



Niagara Catholic District School Board

427 Rice Road, Welland, ON L3C 7C1

Gymnasium HVAC Upgrades – Notre Dame CES, Niagara Falls Tender #T24-002

February 7, 2024

The Niagara Catholic District School Board, hereafter referred to as NCDSB or the Board, is interested in receiving tender submissions from your firm to provide all material, labour and equipment to perform Gymnasium HVAC Upgrades – Notre Dame CES, Niagara Falls, ON, as specified. **Work must commence on or about March 11, 2024, and must be completed by August 30, 2024.**

Mandatory site meeting Tuesday February 13, 2024, starting at 9:30 a.m. local time:

Notre Dame Catholic Elementary School–6559 Caswell Street, Niagara Falls, ON

Questions arising from this request must be in writing and directed to Mark Ferri, Administrator of Purchasing Services e-mail: mark.ferri@ncdsb.com and be received no later than Tuesday February 20, 2024 at 1:00 p.m. local time

TENDERS ARE TO BE RETURNED TO:

Mark Ferri - Administrator of Purchasing Services

Niagara Catholic District School Board, 427 Rice Road, Welland, ON L3C 7C1

CLOSING DATE AND TIME:

Thursday February 29, 2024, on or before 2:30 p.m. local time.

Submissions received after closing deadline will be returned unopened. Submissions must be signed by an authorized representative of the Bidding firm.

IMPORTANT: Sealed tenders must be returned in an envelope marked: “**Gymnasium HVAC Upgrades – Notre Dame CES, Niagara Falls Tender #T24-002**” and company name and address clearly shown on the envelope.

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INSTRUCTIONS TO BIDDERS

The Niagara Catholic District School Board is interested in obtaining Proposals for a service provider to provide all material, labour and equipment to provide interior renovations, as specified.

1.0 SUBMISSION OF TENDERS

- 1.1 Proposals must be received prior to the closing date and time on the Tender Proposal Form provided.
- 1.2 One (1) original copy of the tender submission is to be provided.
- 1.3 Tenders shall be submitted in a sealed envelope, marked with the Tender number and the title of the Tender, and addressed and delivered to the Niagara Catholic District School Board, Purchasing Services Department, 427 Rice Rd. Welland, Ontario, L3C 7C1
- 1.4 **Please Note: The Catholic Education Centre, 427 Rice Road, Welland, ON is open weekdays from 8:30 a.m. to noon and 1:00 p.m. to 4:30 p.m. (closed daily from noon to 1:00 p.m.).**
- 1.5 Proposals submitted by fax or email will not be accepted.
- 1.6 It is the sole responsibility of each Bidder to make sure that its Tender submission is delivered and accepted at the correct address no later than the closing date and time. Proposals shall be deemed to have been submitted only when actually marked as received at the Board offices. Submissions received after the specified closing date and time will be returned unopened to the Bidder.

2.0 FORM OF SUBMISSION

- 2.1 Every proposal shall be submitted on the TENDER PROPOSAL FORM, and shall be completed without interlineations, alteration or erasure of or with respect to any pre-printed text provided by the Board. The Board reserves the right to reject any proposal where the pre-printed text has been altered.
- 2.2 Proposal submissions shall bear the original signature of the Bidder (or, in the case of a Proposal submitted by a corporation, an authorized signing officer of the corporation), inscribed in the space provided.
- 2.3 All blank spaces provided on the Tender Proposal Form shall be filled in including alternate, separate, and additional or unit prices.

3.0 PRICES

- 3.1 The Tender will be awarded by area to the lowest compliant and capable Bidder.

A	Pricing	100%
B	References/Reputation	Pass / Fail

- 3.2 The Board reserves the right to correct a blatant computational or other mathematical error evident on the face of the proposal; however, unit prices will not be adjusted.
- 3.3 Prices quoted must be expressed in accordance with our specified unit of measure.
- 3.4 Alternate Prices, if any, to be submitted with the Proposal Form provided. Alternate prices offered by bidders will be considered if included. Any such alternates shall be submitted with the Proposal Form on a separate sheet and shall be signed by the authorized bidding officer. Alternates shall not affect the base bid price in terms of selection of successful bidder.
- 3.5 All prices to be tendered in Canadian Funds, FOB Destination. HST will be extra and **should not** be included in proposal prices.
- 3.6 The Board reserves the right to disqualify a Bidders' proposal if they receive a "Fail" reference rating.
- 3.7 In the case of two of the lowest Bids being identical, the Board, in the presence of two Board witnesses, will flip a coin to determine the Successful Bidder.

