alarm.
- .4        CAN/ULC-S527-M87 Control Units, Fire Alarm.
- .5        CAN/ULC-S528 (latest edition), Manual Pull Stations.
- .6        CAN/ULC-S529 (latest edition), Smoke Detectors.
- .7        CAN/ULC-S530 (latest edition), Heat Actuated Fire Detectors, Fire Alarm.
- .8        CAN/ULC-S536 (latest edition), Inspection and Testing of Fire Alarm Systems.
- .9        CAN/ULC-S537-(latest edition), Verification of Fire Alarm Systems.
- .10      OBC-2012, Ontario Building Code.

**1.2                DESCRIPTION OF SYSTEM**

- .1        System includes:
  - .1        Existing control panel as manufactured by Edwards c/w remote annunciator with spare zones and relays to carry out fire alarm and protection functions including receiving alarm signals, initiating general alarm, supervising system continuously, actuating zone annunciators, and initiating trouble signals.
  - .2        **Contact local Edwards Sales Representative:  
Ross McKay – Troy Life & Fire Safety Ltd.  
519-778-5839**

**1.3                SHOP DRAWINGS**

- .1        Submit shop drawings in accordance with the Electrical General Requirements Section.

**1.4                OPERATION AND MAINTENANCE DATA**

- .1        Provide operation and maintenance data for Fire Alarm System for incorporation into manual specified in the Electrical General Requirements Section.
- .2        Include:
  - .1        Operation and maintenance instructions for complete fire alarm system to permit effective operation and maintenance.
  - .2        Technical data - illustrated parts lists with parts catalogue numbers.
  - .3        Copy of approved shop drawings.
  - .4        List of recommended spare parts for system.

## **1.5 MAINTENANCE MATERIALS**

- .1 Include:
  - .1 10 % spare glass rods for total number of manual pull box stations if applicable.

## **1.6 TRAINING**

- .1 Arrange and pay for on-site demonstrations by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system. **Obtain written receipt of training session and include in maintenance manual.**

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Equipment and devices: ULC listed and labeled and supplied by single manufacturer.
- .2 Power supply: to CAN/ULC-S524.
- .3 Audible signal devices: to ULC-S525.
- .4 Visual signal devices: to CAN/ULC-S526.
- .5 Control unit: to CAN/ULC-S527.
- .6 Manual pull stations: to CAN/ULC-S528.
- .7 Thermal detectors: to CAN/ULC-S530.
- .8 Smoke detectors: to CAN/ULC-S529.

### **2.2 SYSTEM OPERATION**

- .1 Single stage operation. Operation of any alarm initiating device to:
  - .1 Cause audible signal devices to sound throughout building.
  - .2 Transmit signal to fire department via monitoring station.
  - .3 Cause zone of alarm device to be indicated on control panel and remote annunciator[s].
  - .4 Cause air conditioning and ventilating fans to shut down or to function so as to provide required control of smoke movement.
  - .5 Cause fire doors and smoke control doors if normally held open, to close automatically.

### **2.3 CONTROL PANEL (EXISTING)**

- .1 Class B.
- .2 Single stage operation.
- .3 Zoned in conformance with annunciator schedule.
- .4 Non-coded.

## 2.4 MANUAL ALARM STATIONS

- .1 Pull lever style, wall mounted semi-flush type, non-coded single pole normally open contact for single stage, English signage.
- .2 Where noted on drawings, stations are to be equipped with tamperproof guard equal to Stopper II Cat. # STI-1100.

## 2.5 AUTOMATIC ALARM INITIATING DEVICES

- .1 Thermal fire detectors: fixed temperature, non-restorable, rated 57°C (135° F) or 88°C (194° F) as indicated.
- .2 Thermal fire detectors, combination fixed temperature and rate of rise, non-restorable fixed temperature element, self-restoring rate of rise, fixed temperature 57°C (135° F) or 88°C (194° F), rate of rise 8.3°C (15° F) per minute.
- .3 Smoke detector: ceiling mounted, photo electric type, visual alarm indicator, complete with relay base where noted.
- .4 Smoke detector: photo electric type air duct type with sampling tubes with protective housing.
  - .1 Plug-in type with fixed base.
  - .2 Wire-in base assembly with integral red alarm LED, and terminals for remote alarm LED.

## 2.6 AUDIBLE/VISUAL SIGNAL DEVICES

- .1 150 mm (6") Bells: surface mounted bell, vibration type 24Vdc, 6", 92dBA rating at 10', red finish, FM and ULC listed.
- .2 250 mm (10") Bells: surface mounted bell, vibration type 24Vdc, 10", 94dBA rating at 3 m (10'), red finish, FM and ULC listed.
- .3 Strobe: Semi-recessed, 24Vdc operation, complete with selectable 15/30/75/110 candela output (unless otherwise noted set at 75 cd), synchronized strobe, red finish, FM and ULC listed. Suitable for mounting on a single gang box.

### NOTE:

- .1 **Signal devices with integral strobe lights in high abuse areas (i.e. gymnasium, change rooms, etc.) must be provide with protective wireguards.**
- .2 **Any surface mounted signal devices must be provided with suitable backboxes supplied by the manufacturer.**
- .3 **Provide synchronization modules to suit signal devices (if required by manufacturer).**

## 2.7 DOOR HOLD OPEN DEVICES

- .1 Units to be complete with the following features:
  - .1 Wall mounted style.
  - .2 Long life electromagnet.
  - .3 Low current operation.

- .4 Completely silent operation.
- .5 25 lbf (111N) minimum holding force.
- .6 Adjustable swivel contact plate.
- .7 Brushed zinc finish.
- .8 Maintenance free operation.
- .9 Water resistant design.
- .10 ULC, CSA, and FM approved.

**2.8 END-OF-LINE DEVICES**

- .1 End-of-line devices to control supervisory current in alarm circuits and signalling circuits, sized to ensure correct supervisory current for each circuit. Open, short or ground fault in any circuit will alter supervisory current in that circuit, producing audible and visible alarm at main control panel and remotely at annunciators.
- .2 End-of-line resistors shall be mounted on a stainless steel plate for mounting on a standard single gang box and bear the ULC label.

**2.9 REMOTE ANNUNCIATOR PANELS (EXISTING)**

- .1 Existing LED type with designation cards to indicate zones to be updated to suit additional zones added as part of this renovation.

**2.10 ANCILLARY DEVICES**

- .1 Relay unit to facilitate elevator recall functions as indicated.

**2.11 APPROVED EQUIPMENT**

| <u>DEVICE</u>                 | <u>EDWARDS</u> |
|-------------------------------|----------------|
| <u>Control Panel:</u>         |                |
| (existing)                    | QuickStart     |
| Manual Alarm Stations         | 270 Series     |
| Thermal Detectors             | 280-PL Series  |
| Smoke Detectors (System Type) | C2M-PDC        |
| Smoke Detectors (System)      | C2M-PDHRC      |

|                      |                                |
|----------------------|--------------------------------|
| Type c/w Relay Base) |                                |
| 150 mm (6") Bells    | 439D Series<br>or<br>MB Series |
| 250 mm (10") Bells   | 439D Series<br>or<br>MB Series |
| Door Holder          | 1500 Series                    |
| Strobe               | G1R-VM                         |

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install components in accordance with CAN/ULC-S524 (latest edition).
- .2 Locate and install manual alarm stations and connect to alarm circuit wiring.
- .3 Locate and install detectors and connect to alarm circuit wiring. **Do not mount detectors within 1 m (39") of air outlets.** Maintain at least 600 mm (24") radius clear space on ceiling, below and around detectors. Locate duct type detectors in straight portions of ducts.
- .4 Connect alarm circuits to main control panel.
- .5 Locate and install signal devices and connect to signaling circuits.  
 Note: Any required surface mounted signalling devices must be provided with proper surface mounted boxes from fire alarm manufacturer.
- .6 Connect signaling circuits to main control panel.
- .7 Install end-of-line devices at end of alarm and signaling circuits no higher than 2.4 m (8' 0") above finish floor.
- .8 Install remote annunciator panels and connect to annunciator circuit wiring.
- .9 Locate and install door releasing devices.  
**Note: Door holders must release by way of local smoke detector and signal from main**
- .10 Elevator controllers are to be connected with 4 #14 conductors in conduit from fire alarm control panel spare relay cards or field devices specified with relay bases, to signal elevator recall in the event of a general alarm.
- .11 **Connect smoke damper integral detector outputs to noted zones and include monitor modules for supervision of AC power to smoke dampers.**

### 3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Electrical General Requirements Section and CAN/ULC-S537 (latest edition).
- .2 Fire alarm system:
  - .1 Test each device and alarm circuit to ensure noted devices transmit alarm to control panel and actuate general alarm and ancillary devices.
  - .2 Check annunciator panels to ensure zones are shown correctly.
  - .3 Simulate grounds and breaks on alarm and signaling circuits to ensure proper operation of system.
  - .4 Class B circuits.
    - .1 Test each conductor on all circuits for capability of providing alarm signal on line side of single open-circuit fault condition imposed at electrically most remote device on circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.
    - .2 Test each conductor on all circuits for capability of providing alarm signal during ground-fault condition imposed at electrically most remote device on circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.
- .3 Qualifications:
  - .1 Persons performing any work on this fire alarm system must be CFAA certified. Submit certification upon request.
  - .2 **Provide “Integrated Testing” of this life safety system in conformance with the noted specification section. Include all associated costs in tender.**
- .4 Audibility Testing:
  - .1 The contractor is to coordinate an audibility test prior to occupancy of the facility. The test is to be performed by the representatives of the fire alarm manufacturer in the presence of the consultant. The test report is to be in chart form indicating:
    - .1 Project
    - .2 Date of test
    - .3 Room name and number
    - .4 Ambient dB level
    - .5 Alarm dB level
    - .6 Name of testing technician
  - .2 The test results are to be submitted to the consultant for review prior to issuing to owner’s representatives and/or authorities having jurisdiction.

**END OF SECTION**



**Part 1 General**

**1.1 GEOTECHNICAL INVESTIGATION**

- .1 A copy of the Geotechnical Report and Borehole Logs is enclosed herein for convenience.

**PROJECT NAME: Report – Geotechnical Investigation  
Accessibility Upgrade – Main Entrance and  
Elevator Addition  
Central Public School  
Cambridge, Ontario  
Prepared by: JLP Geotechnical &  
Environmental Consultants  
Date: January 2022  
Proj. Ref. No. G4500-21-12**

**1.2 DISCLAIMER**

- .1 The Geotechnical Report is not part of the Contract Documents prepared by the Architect or his sub consultants. It is bound into the Specifications set for convenient reference only. The Geotechnical report was not prepared by or under the supervision of the Architect. While every effort has been made to attempt to provide comprehensive geotechnical information for the purposes of design and tendering, the Architect claims no responsibility for the accuracy of the information contained in the report.
- .2 Refer to Section 00 21 13 – ‘Instruction to Bidders’, Examination of the Site.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not used.

**END OF SECTION**



Geotechnical & Environmental Consultants

**GEOTECHNICAL INVESTIGATION  
ACCESSIBILITY UPGRADE – MAIN ENTRANCE AND ELEVATOR ADDITION  
CENTRAL PUBLIC SCHOOL  
CAMBRIDGE, ONTARIO**

*Ref. No. G4500-21-12  
January 2022*

*Prepared for:*

*Waterloo Region District School Board  
51 Ardelt Avenue  
Kitchener, Ontario  
N2C 2R5*

*Attn: Dale Wideman*

*Distribution:*

- (1) Copy – Waterloo Region District School Board*
- (1) Copy – Hossack & Associates Architects*
- (2) Copies – JLP Services Inc.*

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**APPENDIX**

**APPENDIX 'A' Statement of Limitations**

**ENCLOSURES**

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| <b>BOREHOLE LOCATION PLAN .....</b>        | <b>1</b>          |
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**1.0 INTRODUCTION:**

*JLP Services Inc., formerly V. A. Wood (Guelph) Inc., was retained by Waterloo Region District School Board to carry out a geotechnical investigation for the proposed accessibility upgrade – main entrance and elevator addition at the Central Public School at 175 Main Street, Cambridge, Ontario*

*It is understood that the proposed accessibility upgrade will consist of an elevator addition which will provide access between ground floor and second floor. It is noted that the site for the proposed elevator addition is presently a landscape area beside the main entrance of the school building on the east elevation. The existing Central Public School is a two-storey building with main entrance at second floor. The ground floor entrance is located at north side of the building, fronting on Main Street.*

*The purpose of the investigation was to reveal the subsurface conditions and to determine the relevant soil properties for recommendations concerning the design and construction of the elevator foundation.*

## **2.0 FIELD WORK:**

*The fieldwork was carried out on December 22, 2021 and consisted of two (2) boreholes at the locations shown on the Borehole location plan, Enclosure 1.*

*Prior to the commencement of drilling and sampling operations at the site, the borehole locations were cleared of underground utilities by Ontario One-Call contractors and a private utility locate firm.*

*The boreholes were advanced to the sampling depths by means of a track-mounted, power-auger machine equipped with hollow stem augers and split spoon samplers for soil sampling. Standard Penetration tests were carried out at frequent intervals of depth and the results are shown on the Borehole Logs as N-values. The subsurface soils were visually examined, logged and sampled at the borehole locations.*

*JLP Services Inc. engineering staff supervised the fieldwork and the ground elevation at each borehole was referred to a temporary benchmark: the top of finished floor at second floor of the existing school. It is understood this reference datum has a geodetic elevation of 289.81m (950.83ft)*

### **3.0 SUBSURFACE CONDITIONS:**

*Full details of the soils encountered in each borehole are given on the Borehole Logs, Enclosures 2 to 3, inclusive and the following notes are intended to summarize this data.*

*The boreholes encountered a surficial deposit of **topsoil** about 150mm± thick. The topsoil consisted of black to dark brown silty sand mixed with organics, and scattered wood pieces and roots.*

*Based on visual and tactile examination, the deposit of topsoil is considered to be in a generally moist condition.*

*The topsoil at the boreholes was underlain by a deposit of **fill** to the depth of about 3.1 metres below grade. The fill generally consisted of brown sand and gravel about 250 to 400mm thick over brown silty sand, some gravel, trace clay and some organic inclusions. Standard Penetration tests in this deposit gave N-values ranging between 5 and 18 blows/300mm and the natural moisture content was found to range from 6 to 21%. A typical grain size distribution curve for the silty sand fill can be found on Enclosure 4.*

*The fill at the boreholes was underlain by a deposit of brown **sand and gravel** to the full depth of the investigation (i.e. 5.0 to 8.0± metres below grade). Borehole 2 was terminated on probable boulders by refusal to augering. Standard Penetration tests in the sand and gravel deposit gave N-values ranging from 58 to over 100 blows/300mm. The natural moisture content was found to range between 3 and 9%.*

*Based on visual and tactile examination and, the test results, the deposit of sand and gravel is medium to coarse grained and is in moist condition.. It is considered to have a generally very dense relative density. It is noted that the presence of gravel, cobbles and/or boulders in this deposit may have resulted in high N-values and these may not accurately represent the relative density of the soil.*

#### **4.0 GROUNDWATER CONDITIONS:**

*Borehole 1 was dry with cave-in at a depth of 6.7 metres below grade while Boreholes 2 was dry and open to the full depth of the investigation on completion of the fieldwork program.*

*An examination of the soil sample indicated that they were generally damp to moist.*

*It is noted that no sub-artesian water pressure was encountered in any of the boreholes.*

*Based on the foregoing, the groundwater table is considered to be located below the full depth of investigation (i.e. 8.0 metres below grade).*

## 5.0 DISCUSSION AND RECOMMENDATIONS:

### 5.1 General:

The boreholes generally encountered a surficial deposit of topsoil over loose to compact fill underlain by a deposit of sand and gravel in a very dense condition.

Borehole 2 encountered refusal augering on probable boulder at 5.0± metres below grade.

The groundwater table is considered to be located below 8.0± metres below grade, Elevation 281.9m.

### 5.2 Foundations:

Based on design drawings available for this project, the finished floor of the existing ground floor is at El. 286.36m (939.50ft). It is understood the footings for the proposed elevator addition will match the underside of the footings of the existing building at about El. 286.40m (939.63ft) and step down to the lowest underside of footing of the elevator pit at Elevation 284.43m (933.17ft).

The proposed elevator addition can be supported on spread footings founded on the very dense sand and gravel deposit and can be designed to a geotechnical reaction of 250 kPa at Serviceability Limit States (S.L.S.) and a factored geotechnical resistance of 375 kPa at Ultimate Limit States (U.L.S.).

Based on the data obtained at Boreholes 1 to 2, suitable foundation grades and their respective allowable bearing pressures at depth will be as follows:

| Borehole No. | Depth to Suitable Bearing Stratum (m±) | Suitable Bearing Stratum Elevation (m±) | Bearing Stratum            | Allowable Bearing Pressure (kPa) |        |
|--------------|--|---|----------------------------|----------------------------------|--------|
|              |  |   |                            | S.L.S.                           | U.L.S. |
| 1            | 3.2 to 5.2                             | 286.4 to 284.4                          | Very dense Sand and Gravel | 250                              | 375    |
| 2            | 3.2 to 6.5                             | 286.7 to 284.4                          | Very dense Sand and Gravel | 250                              | 375    |

All exterior footings or footings in unheated areas should be located at least 1.2 metres below finished grade for adequate frost protection.



*Elevation differences between adjacent footings should not be more than a half of the horizontal distance between them.*

*It is estimated that the total and differential settlements of the footings designed to the above stated bearing pressures will be less than 25 and 20mm respectively, which are normally considered to be acceptable for the proposed structure.*

*It is recommended that all foundation excavations be inspected by geotechnical personnel from JLP Services Inc. to ensure the founding soils are similar to those identified in the boreholes and that they are capable of supporting the design bearing pressures.*

*Based on the 2012 Building Code Compendium, the classification of soils for seismic design should be based on the average properties of the top 30 metres of the soil profile. The deepest boreholes were only 8 metres below grade and were terminated in generally very dense sand and gravel stratum. Assuming this deposit extends to depth, the soils at the site may be classified as Site Class 'D' under the site classification for seismic site response of 2012 Building Code Compendium.*

*For the design of subsurface walls or members resisting lateral loads, the magnitude of which can be determined from:*

$$p = K(\gamma d + q)$$

|               |          |   |   |
|---------------|----------|---|---|
| <i>where;</i> | $p$      | = | <i>earth pressure, kN/m<sup>2</sup></i>   |
|               | $K$      | = | <i>earth pressure co-efficient = 0.33, if retaining structure is permitted to move, otherwise K = 0.5</i> |
|               | $\gamma$ | = | <i>unit weight of backfill, 21 kN/m<sup>3</sup> for sand</i>  |
|               | $d$      | = | <i>depth below finished grade, m</i>  |
|               | $q$      | = | <i>all adjacent surcharge kN/m<sup>2</sup></i>  |

*The above expression assumes that a perimeter drainage is provided at footing founding levels and the perimeter drainage system is effective to prevent the build-up of any hydrostatic pressure behind the perimeter walls.*

### **5.3 Excavation and Groundwater Control:**

*No major construction problems due to water are anticipated with excavations above El. 281.9m±. However, provision should be made for the control of any surface water run-off and minor seepage from any wet seams by pumping from local sumps on an as and where required basis.*

*It should be noted that the native sand and gravel is cohesionless and excavations below grade should be cut back to a side slope of 1 vertical to 1 horizontal or supported using properly designed and constructed shoring system or adequately braced sheeting.*

**5.4 Floor Slabs:**

*All topsoil and any deleterious materials encountered should be stripped from the building areas and the proposed subgrade should be re-compacted from the surface to at least 98% of its Standard Proctor maximum dry density. Any loose/wet material encountered should be sub-excavated and replaced with approved fill.*

*Backfill around footing and under floor slabs may consist of approved on-site materials, primarily sand and gravel, free of organics and cobbles/boulders or approved imported granular fill. All fill materials should be placed in 150 to 200mm thick lifts and compacted to at least 98% of its Standard Proctor maximum dry density.*

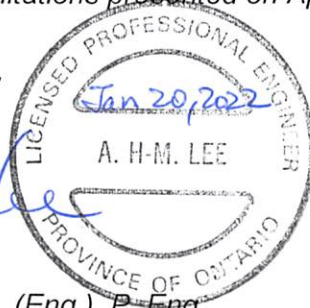
*A layer of well-graded, free-draining material, at least 150mm thick and compacted to 100% of its Standard Proctor maximum dry density, should be placed under the floor slabs to provide a uniform bearing surface and to act as a vapour barrier.*

*Frequent inspections by geotechnical personnel from JLP Services Inc. should be carried out during construction to verify compaction of the subgrade and base courses by in-situ density testing using nuclear gauges.*

**7.0 STATEMENT OF LIMITATIONS:**

*The Statement of Limitations presented on Appendix 'A' is an integral part of this report.*

**JLP SERVICES INC.**



Alexander Lee, M.Sc. (Eng.), P. Eng.  
Senior Geotechnical Engineer



J. Broad, B.A.  
General Manager

AL:al

Encls.

## ***APPENDIX***

**STATEMENT OF LIMITATIONS:**

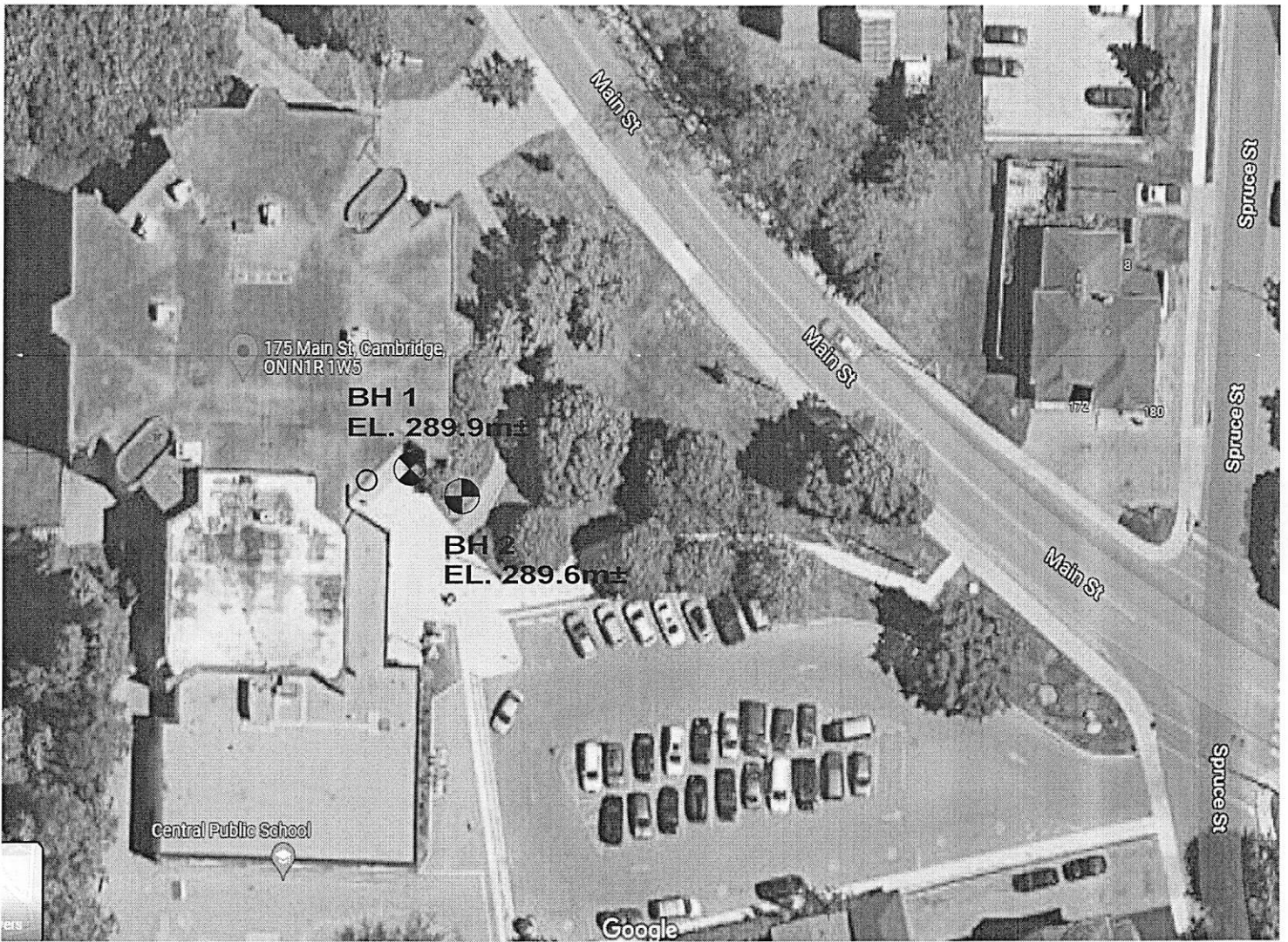
*The conclusions and recommendations in this report are based on information determined at the borehole locations and on geological data of a general nature, which may be available, for the area investigated. Soil and groundwater conditions between and beyond the boreholes may differ from those encountered at the borehole locations and conditions may become apparent during construction, which would not be detected or anticipated at the time of the soil investigation.*

*We recommend that we be retained to ensure that all necessary stripping, subgrade preparation and compaction requirements are met, and to confirm that the soil conditions do not deviate materially from those encountered in the boreholes. **In cases where this recommendation is not followed the company's responsibility is limited to interpreting accurately the information encountered at the boreholes.***

*This report is applicable only to the project described in the introduction, constructed substantially in accordance with details of alignment and elevations quoted in the text.*

*This report was prepared by JLP Services Inc. for Waterloo Region District School Board. The material in it reflects JLP Services Inc. judgment in light of the information available to it at the time of preparation. Any use which a Third Party makes of this report, or any reliance on decisions to be made based on it, is the responsibility of such Third Parties. JLP Services Inc. accepts no responsibility for damages, if any, suffered by any Third Party as a result of decisions made or actions based on this report.*

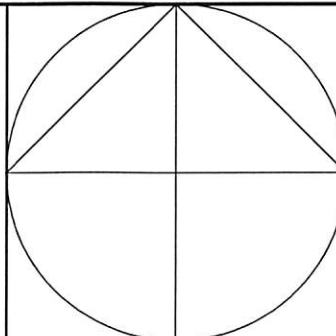
***ENCLOSURES***



- TBM : Top of finished floor at second floor of the existing school  
Elevation: 289.81m (deodetic)

Notes:

1. The soil types and boundaries are applicable only at the location of the boreholes. Between boreholes, they are assumed and may change substantially. The topsoil thicknesses quoted in the report are used for discussion purposes only and should not be used for estimating purposes.
2. The ground surface elevations at the borehole locations were derived from the Temporary Benchmark (TBM) as shown.
3. The soil samples will be retained for three months from the date of issue of the final report and then discarded, unless the client has requested to extend the storage period with fees.



Geotechnical and Environmental Consultants  
405 York Road, Guelph, Ontario N1E 3H3  
Tel. (519) 763-3101  
www.jlp-services.ca

Borehole Location Plan  
Accessibility Upgrade - Main Entrance and Elevator Addition  
Central Public School  
175 Main Street  
Cambridge, Ontario

Scale: N.T.S.

Ref. No. G4500-21-12

Date: January 19, 2022

Enclosure 1

REFERENCE No: G4500-21-12

**BOREHOLE No: 1**

CLIENT: WRDSB

**JLP Services Inc.**  
**GEOTECHNICAL & ENVIRONMENTAL**  
**CONSULTANTS**

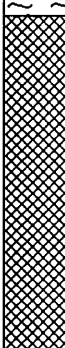

PROJECT: Accessibility Upgrade, Central Public School

ENCLOSURE No: 2

405 YORK ROAD, GUELPH, ONTARIO N1E 3H3  
 PH. (519) 763-3101

LOCATION: 175 Main Street, Cambridge, ON

SUPERVISOR: AK

| SUBSURFACE PROFILE |   |           |   |              | SAMPLE |      |                | PENETRATION RESISTANCE<br>BLOWS/0.3m |    |    |    | WATER CONTENT<br>% |    |         |    |    | UNIT WEIGHT |  |  |  |
|--------------------|---|-----------|---|--------------|--------|------|----------------|--------------------------------------|----|----|----|--------------------|----|---------|----|----|-------------|--|--|--|
| DEPTH (m)          | DESCRIPTION   | ELEVATION | SYMBOL  | GROUND WATER | NUMBER | TYPE | 'N' BLOWS/0.3m | 20                                   | 40 | 60 | 80 | 5                  | 10 | 15      | 20 | 25 |             |  |  |  |
|                    |   |           |   |              |        |      |                |                                      |    |    |    |                    |    |         |    |    |             |  |  |  |
| 0.0                | Ground Surface  | 289.9     |   |              |        |      |                |                                      |    |    |    |                    |    |         |    |    |             |  |  |  |
| 3.1                | TOPSOIL:<br>silty sand mixed with organics;<br>black, moist<br><br>FILL:<br>sand and gravel, about 250mm<br>thick, over silty sand, some gravel,<br>some organic inclusion; brown,<br>moist, loose to compact | 286.8     |    |              | 1      | SS   | 18             |                                      |    |    |    |                    |    |         |    |    |             |  |  |  |
|                    |   |           |   |              | 2      | SS   | 5              |                                      |    |    |    |                    |    |         |    |    |             |  |  |  |
|                    |   |           |   |              | 3      | SS   | 18             |                                      |    |    |    |                    |    |         |    |    |             |  |  |  |
|                    |   |           |   |              | 4      | SS   | 10             |                                      |    |    |    |                    |    |         |    |    |             |  |  |  |
| 8.0                | SAND AND GRAVEL:<br>coarse grained, scattered cobbles<br>or boulders; moist, very dense   | 281.9     |  |              | 5      | SS   | 58             |                                      |    |    |    |                    |    |         |    |    |             |  |  |  |
|                    |   |           |   |              | 6      | SS   | 94             |                                      |    |    |    |                    |    |         |    |    |             |  |  |  |
|                    |   |           |   |              | 7      | SS   | 50             |                                      |    |    |    |                    |    | 50/50mm |    |    |             |  |  |  |
|                    |   |           |   |              | 8      | SS   | 50             |                                      |    |    |    |                    |    | 50/75mm |    |    |             |  |  |  |
|                    | End of Borehole   |           |   |              |        |      |                |                                      |    |    |    |                    |    |         |    |    |             |  |  |  |

CAVE IN @ 93.4m± (22-DEC-2021)

DRILLED BY: London Soil Test Ltd.

HOLE DIAMETER: 200mm

DRILL METHOD: Hollow Stem Auger

DATUM: Geodetic

DRILL DATE: December 22, 2021

SHEET: 1 of 1



REFERENCE No: G4500-21-12

**BOREHOLE No: 2**

CLIENT: WRDSB

**JLP Services Inc.**  
**GEOTECHNICAL & ENVIRONMENTAL**  
**CONSULTANTS**

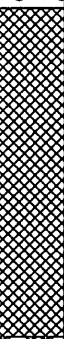

PROJECT: Accessibility Upgrade, Central Public School

ENCLOSURE No: 3

405 YORK ROAD, GUELPH, ONTARIO N1E 3H3  
 PH. (519) 763-3101

LOCATION: 175 Main Street, Cambridge, ON

SUPERVISOR: AK

| SUBSURFACE PROFILE |  |           |  |                   | SAMPLE |      |          | PENETRATION RESISTANCE |    |    |    |   | UNIT WEIGHT |    |    |    |    |  |  |  |  |
|--------------------|--|-----------|--|-------------------|--------|------|----------|------------------------|----|----|----|---|-------------|----|----|----|----|--|--|--|--|
| DEPTH (m)          | DESCRIPTION  | ELEVATION | SYMBOL   | GROUND            | NUMBER | TYPE | N-Values | 20                     | 40 | 60 | 80 | 5 |             | 10 | 15 | 20 | 25 |  |  |  |  |
| 0.0                | Ground Surface   | 289.6     |  |                   |        |      |          |                        |    |    |    |   |             |    |    |    |    |  |  |  |  |
| 3.0                | TOPSOIL:<br>silty sand, mixed with organics;<br>black, moist<br><br>FILL:<br>sand and gravel, about 400mm<br>thick, over silty sand, trace clay;<br>brown, moist to wet, loose to<br>compact | 286.6     |   | DRY (22-DEC-2021) | 1      | SS   | 16       |                        |    |    |    |   |             |    |    |    |    |  |  |  |  |
|                    |  |           |  |                   | 2      | SS   | 10       |                        |    |    |    |   |             |    |    |    |    |  |  |  |  |
|                    |  |           |  |                   | 3      | SS   | 13       |                        |    |    |    |   |             |    |    |    |    |  |  |  |  |
|                    |  |           |  |                   | 4      | SS   | 6        |                        |    |    |    |   |             |    |    |    |    |  |  |  |  |
| 5.0                | SAND AND GRAVEL:<br>coarse grained, scattered cobbles<br>or boulders; brown, moist, very<br>dense  | 284.6     |  |                   | 5      | SS   | 61       |                        |    |    |    |   |             |    |    |    |    |  |  |  |  |
|                    |  |           |  |                   | 6      | SS   | 50       |                        |    |    |    |   |             |    |    |    |    |  |  |  |  |
|                    | Refusal on Probable Boulder  |           |  |                   |        |      |          |                        |    |    |    |   |             |    |    |    |    |  |  |  |  |

DRILLED BY: London Soil Test Ltd.

HOLE DIAMETER: 200mm

DRILL METHOD: Hollow Stem Auger

DATUM: Geodetic

DRILL DATE: December 22, 2021

SHEET: 1 of 1

# GRAIN SIZE DISTRIBUTION

OUR REFERENCE N° G4500-21-12

UNIFIED SOIL CLASSIFICATION SYSTEM

SILT & CLAY

FINE

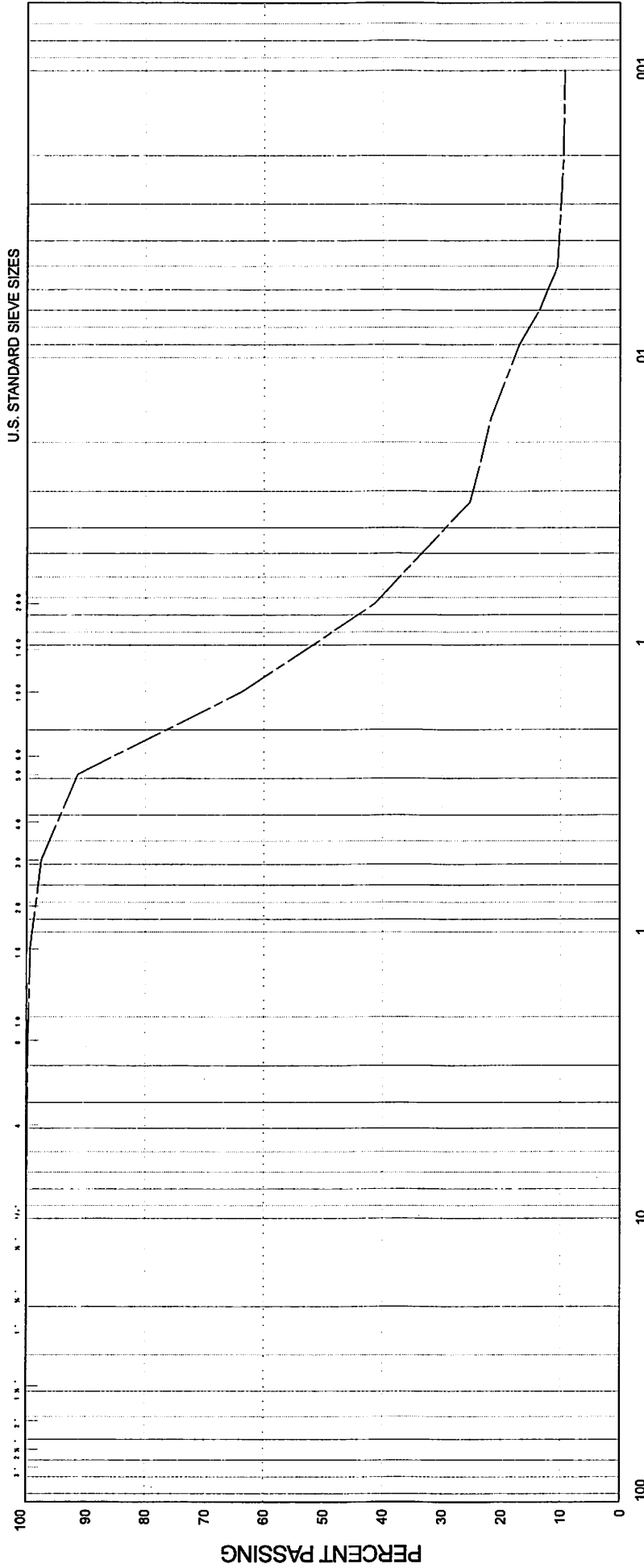
MEDIUM

COARSE

FINE

GRAVEL

COARSE



ENCLOSURE N° 4

PLASTIC PROPERTIES  
 LIQUID LIMIT % = 12.0  
 PLASTIC LIMIT % = 10.9  
 PLASTICITY INDEX % = 1.1  
 MOISTURE CONTENT % = 16.1

COEFFICIENT OF UNIFORMITY:  
 COEFFICIENT OF CURVATURE:

PROJECT: Accessible Upgrade - Central P.S.  
 LOCATION: 175 Main Street, Cambridge, ON  
 BOREHOLE N°: 1  
 SAMPLE N°: 4  
 DEPTH: 2.3 - 2.7 m±  
 ELEVATION:

**Classification of Sample and Group Symbol:**  
 Silty Sand FILL, trace clay (SM)

**Part 1 General**

**1.1 RELATED WORK**

- |    |  |                  |
|----|--|------------------|
| .1 | Summary of Work – Phasing and Sequencing | Section 00 22 00 |
| .2 | Site Grading                             | Section 31 23 13 |
| .3 | Excavating, Trenching and Backfilling    | Section 31 23 10 |

**1.2 SCOPE**

- .1 Refer to survey, site layout, site servicing, landscape and grading drawings and Geotechnical Report.
- .2 Work to this section is anticipated to be carried out under a Site Alteration Permit (Fill Permit).

**1.3 EXAMINATION**

- .1 Examine the Drawings, Specifications, and Geotechnical Report which summarize site soil conditions. Visit the site and determine the work extent and nature of the existing conditions. In no circumstances will any claims against the Owner be allowed resulting from failure to ascertain the work herein described or implied.
- .2 Report to the Consultant in writing any conditions which will prejudice the proper completion of the work of this Section. Commencement of work constitutes acceptance of existing conditions.

**1.4 BURIED SERVICES**

- .1 Before commencing work confirm no buried services remain on the site and locate all services adjacent to the site. Engage private locate firm for underground scan for all areas of work outside the property lines.
- .2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work. Pay costs of relocating services.

**1.5 PROTECTION**

- .1 Establish locations of all electrical, telephone, or other service installations existing in the areas of site preparation by contacting the service owners and obtaining their approval to work in such areas. Contact the Municipality, the Region and local utilities to review proposed scheduling, work activities and regulations pertaining to all work beyond the limits of the property including but not limited to parking areas, storm water outlet and headwall and asphalt driveway entrances. Provide adequate markers or take protective measures to ensure that no damage will be caused under this Section. Repair or replace damaged work as required without cost to the Owner.
- .2 Electronically locate, map and record location of services prior to doing any excavation.

**1.6 DUST CONTROL**

- .1 Provide and maintain to the Consultant's satisfaction, adequate system to avoid any nuisance caused by dust and dirt rising throughout the area of operations.

**1.7 SILT CONTROL**

- .1 Refer to site Plans and any approved Plans issued with the Site Alteration Permit.
- .2 Provide and maintain to the Consultant's and to the Authorities' satisfaction, control systems to prevent silt from entering any storm drainage system.

**Part 2 Products**

**2.1 NOT APPLICABLE**

**Part 3 Execution**

**3.1 DISPOSAL OF WASTE AND SURPLUS MATERIALS**

- .1 Except where specified or indicated on Drawings to be retained on site, or to be reused, remove from the site, all waste and surplus materials resulting from site preparation work on a daily basis. Dispose of as required in accordance with local or provincial regulations. Under no circumstances shall the burning of rubbish be permitted on the site. Where items are to be reused, store on site where designated and provide temporary protection to same to prevent damage by construction operations.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 00 22 00 – Summary of Work – Phasing and Sequencing
- .2 Section 01 33 00 - Submittal Procedures.
- .3 Section 01 56 00 - Temporary Barriers and Enclosures.
- .4 Section 01 35 43 - Environmental Procedures.
- .5 Section 31 23 13 - Rough Grading.
- .6 Section 33 46 20 – Foundation and Underslab Drainage.
- .7 Section 32 12 17 – Asphalt Paving.

**1.2 REQUIREMENTS OF REGULATORY AGENCIES**

- .1 Work of this Section shall include protection measures, consisting of materials, constructions, and methods required by the Occupational Health and Safety Act, 1987, of the Province of Ontario, and as otherwise imposed by Jurisdictional Authorities to save persons and property from harm.
- .2 Submit shop drawings required by authorities.

**1.3 REFERENCES**

- .1 American Society for Testing and Materials (ASTM)
  - .1 ASTM C117-95, Standard Test Method for Material Finer Than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C136-96a, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .3 ASTM D422-98, Standard Test Method for Particle-Size Analysis of Soils.
  - .4 ASTM D698-00a, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>) (600 kN-m/m<sup>3</sup>).
  - .5 ASTM D1557-00, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup>) (2,700 kN-m/m<sup>3</sup>).
  - .6 ASTM D4318-00, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
  - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .3 Canadian Standards Association (CSA)

- .1 CAN/CSA-A3000-98-A5-98, Portland Cement.
- .2 CAN/CSA-A23.1-00, Concrete Materials and Methods of Concrete Construction.

#### 1.4 DEFINITIONS

- .1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.
  - .1 Rock : any solid material in excess of 0.25 m<sup>3</sup> and which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95 to 1.15 m<sup>3</sup> bucket. Frozen material not classified as rock.
  - .2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.
- .2 Unclassified excavation: excavation of deposits of whatever character encountered in Work.
- .3 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
- .4 Waste material: excavated material unsuitable for use in Work or surplus to requirements.
- .5 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.
- .6 Unsuitable materials:
  - .1 Weak and compressible materials under excavated areas.
  - .2 Frost susceptible materials under excavated areas.
  - .3 Frost susceptible materials:
    - .1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM D422 and ASTM C136 : Sieve sizes to CAN/CGSB-8.1 CAN/CGSB-8.2.
    - .2 Coarse grained soils containing more than 20 % by mass passing 0.075 mm sieve.
- .7 Unshrinkable fill: very weak mixture of Portland cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

#### 1.5 SUBMITTALS

- .1 Samples:
  - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Inform Consultant at least 2 weeks prior to commencing Work, of proposed source of fill materials and provide access for sampling.
  - .3 Submit 25 kg samples of type of fill specified including representative samples of excavated material.
  - .4 Ship samples prepaid to Inspection firm, in tightly closed containers to prevent contamination.

## 1.6 QUALITY ASSURANCE

- .1 Qualification Statement: submit proof of insurance coverage for professional liability.
- .2 Where Consultant/Engineer is employee of Contractor, submit proof that Work by Consultant/Engineer is included in Contractor's insurance coverage.
- .3 Submit design and supporting data at least 2 weeks prior to commencing Work.
- .4 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in Province of Ontario, Canada.
- .5 Keep design and supporting data on site.
- .6 Engage services of qualified professional Engineer who is registered or licensed in Province of Ontario, Canada in which Work is to be carried out to design and inspect cofferdams, shoring, bracing and underpinning required for Work.

## 1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Collect and separate plastic, paper packaging and corrugated cardboard and place in designated containers.
- .2 Place materials defined as hazardous or toxic in designated containers.
- .3 Ensure emptied containers are sealed and stored safely.
- .4 The Soil Report chemical analysis results indicate that all samples were below the Table 1 Criteria, except for the levels of Sodium Adsorption Ratio (SAR) and Electrical Conductivity (EC) parameters. The exceedance of the SAR and EC parameters is likely the result of the use of road salt, and it should not present a significant concern at the site. For disposal purpose, it should be noted that the acceptance of fill materials depends on the discretion of the receiving site. Contractor is to consider this when exporting soil from the site and be responsible for any associated costs.

## 1.8 PROTECTION OF EXISTING FEATURES

- .1 Refer to *Section 01 11 00 – ‘Summary of Work – article 1.5 Existing Conditions’* and *Section 31 23 13 – ‘Rough Grading’* for requirements to provide underground scan in addition to service locates for all areas of work beyond the property lines.
- .2 Protect existing features in accordance with Section 01 56 00 - Temporary Barriers and Enclosures and applicable local regulations.
- .3 Existing buried utilities and structures:
  - .1 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
  - .2 Prior to commencing excavation Work, notify applicable Owner or authorities having jurisdiction, establish location and state of use of buried utilities and structures. Owners or authorities having jurisdiction to clearly mark such locations to prevent disturbance during Work.

- .3 Confirm locations of buried utilities by careful test excavations.
- .4 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered as indicated.
- .5 Ensure that adjacent property is not damaged in any way by excavating and grading work; by the removing, stockpiling and transporting of materials; by blown sand and dust or by spillage during the removing, stockpiling and transporting of materials; by the collapse or movement of excavated banks and stockpiles; or by storm water from altered drainage course.
- .6 Ensure that no damage is caused by earthwork to existing structures, trees, buried and above-ground services, bench marks, and survey monuments on the site, or adjacent property. Arrange or ensure that all damage which occurs is repaired completely and immediately.
- .7 Protect newly-graded areas from the action of the elements. Repair settlement and washouts that occurs before acceptance of the work, and re-establish grades to the required elevations and slopes. Fill to required subgrade levels any area where settlement occurs.
- .8 Bail or pump all water out of excavation, from whatever cause, as it accumulates. Take all necessary measures to prevent flow of water and earth fines into the excavation.
- .9 Support existing buildings, walks, roads, and services, and prevent cave-ins of excavated banks. A Professional Engineer specializing in this work shall design all protection. Provide shop drawings for authorities as required.
- .10 Temporarily cover all existing catchbasins and manholes to prevent entry of earth or debris.
- .11 Electronically locate underground services such as electrical and telephone lines, gas and water and sewer lines. Mark line of services with yellow ribbons or stakes with tip fluorescent painted, and indicating both plan location and depth.
- .12 Protect the bottom and sides of the excavated pits and trenches from exposure to sun and rain to prevent cave-ins and softening of the bed upon which concrete and drains rest.

#### **1.9 DUST CONTROL**

- .1 Provide and maintain adequate system to avoid any nuisance caused by dust and dirt rising throughout the area of operations. The use of calcium chloride is prohibited.

#### **1.10 UNIT PRICES REQUESTED IN TENDER FORM**

- .1 For excavation, prices shall include excavation and disposal and units shall represent material measured in its original position by cross-sectioning of the area excavated. Volumes will be computed from the cross-section measurements by average end area method.
- .2 For fill, prices shall include material, compacted to specified degree and measured in place.



**Part 2 Products**

**2.1 MATERIALS**

- .1 NOTE: No recycled material is permitted.
- .2 Fill "A": Granular material meeting OPSS Material Specification for Aggregates, Form 1010, Granular "A". Minimum compaction density 98% Standard Proctor. For use primarily as bedding material.
- .3 Fill "B": Granular material meeting OPSS Material Specification for Aggregates, Form 1010, Granular "B"-Type 2. Minimum compaction density 98% Standard Proctor. For use primarily as fill under building slab on grade areas.
- .4 Fill "C": Site (native) material, containing no organic or foreign matter, and which the Contractor can demonstrate is compactable to a density of 98% to 100% Standard Proctor. Minimum compaction density: 95% Standard Proctor under landscaped areas, 100% under paved areas. For use primarily as fill under playfields areas and under paved areas up to underside of sub-base elevation.
- .5 Fill "D": Refer to Section 32 12 17 –‘Asphalt Paving’ for 50 mm Crushed limestone sub-base and 19 mm crushed limestone base course used under paved areas.
- .6 “Fill E”: Imported fill for general site areas. Imported fill shall be clean, free of organic material and rocks, shale and cobbles, and Contractor to supply environmental documents, including results of sufficient number of chemical tests, to ensure that the fill meets Reg 153/04 (2011)-Table 1 Residential/Industrial. Approval to proceed with importing the fill to the Site will only be issued following review and acceptance by our Consultant.
- .7 Crushed Stone Fill Under Slabs on Grade: Clean, Graded 20mm angular, natural clear crushed stone from approved source, free from shale, clay and friable materials and organic matter and containing no more than 10% passing the No.4 sieve
- .8 Impervious Fill: Fine grain material such as clay, which is relatively impervious to the flow of water.
- .9 Granular Bedding: OPSS Granular "A", concrete sand (CAN/CSA A23.1-M90) or crusher-run limestone. Minimum compaction 100% Standard Proctor density.
- .10 Any imported fill must be chemically clean, meeting Reg 153/04 (2011) - Table 1 Residential/Industrial Criteria.

**Part 3 Execution**

**3.1 SITE PREPARATION**

- .1 Demolition of existing gym and its foundations is part of this contract.
- .1 In the areas of existing footings, the new footings are to be established at or below the underside of the existing footings.

- .2 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- .3 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

### **3.2 EXAMINATION**

- .1 Ensure in examination of the site that all possible factors concerning earthwork are investigated, and that the following are known in particular:
  - .1 Methods and means available for material handling, disposal, storage, and transportation.
  - .2 Physical conditions of site, including ground water table and drainage courses.
  - .3 Conformation and condition of ground surfaces.
  - .4 Character, quality, and quantity of surface and subsurface materials.

### **3.3 SOIL INVESTIGATION**

- .1 Soil investigation of the site was carried out by other consultants engaged by the Owner for the purpose of guidance in design and construction. A report and bore hole log on this investigation were prepared and are provided for information purposes. No responsibility is assumed by the Owner or Architects for the scope, accuracy, or interpretation of the soil investigation report. Be responsible for adjusting estimates to incorporate conditions identified or reasonably inferred in the report, as documented in the Geotechnical Data.

### **3.4 STOCKPILING**

- .1 Stockpile fill materials in areas designated by Engineer Stockpile granular materials in manner to prevent segregation.
- .2 Protect fill materials from contamination.
- .3 If there is an access of clean topsoil, the contractor may stockpile it on the adjacent cemetery site if material is deemed suitable by the adjacent landowner (cemetery). Contractor to consult with Architect regarding details.

### **3.5 COFFERDAMS, SHORING, BRACING AND UNDERPINNING**

- .1 Obtain permit from authority having jurisdiction for temporary diversion of water course.
- .2 Construct temporary Works to depths, heights and locations as directed by Engineer.
- .3 During backfill operation:
  - .1 Unless otherwise as indicated or as directed by Engineer, remove sheeting and shoring from excavations.
  - .2 Do not remove bracing until backfilling has reached respective levels of such bracing.
  - .3 Pull sheeting in increments that will ensure compacted backfill is maintained at an elevation at least 500 mm above toe of sheeting.

- .4 When sheeting is required to remain in place, cut off tops at elevations as indicated.
- .5 Upon completion of substructure construction:
  - .1 Remove cofferdams, shoring and bracing.
  - .2 Remove excess materials from site and restore water courses as indicated and as directed by Engineer.

### **3.6 DEWATERING AND HEAVE PREVENTION**

- .1 Keep excavations free of water while Work is in progress.
- .2 Dewater the site as necessary for the installation of the work, by providing a series of temporary trenches/pits and pumping as necessary. Backfill temporary trenches/pits and restore area when dewatering is no longer required.
- .3 At no additional cost to the Owner, dewater the site as necessary to maintain the schedule and protect the work. Ensure the water pumped from site does not contaminate sewers municipal or on site sewer system. If required, arrange and pay for the cost of flushing sewers used for dewatering drainage routes.
- .4 Submit for Engineer's approval details of proposed dewatering or heave prevention methods, such as dikes, well points, and sheet pile cut-offs.
- .5 Avoid excavation below groundwater table if quick condition or heave is likely to occur. Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.
- .6 Protect open excavations against flooding and damage due to surface run-off.
- .7 Dispose of water in accordance with Section 01 35 43 - Environmental Procedures and in manner not detrimental to public and private property, or any portion of Work completed or under construction.
- .8 Provide flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers, water courses or drainage areas.

### **3.7 EXCAVATION**

- .1 Advise Engineer at least 7 days in advance of excavation operations for initial cross sections to be taken.
- .2 Perform bulk excavation and detailed excavation for construction of building (and for installation of mechanical and electrical services). Excavate beyond wall faces sufficiently to allow removal of forms, if applicable, but generally no more than 900 mm beyond centre of wall. Do not re-fill over excavated areas with materials removed, nor any other material without the approval of the Consultant. Excavation and disposal of boulders is part of this section.
- .3 The building area and all paved areas is to be stripped of topsoil, disturbed soils and any organic materials.

- .4 The exposed native subgrade should be proof-rolled. All soft and heaving areas should be sub-excavated and replaced with competent fill. The exposed native subgrade should be examined and approved by the geotechnical engineering prior to placement of fill.
- .5 Remove disturbed earth displaced by adjacent construction.
- .6 Notify the Consultant of completion of excavation work and before any concrete or fill is placed on the bearing strata, in order that he may inspect the exposed bearing surfaces.
- .7 If the Consultant requires additional excavation below the elevation indicated or specified, such additional excavation and disposal will be paid for on the basis of unit prices quoted in the Bid Form. Units of measurements will be those given for the unit prices, and shall be measured in their original position and computed by the method of average end areas.
- .8 Remove excess and unsuitable excavated materials from the site. Comply with the MOE regulations and those of other regulating bodies, regarding disposal of contaminated soil.
- .9 Blasting is prohibited, except upon written permission of Consultant. Rock removal, if required, shall be by means of Ram Splitting equipment only.
- .10 Keep all surfaces against which concrete, unit masonry or fill is to be placed free from frost. Thaw out frozen surfaces against which concrete or fill is to be placed to unfrozen depth.
- .11 Excavation must not interfere with bearing capacity of adjacent foundations.
- .12 Do not disturb soil within branch spread of trees or shrubs that are to remain. If excavating through roots, excavate by hand and cut roots with sharp axe or saw.
- .13 Keep excavated and stockpiled materials a safe distance away from edge of trench as directed by Engineer.
- .14 Restrict vehicle operations directly adjacent to open trenches.
- .15 Do not obstruct flow of surface drainage or natural watercourses.
- .16 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .17 Notify Engineer when bottom of excavation is reached.
- .18 Obtain Engineer approval of completed excavation.
- .19 Hand trim, make firm and remove loose material and debris from excavations. Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil. Clean out rock seams and fill with concrete mortar or grout to approval of Engineer.
- .20 Surplus Excavated Material and Removals: The Contractor is to make his own arrangements for the disposal of all excavated materials, removals, grindings and all other debris not suitable for re-use in the construction. If the Contractor enters into an

agreement with an individual for the use of land for the disposal of excavated materials or for any other reason, a copy of the said Agreement clearly stating the obligation of all concerned and signed by all parties shall be submitted to the Consultant. The Contractor shall comply with the requirements of all Federal, Provincial and Municipal Laws, Acts, Ordinances, Regulations, Orders-in-Council and By-Laws, which could in any way pertain to the work outlined in the Contract. The items in the Form of Tender include all costs for disposal of unsuitable material off the site and the Contractor shall make the arrangements for the disposal of the materials removed in accordance with MOE Reg. 558.

### **3.8 COMPACTION**

- .1 Provide, operate and maintain compacting equipment necessary to achieve the compaction densities specified.
- .2 Compact fill until the required density is achieved. Do not compact material containing frost.
- .3 Fill hollows and depressions which develop under compaction with matching backfill material. If the base becomes rutted or displaced due to any cause, regrade the surface.
- .4 Compact backfill by means of vibratory type equipment capable of achieving the desired degree of compaction. Use manually operated vibratory tampers in the proximity of foundations and in areas not readily accessible to roller equipment. Make good damage to the structure due to compaction and settlement of fill. Report damage to foundations promptly to the Consultant. Obtain approval of remedial procedures.

### **3.9 BACKFILLING**

- .1 Plug unused services such as drains, sewers, field tile, and service pipes uncovered by excavation.
- .2 Backfill at foundation walls only after they have been approved by Consultant.
- .3 Backfill with 200 mm deep layers of fill or as specified, each consolidated before the next is placed.
- .4 Backfill to mechanical and electrical service trenches as specified in the electrical and mechanical specifications.
- .5 When backfilling both sides of walls, place fill simultaneously on both inner and outer faces to balance pressure on wall.
- .6 Where walls are to be backfilled on one side only, commence backfilling only when the ground floor structural members are in place, if applicable, or adequate bracing is provided for top and bottom of foundation walls.
- .7 Compact fill to densities specified for material requirements.
- .8 Do not proceed with backfilling operations until [Engineer] [Consultant] has inspected and approved installations.

- .9 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
- .10 Do not use backfill material which is frozen or contains ice, snow or debris.
- .11 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.
- .12 Backfilling around installations.
  - .1 Place bedding and surround material as specified elsewhere.
  - .2 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.
  - .3 Place layers simultaneously on both sides of installed Work to equalize loading.
  - .4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:
    - .1 Permit concrete to cure for minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure and approval obtained from Engineer.
    - .2 If approved by Engineer erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by Engineer.
- .13 Install drainage system in backfill as directed by Consultant.

### **3.10 FILL UNDER FLOOR SLABS**

- .1 All fill required to raise grades under floor slab to proposed finished floor elevation (FFE) is to be imported Granular "B"-Type 2.
- .2 Prior to placing fill, all organics and existing unsuitable fill material is to be removed, and the subgrade is thoroughly proof-rolled, inspected and approved by the geotechnical engineer, per the geotechnical investigation. Any soft spots revealed during proof-rolling is to be sub-excavated and backfilled with Granular B, placed and compacted per the geotechnical report.
- .3 Prior to filling, proof-roll existing earth subgrade in order to identify inconsistencies or soft areas. Proceed with filling operations only after inconsistencies or soft areas have been reworked and compacted or excavated, backfilled and compacted as required to eliminate such conditions.
- .4 Avoid proof-rolling close to caissons, columns, walls and other structures within the confines of the proof rolling operations.
- .5 Prior to placing fill, ensure existing ground is compacted to 98% Standard Proctor density.
- .6 Place approved fill under floor slabs as soon as foundation walls are completed to floor level and mechanical and electrical services are installed in trenches.
- .7 Place fill in layers of 150mm maximum, and consolidate each before placing next layer.
- .8 Compact fill to density specified for material requirements with a heavy vibrating roller. Compact fill adjacent to walls, piers, or wherever else heavy roller equipment cannot

approach, with mechanical tampers to equivalent density. Dig out soft spots and re-fill and compact to specified density.

- .9 Where undisturbed soil surface is low below areas of slab-on-grade, bring level up to within 200 mm of underside of slab fill with Fill "B". Do not use fill "C" within building area.
- .10 Backfill trenches to within 200 mm of underside of slab fill with Fill "B".
- .11 The final 200 mm layer under slabs shall be clear crushed stone, as specified. Place crushed stone in maximum 100 mm layers and compact to 100% Standard Proctor Density.

### **3.11 FILL UNDER PAVED AREAS**

- .1 Prior to filling, proof-roll existing earth subgrade in order to identify inconsistencies or soft areas. Proceed with filling operations only after inconsistencies or soft areas have been reworked and compacted or excavated, backfilled and compacted as required to eliminate such conditions.
- .2 Avoid proof-rolling close to caissons, columns, walls and other structures within the confines of the proof rolling operations.
- .3 Prior to placing fill, ensure existing ground is compacted to 98% Standard Proctor density.
- .4 Place specified granular fill in layers of 150mm maximum, and consolidate each before placing next layer, up to underside of pavement sub-base elevation.
- .5 Compact fill to density specified for material requirements with a heavy vibrating roller. Compact fill adjacent to walls, piers, or wherever else heavy roller equipment cannot approach, with mechanical tampers to equivalent density. Dig out soft spots and re-fill and compact to specified density.

### **3.12 FILL UNDER PLAYFIELDS AND LANDSCAPED AREAS**

- .1 Construction access, contractor parking areas and Portables Area are intended to be reinstated in time for sod to have a minimum of 6 weeks to "take" prior to Fit for Occupancy. Identify this target date on the project schedule. Conduct site work and schedule accordingly to complete work related to sodding these areas as early as possible prior to contract completion.
- .2 Use Fill "C" native site material for fill under the landscaped areas as indicated on drawings. Fill Type "E" may be considered for use, subject to all of the conditions being met as outlined above.
- .3 Prior to placing fill, ensure existing ground is compacted to 95% Standard Proctor Density.
- .4 Place fill in layers of 300 mm maximum and consolidate each before placing next layer.
- .5 Compact Fill "C" to minimum 95% Standard Proctor Density under playfields.