4.0 CONFIDENTIALITY

- 4.1 It is the Board practice to publish the name of the successful Bidder(s). The Board shall make every effort to safeguard the confidentiality of other information included in each submission, however all submissions are subject to the provisions of the *Municipal Freedom of Information and Privacy Act* and the *Personal Information Protection and Electronic Documents Act*.

5.0 CONFLICT OF INTEREST

- 5.1 No employee of the Board shall personally sell goods or services to the Board, nor have a direct or indirect interest in a company that sells goods or services to the Board. The Board may reject any Proposal submitted, or cancel any contract awarded, in contravention of this requirement.

6.0 WITHDRAWAL OF PROPOSALS BY BIDDER

- 6.1 A Bidder may withdraw a submission at any time prior to the closing date and time by delivering a written request to that effect to the address specified for the deposit of tender, but no such request received after that closing date and time shall be effective. A withdrawal request shall be effective only where made in writing, on company letterhead, and actually received by the Purchasing Services Department. A faxed withdrawal may be accepted where its authenticity appears genuine in the absolute discretion of the Administrator of Purchasing Services.
- 6.2 A Bidder who withdraws a submission prior to the closing time and date may submit a revised proposal at any time prior to that closing date and time, but otherwise no amendment may be made to a proposal after it has been submitted, and in particular no amendment may be made to a proposal orally, or by fax, email, or otherwise than by a sealed document.

However, if more than one proposal has been inadvertently submitted prior to the official closing date and time, the last submission received shall supersede and invalidate all those previously submitted by that Bidder

7.0 OPEN FOR ACCEPTANCE

- 7.1 A submission shall be irrevocable (i.e. open for acceptance by the Board) for a period of ninety (90) days following the closing date.

8.0 FORMATION OF AN AGREEMENT

- 8.1 The Board will issue a purchase order(s) to the Successful Bidder(s) which will incorporate all of the terms and conditions of the Tender and the Agreement. **Notification of award will be made via Biddingo.com**

9.0 INTERPRETATION, CLARIFICATION AND ADDENDA

- 9.1 The Board reserves the right at any time prior to the closing time
- To withdraw or cancel the tender;
 - To extend the time for the submission of tender; or

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- To modify these Instructions, the Tender Proposal Form, and the Specifications by the publication of an Addendum or other notice, and the Board shall not be liable for any expense, cost, loss or damage incurred or suffered by any Bidder (or any other person) as a result of its so doing.
- 9.2 All Addenda will be posted on the Biddingo website. It is the responsibility of the Bidder to check for Addenda at Biddingo.com.
- 9.3 All Addenda issued shall become part of the tender documents and will be considered in determining the proposal prices.
- 9.4 It is the responsibility of the Bidder to seek clarification of any matter that they consider unclear before submitting a Tender. Any request for clarification of these Instructions, the Tender Proposal Form, or any of the submission documents considered to be material shall be submitted in writing prior to Tuesday February 20, 2024 – 1:00 p.m. local time. All questions will be answered and posted to the Biddingo website by Thursday February 22, 2024 – 3:00 p.m.
- 9.5 All communication between a Bidder and the Board shall be in writing and be directed to the designated representative shown on the tender cover page (including requests for information, instructions or clarification). Written answers or clarifications shall be shared with all Bidders and issued in the form of an Addendum. The Board shall not be bound by any oral instruction, amendment, clarification, information, advice or suggestion from any member of the Board's staff or Consultant to the Board.
- 9.6 Where a tender has been received by the Board prior to the publication of an addendum or notice, the Board shall allow the Bidder concerned to submit a revised submission prior to the closing date and time or to send a written acknowledgment that the original submission shall stand.

10.0 CONDITIONS OF THE TENDER**10.1 Proposal Timelines:**

Issue Request for Proposal	February 7, 2024
Mandatory Site Meeting	February 13, 2024 9:30 am
Questions in Writing Deadline	February 20, 2024 1:00 pm
Response to Submitted Questions	February 22 2024 3:00 pm
Proposal Closing Date and Time	February 29, 2024 2:30 pm