**3.13 RESTORATION**

- .1 Upon completion of Work, remove waste materials and, trim slopes, and correct defects as directed by Consultant.
- .2 Place topsoil as directed by Consultant.
- .3 Reinstate lawns to elevation which existed before excavation.
- .4 Reinstate pavements and sidewalks disturbed by excavation to thickness, structure and elevation which existed before excavation.
- .5 Clean and reinstate areas affected by Work as directed by Consultant.
- .6 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 hours.
- .7 The Owner will engage the services of an Inspection and Testing Company to verify that work conforms to the requirements of the specifications.
- .8 The Contractor shall cooperate fully with the testing and inspection company.
- .9 The Contractor shall maintain its own quality control program to ensure that its work conforms to the drawings and specifications.
- .10 Submit 4 kg. samples of the fill materials to the inspection and testing company at least 10 days prior to commencement of backfill operations. Materials tested and approved shall constitute a standard for the acceptance of material delivered to the site.
- .11 The inspection and testing company shall be responsible for the following work:
  - .12 Determine the depth of unsatisfactory material, if any, to be removed.
  - .13 Inspect and approve the sub-grade prior to commencement of backfill operations.
  - .14 Test and approve the proposed backfill materials.
  - .15 Be present full time during operations in order to inspect and approve the methods of placing and compacting and to carry out the necessary tests to determine the Proctor Density of the backfill and the actual field densities being obtained. Take sufficient tests to ensure that adequate information is obtained to judge the uniformity of compaction. Inspect all piping and conduit in place in trenches prior to backfilling to ensure correct slope and placement as designed.
- .16 Check the quality of backfill being delivered to the site.
- .17 Check the depth of granular fill.
- .18 Confirm bearing elevations. Confirm and record spot elevations of all piping at critical locations to confirm design depths and slopes.
- .19 Check installation of weeping tile.



- .20 Issue reports to the Consultant tabulating test results and giving final approval and suggestions as to the backfilling and compaction operation.
- .21 The cost of such inspection and testing shall be paid for under the Fill and Compaction Testing Allowance specified in Section 01 11 00- Summary of Work. The cost of retesting unacceptable compaction shall be borne by this Section.

**3.14 INSPECTION AND TESTING**

- .1 Refer to Section 01 11 00- Summary of Work, Section 1.29.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 01 11 00 – Summary of Work-*Phasing and Sequencing*
- .2 Section 013543 – Environmental Protection.
- .3 Section 329121 – Topsoil and Finish Grading.
- .4 Section 329310 – Planting of Trees, Shrubs and Ground Covers.
- .5 Section 31 23 10 - Excavation, Trenching and Backfilling.
- .6 Section 33 46 20 – Foundation and Underslab Drainage .
- .7 Section 033000 – Cast-in-Place Concrete.
- .8 Section 32 12 17 – Asphalt Paving.

**1.2 REFERENCES**

- .1 American Society for Testing and Materials (ASTM)
  - .1 ASTM D698-[91(1998)], Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m<sup>3</sup>).

**1.3 EXISTING CONDITIONS**

- .1 Demolition of existing school is occurring under separate contract.
- .2 Contractor shall coordinate and obtain required separate Temporary Road Occupancy Permit and Fill Permits for all work.
- .3 For work to public boulevard areas outside the property line. Refer to *Section 00 11 00 – ‘Summary of Work, article 1.5 Existing Conditions’* for permit requirements prior to construction.
- .4 Contractor is responsible to coordinate with Site Plans, Structural Drawings and Specifications to determine depths of foundations and grade levels to be reached as Part of Phase 1 operations, prior to issuance of Building Permit. Refer to Geotechnical Report and all site plans.
- .5 Contractor is responsible to quantify all on-site material to achieve design grades and is responsible for the importation or exportation of material from the site as required.
- .6 Any known underground and surface utility lines and buried objects are indicated on site plan. Confirm exact locations of utility lines and buried objects prior to machine excavation or grading. In addition to all utility locates, contractor shall conduct engage a private locate company to conduct an underground scan for all areas of grading and excavation outside the property lines.

#### **1.4 PROTECTION**

- .1 Protect and/or transplant existing trees, landscaping, natural features, bench marks, pavement, surface or underground utility lines which are to remain as directed by Consultant. If damaged, restore to original or better condition unless directed otherwise.
- .2 Maintain access roads to prevent accumulation of construction related debris on roads.

### **Part 2 Products**

#### **2.1 MATERIALS**

- .1 Fill material to all parking and driveway areas, asphalt and concrete paving areas and building pad: OPSS Granular B-Type 2 in accordance with of Section 31 23 10 - Excavating, Trenching and Backfilling.
- .2 Excavated or graded material existing on site may be suitable to use as fill for grading work if approved by Consultant and uncontaminated type of existing materials meets the requirements herein for stated locations.

### **Part 3 Execution**

#### **3.1 STRIPPING OF TOPSOIL**

- .1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected as determined by Consultant
- .2 Examine the site and determine the extent of areas previously stripped and approximate depth of remaining topsoil, if any.
- .3 Strip the topsoil from the site as part of the work in this Section.
- .4 Remove top soil from areas to be excavated, paved and regraded.
- .5 Strip top soil when dry enough to prevent contamination of subgrade.
- .6 Contractor is responsible to quantify all on-site material to achieve design grades and is responsible for the importation or exportation of material from the site as required. Existing excess topsoil, if any, must be quantified before tender and may be re-used for general sodded areas as described in Section 32 91 21 Topsoil Placement and Grading.
- .7 Remove from site existing grass and vegetation and surplus top soil, if any.

#### **3.2 BULK FILL & ROUGH GRADING**

- .1 Refer to site plans (SP1, SC1, SG1, and L1) and related details and specification sections and note the initial permit will include rough grading only and not site servicing or foundation or building work.
- .2 Begin rough grading operation only after all sedimentation measures have been established and inspected.

- .3 The Contractor shall use the information shown on the site plan, the grading plan, the Geotechnical Report, as well as the information observed during visits to the site during the Tender Period, as the basis for the "Existing Conditions" of the site and to determine the extent of engineered fill in the building area to be completed as part of Phase 1, based on his approach to foundation construction.
- .4 Rough grade to levels, profiles, and contours allowing for surface treatment as indicated. Ensure that rough grading operations to not promote water ponding in construction areas. Level depressions outside the building area with Type "D" for paved areas. Fill "E" or Type "C" may only be used fill if suitable moisture content and compaction can be demonstrated.
- .5 Perform construction grading to allow proper construction access to the work.
- .6 Grade to prevent water ponding on site during construction period. Create additional ditches, swales, slopes, ponds, etc. as required by Contract Documents and Municipal Authorities for control of drainage, sedimentation and topsoil retention.
- .7 Unless suitable uncontaminated fill or cut has been completed by previous contract, rough grade to following depths below finish grades:
  - .1 200 mm for grassed areas.
  - .2 400 mm for flowerbeds.
  - .3 450 mm for shrub beds.
  - .4 600 mm for heavy asphalt paving.
  - .5 540 mm for medium duty asphalt paving.
  - .6 275 mm for concrete walks.
  - .7 Maximum tolerance for rough grade elevation : .+/- 25 mm
- .8 Slope rough grade away from building 1:50 2 % minimum.
- .9 Grade swales and ditches to depths as indicated.
- .10 Prior to placing fill over existing ground, scarify surface to depth of 150 mm. Maintain fill and existing surface at approximately same moisture content to facilitate bonding.
- .11 Compact filled and disturbed areas to maximum dry density to ASTM D698, as follows:
  - .1 95% under landscaped areas.
  - .2 98 % under paved and walk areas.
- .12 Do not disturb soil within branch spread of trees or shrubs to remain.

### 3.3 TESTING

- .1 Inspection and testing of soil compaction will be carried out by testing agency hired by the owner.
- .2 Tests to be conducted on imported soils and provided by a ULC designated laboratory prior to bringing to and placing on the site.

- .3 Costs of tests will be paid under a Cash Allowance. Refer to Section 01 11 00 – Summary of Work.
- .4 Submit testing procedure, frequency of tests, [testing laboratory as designated by ULC or certified testing personnel to Consultant for approval and review.

**3.4 SURPLUS MATERIAL**

- .1 Refer also to Section 32 91 21 – Topsoil for re-use of on-site topsoil.
- .2 Remove surplus material and material unsuitable for fill, grading or landscaping as directed by Consultant and Municipal Authorities.
- .3 Include for removal and disposal of asphalt driveways, excess fill, rubble, etc. beyond property lines within work areas shown on site plans
- .4 Confirm locations on site prior to tender.

**END OF SECTION**

## **Part 1 General**

### **1.1 RELATED WORK**

- .1 Section 31 23 13 - Rough Grading

### **1.2 QUALITY ASSURANCE**

- .1 Contractor

- .1 The Contractor shall carry out all works in a true horticultural manner.
- .2 The Contractor shall ensure that the hoarding is erected beyond the drip line of the trees and root systems of the trees to be protected.
- .3 The Contractor shall supervise all work in this section including implementation and maintenance until final acceptance.
- .4 The Contractor shall obtain approvals for suppliers, sub- contractors and all materials to be used in this section of Work.
- .5 Comply with the City of Mississauga Guidelines, details and requirements for tree protection. Refer to detail on drawing.

- .2 Maintenance

- .1 Maintain all hoarding and accessories until final acceptance of Work.  
Maintenance includes all measures necessary to protect the existing trees.

### **1.3 PRODUCT DELIVERY. STORAGE. HANDLING**

- .1 Deliver hoarding in a timely manner prior to commencement of construction.
- .2 The Contractor shall not be responsible for the cost of replacements resulting from theft, vandalism, carelessness or neglect on the part of others or any other causes due to circumstances beyond his control.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Hoarding: 4' x 8' sheets of ½ " plywood or particle board or approved equal.
- .2 Fencing: paige wire 1.2 m high.
- .3 Stakes and braces: 4" x 4" spruce and metal 'T' bars.
- .4 Siltation fence: woven geotextile with minimum equivalent opening size of 0.15mm and a maximum opening equivalent opening size of 0.25mm by Terrafix, Terrafence or

approved equal.

- .5 Conform to Municipal details and requirements.

### **Part 3 Execution**

#### **3.1 INSPECTION**

- .1 Verify areas to receive work in this section and report any conditions or defects encountered to the Consultant. before Work commences.
- .2 Do not commence Work until hoarding has been approved.

#### **3.2. PROTECTION AND PRESERVATION OF EXISTING VEGETATION**

- .1 All existing trees which are to remain shall be fully protected with hoarding to height 1.2 m high or as indicated, i.e. erected beyond their "dripline" or as indicated on the drawings prior to the issuance of the Building Permit, to the satisfaction of the Consultant.. Groups of trees and other existing plantings to be protected, shall be treated in a like manner with hoarding around the entire clump(s). Areas within the protective fencing shall remain undisturbed and shall not be used for the storage of building materials or equipment.
- .2 On city road allowance or where visibility must be maintained erect 1.2 m high orange plastic web snow fencing on 2" x 4" wood frames.
- .3 No rigging cables shall be wrapped around or installed in trees and surplus soil, equipment, debris or materials shall not be placed over root systems of the trees within the protective fencing. No contaminants will be dumped or flushed where feeder roots of trees exist.
- .4 The contractor shall take every precaution necessary to prevent damage to trees or shrubs to be retained.
- .5 Where limbs or portions of trees are removed to accommodate construction work, they will be removed carefully in accordance with accepted arbor cultural practice.
- .6 Where root systems of trees are exposed directly adjacent to or damaged by construction work, they shall be trimmed neatly and the area backfilled with appropriate material to prevent desiccation. Prune tree(s) to restore the balance between roots and top growth or to restore the appearance of the tree(s).
- .7 Trees that have died due to improper protection and maintenance or have been damaged beyond repair, shall be removed and replaced by the Contractor at this own expense with trees of a size and species as approved by the Consultant.
- .8 If grades around trees to be protected are likely to change, the Contractor shall be required to take such precautions as dry welling, retaining walls and root feeding, as approved by the Consultant.

**3.3 HOARDING/SILTATION CONTROL FENCE**

- .1 Install fence as located on drawings and as per details.
- .2 Install fabric and paige wire fence in uphill side of posts.
- .3 Overlap geotextile 1.0 m at joints.
- .4 Bury geotextile 150 mm into grade at bottom of fence and backfill.

**3.3 FINAL ACCEPTANCE**

- .1 Remove tree protection and hoarding/siltation prior to final acceptance.

END



**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 31 23 13 - Rough Grading.
- .3 Section 31 23 10 – Excavation, Trenching and Backfilling.
- .4 Section 03 30 00 – Cast-in-Place Concrete.

**1.2 REFERENCES**

- .1 American Society for Testing and Materials International, (ASTM)
  - .1 ASTM D698-[00a], Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.5- [M91 (March 1999)], Low Flash Petroleum Spirits Thinner (Reaffirmation of December 1991).
  - .2 CAN/CGSB-1.74- [2001], Alkyd Traffic Paint.
- .3 Government of Québec, Minister of Transport
  - .1 Cahier des charges et devis généraux (CCDG)-[97].
- .4 Ontario Provincial Standard Specifications (OPSS)
  - .1 OPSS 302-[April 1999], Construction Specification for Primary Granular Base.
  - .2 OPSS 310-[March 1993], Construction Specification for Hot Mixed, Hot Laid Asphaltic Concrete Paving and Hot Mix Patching.
  - .3 OPSS 314-[December 1993], Construction Specification for Untreated Granular, Subbase, Base, Surface Shoulder and Stockpiling.
  - .4 OPSS 1010-[March 1993], Material Specification for Aggregates, Granular A, B, M and Select Subgrade Material.
  - .5 OPSS 1103-[February 1996], Material Specification for Emulsified Asphalt.
  - .6 OPSS 1150-[May 1994], Material Specification for Hot Mixed, Hot Laid Asphalt Concrete.

**1.3 SAMPLES**

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit to Consultant, samples of material for sieve analysis at least 2 weeks before beginning Work.

**1.4 WASTE MANAGEMENT AND DISPOSAL**

- .1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .2 Place materials defined as hazardous or toxic in designated containers.

- .3 Divert unused aggregate materials from landfill to facility for reuse as approved by Consultant.
- .4 Dispose of unused paint and paint thinner materials at official hazardous material collections site as approved by Consultant.
- .5 Fold up metal banding, flatten and place in designated area for recycling.
- .6 Do not dispose of unused paint and paint thinner material into sewer system, into streams, lakes, onto ground or in other location where it will pose health environmental hazard.
- .7 Divert unused asphalt from landfill to facility capable of recycling materials.

## **1.5 EXTENDED WARRANTY**

- .1 Submit a warranty for asphalt paving installation, covering materials and labour and the repair or replacement of defective work in accordance with the Contract, but for two (2) years total.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 **Sub-Base:** Suitably compacted native material only where approved density and drainage is achieved. Otherwise in upfill locations use Fill type "B" where required to reach design elevations.
- .2 **Base:** 50 mm and 19 mm graded, crusher run limestone to depths indicated on AD details.
- .3 **Heavy Duty Pavement for Parking and Driveways:** Hot mix, hot laid asphaltic concrete HL8 and HL3, mixture conforming to O.P.S.S. #1150.05.
- .4 **Medium Duty Pavement for Play Areas, Parking (where indicated on Site Plan) and Walkways:** Hot mix, hot laid asphaltic concrete HL8 and HL3, mixtures conforming to O.P.S.S. #1150.05.
- .5 **Light Duty Pavement for Walkway:** Hot mix, hot laid asphaltic concrete HL3, mixtures conforming to O.P.S.S. #1150.05.
- .6 **Joint Painting Material:** SS-1 emulsion in accordance with O.P.S.S. #1103.05.

## **Part 3 Execution**

### **3.1 PREPARATION**

- .1 Regard locations and instructions on drawings. Report any discrepancies or questions to the Consultant prior to proceeding with the work. In particular pay attention to the exact delineation of all edges of pavement and types of pavement;
- .2 Set out work in accordance with lines and levels shown on Drawings. Maintain such lines and levels through duration of work. Ensure positive drainage toward catch basins is maintained in all areas.
- .3 Compact sub-grade to a minimum of 98% Standard Proctor density.
- .4 Paint exposed edge of asphaltic joints, edge of manhole and catchbasin frames, curbs and similar items with SS-1 emulsion.

### 3.2 INSTALLATION

- .1 Inspect site grades prior to installation. Review the precise grade requirements required on the grading plan. Review with the Consultant prior to installation if any conditions exist that may cause deviations from grades shown on Drawings. Coordinate catchbasin elevations with those shown on Mechanical site plan.
- .2 **Pavement Section:**
  - .1 Heavy Duty: at all parking and driveway areas (refer also to AD 200)
    - .1 minimum 300 mm compacted thickness of 50 mm crusher run limestone compacted to 100% Standard Proctor Maximum Dry Density (SPMDD), ASTM-D698 .
    - .2 150 mm compacted thickness Base course of 19 mm crusher run limestone compacted to 100% SPMDD.
    - .3 60 mm compacted thickness of granular asphalt HL8.
    - .4 40 mm compacted thickness of granular asphalt HL3.
  - .2 Medium Duty: at rear and side yard play and walkway areas noted on Site Plans.(refer also to AD 200)
    - .1 200 mm compacted thickness of 50 mm crusher run limestone Sub-Base compacted to 100% Standard Proctor Maximum Dry Density (SPMDD), ASTM-D698.
    - .2 150 mm compacted thickness Base course of 19 mm crusher run limestone compacted to 100% SPMDD..
    - .3 40 mm compacted thickness of granular asphalt HL8.
    - .4 40 mm compacted thickness of granular asphalt HL3.
- .3 **Placing Granular Materials:**
  - .1 Exercise due care at all times to prevent granular materials from being contaminated by clay or other types of deleterious materials.
  - .2 Place materials immediately after sub-grade is inspected by the Architect and as follows:
    - .1 To required width and thickness indicated on Drawings in layers not exceeding 100 mm compacted thickness crusher run limestone?
    - .2 Grade each layer and compact to a minimum 100% standard Proctor density to a smoother surface conforming to required cross-section.
  - .4 Finished surface of granular material must not deviate more than 10 mm from designed grade.
- .5 **Placing Asphaltic Pavement:**
  - .1 Obtain Consultant's inspection of compacted granular base before commencing asphalt paving.
  - .2 Air temperature during placing of mixture must be minimum 7 deg. C and rising. Temperature of mixture when spread must be not less than 120 deg. C nor more than 150 deg. C. Do not increase temperature of mixture to offset long distance hauling.

- .3 Compact asphaltic mixture as soon as it can bear roller without undue displacement and hairline cracking and continue until all roller marks are eliminated. Speed of roller must at all times be slow enough to avoid displacement of mixture. Keep roller wheels slightly moistened by water to prevent adhesion of mixture. Excess water will not be permitted. Compact mixture with hot tampers in locations that are not easily accessible to machine roller.
- .4 Rolling Procedure:
  - .1 Initial and final rolling must be accomplished using self-propelled Class "B" roller.
  - .2 Intermediate rolling must be carried out using self-propelled Class "C" roller or "D" roller. Intermediate roller must follow breakdown roller as closely as possible.
- .5 Upon completion of compaction each pavement course must be:
  - .1 Smooth and true to crown and grade with variation not more than 6 mm from thickness shown on Drawing. Do not place any asphaltic course less than 25 mm thick nor more than 75 mm thick.
  - .2 Free from depressions exceeding 3 mm as measured with 3 m straight edge paralleling centre line of driveways/aisles.
  - .3 Compacted to a density not less than 97% Marshall.
- .6 Joints:**
  - .1 Cut back bituminous course to its full depth in straight or curved lines as required to expose fresh, straight, vertical surface. Remove broken and loose material.
  - .2 Asphalt must be placed in such a manner that joint must not be allowed to cool before adjacent asphalt course is applied.
  - .3 Where paving is comprised of two or more courses, joints must overlap by not less than 600 mm.
  - .4 Carefully place and compact hot asphaltic material against joints. Correct any unsatisfactory joint before proceeding with work.
  - .5 Feathering of joints will not be permitted.
- .7 Inspection and Testing:**
  - .1 Refer to Section 01 11 00 – Summary of Work, section 1.29.
  - .2 Field inspections during installation, and core samples of all asphalt areas will be taken as part of Inspection and Testing. If tests show asphalt to be substandard to that specified, all asphalt shall be removed and replaced at the Contractor's expense. Cash credits will not be accepted for work which does not fully comply with drawings and specifications.

### **3.3 CERTIFICATION OF GRADES**

- .1 The Contractor is required to provide as-constructed elevations of the parking area to verify that the parking lot has been constructed in accordance with the contract drawings.

**END OF SECTION**

1 General

1.1 RELATED SECTIONS

- .1 Section 31 23 23 – Fill.
- .2 Section 31 23 33 – Trenching and Backfilling.

1.2 GENERAL

- .1 This section specifies the supply and installation of concrete curbs, curb-faced walks, concrete paving, and poured in place concrete planter walls.

1.3 QUALITY ASSURANCE

- .1 All materials must conform to CSA CAN A.23.1-M90, latest edition (metric).
- .2 Furnish the owner with a certificate prepared by the Ready-Mix concrete suppliers stating that all requirements regarding strength, slump, air entrainment, mix, materials and ration have been maintained.
- .3 When required by the owner, have core tests taken at not less than 30 metre intervals, to determine the actual thickness of the slab. Pay all costs incurred. Patch slab to satisfaction of the owner at no extra cost.
- .4 When required by the owner, have all concrete tested for compressive strength, slump and air content, in accordance with CSA CAN A.23.2-M90. Submit test reports in duplicate and pay all costs incurred.

1.4 PRODUCT DELIVERY, STORAGE & HANDLING

- .1 Store all materials in accordance with CSA CAN A.23.1-M90 latest edition.
- .2 Store reinforcing steel on racks or skids. Protect from contamination by dirt or other materials. Maintain steel in its fabricated form.
- .3 Store forms off the ground and sufficiently supported to prevent warping or distortion. Protect from contamination by oil, grease, water, earth, etc.
- .4 All concrete is to be ready-mixed at plant and transported to the site by truck in accordance with CSA CAN A.23.1-M90. Hand mixed concrete is not allowed unless approved in writing by the owner prior to starting any work.
- .5 Place concrete in final position at such a rate that it remains plastic at all times and flows readily between reinforcement, into all corners and crevices and around all embedded fixtures. Pour in a continuous operation between expansion joints.
- .6 Do not allow concrete to be contaminated by foreign materials or hardened concrete. Do not use retempered concrete unless approved in writing by the owner.

1.5 JOB CONDITIONS

- .1 Protect all concrete surfaces from damage or harmful effects of weather, water, mechanical shock or trespassers until concrete is properly cured.
- .2 If temperature is expected to drop below 5° below, place and protect concrete in accordance with ACI.605.

1.6 INSPECTION

- .1 Obtain the approval of the owner of the layout, compacted sub-grade, compacted granular base, formwork and reinforcing before proceeding with subsequent work.

## 2 Products

### 2.1 MATERIALS

- .1 Granular base to be 19mm diameter crusher run limestone.
- .2 Portland Cement: Standard grey Portland cement, conforming to CSA CAN-A5-M88, latest edition.
- .3 Aggregates: Nominal size as specified and conforming to CSA CAN-A23.1-M90 latest edition.
- .4 Water: Clean and free from oil, acid, alkali, organic matter and other deleterious substances.
- .5 Air entraining admixtures: Conforming to CSA CAN-A266.1-M78 and of approved manufacturer.
- .6 Reinforcing steel: Conforming to CSA G30.12-M1977 for bars and CSA G.30.5-M1983 for welded steel wire mesh.
- .7 Synthetic reinforcing: Maximum 25mm long synthetic fibres such as “Fibrin 23”, “Fibremesh” or approved equal.
- .8 Expansion joint filler: As specified, either moulded composition joint filler conforming to A.S.T.M. D-1752-60T (Type II) or self expanding cork (Code 4324) conforming to A.S.T.M. D-1752-60T (Type III).
- .9 Curbing Compounds: Conforming to C.G.S.B. 90-GP-1.
- .10 Formwork: Conforming to CSA CAN-A23.1-M90 and ACI-347 and of sound wood, in good condition and equal or better than No. 1 grade construction spruce or 19mm Douglas Fir plywood, with a smooth surface treatment.

### 2.2 MIXES

- .1 Mix concrete materials in accordance with CSA CAN-A23.1 M90, in the proper proportions and ratios to provide a finished product as specified.
- .2 Concrete mix shall meet the following requirements: Compressive strength – minimum 25Mpa at 28 days, exposure A, unless otherwise noted on drawings and details; slump – 75mm maximum at point of deposit; air entrainment – 6% ( $\pm 1\%$ ).
- .3 With the exception of air entraining agents, other admixtures may only be used with the written approval of the Owner. The use of agents to lower the freezing point of the mix will not be permitted.
- .4 The contractor is responsible for ensuring concrete mixes shall conform to the above noted specifications. No concrete mix approvals will be issued by the consultant.

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3 Execution

3.1 PREPARATION

- .1 Fine grade sub-grade eliminating uneven areas and filling low spots. Remove all debris.
- .2 Compact finished sub-grade to 98% Standard Proctor Dry Density

3.2 GRANULAR BASE

- .1 Spread the specified granular materials in horizontal layers not exceeding 100mm loose depth and compact to 98% Standard Proctor Dry Density.
- .2 In areas where compaction by roller is not possible, compact with approved mechanical or hand tamping devices to the specified density.
- .3 Correct all irregularities or depressions resulting from rolling and compact until the granular surface is smooth, uniform and true to line and grade.

3.3 FORM WORK

- .1 Erect forms true to line and level in accordance with the drawings, and sufficiently braced to maintain their shape and alignment when pouring concrete.
- .2 Prior to each pouring operation, coat affected form surfaces with an approved form separating material.
- .3 Provide for all openings, sleeves, hangers, anchors and ties to be case into the concrete.

3.4 REINFORCEMENTS

- .1 Before placing reinforcement, clean all loose scale, dirt and any other coating that would reduce bonding to concrete.
- .2 Place all reinforcement accurately in accordance with the drawings and/or approved shop drawings. Use approved spacers, hangers or ties to secure the reinforcing in position.
- .3 Unless directed otherwise, provide the following minimum concrete cover over reinforcing:
  - .1 75mm cover where concrete is deposited against soil.
  - .2 50mm for bars 10m and larger and 40mm for bars smaller than 10m where concrete surface is exposed.

3.5 JOINTS

- .1 Locate expansion joints as shown on the drawings and between new concrete and all new or existing structures. Joints must be case in place. Sawcut joints will not be allowed.
- .2 Execute construction joints in accordance with ACI-301 and as detailed on the drawings. Thoroughly clean the joint surface, wet thoroughly and slush with a coat of cement grout immediately before placing new concrete.

- .3 Except for expansion joints, continue reinforcing uninterrupted through joints, unless shown otherwise on the drawings or directed by the owner.
- .4 Stop reinforcing on each side of expansion joints. Where dowels are indicated, cast one half into one side of the joints. The exposed half shall be machined smooth and heavily greased before placing adjoining sections.
- .5 Locate control joints as shown on the drawings. Ensure joints are to a minimum depth of  $\frac{1}{4}$  the thickness of the concrete. Make joints by one of the following methods:
  - .1 Sawed joints.
  - .2 Hand formed and hand tooled.
  - .3 Inset joints paced in plastic concrete.
- .6 No offsets will be allowed between adjacent sections of joint fillers and no plugs of concrete will be permitted anywhere within an expansion joint.
- .7 Apply joint sealant in accordance with the manufacturer's directions. Ensure joints are clean and free of any foreign substances before sealing. Clean any sealant spilled on concrete surface immediately.

### 3.6 PLACING OF CONCRETE

- .1 Do not place concrete until formwork and grades have been inspected and approved by the owner.
- .2 Convey concrete from the mixer to the place of final deposit as rapidly as possible, with as little re-handling as is practical. Avoid separation and/or loss of material.
- .3 While placing concrete, compact thoroughly and uniformly by approved means to ensure a dense homogeneous structure free of air pockets or honeycombs and closely bonded with reinforcement.
- .4 Do not over vibrate to a point where segregation of the mix occurs.

### 3.7 FINISHING

- .1 Finish all surfaces in accordance with CSA CAN-A23.1-M90.
- .2 Strike off and float all exposed paving surfaces as soon as possible after consolidation and in accordance with recommendations of the Portland Cement Association.
- .3 Walkways shall have a broom finish, evenly swept perpendicular to length of walkway. Other concrete shall be finished as shown on drawings and details.
- .4 Ensure finished surface is true to line and level as shown on the drawings. Walks adjacent to curbs will have a pitch of 20mm per meter towards the curb. Other walks will be pitched as shown on the drawings.



- .5 All irregularities greater than 3mm under a 3m straight edge, operated parallel to the centre line must be repaired.
- .6 Immediately after stripping form work, obtain the approval of the owner before commencing patching, finishing or curing operations.
- .7 The intent, method and type of mix for patching shall have the approval of the owner before commencing work. Ensure patching mix contains an approved bonding and waterproofing agent and that it is installed in accordance with the manufacturer's specifications.
- .8 Backfill all curbs and pathways in accordance with section 31 23 33. Responsibility for backfill is that of the concrete sub-trade.

### 3.8 CURING

- .1 Keep concrete moist for at least three days after placement, in accordance with CSA CAN-A23.1-M90.
- .2 Moist curing: Use burlap or approved equal. Ensure it is thoroughly wet when applied and kept continuously wet and in full contact with the surface during the curing period.
- .3 Waterproof paper or white polyethylene sheeting: Ensure sheet is large enough to cover entire concrete surface. Secure to prevent displacement during curing period. Immediately repair any tears or holes.
- .4 White liquid membrane compound: Apply at the rate of 1 litre per five square metres after final finishing and all free water has disappeared. Keep membrane compound agitated to prevent settling of compound. Apply membrane compound to edges immediately after form work is removed. Ensure a continuous and unbroken membrane cover is applied.

### 3.9 CLEAN-UP

- .1 Clean and remove all concrete spills from the site.

END OF SECTION

1 General

1.1 GENERAL

- .1 This section specifies the installation of chain link fencing.

1.2 QUALITY ASSURANCE

- .1 The Contractor must have 5 years experience (minimum) in chain link fence installation work.

1.3 INSPECTION

- .1 Obtain the approval of the Owner of fence location (stake out) before proceeding.

2 Products

2.1 MATERIALS

- .1 No shop drawings shall be forwarded. The contractor and be responsible for the manufacture of chain link fences and gates according to the drawing details and this specification section.
- .2 Fence Fabric: No 9 gauge steel wire woven in a 38mm mesh, hot dipped galvanized after weaving and knuckled finish top and bottom selvage edges. Galvanized fabric to have a minimum zinc application of 450g per square meter of surface area. Fabric to be black vinyl coated.
- .3 Posts: Standard butt-welded Schedule 40, ASTM 120, galvanized pipe, electrostatic painted black. Supply according to the following height schedule:

|            |   |
|------------|---|
| Line posts | 60mm O.D., 3.7mm wall<br>thickness 850mm longer<br>than fabric height |
|------------|---|

|                             |  |
|-----------------------------|--|
| End, corner &<br>gate posts | 89mm O.D., 3.9mm wall<br>thickness 1075mm longer<br>than fabric height |
|-----------------------------|--|

No tubing, conduit or open seam material will be accepted.