- 10.2 Where in the view of the Board, an insufficient number of submissions have been received; the Board may cancel and re-issue the tender (on the same or revised terms from the original request).
- 10.3 Where the contract is awarded to the highest ranked qualifying Bidder, the Board may negotiate amendments to the contract or to the work to be done or services or materials to be supplied under the contract and no other Bidder shall have any right to object that its Tender submission would have been ranked higher had the negotiated amendments been included in the original tender.
- 10.4 Regardless if a submission otherwise satisfies the requirements of the tender, the NCDSB reserves the right to reject any submission received from a person or agency that:
- I. Is or has been involved in litigation with the Board, within the five year period preceding the date of the proposal.
 - II. The Board has made a claim under a bid bond, a performance bond or a warranty bond within a five year period preceding the date of the proposal.
 - III. In the opinion of the Board or its legal advisors, does not possess the experience, or financial, technical, personnel or other resources that may reasonably be expected to be necessary in order to carry out the obligations that the Bidder proposes to assume under the terms or its submission.
- 10.5 Bidders submitting shall be actively engaged and thoroughly experienced in the lines of work required and shall be able to refer to previous work of a similar nature satisfactorily performed by them. The contractor shall carry out all work and perform all of its obligations in a good professional manner, according to the best standards of practice of the industry, profession or trade in which the contractor carries on business (including any applicable standards of professional conduct).
- 10.6 The contractor shall employ properly qualified and experienced workers to carry out all work required in connection with the Contract. The contractor shall neither bring onto nor allow the use of tobacco, alcohol or illegal narcotics or controlled substances upon any Board property.
- 10.7 The contractor shall use only new, first class materials, and shall cause their suppliers to do the same. The contractor shall correct or replace any defective work or material at its own expense, upon the direction of the Board. Where the Bidder refuses or neglects to remove any defective

work or material supplied by it in accordance with a written notice by the Board, such work or material may be removed by order of the Board at the Bidders expense. The Board reserves the right to deduct the cost and expense of such removal from any moneys due to or that become due to the contractor on any account.

- 10.8 The Bidder shall have an adequate work force with proper equipment in good working condition, and shall have ready access to all materials, equipment and accessories required to perform its obligations under the contract.
- 10.9 Three (3) references, with one from a School Board or Education Institute **must** accompany the submission. Only the references from the best ranked Bidder(s) shall be checked. If the references do not indicate performance satisfactory to the NCDSB, the Bidder will not be considered. **The Board reserves the right to check references other than those provided by the bidder.**
- 10.10 All electrical equipment must be approved by agencies recognized by the Electrical Safety Authority of Ontario and must be labeled accordingly. The Board reserves the right to refuse delivery of or return any equipment received without a recognized certification sticker affixed.
- 10.11 Electrical Under Voltage Protection – All electrically operated equipment shall be supplied with electrical controls that meet the requirements of the Ontario Electrical Safety code, Section 20-400.
- 10.12 Payment shall be made to the supplier on a net thirty (30) day basis, after completion of the work and upon receipt of a properly executed invoice. Invoices shall include the name of the school / location, the dates the services were provided, the unit cost per service, a subtotal, the payment terms/discount, the amount of Harmonized Sales Tax (HST) and the Total with HST.

Original invoice covering services performed should be mailed to:

Accounts Payable Department
Niagara Catholic District School Board
427 Rice Rd.
Welland, ON, L3C 7C1

Or emailed to: accounting@ncdsb.com

- 10.13 **The Board will assume no responsibility for payment for any services over and above those specified, unless approved in advance in writing by the Boards' Authorized Representative(s)**

11.0 GUIDELINES REGARDING TENDER IRREGULARITIES

- 11.1 Late submissions will not be accepted.
- 11.2 Submissions that are not completed in full, or are not typewritten, or not legible writing (in ink) may be rejected.
- 11.3 The Board reserves the right to reject qualified or conditional submissions, i.e. tenders which are submitted subject to a caveat added or alterations to the Tender Proposal Form, or under a covering letter.
- 11.4 Unsigned submissions will be rejected.
- 11.5 Proposals not complying with these instructions, and any addendum will be rejected.
- 11.6 Proposals not completed on the proper form, or received on a document other than the original document supplied by the Board, may be rejected by the Board at its discretion.
- 11.7 The Board may at its discretion reject any proposal where the Tender Proposal Form or related document contains any erasure, change, over-writing, white-out, cross-out or strike out, where the same has not been initialed by the Bidder, or where (in absolute discretion of the Administrator of Purchasing) the effect of that amendment is ambiguous or otherwise unclear.
- 11.8 Where an Addendum is not acknowledged on the Tender Proposal Form, the Board may reject the Proposal where the Addendum has financial implications, unless it is clearly evident, in the absolute discretion of the Administrator of Purchasing, that the Addendum has been factored into the prices quoted.

12.0 BRAND NAME

- 12.1 Unless otherwise specified on the Tender Proposal Form, any reference to the trade name, brand name or catalogue number of a particular manufacturer shall be understood to have been made solely for the purpose of establishing and describing general performance and quality levels of the item to be supplied and shall not be construed to restrict Bidders to that manufacturer.
- 12.2 Despite subsection 12.1, if an item is other than the one specified in this proposal, it is the Bidder's responsibility to demonstrate that the product proposed meets the specifications, and the Bidder shall submit brochures and samples upon request and provide full specifications in detail on the

item(s) proposed. The Board shall be the sole judge (in its absolute discretion) as to whether an item proposed meets its specifications.

13.0 LIABILITY

- 13.1 The successful Bidder shall provide and maintain, during the term of the Contract, Commercial General Liability Insurance acceptable to the NCDSB and subject to limits of not less than \$5,000,000 inclusive per occurrence for bodily injury, death and damage to property including loss of use thereof.
- 13.2 The successful Bidder, their agent, all workers and persons employed by them, or under their control, will use due care that no person or persons are injured and that no property is damaged in the execution of the work and the successful Bidder will be solely responsible for all damages to person or property, including theft.

14.0 ANTI LOBBYING RESTRICTIONS AND REQUIRED DISCLOSURE

- 14.1 Bidders, their company staff members, or anyone involved in preparing their proposal submission must not engage in any form of political or other lobbying whatsoever with respect to this project or seek to influence the outcome of the proposal and subsequent procurement process. This anti-lobbying restriction extends to all Board staff and elected trustee members of the Board.
- 14.2 In the event of any such lobbying, the Board may reject any proposal submission by that Bidder without further consideration and terminate that Bidder's right to continue in the proposal and any subsequent procurement process. All correspondence by interested parties with the Board must be directly and only with the Board contact person identified in the tender document. It should be duly noted by all Bidders that this anti-lobbying restriction extends from the release date of this tender through to the date and time when the Board formally awards the contract by purchase order or other means. Any lobbying undertaken during this time frame by any Bidder or the Bidder's company staff members, or anyone involved with their tender submission may result in immediate disqualification from the process. This anti-lobbying restriction is not meant to affect the day-to-day operations of the Board, its staff and the elected trustees of the Board that may necessarily include contact with potential proponents to this Proposal regarding other business.
- 14.3 This section shall not be intended to disallow any meetings, interviews, or clarifications requested or authorized by the Board, its authorized staff, the Board's representative for this work or their authorized designates.

15.0 ENVIRONMENTAL CONSIDERATIONS

- 15.1 The NCDSB encourages vendors to minimize the amount of packaging used for transporting materials to our facilities and to reduce multiple layers of packaging whenever product integrity will not be threatened. The Board also requests that vendors use “green” packaging made with recycled content materials and/or materials which are recyclable or biodegradable.

The NCDSB expects responsible vendors to do their part in helping to reduce the volume of materials that get sent to landfills and reduce the environmental impact associated with packaging materials.

16.0 PRESENTATIONS

- 16.1 Upon review of the proposals the NCDSB may request the short-listed proponents to make a presentation to the committee in order to clarify or verify the proposal and to develop a comprehensive assessment of the proposal. Presentations are at the option of the Board and may not necessarily be conducted. Proponents are therefore encouraged to present as complete a proposal as possible initially. If deemed necessary, proponents will be contacted to schedule a specific date and time for a presentation.

17.0 ACCESSIBILITY

- 17.1 The Successful Bidder shall comply with the provisions of the Accessibility for Ontarians with Disabilities Act, 2005, and the Regulations there under with regard to the provision of its goods or service to persons with disabilities. The Successful Bidder acknowledges that pursuant to the Accessibility for Ontarians with Disabilities Act, 2005, the Board must, in deciding to purchase goods or service through its procurement process, consider the accessibility for persons with disabilities to such goods or service. This legislation can be accessed through the following link to the Government of Ontario's website:
http://www.mcass.gov.on.ca/en/mcass/programs/accessibility/understanding_accessibility/aoda.aspx

18.0 PURPOSE AND TIME LIMITATION

The purpose of this request is to supply all material, labour and equipment necessary to complete the scope of work in a manner which is acceptable to the Niagara Catholic District School Board.