- .4 Post Tops: Non-decorative aluminum caps or approved equal, securely attached to eliminate removal by hand and allowing for the insertion of 43mm top rail in a horizontal position for fencing over 2.0m height and 43mm top rail for fences under 2.0m height. Electrostatic painted black.
- .5 Top and Bottom Rail: 43mm O.D, top rail, and 43mm O.D. bottom rail, 3.5mm wall thickness standard butt-welded, galvanized pipe or high strength hollow structural steel, 2.5mm (0.1”) wall, pipe with mechanical properties similar to ASTM A-36. No tubing, conduit or open seam material will be accepted. Electrostatic painted black.
- .6 Gates: 1.0m wide unless specified otherwise with frames constructed of 43mm O.D., 3.5mm wall thickness standard butt-welded, all joints electrically welded, and hot dipped galvanized after fabrication, complete with galvanized malleable iron hinges, and three piece drop latch.

Hinges must allow gate to swing back against fence. Gate braces to be 43mm O.D., 3.2mm wall thickness galvanized pipe, if required. Electrostatic painted black.

- .7 Concrete: 25MPa strength at 28 days; slump 75mm maximum at point of deposit ready mixed at plant and transported to the site by truck in accordance with CSA CAN A23. I-M77. Concrete mixed on site will not be accepted unless approved in writing by the Owner prior to use.

### 3 Execution

#### 3.1 INSTALLATION

- .1 Remove existing fence and dispose of off site; use of existing fence materials will not be permitted unless specifically noted on the contract drawings.
- .2 Provide all new material unless directed otherwise.
- .3 Post spacing to be a maximum of 3.0m on centre.
- .4 Provide post footings according to the following schedule (minimum dimensions):

|                          | Under 2.0m fence height |        | Over 2.0m fence height |        |
|--------------------------|-------------------------|--------|------------------------|--------|
|                          | Diameter                | Depth  | Diameter               | Depth  |
| Line posts               | 250mm                   | 1200mm | 300mm                  | 1200mm |
| End, corner & gate posts | 300mm                   | 1200mm | 350mm                  | 1500mm |

- .5 Set posts in concrete footings to the height required. Top of footings is to be 150mm below finished grade.
- .6 Join adjacent pieces of top rail with outside sleeve type coupling at least 175mm long, to form a continuous top rail. Secure top rail at corner and gate posts using a receptacle coupler.
- .7 Install bottom rail, and secure to posts, top rail and tension wire with No. 16 gauge galvanized wire twists.
- .8 Install fabric, stretch taut, and secure to posts and top rail with 9 gauge aluminum hog ties.
- .9 Ensure space between bottom of fabric and ground is no greater than 50mm in any location. Where required by abrupt changes in grade, bottom edge of fence may be buried up to 50mm.

END OF SECTION

**Part 1 General**

**1.1 SECTION INCLUDES**

- .1 Materials and installation for foundation and underslab drainage.

**1.2 RELATED SECTIONS**

- .1 Section 31 23 10 - Excavating, Trenching and Backfilling.
- .2 Section 03 30 00 – Cast-in-Place Concrete.

**1.3 REFERENCES**

- .1 American Society for Testing and Materials International, (ASTM)
  - .1 ASTM D698-[00a], Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-34.22-[94], Asbestos-Cement Drain Pipe.
- .3 Canadian Standards Association (CSA International)
  - .1 CSA-A23.1/A23.2-[00(June 2001)], Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.
  - .2 CSA B1800-[02], Plastic Non-pressure Pipe Compendium - B1800 Series (Consists of B181.1, B181.2, B181.3, B181.5, B182.1, B182.2, B182.4, B182.6, B182.7, B182.8 and B182.11).
    - .1 CSA B182.2-[02], PVC Sewer Pipe and Fittings (PSM Type).
  - .3 CSA-G401-[01], Corrugated Steel Pipe Products.
- .4 Department of Justice Canada (Jus)
  - .1 Canadian Environmental Protection Act, 1999 (CEPA)
- .5 Transport Canada (TC)
  - .1 Transportation of Dangerous Goods Act, 1992 (TDGA)

**1.4 WASTE MANAGEMENT AND DISPOSAL**

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 Collect and separate for disposal packaging material for recycling.
- .3 Divert unused concrete materials from landfill to local facility.
- .4 Divert excavated native material to local facility.
- .5 Divert unused aggregate materials from landfill to facility for reuse.

- .6 Divert unused metal materials from landfill to metal recycling facility for disposal approved by Consultant.
- .7 Divert unused geotextiles from landfill to plastic recycling facility for disposal approved by Consultant.
- .8 Place materials defined as hazardous or toxic in designated containers.
- .9 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.
- .10 Dispose of unused asbestos cement pipe in accordance with regulations governing the disposal of hazardous materials.

## **1.5 SITE CONDITIONS**

- .1 Examine sub-surface investigation report which is bound into specifications.
- .2 Known underground utility lines and buried objects are as indicated on plans.

## **Part 2 Products**

### **2.1 BEDDING AND SURROUND MATERIALS**

- .1 Coarse filter aggregate: to CSA-A23.1/A23.2, Group 1, 15 mm.
- .2 Fine filter aggregate: to CSA-A23.1/A23.2.
- .3 Flexible plastic tubing and fittings. Corrugated, Non-perforated, nominal inside diameter 100 and 150 mm. Type 1 for discharge lines, Type 2 perforated and wrapped with filter fabric for collector lines.
- .4 Geodrains: “Terradrain” 600 by Terrafix or approved equal.
- .5 Filter Fabric: “Terrafix” 270R or Mirafi 140.

### **2.2 BACKFILL MATERIAL**

- .1 In accordance with Section 31 23 10 - Excavating, Trenching and Backfilling and as indicated on drawings.
- .2 Excavated or graded material existing on site is not suitable for backfill. Backfill shall be Granular “B” Type II, refer to drawings.
- .3 The drawings and specifications supersede all recommendations from the geotechnical report prepared by McClymont & Rak Engineers Inc. (G3947).

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Ensure graded subgrade conforms with required drainage pattern before placing bedding material.
- .2 Ensure improper slopes, unstable areas, areas requiring additional compaction or other unsatisfactory conditions are corrected to approval of Consultant.
- .3 Ensure foundation wall have been installed and approved by Consultant before placing bedding material.

**3.2 BEDDING PREPARATION**

- .1 Cut trenches in subgrade and place bedding material in uniform layers not exceeding 150 mm compacted thickness to depth as indicated.
- .2 Shape bed true to grade and to provide continuous, uniform bearing surface for tubing.
- .3 Shape transverse depressions, as required, to suit joints.
- .4 Compact each layer full width of bed to at least 95% of corrected maximum dry density.
- .5 Fill excavation below design elevation of bottom of specified bedding with compacted bedding material.

**3.3 INSTALLATION AT PERIMETER OF BUILDING AND AREAS WITHIN FOUNDATION PERIMETER**

- .1 If drain is not on footing, place a min. 100 mm of coarse filter material.
- .2 At planter locations, install geodrain against wall from finish grade to weeping tile invert elevation – temporary hold it in place until backfilled.
- .3 Lay wrapped perforated pipe directly on coarse filter material. Invert of pipe to be minimum of 250 mm below underside of floor slab. Provide pipes sloping to drains as shown on drawings. Minimum slope 1%. Connect perforated pipe to storm main.
- .4 Install minimum 150 mm of coarse filter material to sides and top of perforated pipe for perimeter drainage.
- .5 Install minimum 300 mm Granular "B" all around coarse filter material (sides and top).
- .6 Install minimum 150 mm coarse filter material cover on all sides of non-perforated pipe.
- .7 Ensure pipe interior and coupling surfaces are clean before laying.
- .8 Do not use concrete, masonry, stones, wood or any type of shim to establish pipe slope.
- .9 Connect pipes using manufacturer's recommended fittings and seal joints with sewer compound.

- .10 Protect pipe ends from damage and ingress of foreign material at each end of each day's work or work stoppage.
- .11 Place filter material after pipe installation has been inspected.
- .12 Place filter material by hand in 150 mm lifts. Consolidate by tamping lightly. Prevent displacement of pipe.
- .13 Backfill trench (1 m wide minimum) with Granular "B" lightly compacted to 95% standard density (except under paved and slab on grade areas: 98%) up to 700 mm below finished grade.
- .14 In landscaped areas place 600 mm of impermeable backfill seal compacted clay prior to the placing of top soil.

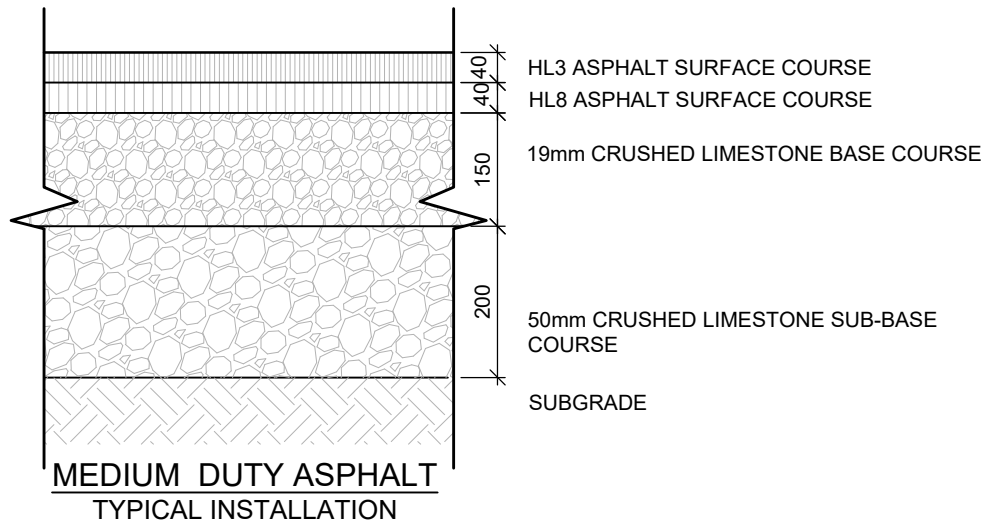
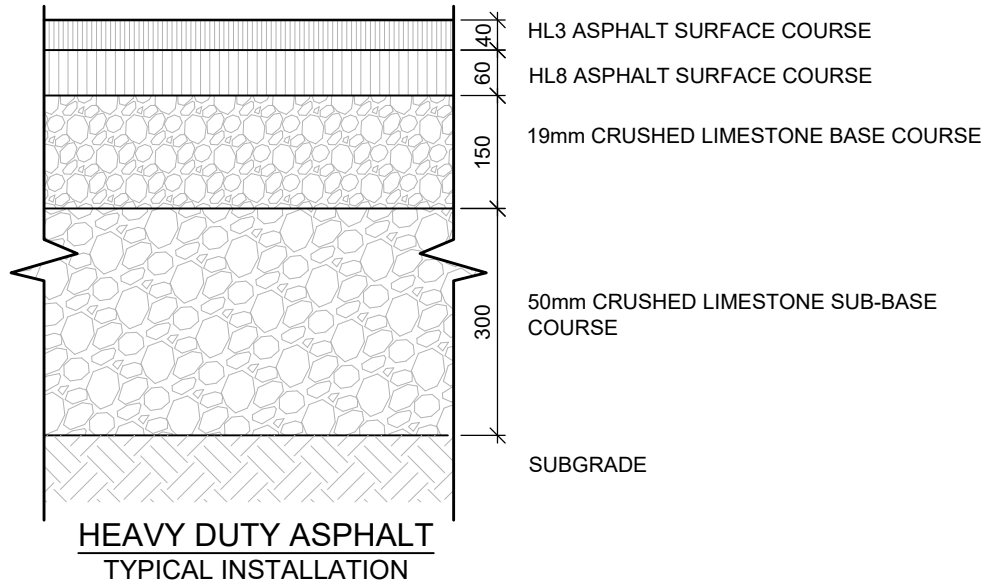
### **3.4 INSTALLATION UNDER PAVED AREAS**

- .1 Install weeping tile around parking perimeter at concrete curbs and at drains were indicated.
- .2 Trench for weeping tile will be 300 mm wide and extend to a depth of 350 mm minimum in the subgrade below granular base.
- .3 Line trench with filter cloth. Filter cloth shall be wide enough to overlap 150 mm minimum after backfilling.
- .4 Place 40 mm of clear crushed aggregate and compact to 98% standard proctor maximum dry density.
- .5 Lay 150 mm diameter perforated pipe directly on compacted granular material. Minimum slope 0.5%.
- .6 Where weeping tile pipe joins into other piping or material at storm drains or catch basins and at all direction changes, use specifically designed fittings and seal joints with sewer compound in accordance with manufacturer's instructions.
- .7 Fold filter cloth over compacted granular. Overlap 150 mm minimum.
- .8 Backfill trench up to subgrade elevation with clear crushed aggregate compacted to 98% standard proctor maximum dry density.

### **3.5 BACKFILL MATERIAL**

- .1 Place backfill material above tubing surround in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
- .2 Under paving and walks, compact backfill to at least 95% corrected maximum dry density. In other areas, compact to at least 90% corrected maximum dry density.

**END OF SECTION**



ASPHALT DETAILS

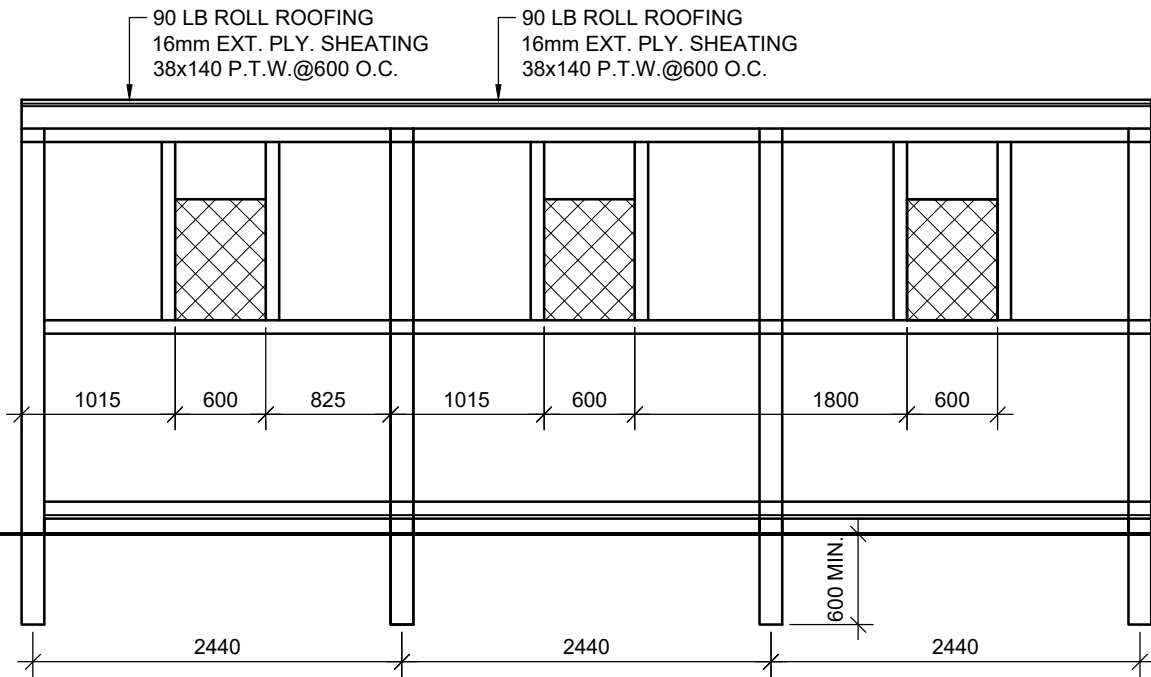
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 DATE: 22 12 05



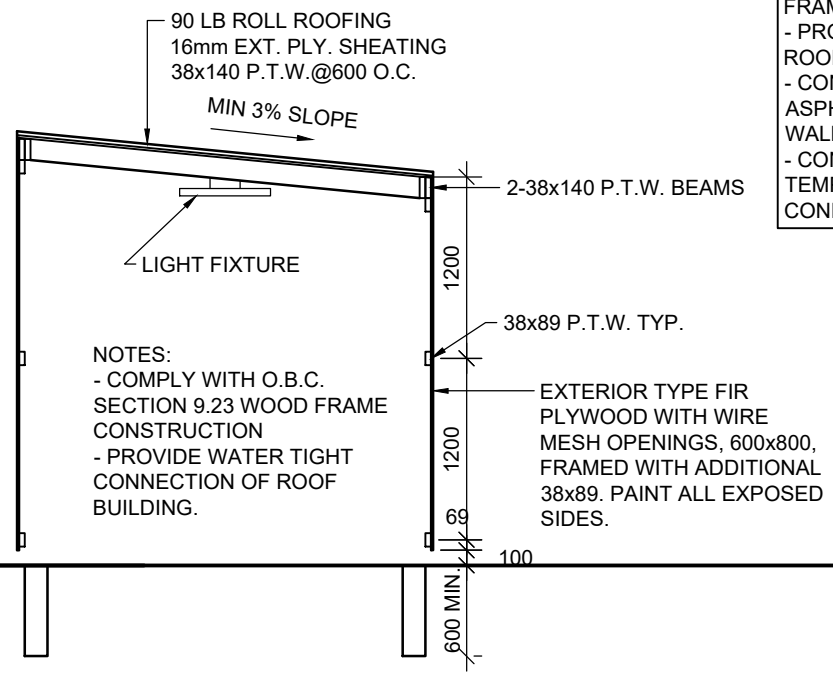
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NOTES:  
 - COMPLY WITH O.B.C. SECTION 9.23 WOOD FRAME CONSTRUCTION  
 - PROVIDE WATER TIGHT CONNECTION OF ROOF BUILDING.  
 - CONTRACTOR TO REPAIR ASPHALT/CONCRETE ONCE COVERED WALK-WAY IS REMOVED.  
 - CONTRACTOR IS RESPONSIBLE FOR TEMPORARY LIGHTING, INCLUDING CONDUITS, WIRING, ETC.



NOTES:  
 - COMPLY WITH O.B.C. SECTION 9.23 WOOD FRAME CONSTRUCTION  
 - PROVIDE WATER TIGHT CONNECTION OF ROOF BUILDING.

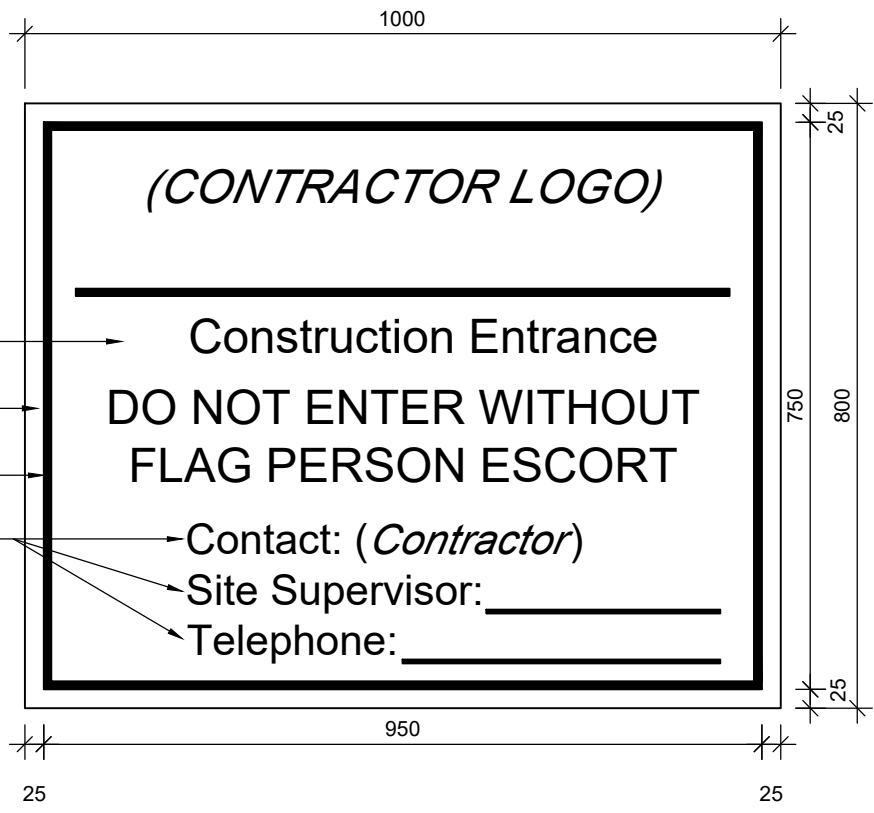
# TEMPORARY CONSTRUCTION COVERED WALK-WAY

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| DATE:  | 22 10 13 |

**HOSSACK & ASSOCIATES ARCHITECTS**

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A



Arial 45 mm high (black)

Arial 45 mm high

15mm black band

Arial 40 mm high

*(CONTRACTOR LOGO)*

Construction Entrance

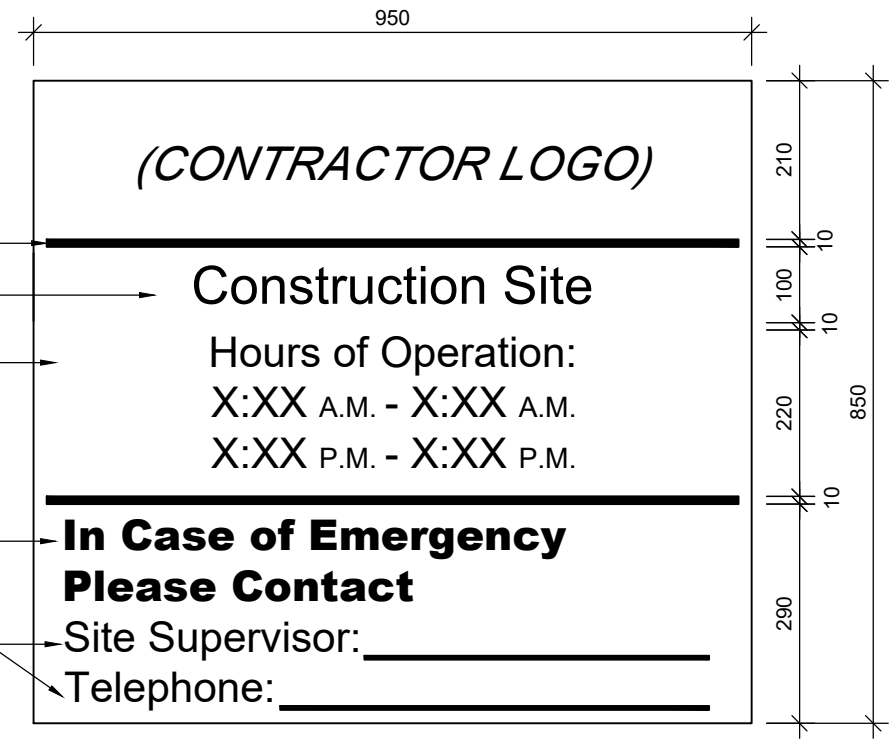
DO NOT ENTER WITHOUT  
FLAG PERSON ESCORT

Contact: *(Contractor)*

Site Supervisor: \_\_\_\_\_

Telephone: \_\_\_\_\_

B



10mm black band

Arial 50 mm high

Arial 40 mm  
high (black)

Arial 40 mm  
high (black)

Arial 40 mm high

*(CONTRACTOR LOGO)*

Construction Site

Hours of Operation:

X:XX A.M. - X:XX A.M.

X:XX P.M. - X:XX P.M.

**In Case of Emergency  
Please Contact**

Site Supervisor: \_\_\_\_\_

Telephone: \_\_\_\_\_

JOB SITE SIGNAGE

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DRAWN: GB

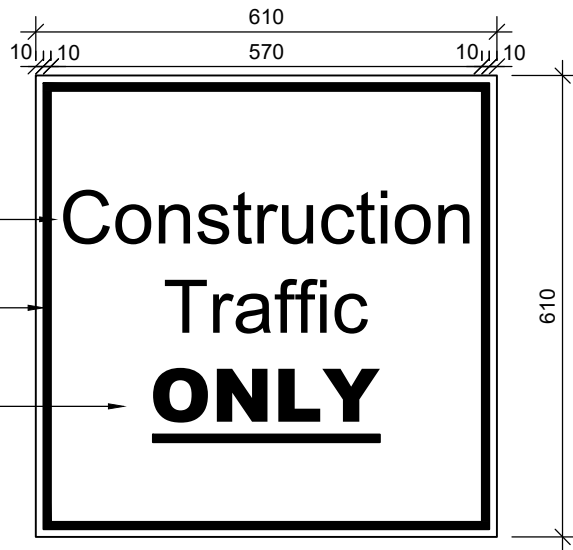
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**HOSSACK  
& ASSOCIATES  
ARCHITECTS**



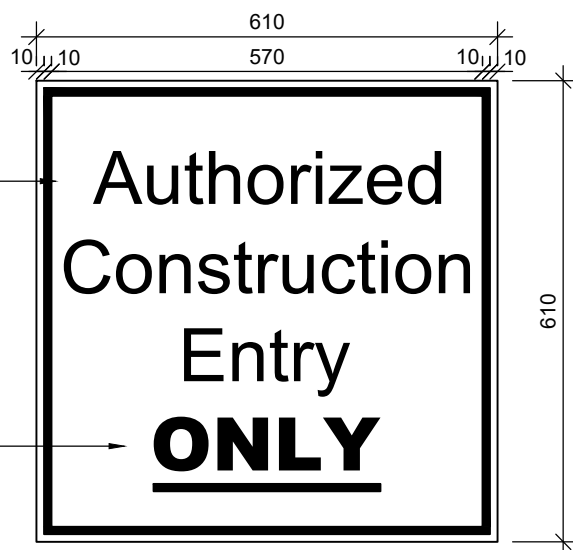
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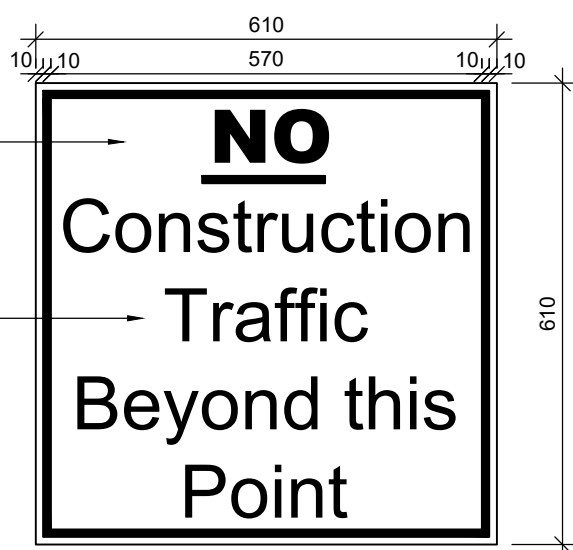
C

Arial 70 mm high  
 10mm black band  
 Arial 70 mm high (black)



D

Arial 70 mm high  
 Arial 70 mm high (black)



E

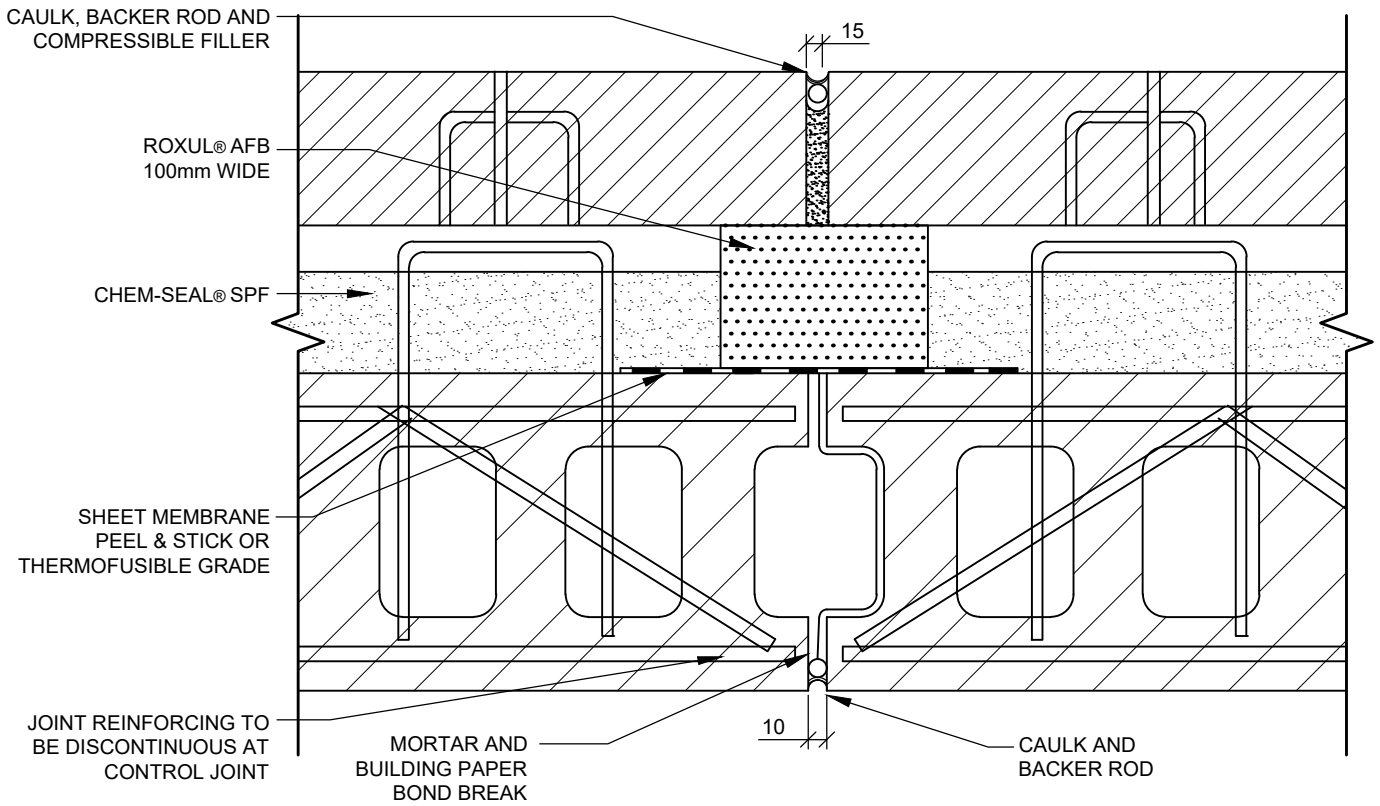
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 Arial 70 mm high