18.1 The contractor shall:

- a) Secure and maintain, during the full term of this Contract, liability insurance coverage to the extent of at least \$5,000,000 per incident and commercial general automobile liability insurance to the extent of \$2,000,000 per incident for all licensed vehicles provided; however, if the contractor has already such coverage on his business in the said amount, he/she shall not be required to place additional coverage. The NCDSB shall be designated as a named insured on any policy if requested.
- b) Enroll all workers, including all principals if so designated, and ensure all sub-contractor workers are enrolled under the Worker's Compensation Act and pay all rates and levies in connection therewith and do all things required of an employer under the said act. Where an independent operator, employer or executive officer provides onsite work, they must first have applied to and be deemed a worker by the Worker's Compensation Board.
- c) Pay all employees' wages and salaries promptly and pay for all materials promptly and shall indemnify and save harmless the NCDSB from all claims for construction lien as registered during the term of this contract or after the expiration date of the same, whether such lien is valid or not. The contractor shall forthwith have the said lien removed from the title of the school properties, or any part thereof, at the expense of the contractor and the contractor agrees to indemnify the NCDSB, against any damages and /or costs suffered or incurred by it as a consequence of the registration of any such lien.

18.2 The contractor shall furnish all materials, labour, and equipment and any other incidentals required for the completion of work as listed, except as otherwise specified.

18.3 The contractor shall obtain any required permits and conform to any existing applicable codes, such as the Canadian Standards Association, Underwriter's Laboratories of Canada, Ontario Fire Code, Ontario Building Code, Ministry of Labour, and all local Bylaws and any other applicable regulatory requirements.

18.4 The contractor shall be solely responsible for loss or damage of his tools, equipment or any materials on NCDSB property.

- 18.5 The amount payable to the contractor will not be increased or decreased by reason of any increase or decrease in the cost of plant equipment, labour, materials, taxes or the wage as set out in the contract or purchase order.
- 18.6 No variation from the work that may involve or will result in addition to the amount of the contract or reduction of quality, shall be proceeded with until written approval has been obtained from the NCDSB.
- 18.7 When there is a scheduled mandatory site meeting, each bidder must attend and examine the site to obtain a clear and comprehensive knowledge of the conditions and limitations thereof.
- 18.8 On completion of work, the site shall be left in a clean and orderly condition. All construction-generated debris shall be removed and disposed of off-site. Under no circumstances shall the contractor dispose of any materials in NCDSB garbage receptacles or dumpsters.
- 18.9 The contractor shall be responsible to meet quoted project completion deadlines.
- 18.10 If the contractor should neglect to execute the work properly or otherwise fails to comply with the requirements of the Contract to a substantial degree, the Board may:
 - a) Correct such default and deduct the cost thereof from any payment then or thereafter due to the contractor, or
 - b) Terminate the contractor's right to continue with the work in whole or in part or terminate the Contract.
- 18.11 Prior to commencement of work, the contractor shall review the asbestos report for the building (available at the building). The contractor shall evaluate the potential presence of asbestos in the specific work zone. If present, the Administrator of Facilities Services shall be notified, and no work is to proceed until any material containing asbestos have been dealt with in accordance with the "Specifications for Asbestos Control/Removal Work in the Niagara Catholic District School Board Facilities".
- 18.12 The contractor shall ensure the work zone is clearly delineated by means of visual marker or barricades and that no persons other than those employed by the contractor are present in the work zone.

Student safety is a paramount concern and the contractor must employ on their own initiative, any and all reasonable preventive measures to secure the safety of the students while performing the work.

- 18.13 The contractor shall be responsible for taking such action to prevent damage to surrounding structures, equipment or properties. The contractor shall be liable for the cost of any damage to surrounding structures, equipment, or properties resulting from the contractors, or sub-contractors, failure to take reasonable precautions, negligence or neglect.
- 18.14 It shall be the contractor responsibility to ensure all workers including owners designated as workers on the project abide by the regulations for construction projects as outlined by the Occupational Health & Safety Act latest version, as well as any other safety standards that are applicable by law or established by generally accepted industry standards or by applicable industry associations.
- 18.15 The contractor agrees to indemnify the NCDSB against any claims, fines and costs incurred by it as a result of the contractor or workers breaching the Occupational Health & Safety Act herein including costs incurred in preparing for and attending any hearing or trials in connection therein.
- 18.16 Except as expressly and specifically permitted in these instructions, no proponent shall have any claim for any compensation of any kind whatsoever as a result of participating in this tender and by submitting a proposal each proponent shall be deemed to have agreed that it has no claim.

19.0 GENERAL CONDITIONS AND REQUIREMENTS

Start Date

- 19.1 Within two weeks of award of contract or letter of intent a construction schedule with start/completion dates must be submitted by the contractor. Please note that work must commence on or about March 11, 2024, and must be completed by August 30, 2024.

Interruptions

- 19.2 The Contractor shall not interfere, interrupt or inconvenience any program or operations in the school or cause it to be done so by others unless agreed upon by school administration. Furthermore, the contractor is expected to fully cooperate with school administration in the execution of all work and schedules.