JOB SITE SIGNAGE

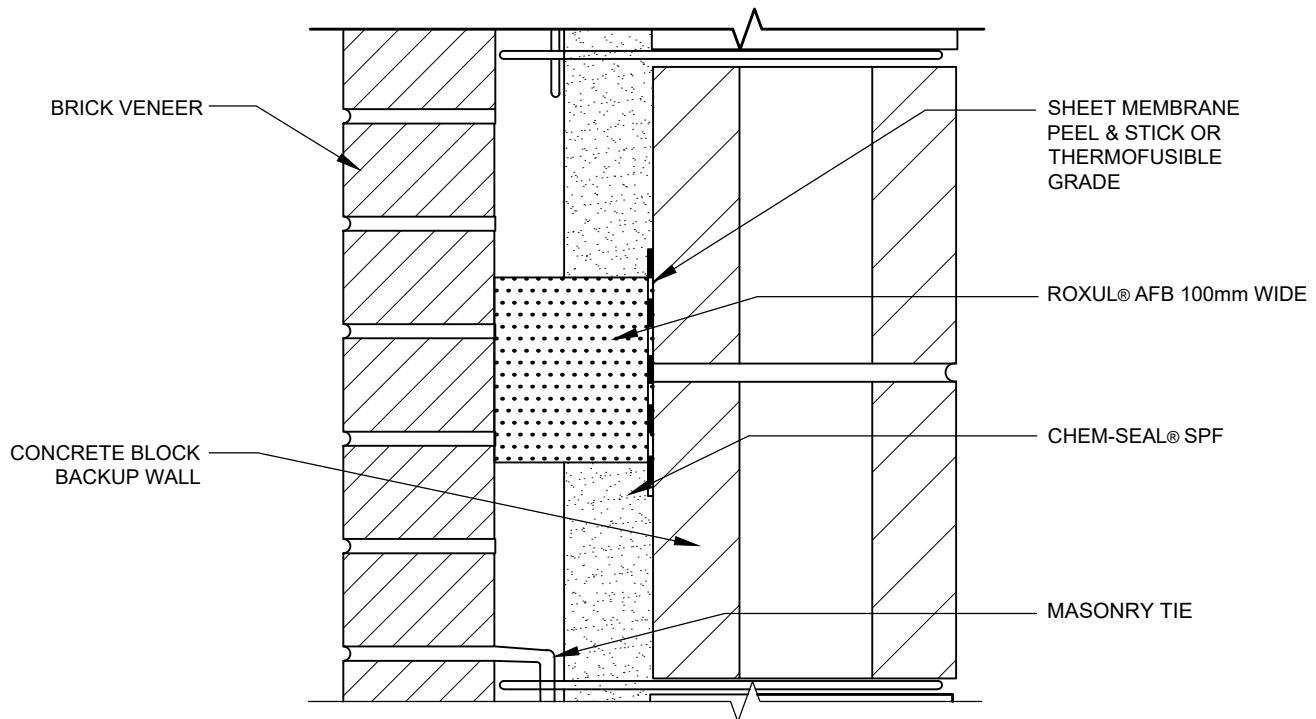
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**VERTICAL FIRE STOPPING**



**HORIZONTAL FIRE STOPPING**

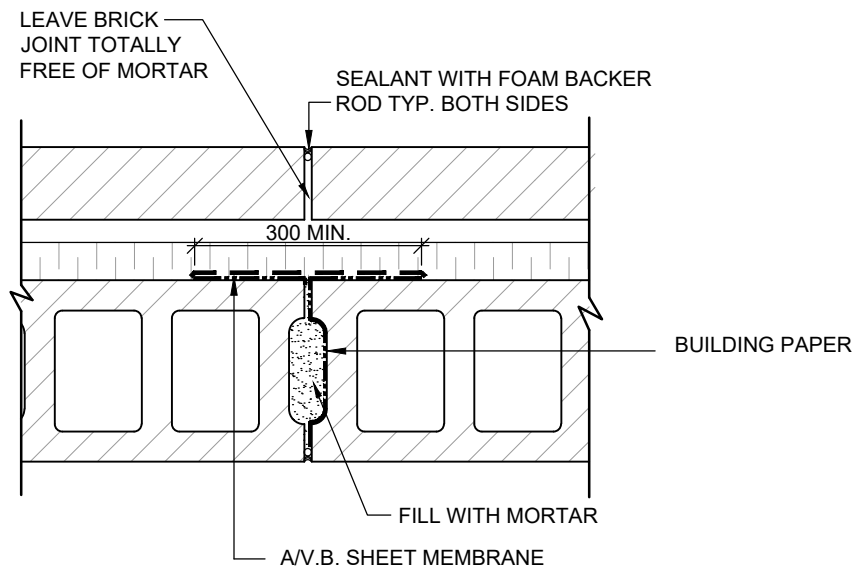
**FIRESTOPPING DETAIL AT CAVITY WALL**

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**HOSSACK & ASSOCIATES ARCHITECTS**

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WALL CONSTRUCTION:  
 FACE BRICK  
 AIR SPACE  
 INSULATION  
 CONC. BLOCK



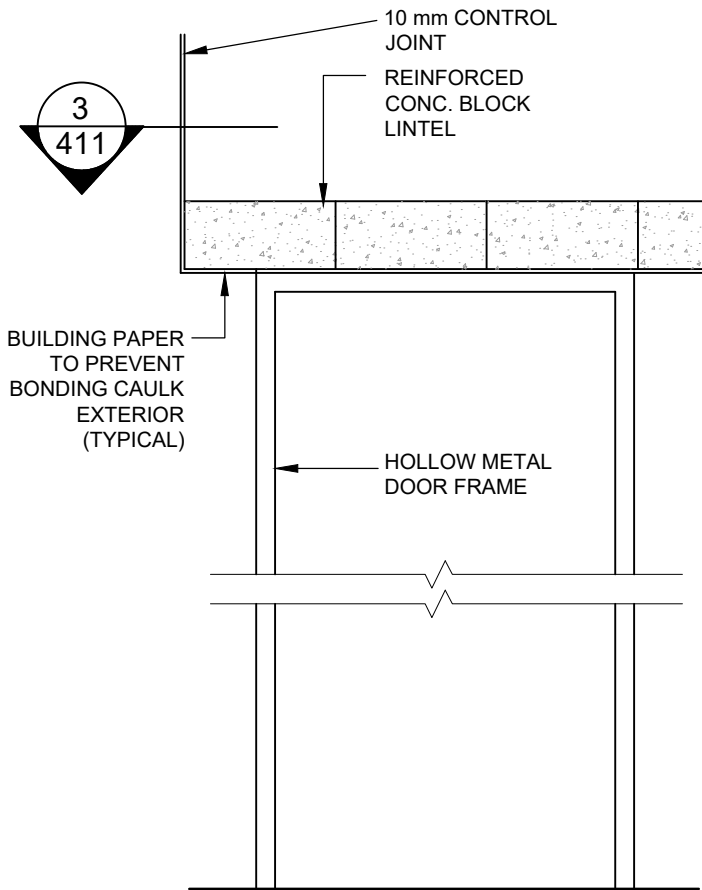
EXTERIOR CAVITY WALL CONTROL JOINT DETAIL

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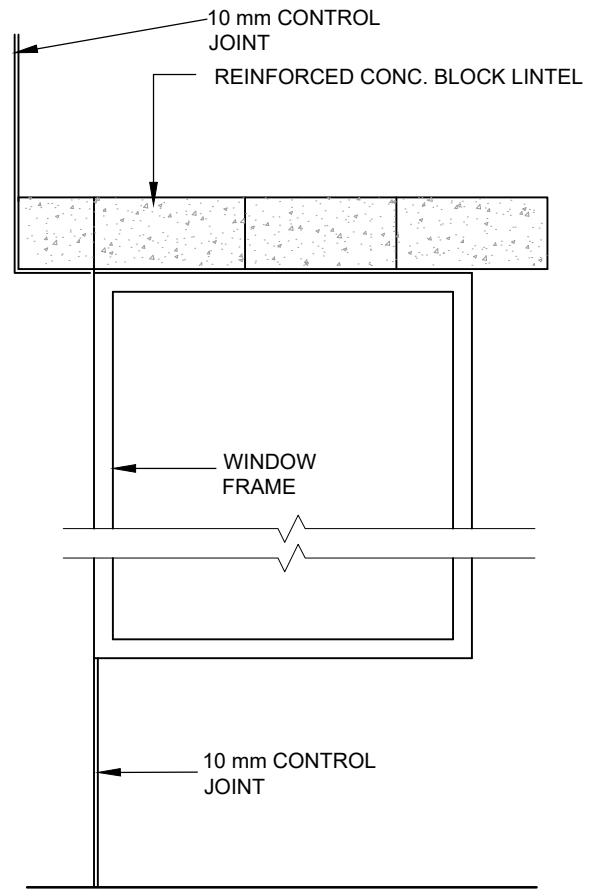


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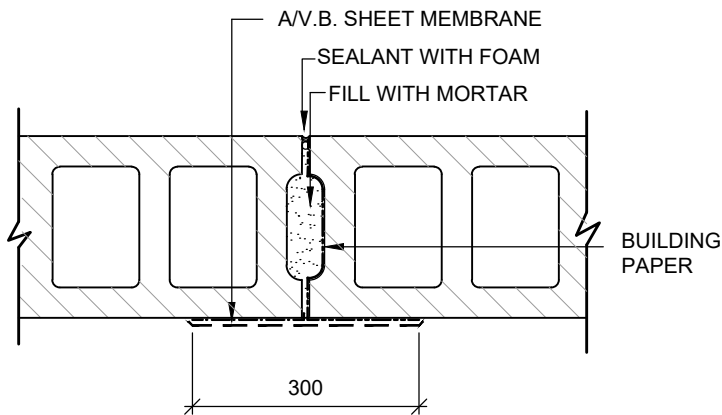
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**1** DOOR CONTROL JOINT  
AD411 SCALE 1:20



**2** WINDOW CONTROL JOINT  
AD411 SCALE 1:20



**3** PLAN DETAIL  
AD411 SCALE 1:10

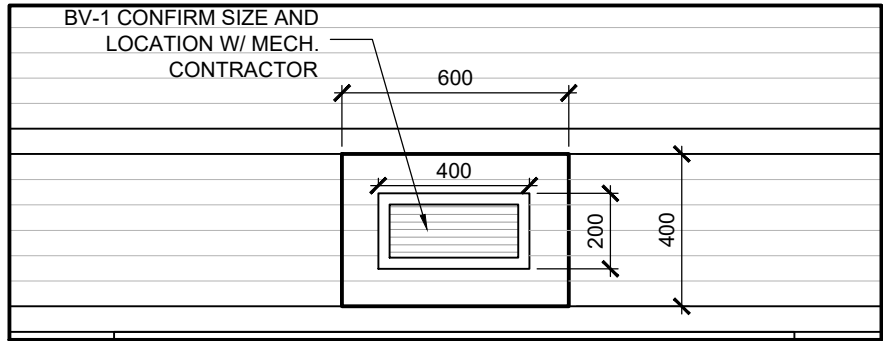
WALL CONTROL JOINT DETAILS INTERIOR SIDE

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1 BV-1 DETAIL  
AD412

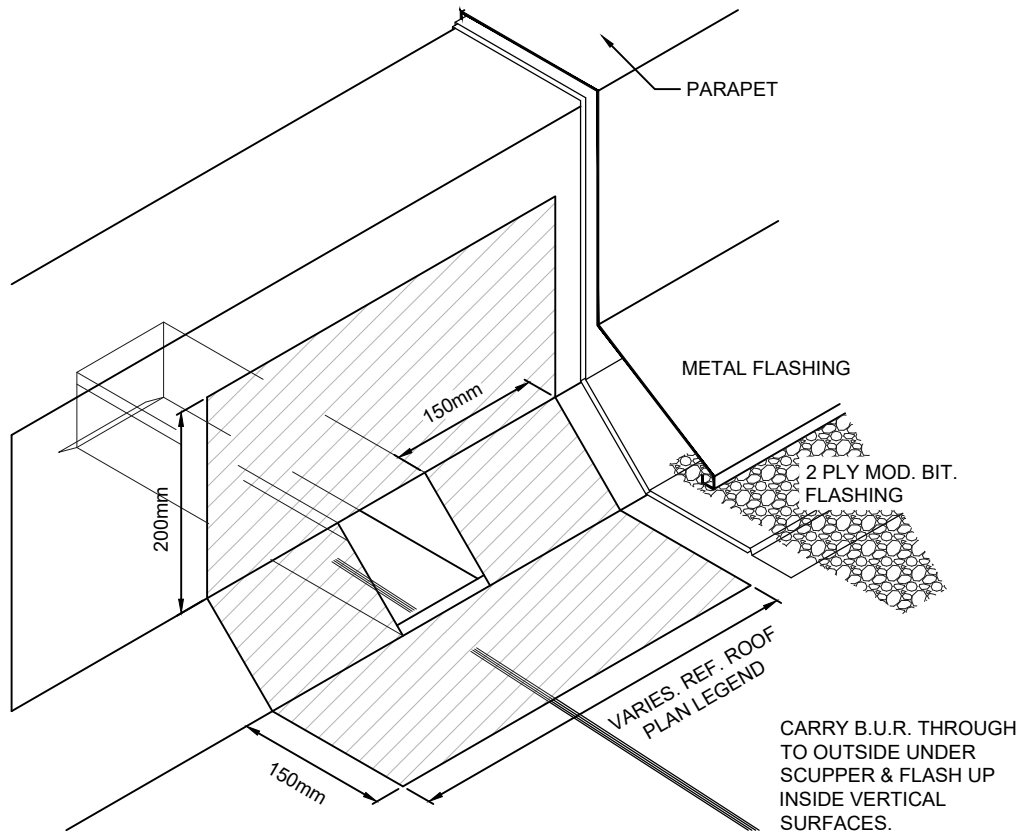
BRICK VENT DETAILS

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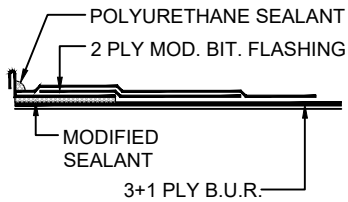
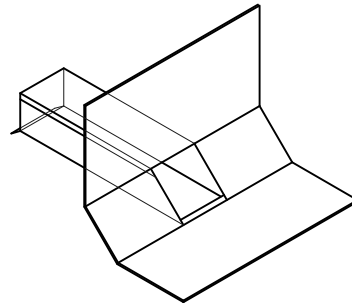
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NOTES:

1. FABRICATE SCUPPER FROM 454gm (16oz) COPPER OR 26ga. STAINLESS STEEL.
2. ALL SEAMS TO BE CONTINUOUSLY SOLDERED OR WELDED.
3. EXTEND SCUPPER MIN. 200mm BEYOND OUTSIDE FACE OF EAVE.
4. REFER TO STRUCTURAL FOR STEEL PLATE REQUIRED TO SUPPORT BRICK/BLOCK ABOVE OPENING.



ROOF SCUPPER - NO DOWNSPOUT

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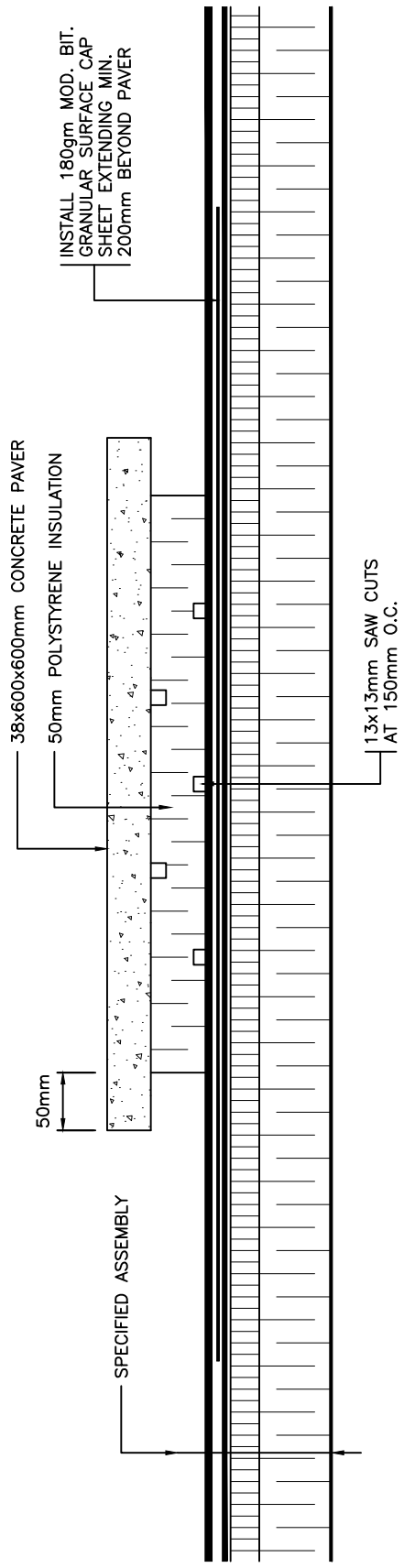
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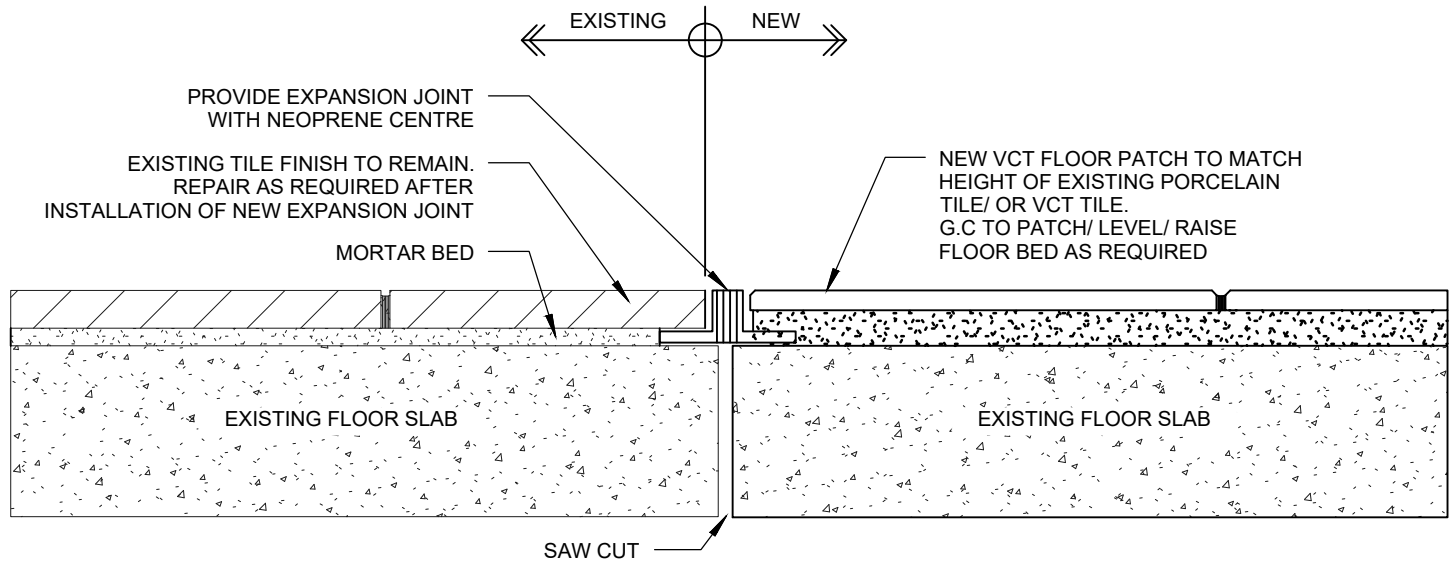
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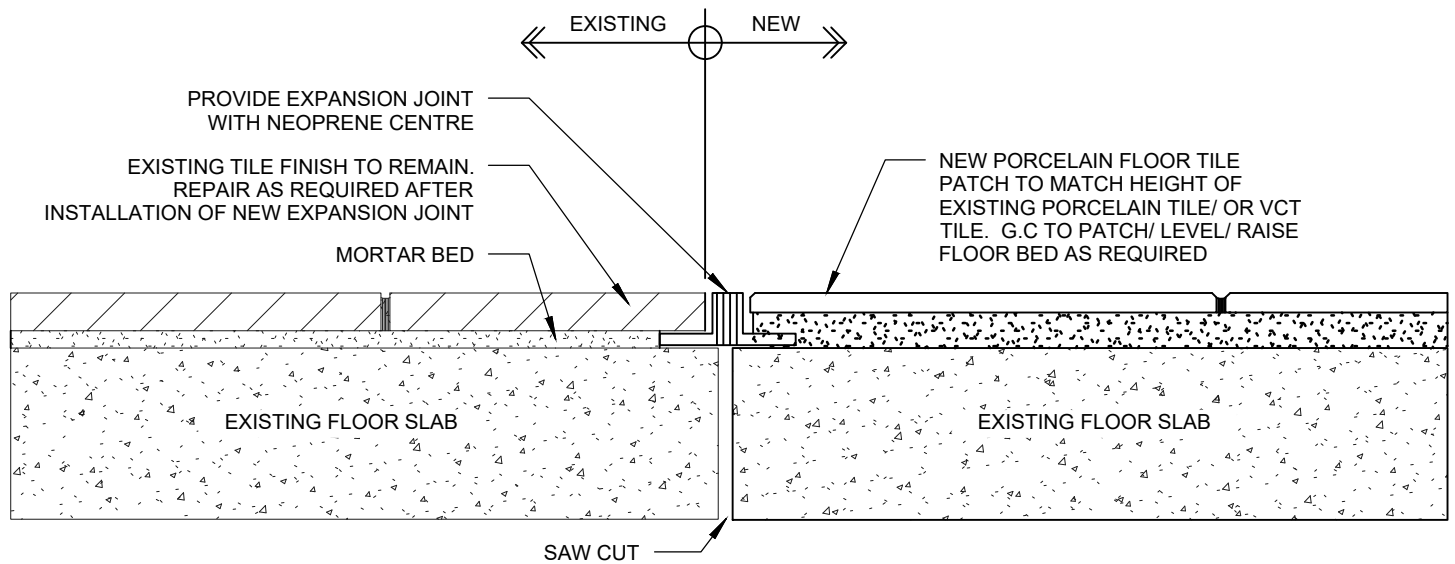


CONCRETE PAVER DETAIL

NOTES:  
1. REFER TO SPECIFICATIONS FOR ROOF ASSEMBLIES



VLC FLOOR CONNECTION



PORCELAIN TILE FLOOR CONNECTION

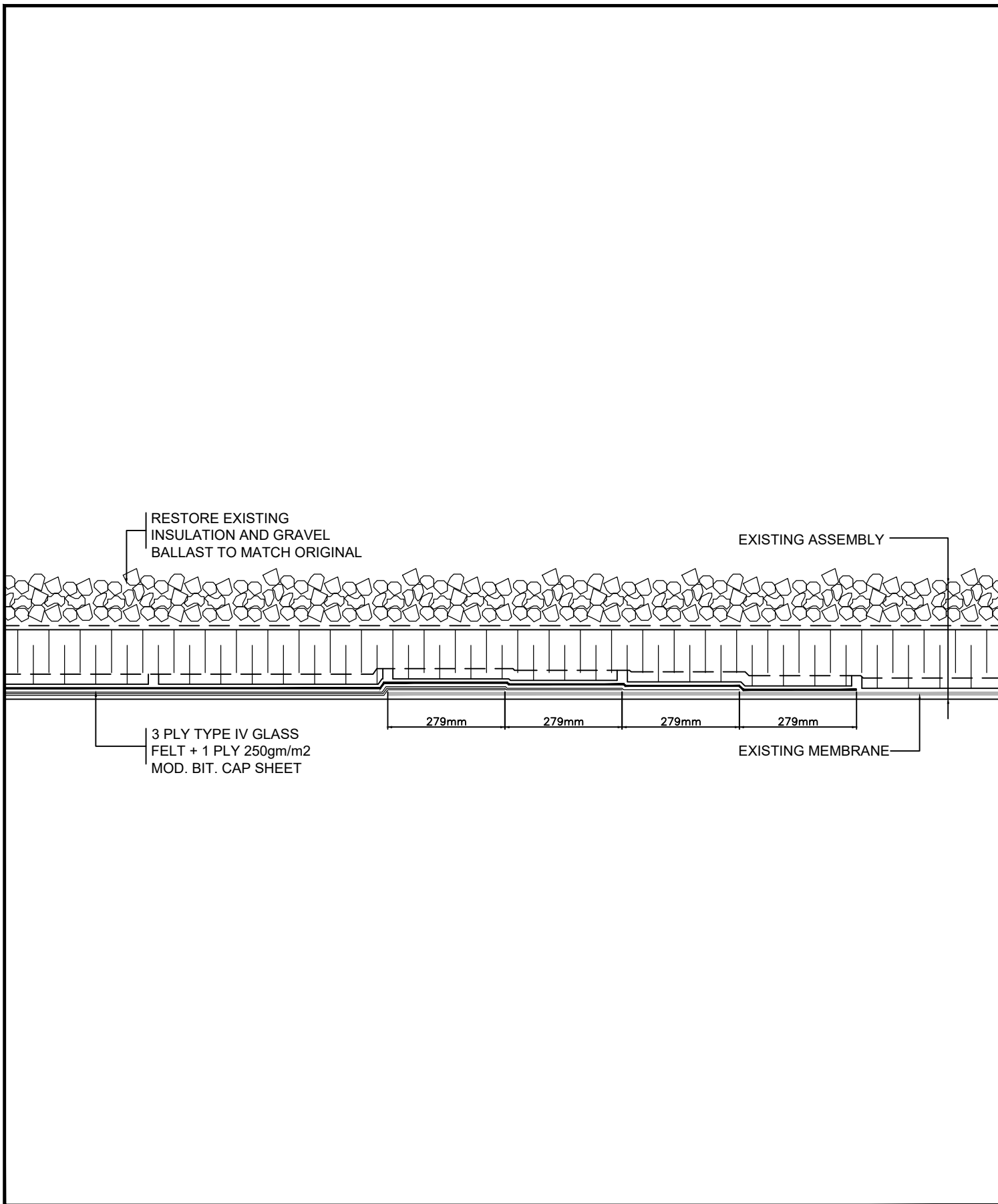
# EXISTING FLOOR CONNECTION

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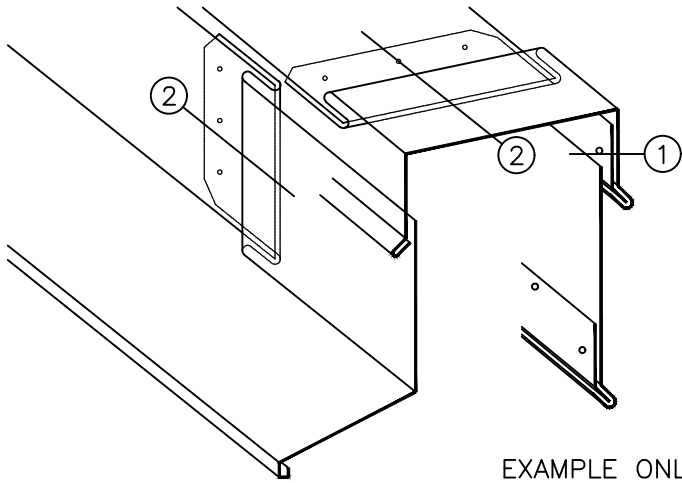


ROOF TIE-IN DETAIL

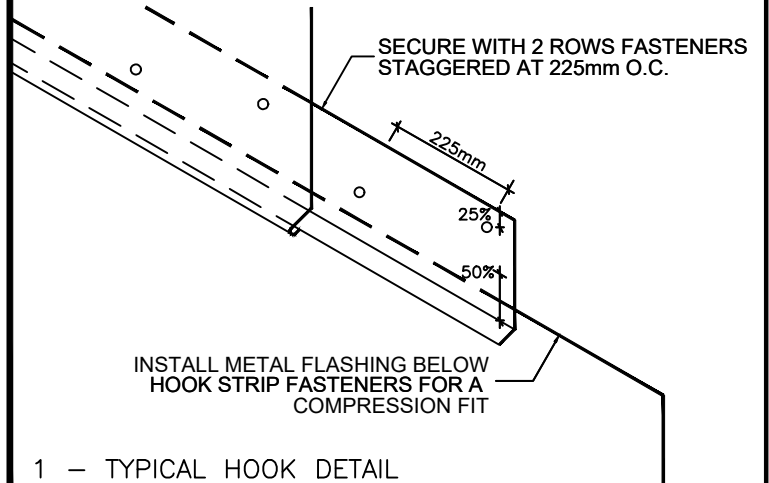
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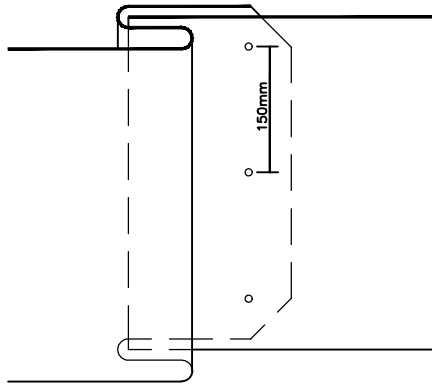
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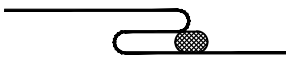
EXAMPLE ONLY



1 – TYPICAL HOOK DETAIL



STEP 1 SECURE FLASHINGS INTO PLACE AT S-LOCK JOINT.



STEP 2 INSTALL BEAD OF POLYURETHANE CAULKING CONTINUOUSLY ALONG LOCK JOINT AND TURN DOWN VERTICAL FACE APPROXIMATELY 25mm.



STEP 3 LOOSELY FIT NEXT SHEET OF FLASHING AND INSTALL INTO S-LOCK APPROXIMATELY 6mm. CAULK TOP SIDE OF FLASHING AS NOTED IN STEP 2.



STEP 4 PUSH FLASHING INTO JOINT AS TO ALLOW FOR SOME MOVEMENT OF THE FLASHING DUE TO THERMAL EXPANSION AND CONTRACTION. CLEAN OFF ANY EXCESS CAULKING WHERE EXPOSED TO VIEW.

2 – EXAMPLE PROCEDURE FOR SECURING & SEALING METAL FLASHING

TYPICAL HOOK & S-LOCK JOINT.DETAIL

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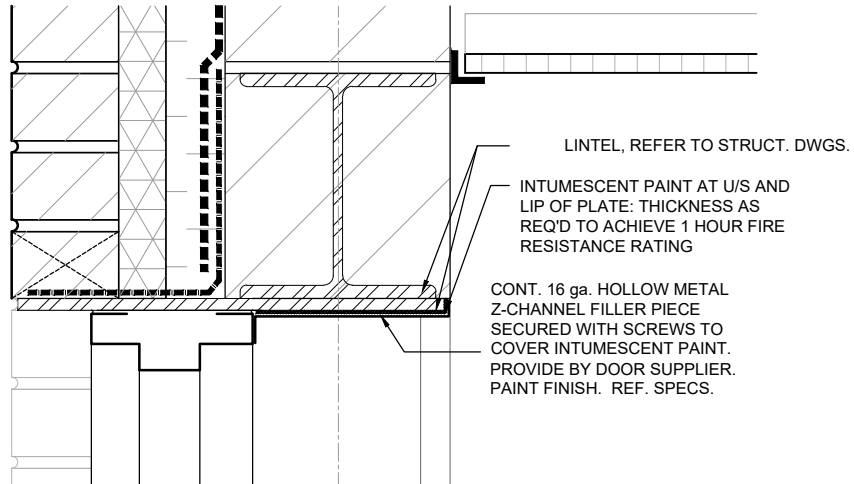


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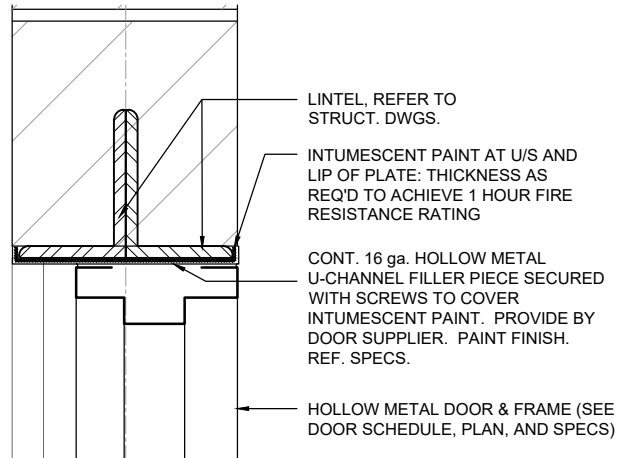
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525

NOTES:

1. Refer to Door Schedule notes for locations required at interior and exterior doors



*Fire Protection at Exterior Door Head*



*Fire Protection at Interior Door Head*

**FIRE PROTECTION AT WINDOW AND DOOR HEAD**

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SCALE: 1:10

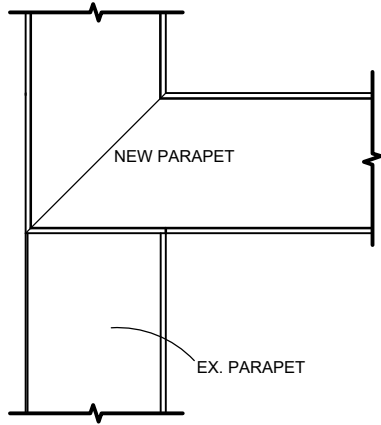
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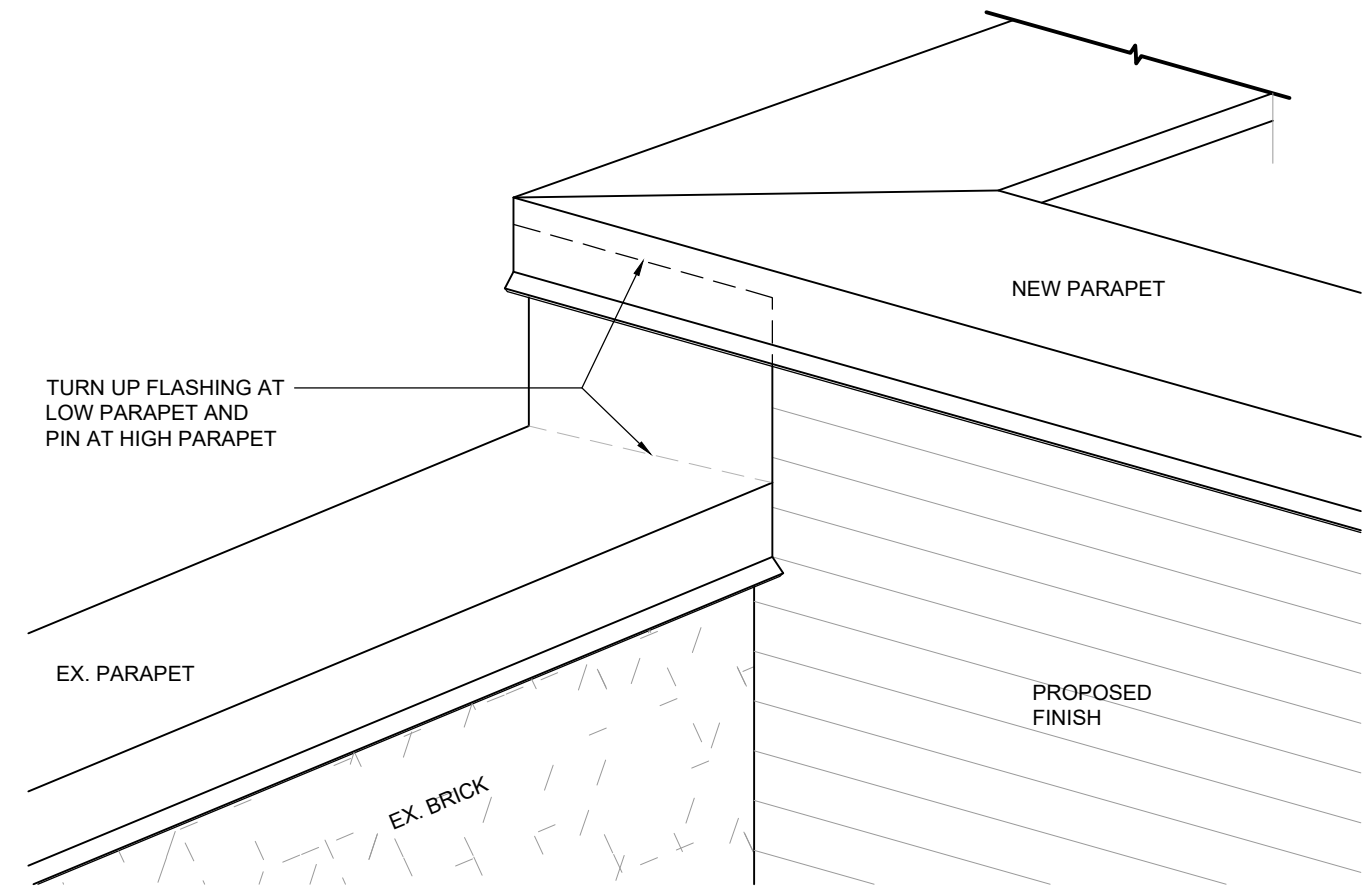


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Plan Detail



Axonometric Detail

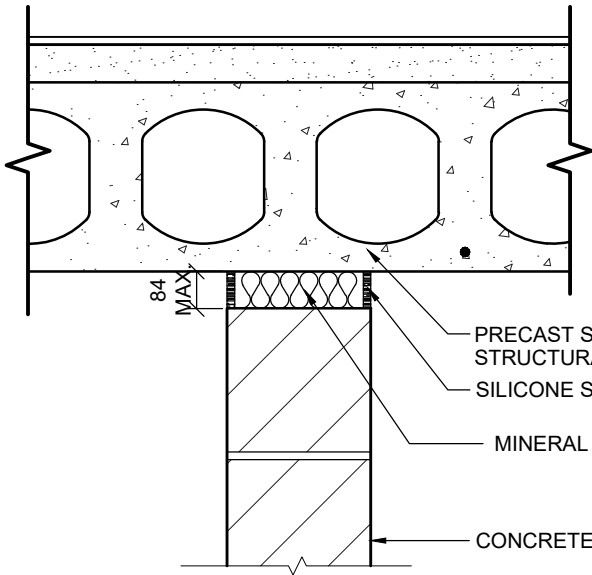
# ROOF PARAPET CONNECTION

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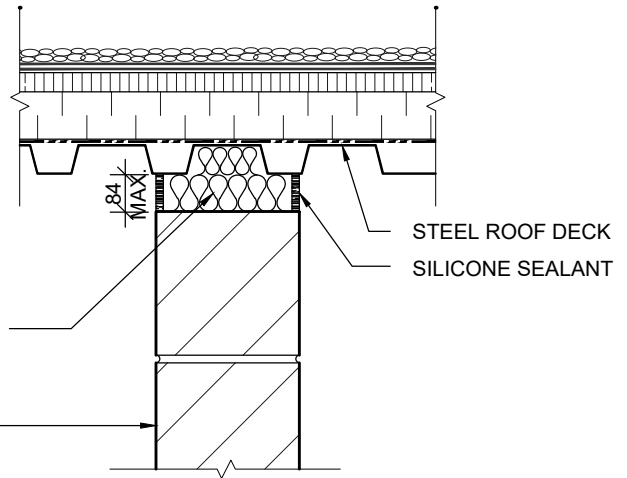
**HOSSACK  
& ASSOCIATES  
ARCHITECTS**

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**530**

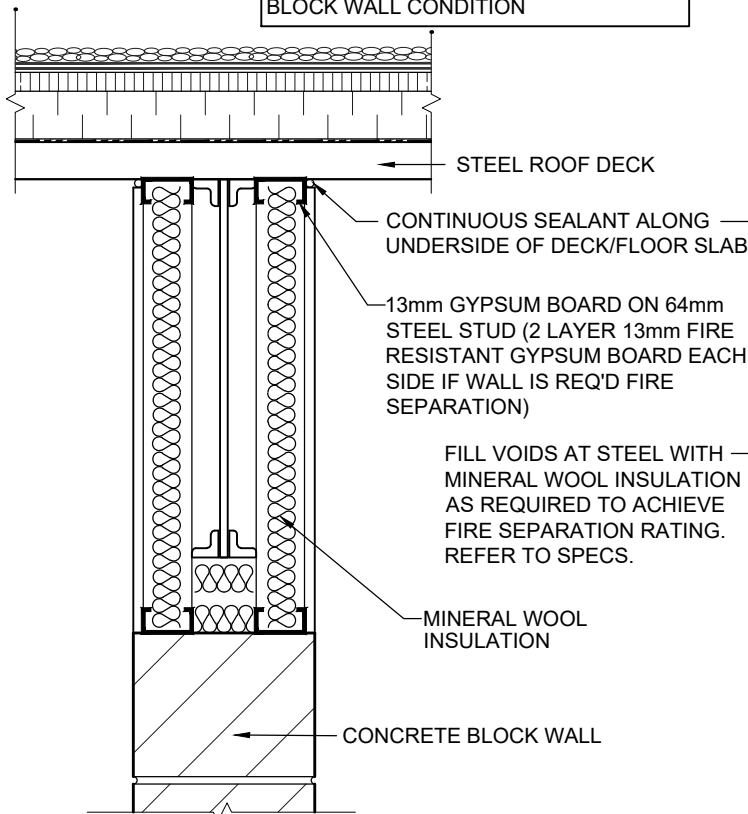


CONDITION AT FLOOR

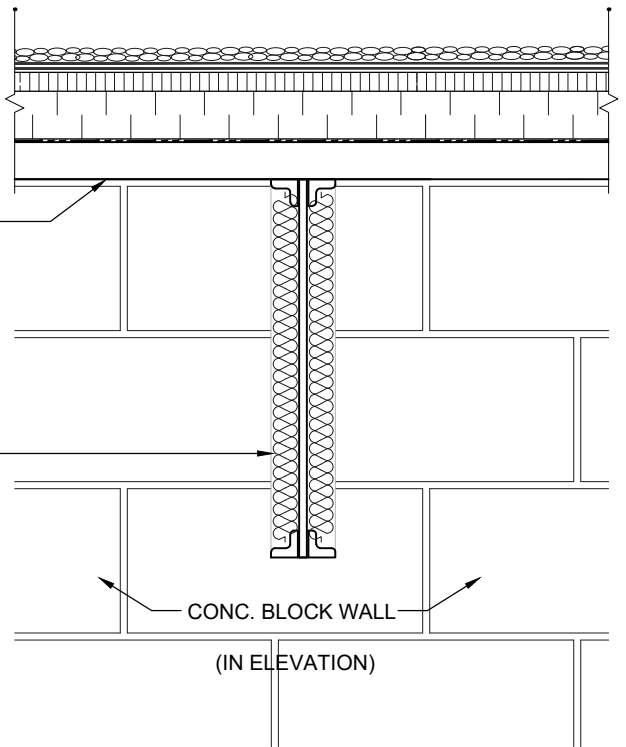


CONDITION AT ROOF

NOTE:  
ADJUST STEEL STUD SIZES TO SUIT  
BLOCK WALL CONDITION



CONDITION AT PARALLEL  
JOIST OR BEAM



CONDITION AT PERPENDICULAR  
JOIST OR BEAM

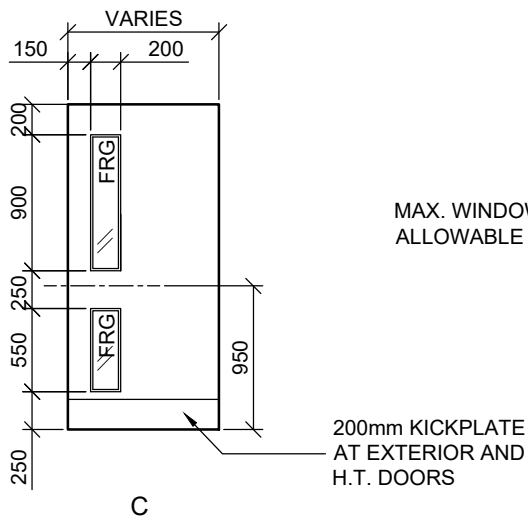
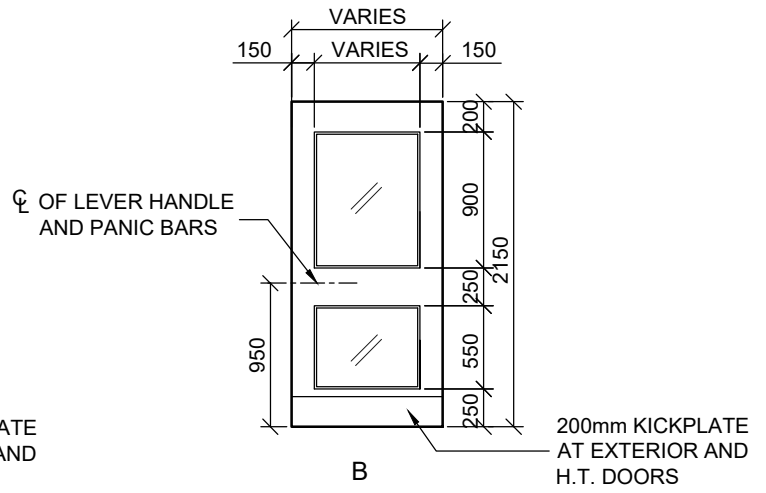
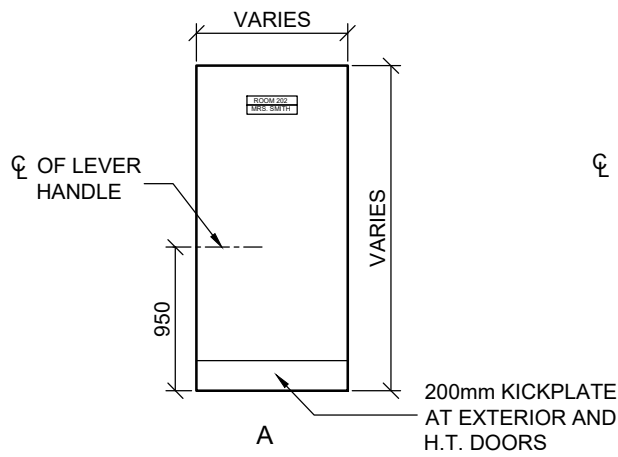
TOP OF WALL FIRE SEPARATION ASSEMBLY

|        |          |
|--------|----------|
| PROJ:  | 20118    |
| SCALE: | 1:5      |
| DRAWN: | GB       |
| DATE:  | 22 05 12 |

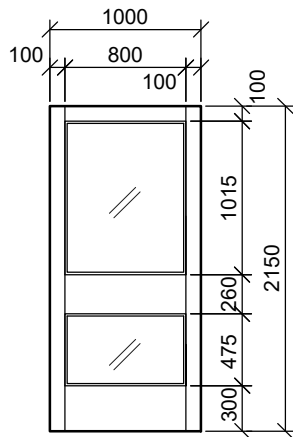
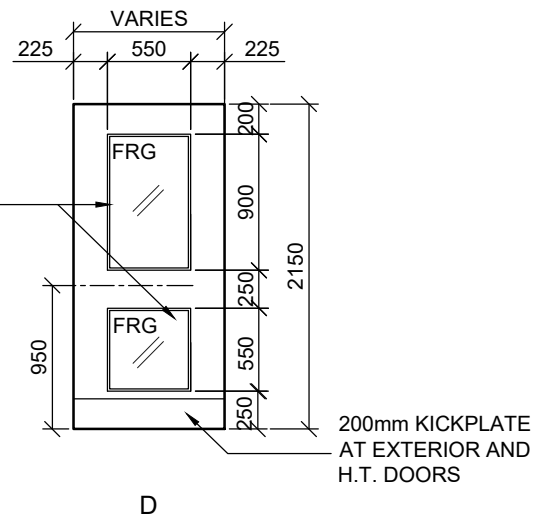


ISSUE/REV.  
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725



MAX. WINDOW SCREEN ALLOWABLE = .8 SQ.M.



ALUM. EXT

NOTES:

1. REFER TO SPECIFICATIONS AND DOOR SCHEDULE FOR GLAZING TYPE
2. ALL DOORS AND FRAMES ARE VIEWED FROM EXTERIOR OF ROOM OR AREA SERVED

DOOR TYPES

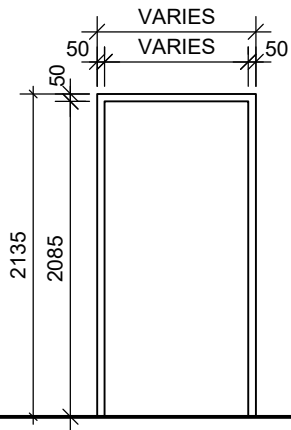
PROJ: 20118  
 SCALE: 1:50  
 DRAWN: GB  
 DATE: 22 10 13



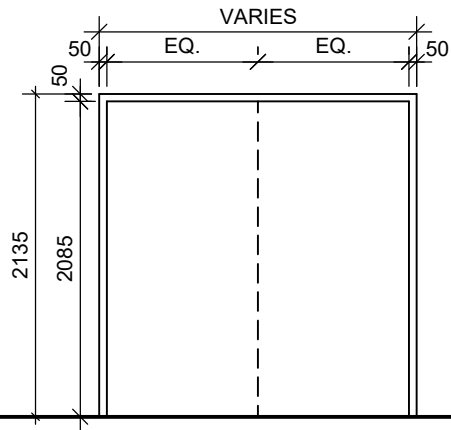
ISSUE/REV.  
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800



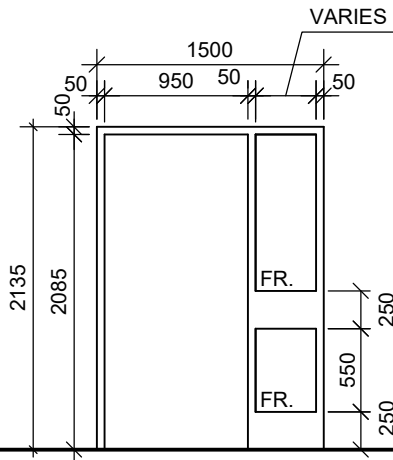


**TYPE 1**  
H.M. INT/EXT

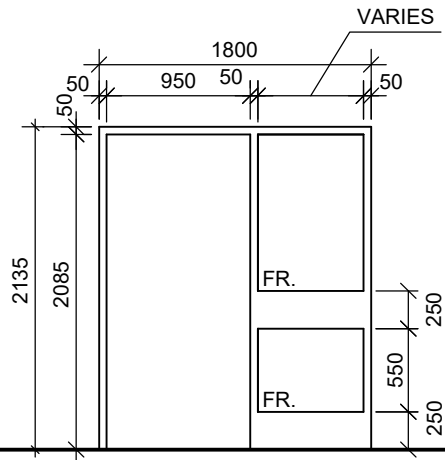


**TYPE 2**  
H.M. INT

NOTE: REFER TO FIRE SEPARATION PLANS FOR LOCATIONS OF FIRE RATED GLASS.



**TYPE 3**  
H.M. INT



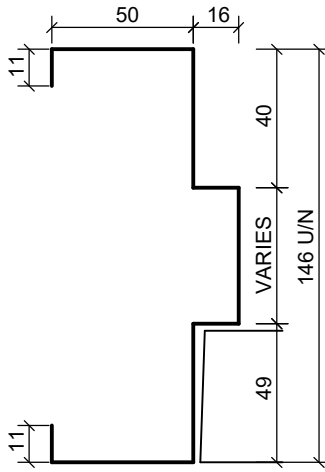
**TYPE 4**  
H.M. INT

HOLLOW METAL FRAMES

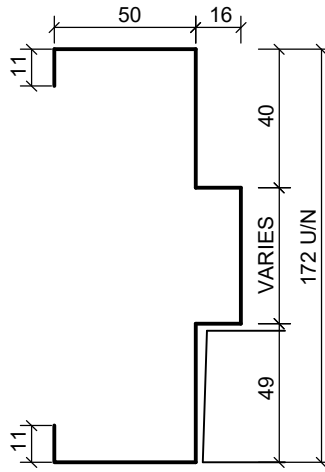
|        |          |
|--------|----------|
| PROJ:  | 20118    |
| SCALE: | 1:50     |
| DRAWN: | GB/SC    |
| DATE:  | 22 01 18 |



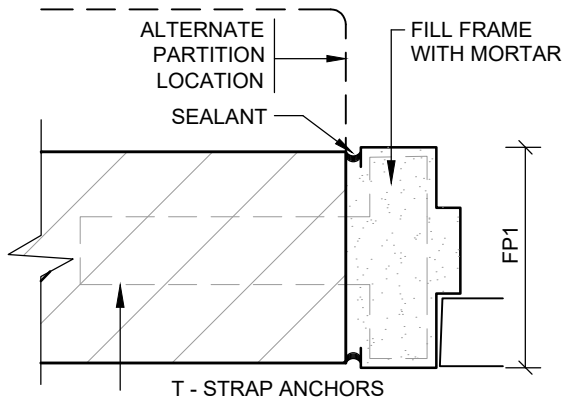
|            |     |
|------------|-----|
| ISSUE/REV. | 00  |
| AD         | 801 |



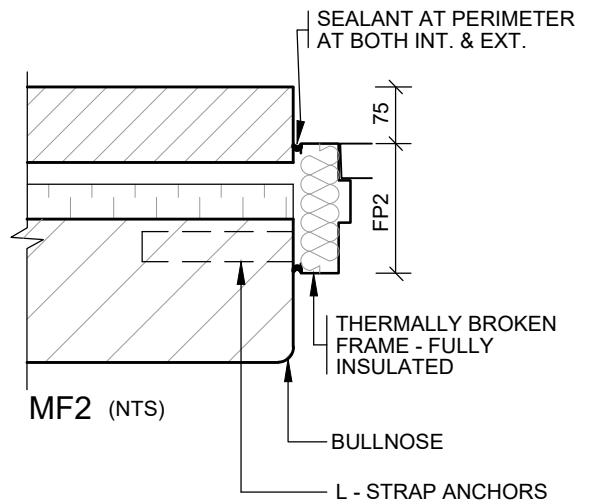
**FRAME PROFILE FP1**  
METAL FRAME SECTION  
(FOR INTERIOR DOORS)



**FRAME PROFILE FP2**  
METAL FRAME SECTION  
(FOR EXTERIOR DOORS)



**MF1 (NTS)**



**MF2 (NTS)**

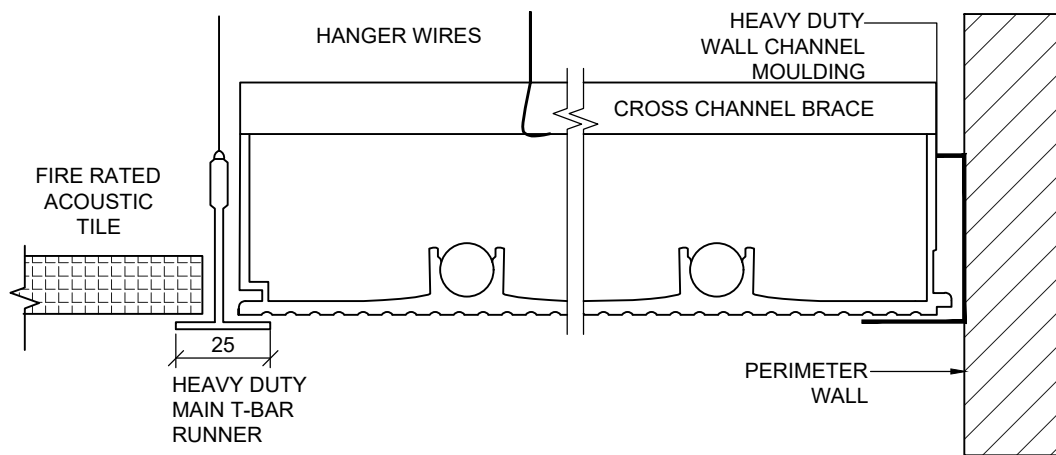
**DOOR JAMB SECTIONS**

|        |          |
|--------|----------|
| PROJ:  | 20118    |
| SCALE: | 1:50     |
| DRAWN: | GB       |
| DATE:  | 22 10 13 |



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**815**



**NOTE:**

T-BAR AND WALL CHANNEL  
MOULDING REFER TO SPECS.

UNIT VENTILATOR, REFER TO  
MECH. DRAWINGS FOR

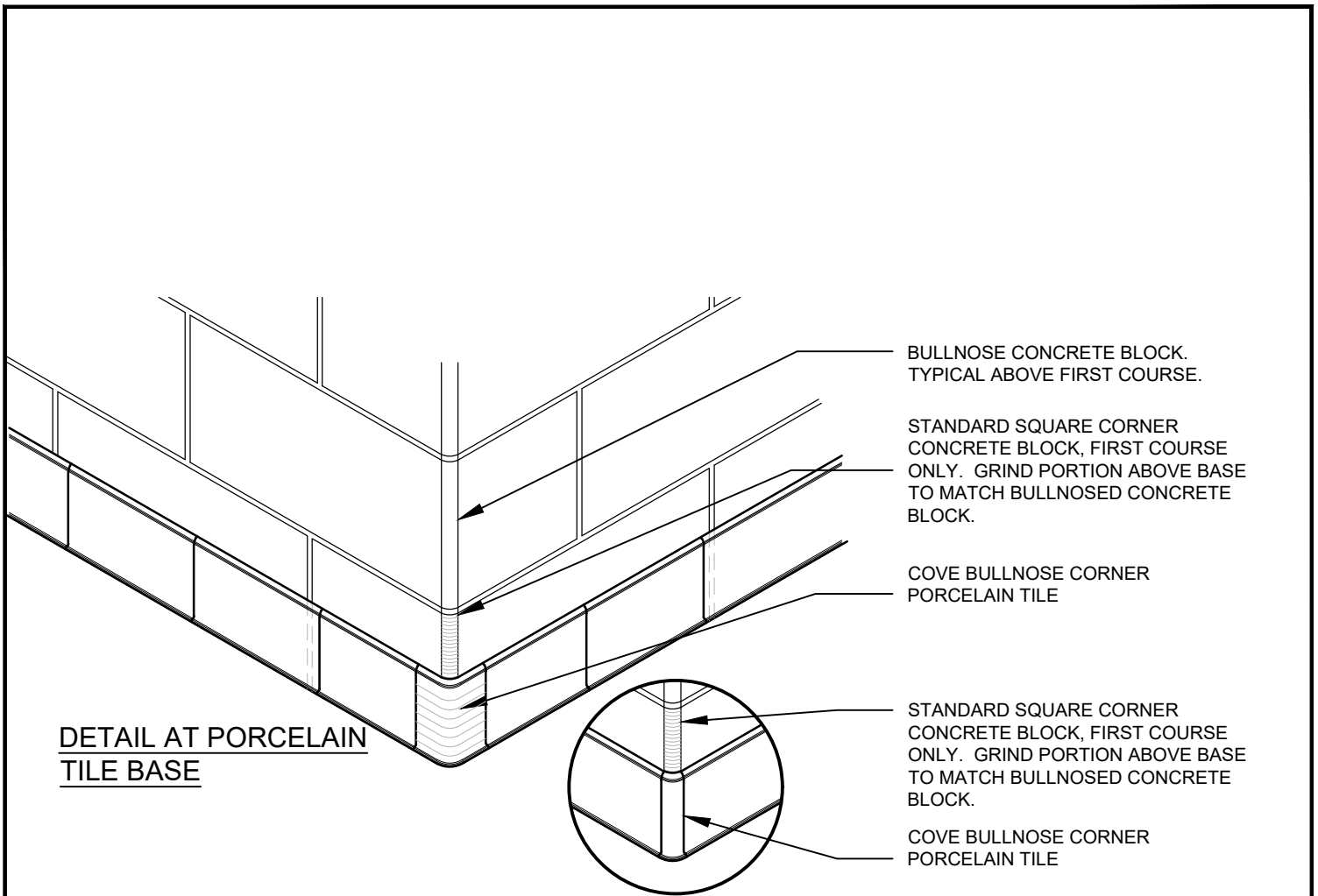
UNIT VENTILATOR - CEILING MOUNTED DETAIL

PROJ: 20118  
SCALE: 1:2  
DRAWN: GB  
DATE: 22 12 07



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900



BULLNOSE CONCRETE BLOCK.  
TYPICAL ABOVE FIRST COURSE.

STANDARD SQUARE CORNER  
CONCRETE BLOCK, FIRST COURSE  
ONLY. GRIND PORTION ABOVE BASE  
TO MATCH BULLNOSED CONCRETE  
BLOCK.

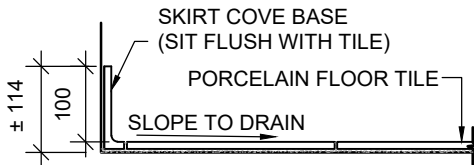
COVE BULLNOSE CORNER  
PORCELAIN TILE

STANDARD SQUARE CORNER  
CONCRETE BLOCK, FIRST COURSE  
ONLY. GRIND PORTION ABOVE BASE  
TO MATCH BULLNOSED CONCRETE  
BLOCK.

COVE BULLNOSE CORNER  
PORCELAIN TILE

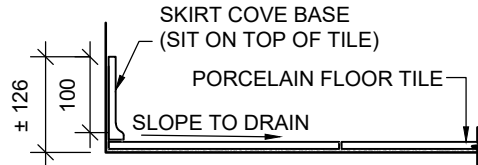
DETAIL AT PORCELAIN  
TILE BASE

OPTIONAL PORCELAIN TILE BASE



BASE INSTALLATION DETAIL 1

NOTE: THIS IS THE PREFERRED INSTALLATION METHOD  
IF TILE SELECTION PERMITS.