Pre-Construction Site Meeting

- 19.3 Prior to the project commencement date, a meeting will be held at the school site with the following parties present (as required): Generals and/or Sub-Contractors, The Board and/or Consultant, School Principal / Vice Principal, Head Custodian.
The purpose of this meeting will be to discuss pertinent concerns, the proposed work schedule, and any other relevant project details.

Contractor's Use of Site

- 19.4 The Contractor shall be responsible for the following:
- a) Removal and disposal of all surplus or waste material, with the exception of that specifically identified as Board property.
 - b) Not encumbering the work site with material and equipment.

Protection of Adjacent Structures or Properties

- 19.5 The Contractor shall be responsible for providing protection to surrounding structures, equipment and property. The contractor shall be liable for the costs to repair any damage to the above.

Environmental Protection

- 19.6 The Contractor shall dispose of all waste or surplus materials, used or generated on the site, in accordance with Ministry of Energy and Environment Standards and Regulations.

Codes and Standards

- 19.7 All work shall be performed in accordance with all national, provincial or municipal codes. The contractor shall accept liability for any work required to complete the job or rectify deficiencies in accordance with such codes and shall indemnify the Board in the event of injury or damage, claim or action, arising from the Contractor's, or sub-contractors, failure to comply with all applicable codes and regulations.

Workmanship

- 19.8 All work shall be performed by qualified and certified personnel licensed in the Province of Ontario and trained in the operation of equipment and the execution of work required.

Safety Requirements

- 19.9 The Contractor shall comply with:
- a) All requirements set forth in the Occupational and Safety Act for Industrial Establishments.
 - b) The requirements of the Workplace Hazardous Materials Information System (W.H.M.I.S.) regarding the use and storage of hazardous materials.

Sub Contracts and Assignment

- 19.10 No sub-contractors are to be used for this work unless prior written authorization is obtained from the Board. It is mutually agreed and understood that the Successful Bidder shall not assign, transfer, convey, sublet or otherwise dispose of the contract or the right, title or interest therein, or the Bidder's power to execute such a contract, to any other person, firm, company or corporation without the express written consent of the Board. Any unauthorized, assignment shall be void and have no force or effect against the Board. If assignment is authorized, any work undertaken by sub-contractor shall, in no way, relieve the Successful Bidder of its responsibilities to the Board.

Services Performance Warranty

- 19.11 The contractor warrants that the services delivered by the contractor to the NCDSB under this contract shall be performed promptly and completely in a professional manner, including consistent, uninterrupted delivery and performance of such service.

Termination

- 19.12 The NCDSB shall have the right to forthwith terminate this Contract without prejudice to any other rights which it may have in this Contract, in law or in equity, upon the occurrence of any one or more of the following events (hereinafter called a "Default"):
- a) The Supplier defaults in the performance of any of its material obligations provided for in this Contract or fails to diligently provide any related services in accordance with the terms and conditions of this Contract.
 - b) The Supplier fails to conform to any relevant federal, provincial, or municipal law, regulation, by-law or other requirement, including, without limitation, any applicable health and safety act or regulation.

- c) The Supplier is unable to pay its debts when due, makes any assignment for the benefit of creditors, files any petition under the bankruptcy or insolvency laws of any jurisdiction, has a receiver or trustee to be appointed for its business or partners, or is adjudicated to be bankrupt or insolvent.

In the event of Default of this Contract, the NCDSB is required to serve written notice of such default or contravention to the Supplier. If within ten (10) days of the date of receipt of such notification the Supplier fails to rectify the default or cease the contravention, the NCDSB may terminate this Contract by providing the Supplier with twenty (20) days' notice of termination.

In the event of a violation that is deemed severe by the Board, the Board may terminate with a shorter or immediate notice.

Debriefing

- 19.13 Not later than sixty (60) days following the date of posting of a contract award notification in respect of the RFP, a Proponent may contact the Administrator of Purchasing Services requesting a debriefing from the Board.

Any request that is not timely received will not be considered and the Proponent will be notified in writing.

The Board will not disclose submission information from other Proponents. The intent of the debriefing information session is to aid the Proponent in presenting a better Proposal in subsequent procurement opportunities.

Dispute Resolution

- 19.14 The bid dispute resolution process is intended to ensure that any dispute is handled in an ethical, fair, reasonable, and timely fashion. This bid dispute resolution procedure complies with bid protest or dispute resolution procedures set out in the BPS procurement directives and applicable trade agreements.