BASE INSTALLATION DETAIL 2

**PORCELAIN TILE AND  
RESILIENT RUBBER BASE DETAILS**

|        |          |
|--------|----------|
| PROJ:  | 20118    |
| SCALE: | NTS      |
| DRAWN: | GB       |
| DATE:  | 22 01 18 |



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| AD         | 903 |



## WRDSB MILLWORK LEGEND

- ① DISPLAY CASE
- ② 100 HIGH RUBBER BASE TOE KICK ON 19 VENEER CORE PLYWOOD
- ③ 19mm MELAMINE PANEL OPEN STORAGE c/w 5 ADJUSTABLE SHELVES
- ④ 19mm MELAMINE PANEL DRAWER FRONT c/w 3mm PVC EDGES. REFER TO SPEC FOR DRAWER SLIDERS AND DRAWER CONSTRUCTION (METABOX)
- ⑤ 19mm MELAMINE GABLE PANEL c/w 3mm PVC ON ALL EXPOSED EDGES AND PIN HOLES FOR 19mm ADJUSTABLE SHELVES AS SHOWN
- ⑥ 19mm MELAMINE PANEL BANK OF 4 DRAWERS
- ⑦ POST FORMED PLASTIC LAMINATE COUNTERTOP c/w 76 HIGH BACKSPLASH ON STOCK
- ⑧ GYPSUM BOARD BULKHEAD
- ⑨ 19mm MELAMINE PANEL UPPER CABINETS c/w FINISHED END GABLES WHERE REQUIRED AND ADJUSTABLE SHELVES AS SHOWN
- ⑩ 80 HIGH MELAMINE PANEL VALANCE x 19mm
- ⑪ STAINLESS STEEL SINGLE SINK
- ⑫ PLASTIC LAMINATE SEPARATE BACKSPLASH ON 19mm PLYWOOD
- ⑬ 19mm MELAMINE COUNTERTOP C/W 3mm PVC ON ALL EXPOSED EDGES AND BETWEEN BUTT JOINT EDGES
- ⑭ DISHWASHER
- ⑮ 19mm MELAMINE ADJUSTABLE SHELF WITH 3mm PVC EDGES
- ⑯ 16mm MELAMINE BACK c/w 3mm PVC EDGE WHERE EXPOSED
- ⑰ 19mm MELAMINE TOP, BOTTOM c/w 3mm PVC EDGE
- ⑱ ENAMELLED STEEL VANITY LAVATORY
- ⑲ LOCKABLE CASTERS REFER TO SPEC.
- ⑳ PLASTIC LAMINATE POST FORMED WORKSURFACE ON MELAMINE PANEL INTERMEDIATE GABLES
- ㉑ PLASTIC LAMINATE POST FORMED COUNTERTOP AND MELAMINE PANEL OPEN STORAGE c/w FINISHED GABLE END WHERE REQUIRED AND ADJUSTABLE SHELVES AS SHOWN
- ㉒ 19mm MELAMINE FIXED SHELF c/w 3mm PVC EDGE
- ㉓ 19mm MELAMINE DOOR c/w 3mm PVC EDGE ON ALL EXPOSED EDGES
- ㉔ 19mm MELAMINE PANEL c/w 3mm PVC EDGE ON ALL EXPOSED EDGES
- ㉕ 16mm MELAMINE PANEL c/w 3mm PVC EDGE ON ALL EXPOSED EDGES FRAME
- ㉖ 16mm FIXED MELAMINE PANEL/SHELF c/w 3mm PVC EDGE ON ALL EXPOSED EDGES
- ㉗ PLASTIC LAMINATE POST FORMED COUNTERTOP AND MELAMINE PANEL GABLES
- ㉘ PLASTIC LAMINATE ON 19mm PLYWOOD
- ㉙ 25mm MELAMINE WITH PVC EDGE AT FRONT FACE AND EACH FACE OF THE JOINTS IN THE COUNTER TOP
- ㉚ 38mm X 89mm SOLID HARDWOOD SUPPORT
- ㉛ SINGLE 19mm MELAMINE GABLE C/W 1/8" PVC EDGE
- ㉜ TRIPLE 19mm MELAMINE GABLE SUPPORT C/W 3mm PVC EDGE ON FRONT AND FLOOR EDGE AT APROX. 910mm O.C. MAX. WAFFER AND SCREW TOGETHER.
- ㉝ ADJUSTABLE FEET SEE SPEC.
- ㉞ 51mm X 102mm OR 19mm PLYWOOD CONTINUOUS BLOCKING ON WALL, PROVIDE WOOD BLOCKING AT ALL EDGE END WAL CONDITIONS.
- ㉟ 19mm HARDWOOD SCREW STRIP BETWEEN MELAMINE GABLES.
- ㊱ PLYWOOD PANEL FILLER 19mm
- ㊲ 19mm VENEER CORE PLYWOOD CONTINUOUS JOINTS TO BE AT GABLE LOCATIONS.

NOTE: REFER TO SPECIFICATION.

NOTE: MILLWORK DETAILS PREPARED BY WRDSB

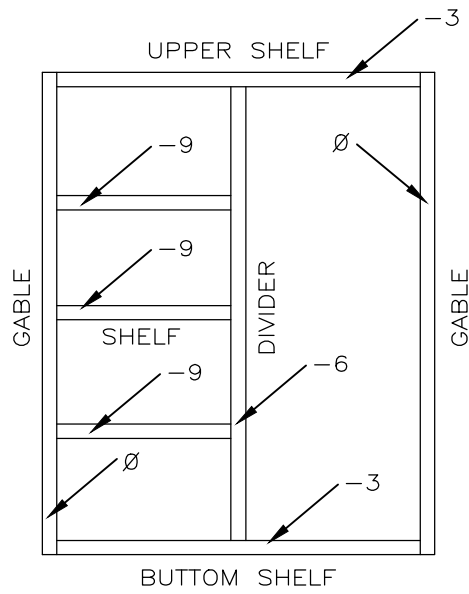
## GENERAL NOTES AW001 - MILLWORK LEGEND

|        |          |
|--------|----------|
| PROJ:  | 20118    |
| SCALE: | N.T.S.   |
| DRAWN: | GB       |
| DATE:  | 22 12 05 |

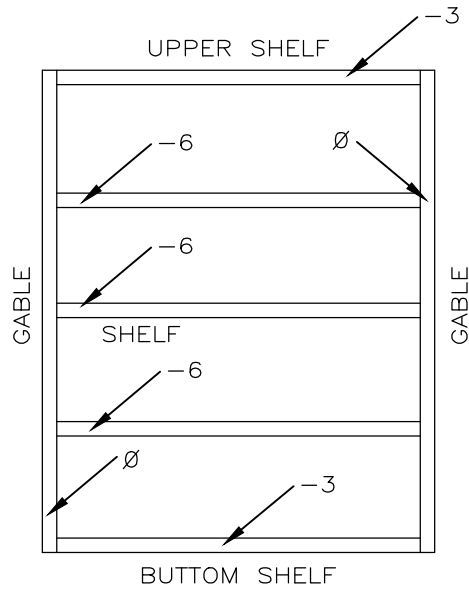


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AW001



SAMPLE SETBACKS OF  
PANELS AND SHELVES  
(STEPPED TO MATCH PVC  
EDGING)



NOTE: MILLWORK DETAILS PREPARED BY WRDSB

REFER TO AW001 FOR MILLWORK LEGEND

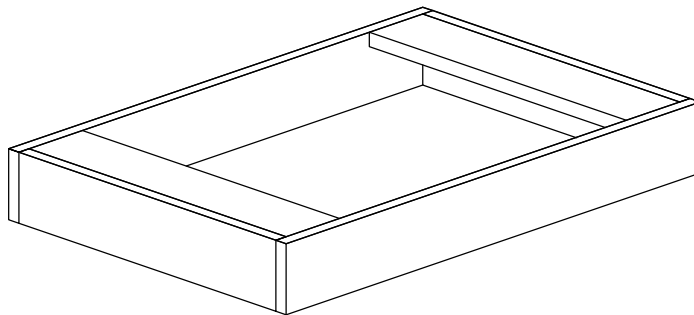
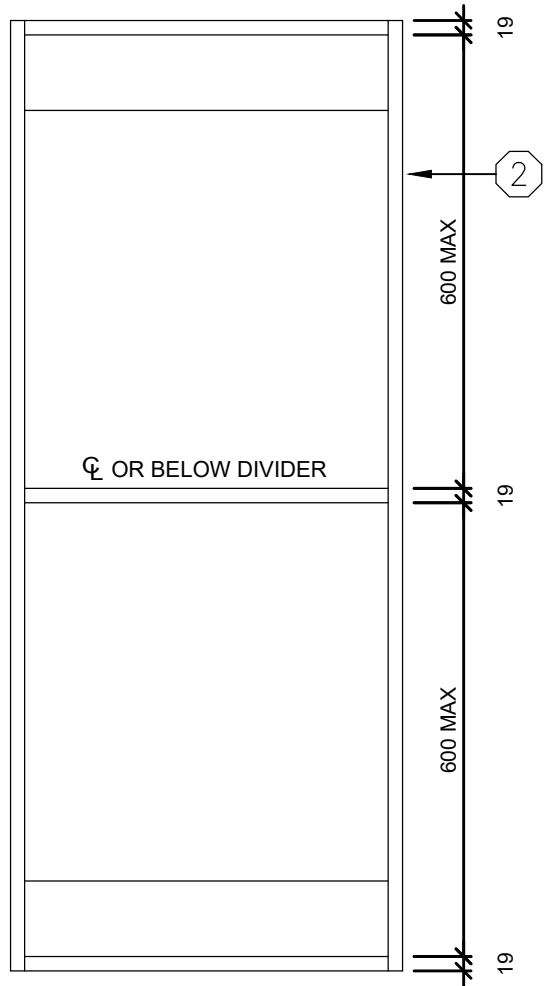
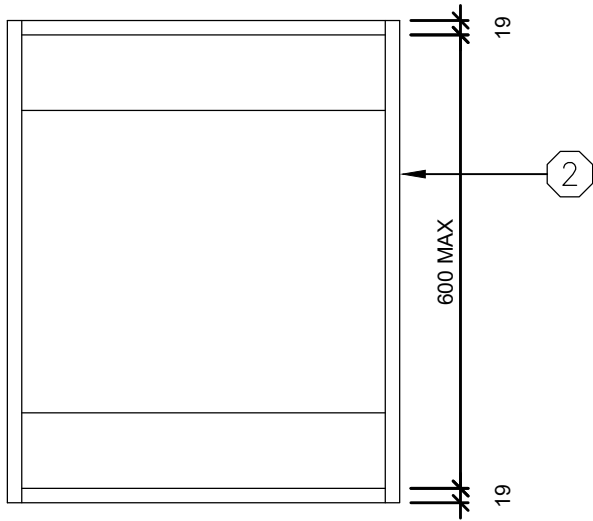
AW003 - ELEVATION

PROJ: 20118  
SCALE: 1:10  
DRAWN: GB  
DATE: 22 12 05



ISSUE/REV.  
00

AD  
AW003



NOTE: MILLWORK DETAILS PREPARED BY WRDSB

REFER TO AW001 FOR MILLWORK LEGEND

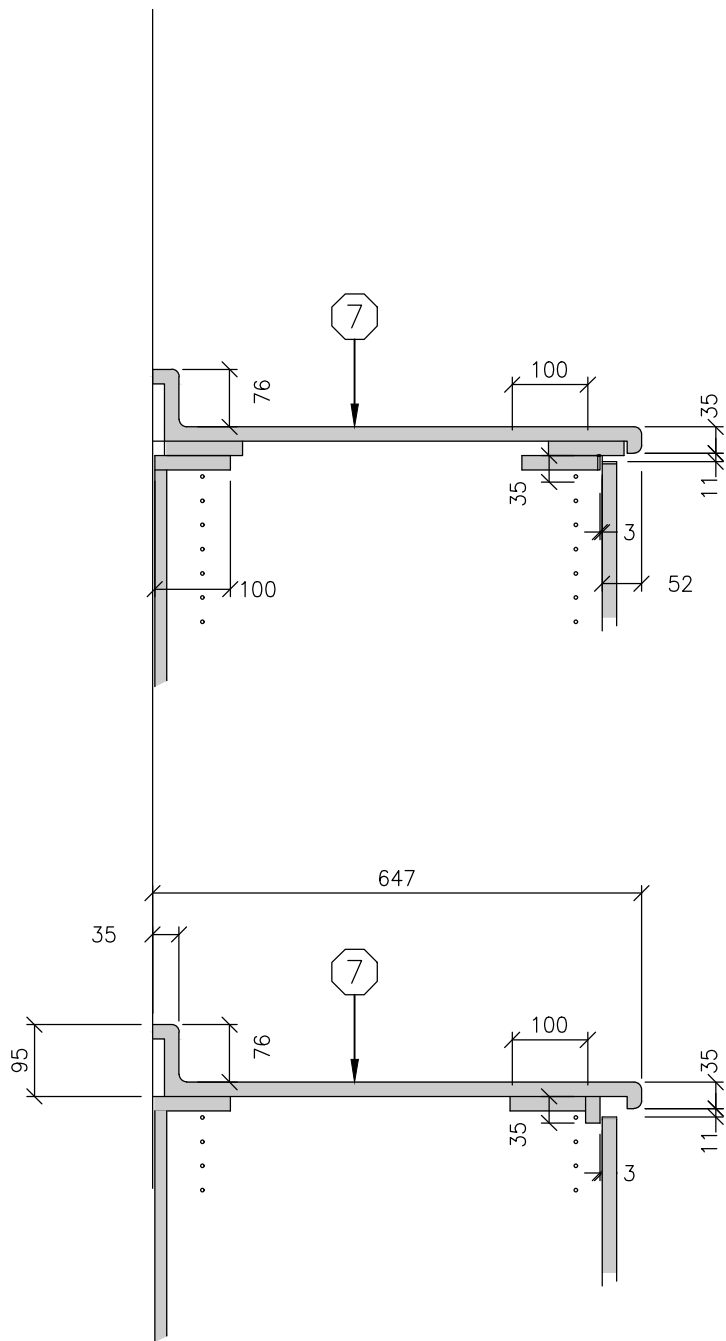
AW004 - PLAN

|        |          |
|--------|----------|
| PROJ:  | 20118    |
| SCALE: | 1:10     |
| DRAWN: | GB       |
| DATE:  | 22 12 05 |



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| ISSUE/REV.   | 00 |
| AD           |    |
| <b>AW004</b> |    |





NOTE: MILLWORK DETAILS PREPARED BY WRDSB

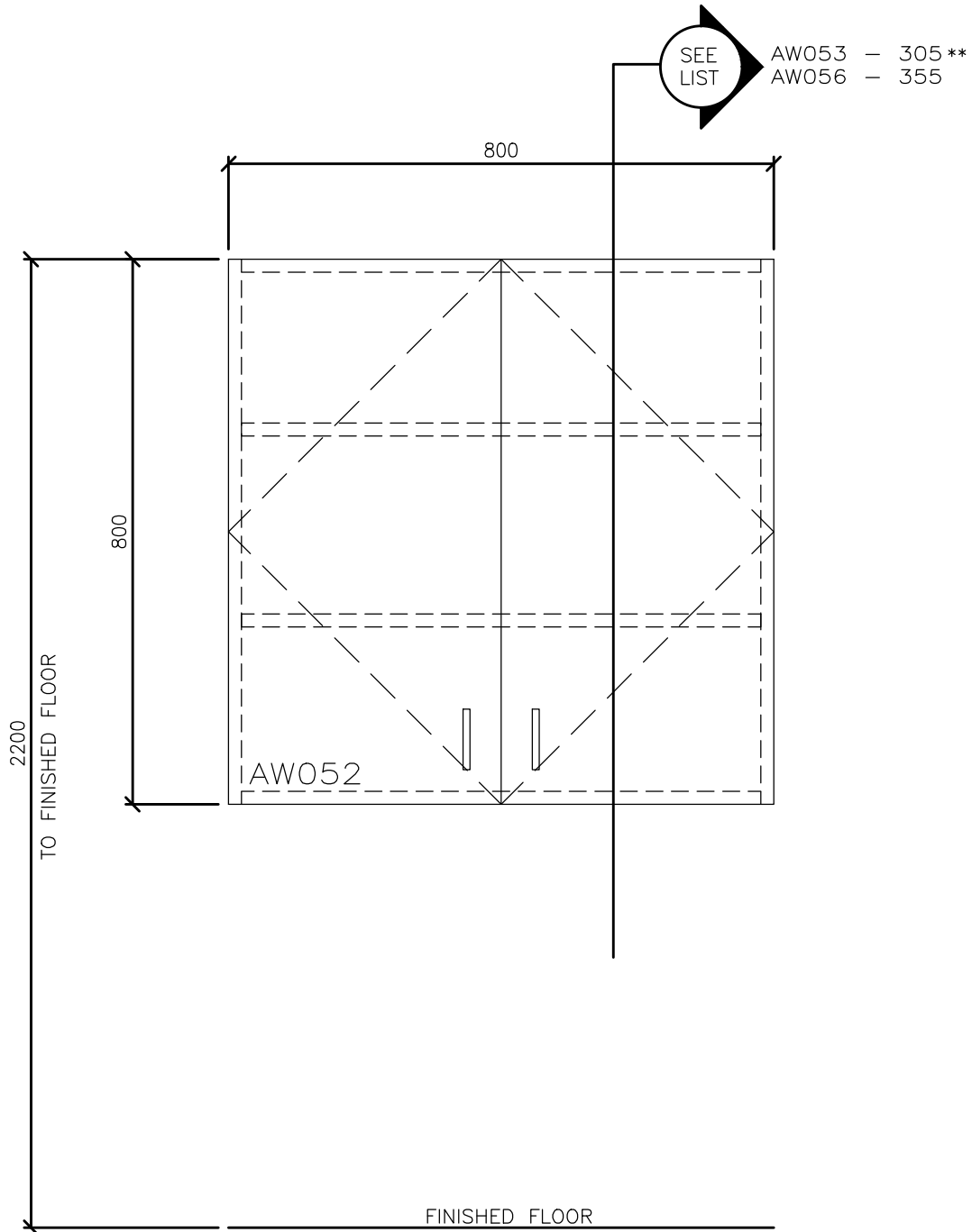
REFER TO AW001 FOR MILLWORK LEGEND

# AW010 - SECTION

|        |          |
|--------|----------|
| PROJ:  | 20118    |
| SCALE: | 1:10     |
| DRAWN: | GB       |
| DATE:  | 22 12 05 |



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| ISSUE/REV. | 00 |
| AD         |    |
| AW010      |    |



\*\* ONLY USE 305 DEPTH  
CABINETS TO MATCH  
EXISTING MILLWORK

NOTE: MILLWORK DETAILS PREPARED BY WRDSB

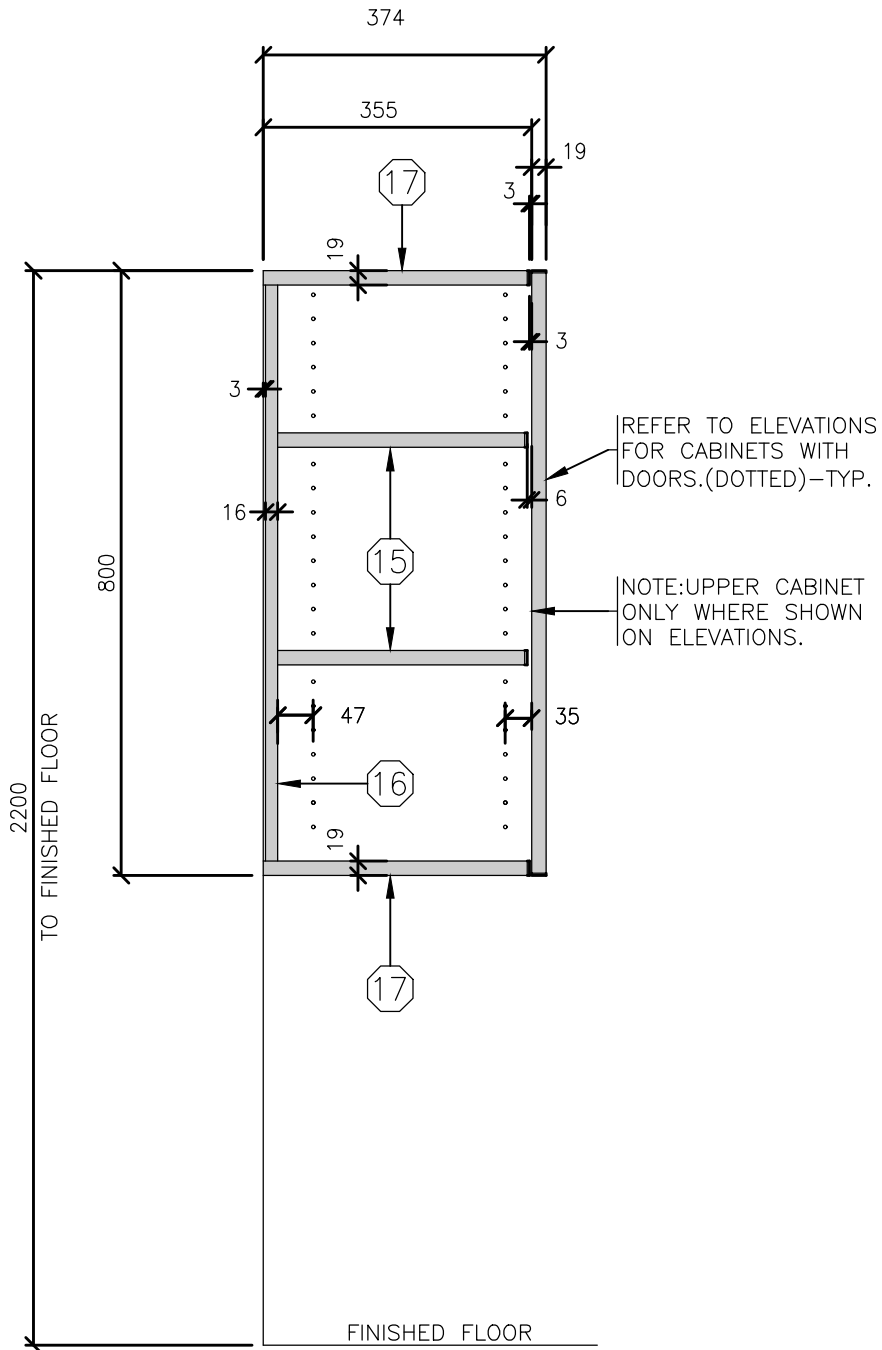
REFER TO AW001 FOR MILLWORK LEGEND

# AW052 - ELEVATION

|        |          |
|--------|----------|
| PROJ:  | 20118    |
| SCALE: | 1:10     |
| DRAWN: | GB       |
| DATE:  | 22 12 05 |



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| ISSUE/REV.   | 00 |
| AD           |    |
| <b>AW052</b> |    |



NOTE: MILLWORK DETAILS PREPARED BY WRDSB

REFER TO AW001 FOR MILLWORK LEGEND

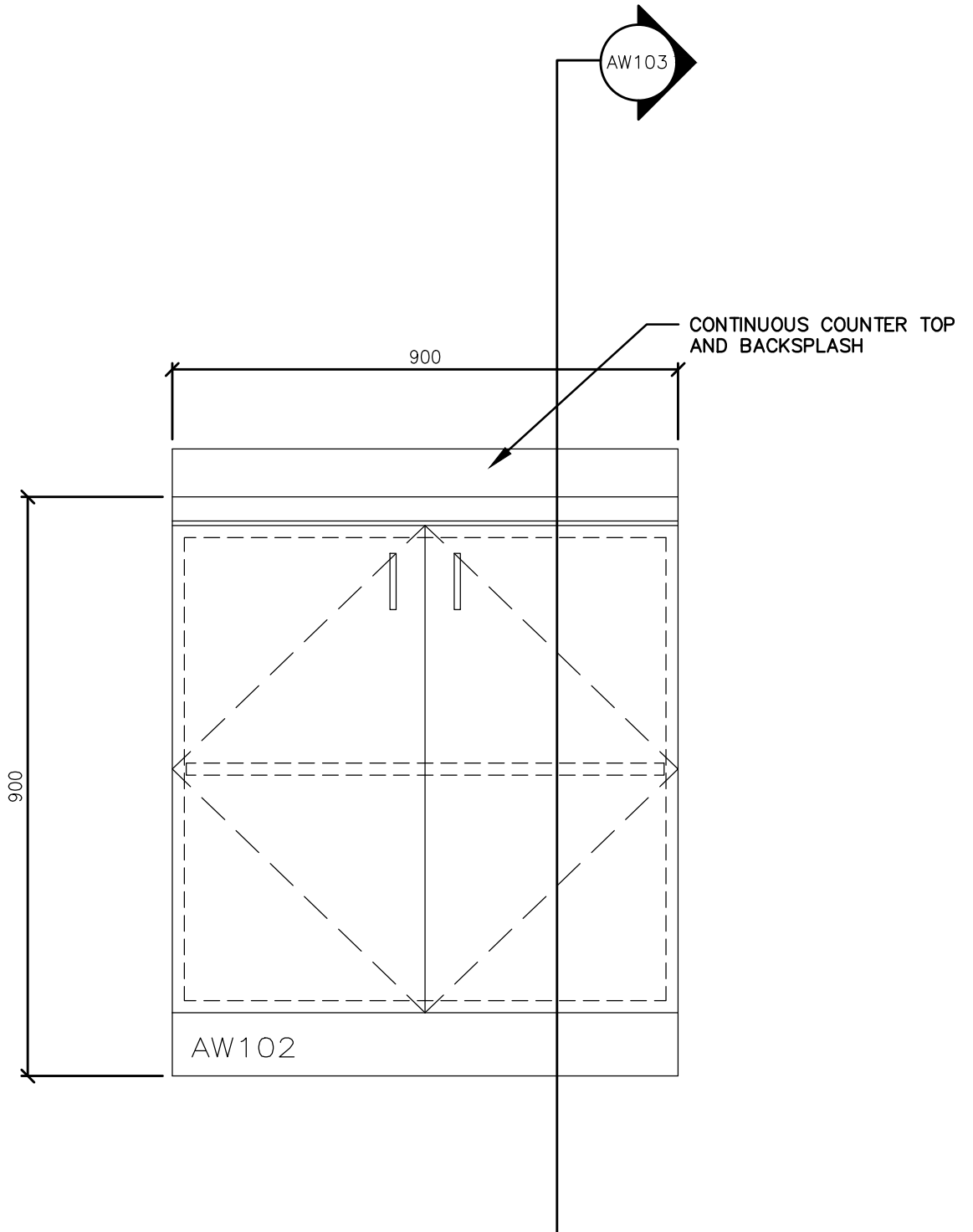
AW056 - SECTION

PROJ: 20118  
 SCALE: 1:10  
 DRAWN: GB  
 DATE: 22 12 05



ISSUE/REV.  
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 AW056



NOTE: MILLWORK DETAILS PREPARED BY WRDSB

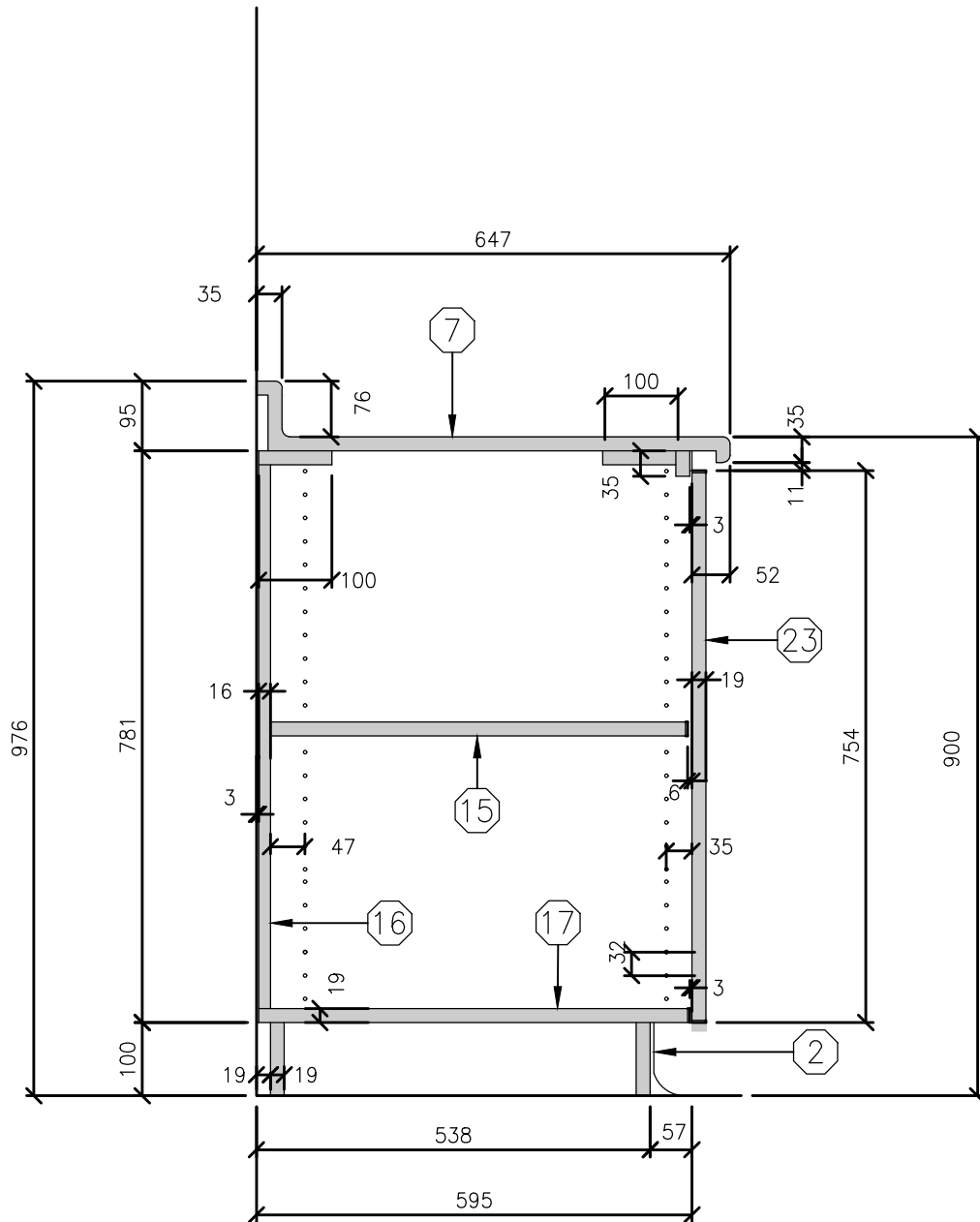
REFER TO AW001 FOR MILLWORK LEGEND

# AW102 - ELEVATION

|        |          |
|--------|----------|
| PROJ:  | 20118    |
| SCALE: | 1:10     |
| DRAWN: | GB       |
| DATE:  | 22 12 05 |