Where a proponent wishes to dispute the outcome of a project, subsequent to a debriefing with Purchasing Services, the process outlined below is to be followed:

- I. The aggrieved party (aggrievor) is to file their bid protest with the Administrator of Purchasing Services in writing, within 7 business days of the debriefing meeting. The aggrievors filing should include:

- Their name and address
 - Identification of the contract or bid solicitation being protested
 - Detailed and factual statement of the grounds for protest
 - Supporting documentation
 - Desired relief, action or ruling
- II. The Administrator of Purchasing Services will respond to the aggrieved, within 10 business days of receiving the bid protest notice.
- III. If the aggrieved is not satisfied with the resolution, the aggrieved must contact the Superintendent of Business & Financial Services and copy the Administrator of Purchasing Services, by certified mail, within 10 business days of receiving the first response from the Administrator of Purchasing Services.
- IV. The Superintendent of Business & Financial Services will respond to the aggrieved, by certified mail, within 10 business days of receiving the bid protest notice.
- V. The final decision on the issue will be made by the Superintendent of Business & Financial Services and will be resolved within 10 business days of receiving the bid protest.

20.0 SCOPE OF WORK AND DRAWINGS

Specifications - Gymnasium HVAC Upgrades – Notre Dame CES #T24-002 (383 pages)

Drawings - Gymnasium HVAC Upgrades – Notre Dame CES #T24-002 (28 pages)

Note:

Nothing contained herein, nor on the drawings shall be construed to relieve the contractor from making good and perfect, in all the usual details of construction, the work involved in the completion of these various projects.

**Niagara Catholic District School Board**

427 Rice Road, Welland, ON L3C 7C1

Gymnasium HVAC Upgrades – Notre Dame CES, Niagara Falls Tender #T24-002

21.0 BID SUBMISSION CHECKLIST

21.1 Below is a list of mandatory requirements. If you answer “no” to any of the questions below, then your submission will be in jeopardy of being disqualified.

This checklist does not form part of the tender and is provided for information only.

Mandatory Requirements	Yes / No
All documents requiring signature must be signed by authorized representative of the Bidding firm.	
One (1) original copy of all documents requiring completion must be submitted with your proposal.	
Proposals must be received prior to the closing date and time	
Three (3) references, with one from a School Board or Education Institute must accompany the submission.	
Tenders shall be submitted in a sealed envelope, marked with the Tender number and the title of the Tender, and addressed and delivered to: Niagara Catholic District School Board c/o Mark Ferri, Administrator of Purchasing Services, 427 Rice Road, Welland, ON L3C 7C1	
Every proposal shall be submitted on the Tender Proposal Form, and shall be completed without interlineations, alteration or erasure of or with respect to any pre-printed text provided by the Board.	
All blank spaces provided on the Tender Proposal Form shall be filled in including alternate, separate, and additional or unit prices.	



Niagara Catholic District School Board
427 Rice Road, Welland, ON L3C 7C1
Gymnasium HVAC Upgrades – Notre Dame CES, Niagara Falls Tender #T24-002

**GYMNASIUM HVAC UPGRADES –
NOTRE DAME CES, NIAGARA FALLS
TENDER #T24-002**

PROPOSAL ENVELOPE ADDRESS LABEL

This sample envelope label serves as a guide showing the information required on the outside of your submission envelope.

Proposal must be submitted in a sealed envelope to:

----- ✂ ----- ✂ -----

**GYMNASIUM HVAC UPGRADES –
NOTRE DAME CES, NIAGARA FALLS
TENDER #T24-002**

**Niagara Catholic District School Board
c/o Mark Ferri, Administrator of Purchasing Services,
427 Rice Road, Welland, ON L3C 7C1**

Closing Date & Time: Thursday February 29, 2024 2:30 PM Local Time

COMPANY NAME: _____
(print)

CONTACT NAME: _____
(print)

CONTACT TITLE: _____
(print)

PHONE: _____

EMAIL: _____

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NO. DESCRIPTION

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A0.05	Site Plan
A1.00	Demolition Floor Plan
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A2.00	Floor Plan – Gymnasium
A2.05	Reflected Ceiling Plan
A2.10	Floor Plan - Library
A2.15	Roof Plan
A3.00	Gymnasium - Interior Elevations
A4.00	Gymnasium Court Layouts
A5.00	Millwork
A8.00	Room Finish and Door Schedules

STRUCTURAL DRAWINGS

S0.0	General Notes
S1.0	Floor and Roof Plans

MECHANICAL DRAWINGS

M1.00	Drawing List, Key Plan and Legends
M2.00	Gym Floor Plan – Plumbing Installation
M3.00	Gym Floor Plan – HVAC Demolition
M3.01	Gym Floor Plan – HVAC Installation
M3.02	Gym Roof Plan – HVAC Installation
M4.00	Mechanical Details
ME5.0	Mechanical and Electrical Schedules

ELECTRICAL DRAWINGS

E0.00	Electrical Legends, Symbols and Drawing List
E1.00	Overall Plan
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E2.10	Gym Floor Plan - Power & Systems Demo
E3.00	Gym Floor Plan - Lighting New
E3.10	Gym Floor Plan - Power & Systems New
E4.00	Lighting Schedule and Details

End of Section



Environmental Services (Niagara) Ltd.