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| ISSUE/REV.   | 00 |
| AD           |    |
| <b>AW102</b> |    |



NOTE: MILLWORK DETAILS PREPARED BY WRDSB

REFER TO AW001 FOR MILLWORK LEGEND

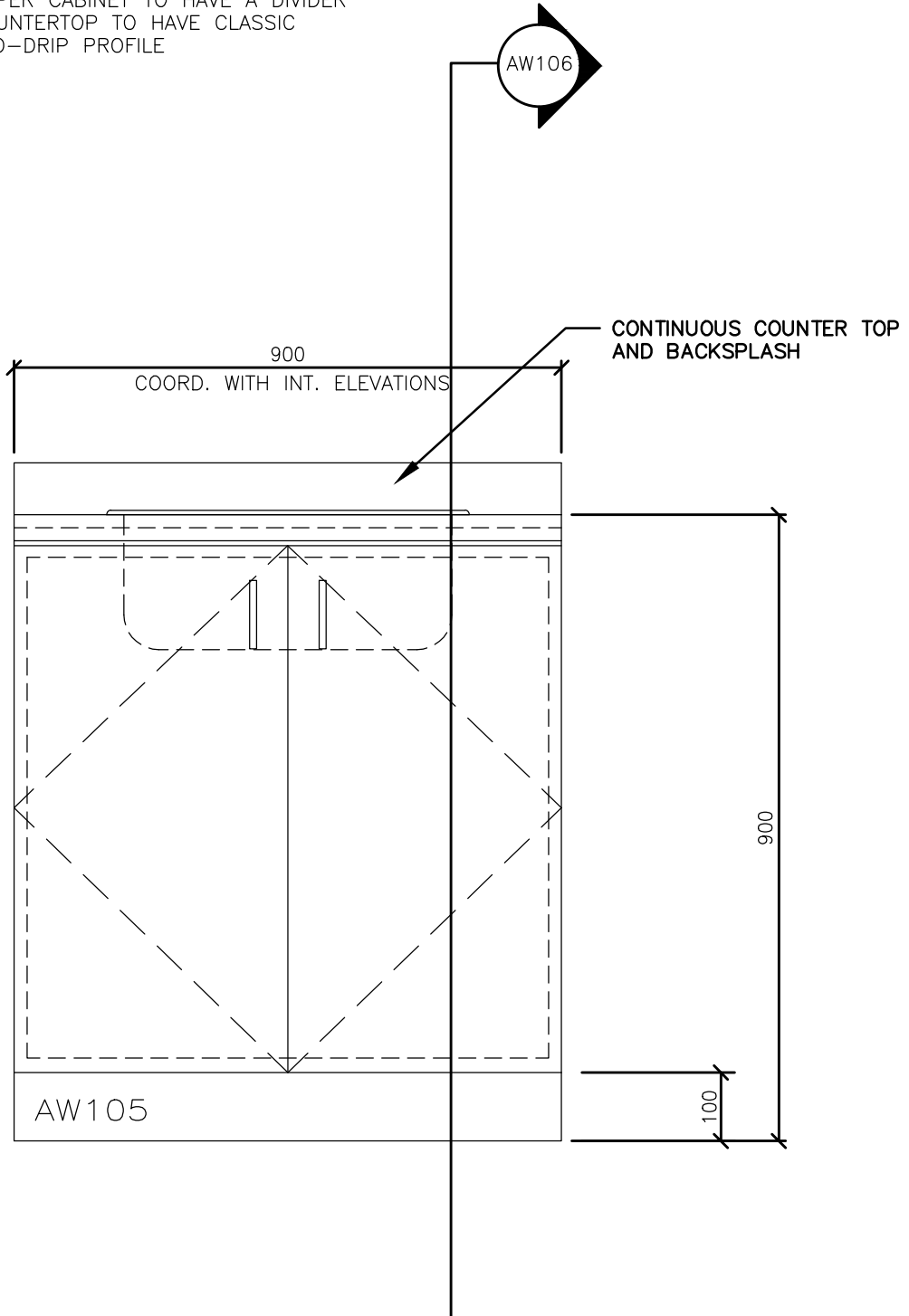
# AW103 - SECTION

|        |          |
|--------|----------|
| PROJ:  | 20118    |
| SCALE: | 1:10     |
| DRAWN: | GB       |
| DATE:  | 22 12 05 |



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| ISSUE/REV.   | 00 |
| AD           |    |
| <b>AW103</b> |    |

- SINGLE SINK: 800 WIDE
- DOUBLE SINK: 863 WIDE MINIMUM,  
USE 900 WIDE CABINET
- UPPER CABINET TO HAVE A DIVIDER
- COUNTERTOP TO HAVE CLASSIC  
NO-DRIP PROFILE



NOTE: MILLWORK DETAILS PREPARED BY WRDSB

REFER TO AW001 FOR MILLWORK LEGEND

## AW105 - ELEVATION

|        |          |
|--------|----------|
| PROJ:  | 20118    |
| SCALE: | 1:10     |
| DRAWN: | GB       |
| DATE:  | 22 12 05 |



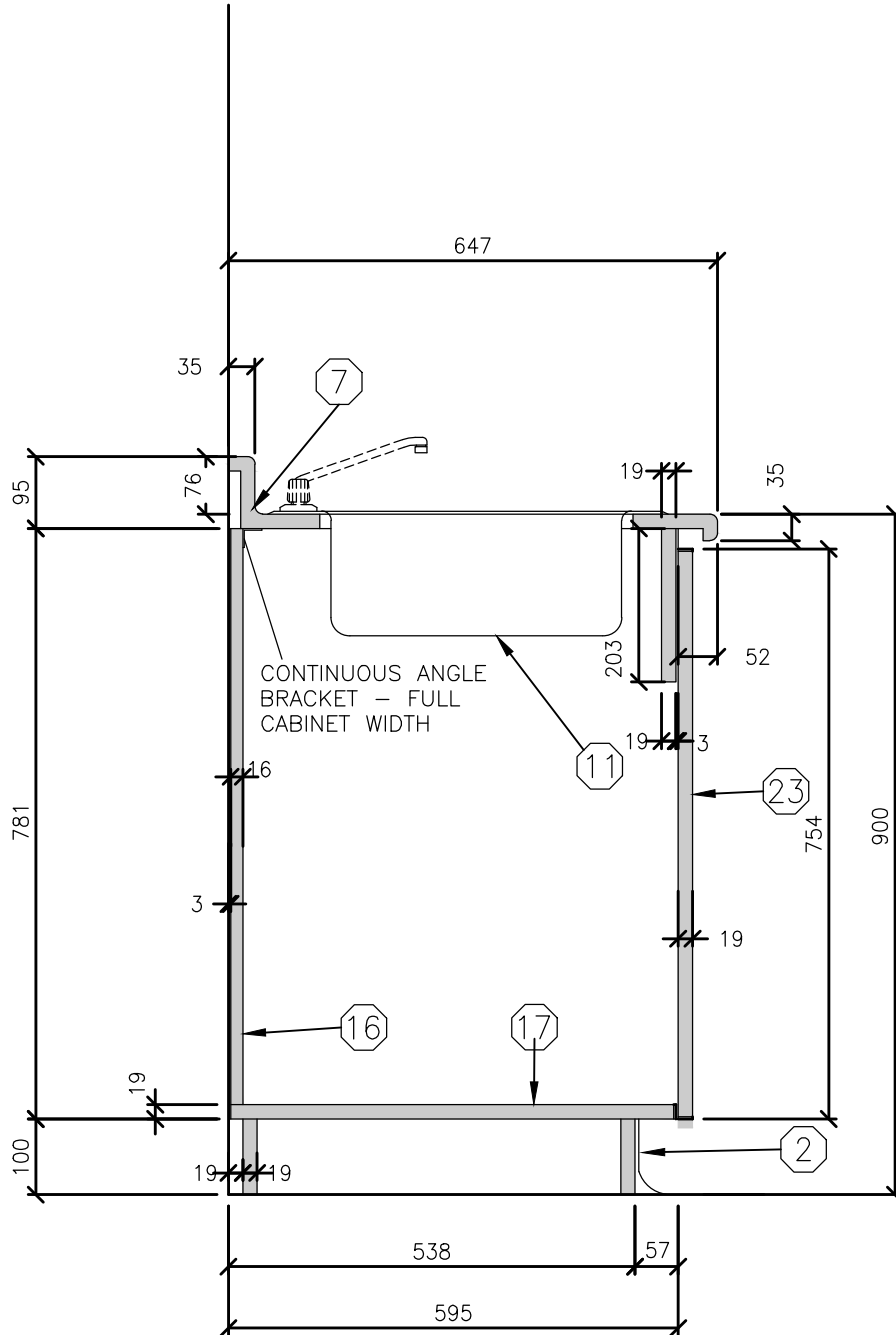
**HOSSACK  
& ASSOCIATES  
ARCHITECTS**



ISSUE/REV.  
00

AD  
**AW105**

- SINGLE SINK: 800 WIDE
- DOUBLE SINK: 863 WIDE MINIMUM,  
USE 900 WIDE CABINET
- UPPER CABINET TO HAVE A DIVIDER
- COUNTERTOP TO HAVE CLASSIC  
NO-DRIP PROFILE



NOTE: MILLWORK DETAILS PREPARED BY WRDSB

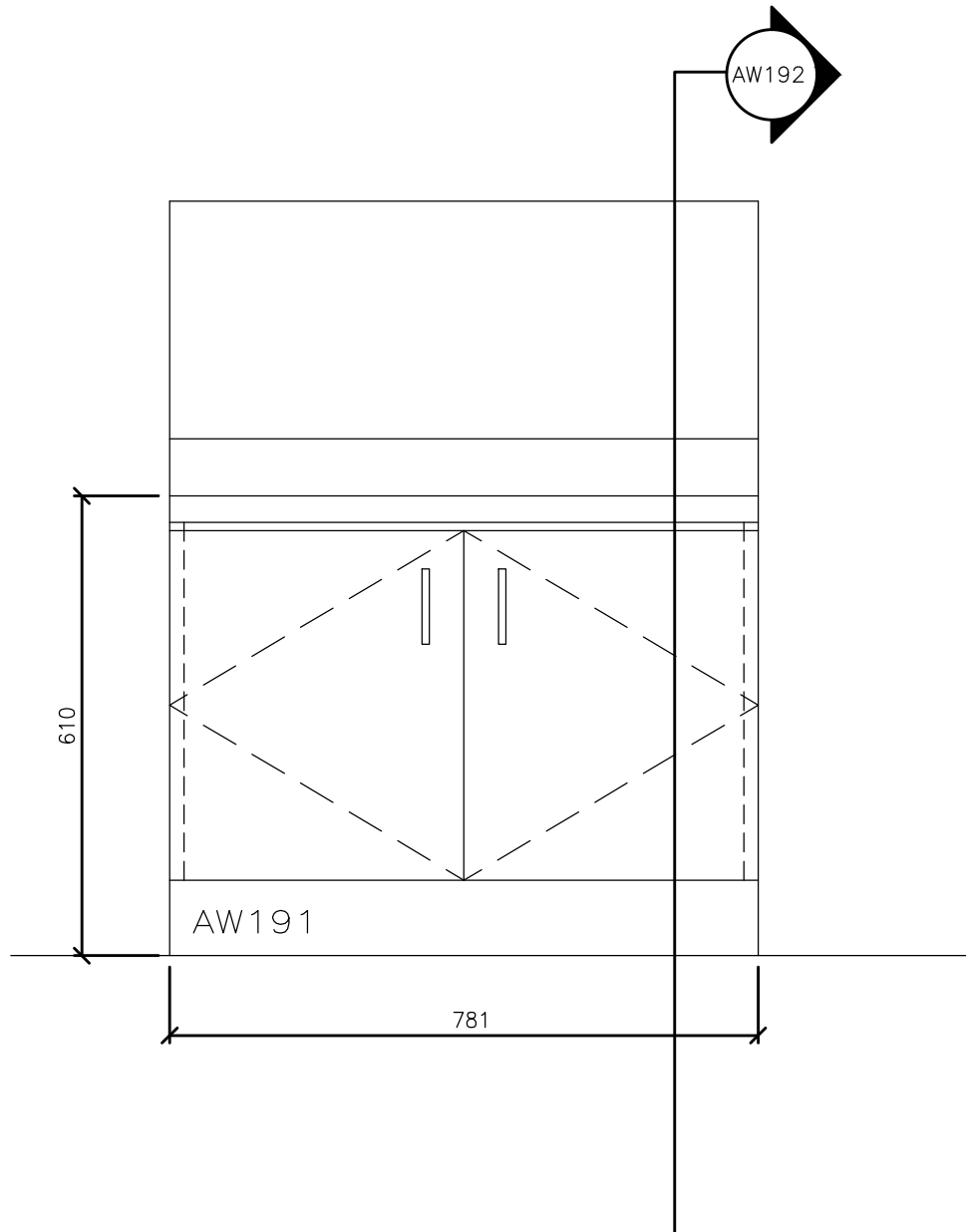
REFER TO AW001 FOR MILLWORK LEGEND

# AW106 - SECTION

|        |          |
|--------|----------|
| PROJ:  | 20118    |
| SCALE: | 1:10     |
| DRAWN: | GB       |
| DATE:  | 22 12 05 |



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| ISSUE/REV.   | 00 |
| AD           |    |
| <b>AW106</b> |    |



NOTE: MILLWORK DETAILS PREPARED BY WRDSB

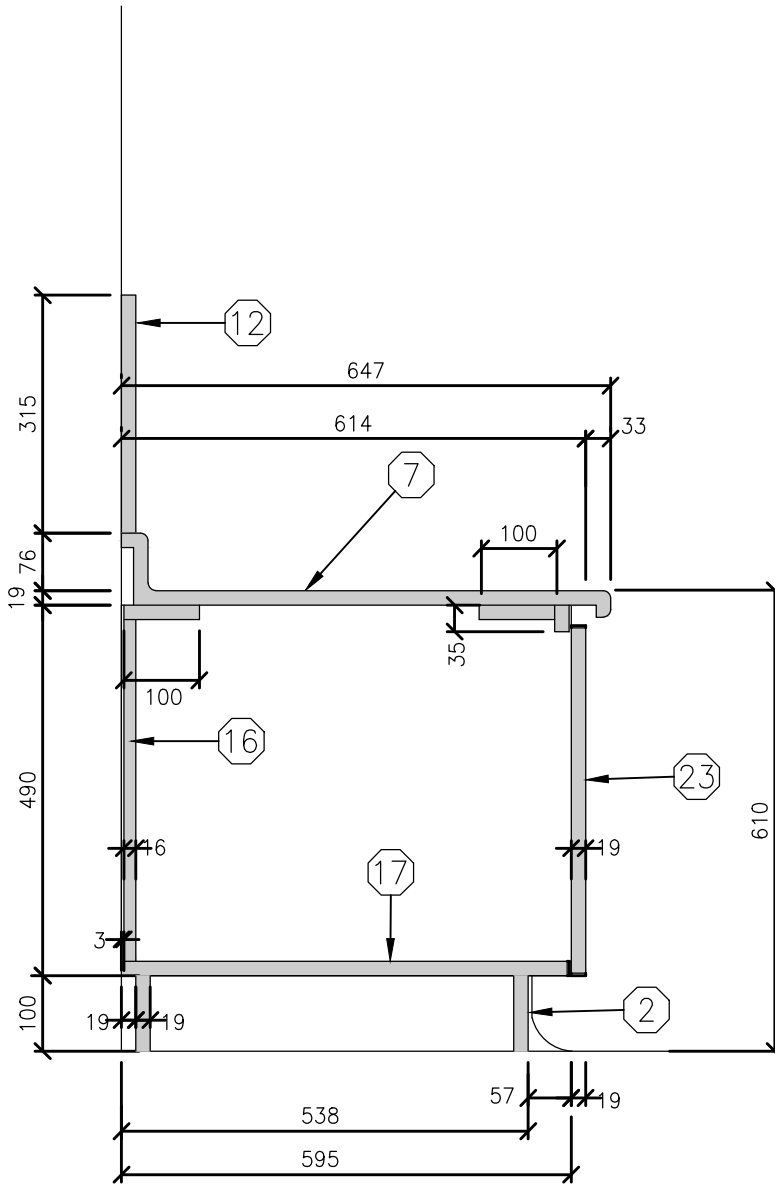
**AW191 - KINDERGARTEN  
LOWER CABINET ELEVATION**

|        |          |
|--------|----------|
| PROJ:  | 20118    |
| SCALE: | N.T.S.   |
| DRAWN: | GB       |
| DATE:  | 22 12 05 |



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|--------------|----|
| ISSUE/REV.   | 00 |
| AD           |    |
| <b>AW191</b> |    |





NOTE: MILLWORK DETAILS PREPARED BY WRDSB

REFER TO AW001 FOR MILLWORK LEGEND

AW192 - KINDERGARTEN  
LOWER CABINET SECTION

PROJ: 20118  
SCALE: 1:10  
DRAWN: GB  
DATE: 22 12 05

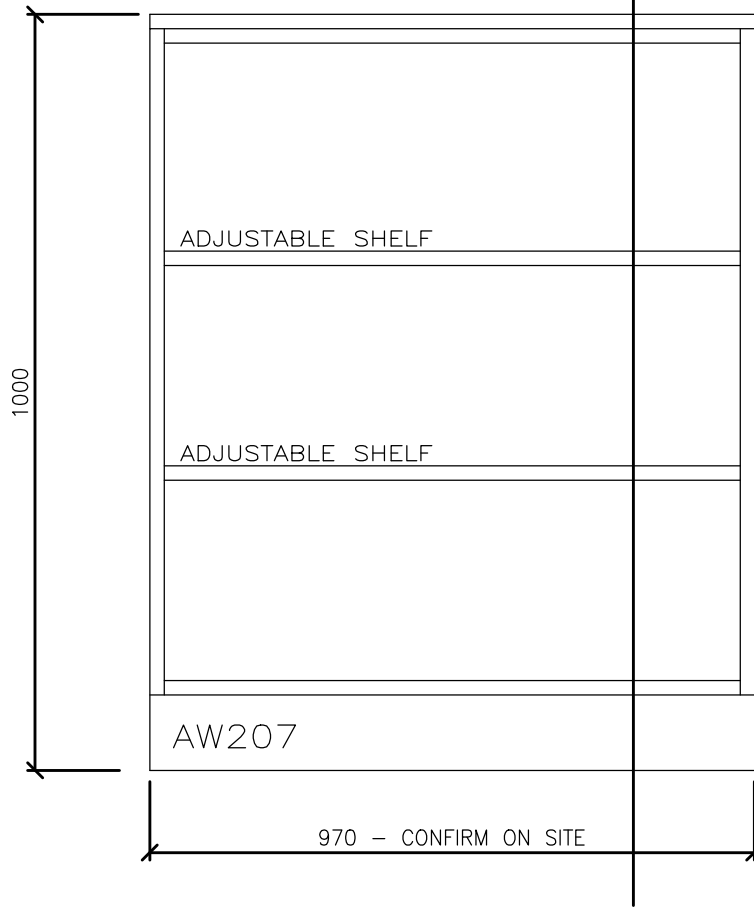


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AW192



AW209 - 305  
AW210 - 375



NOTE: MILLWORK DETAILS PREPARED BY WRDSB

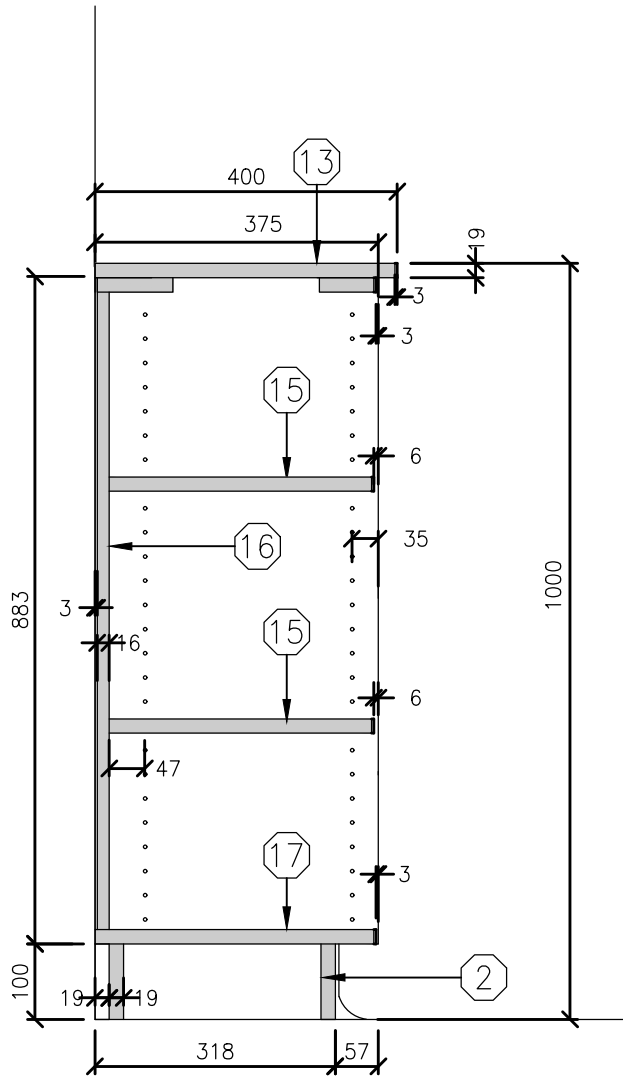
REFER TO AW001 FOR MILLWORK LEGEND

# AW207 - ELEVATION

|        |          |
|--------|----------|
| PROJ:  | 20118    |
| SCALE: | 1:10     |
| DRAWN: | GB       |
| DATE:  | 22 12 05 |



|              |    |
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| ISSUE/REV.   | 00 |
| AD           |    |
| <b>AW207</b> |    |



NOTE: MILLWORK DETAILS PREPARED BY WRDSB

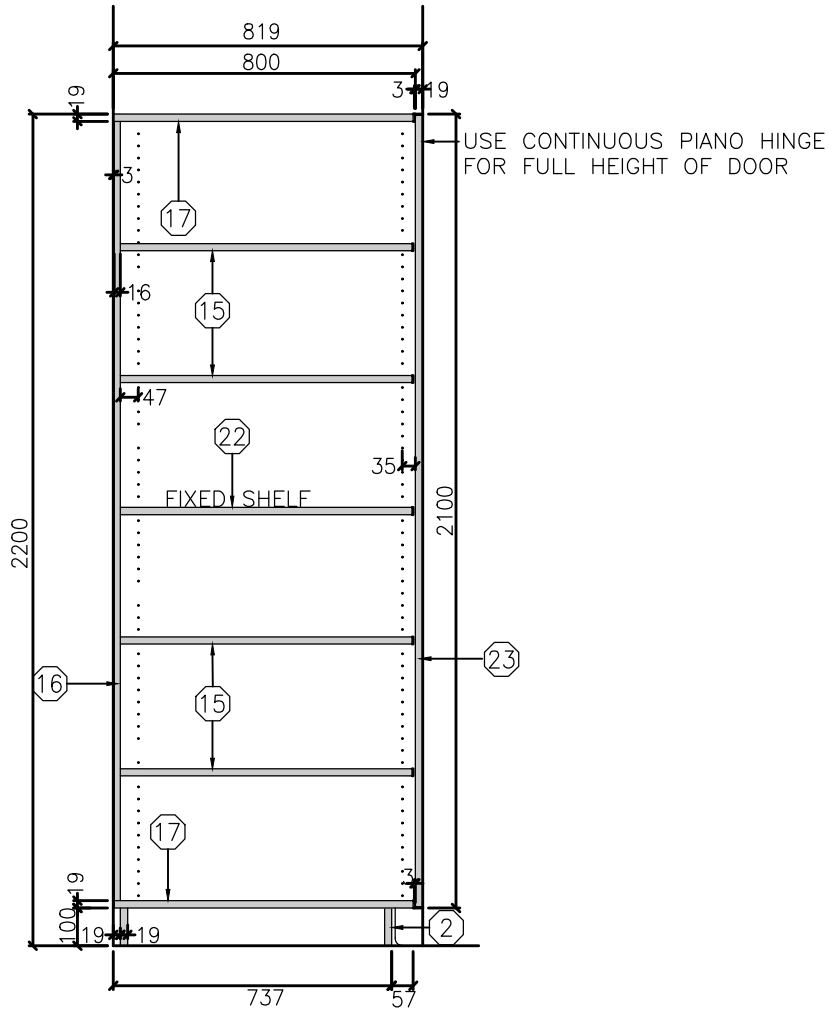
REFER TO AW001 FOR MILLWORK LEGEND

# AW210 - SECTION

|        |          |
|--------|----------|
| PROJ:  | 20118    |
| SCALE: | 1:10     |
| DRAWN: | GB       |
| DATE:  | 22 12 05 |



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| ISSUE/REV.   | 00 |
| AD           |    |
| <b>AW210</b> |    |



NOTE: MILLWORK DETAILS PREPARED BY WRDSB

REFER TO AW001 FOR MILLWORK LEGEND

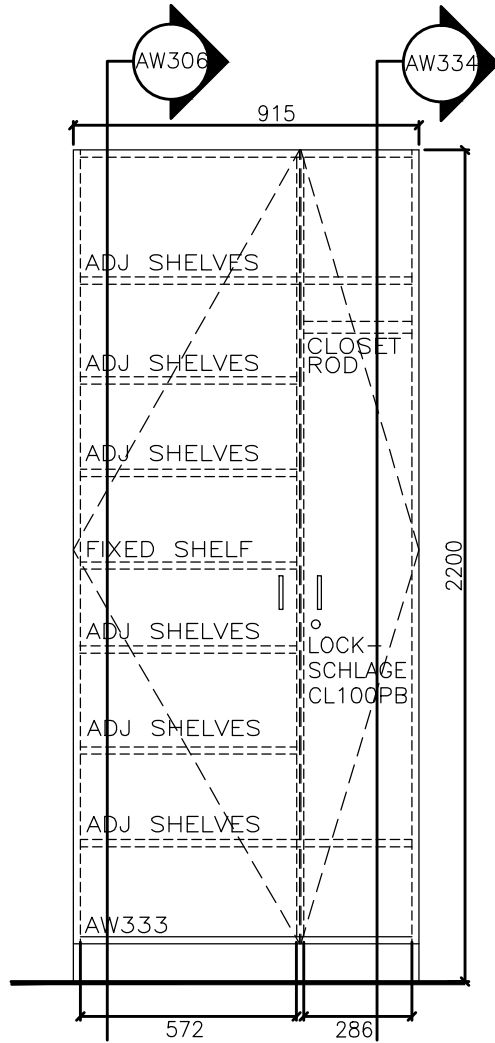
# AW306 - SECTION

|        |          |
|--------|----------|
| PROJ:  | 20118    |
| SCALE: | 1:20     |
| DRAWN: | GB       |
| DATE:  | 22 12 05 |



ISSUE/REV.  
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AD  
AW306



NOTE: MILLWORK DETAILS PREPARED BY WRDSB

REFER TO AW001 FOR MILLWORK LEGEND

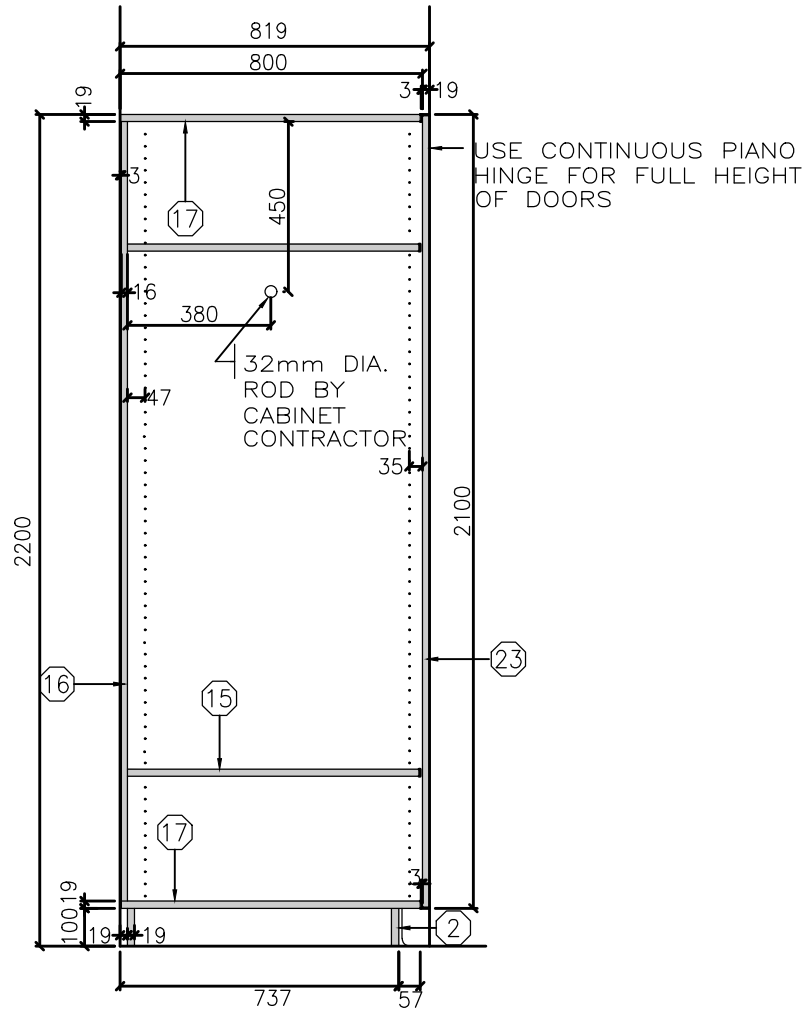
# AW333 - ELEVATION

|        |          |
|--------|----------|
| PROJ:  | 20118    |
| SCALE: | 1:20     |
| DRAWN: | GB       |
| DATE:  | 22 12 05 |



ISSUE/REV.  
00

AD  
**AW333**



NOTE: MILLWORK DETAILS PREPARED BY WRDSB

REFER TO AW001 FOR MILLWORK LEGEND

# AW334 - SECTION

|        |          |
|--------|----------|
| PROJ:  | 20118    |
| SCALE: | 1:20     |
| DRAWN: | GB       |
| DATE:  | 22 12 05 |



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|--------------|----|
| ISSUE/REV.   | 00 |
| AD           |    |
| <b>AW334</b> |    |