Tel: 905-984-3455

Fax: 905-984-3055

Our Compliments: 1-888-431-3986

Email ~ info@gbenvironmental.net



**2022 Asbestos Re-Assessment
Notre Dame Elementary School
6559 Caswell St
Niagara Falls, ON**

GBE Project #04-087-2022

November 15, 2021

Niagara Catholic District School Board
Attn: Tony Ferrara
Manager of Plant Services
427 Rice Rd.
Welland, On
L3C 7C1

Dear Tony:

Between July 1 and October 31, 2022, GB Environmental Services conducted a re-assessment to determine the presence and condition of asbestos containing materials identified within school buildings owned by the Niagara Catholic District School Board (NCDSB).

There is no recommended remediation items (asbestos and / or other hazardous material) identified while inspecting Notre Dame.

On behalf of GB Environmental Services, we would like to thank you for the opportunity to serve you. If you have any questions regarding this report, please call us at (905) 984-3455.

Sincerely,

Jim Anderson
Project Manager

2022 Asbestos Summary Listing

CONDITION:

Good: Materials observed to be in satisfactory condition, firmly bound or encapsulated and requiring no remedial action

Fair: Materials observed to be in a condition that does not currently require immediate remedial action. However, proactive measures to maintain or upgrade the surface finish of the material can be considered.

Poor: Materials that are damaged due to physical or chemical disturbance including: crumbling, blistering, nicks, gouges, abrasion, water damage or other damage. Remedial action is recommended.

CODING:

- A. A material which has been removed (A1) or encapsulated (A2);
- B. Material that has deteriorated in condition since the previous assessment (ie. good to fair or poor);
- C. Material which has been repaired or has improved in condition (ie. poor to fair or good);
- D. Material which has been deleted from the summary list due to errors in previous assessments;
- E. Material which has been added to the summary list due to errors in previous assessments;
- F. Additional information to distinguish between several types of the same material within the same room;
- G. Information contained within the summary list which was found to be incorrect;
- H. Material which was considered to be in poor condition and warrants the need for remedial action. A respective number (ie. 100-2016-1) is designated for the specific location of remediation.

PRIORITY:

Low: Material is damaged, but has a low potential for airborne fiber emission due to non-friability, inaccessibility, and / or other conditions;

Medium: Material is damaged, and has a moderate potential for airborne fiber emission due to friability, relative accessibility, and / or other conditions;

High: Material is damaged and is likely to result in airborne fiber emission if left in place. This includes friable debris, material likely to incur additional damage due to daily activities, and / or other conditions.



Plant ID #	Old Plant ID #	Asbestos Type	Comments	Friable	2021 Condition	Response
		Vermiculite	Block walls may contain vermiculite	Yes	Unkown	
Basement	No I.D.	Pipe Fittings		Yes	Good	
1.03	48	Pipe Fittings		Yes	Good	
1.03	48	2' x 4' Ceiling Tiles	Assumed asbestos containing	Yes	Good	
1.04	55	Pipe Fittings		Yes	Good	
1.04	55	2' x 4' Ceiling Tiles	Assumed asbestos containing	Yes	Good	
1.05	56	Pipe Fittings		Yes	Good	
1.05	56	2' x 4' Ceiling Tiles	Assumed asbestos containing	Yes	Good	
1.07	49	Pipe Fittings		Yes	Good	
1.07	49	2' x 4' Ceiling Tiles	Assumed asbestos containing	Yes	Good	
1.08	54	Pipe Fittings		Yes	Good	
1.08	54	2' x 4' Ceiling Tiles	Assumed asbestos containing	Yes	Good	
1.10	47	2' x 2' Ceiling Tiles	Assumed asbestos containing	Yes	Good	
1.10	47	Pipe Fittings		Yes	Good	
1.11	46	2' x 2' Ceiling Tiles	Assumed asbestos containing	Yes	Good	
1.11	46	Pipe Fittings		Yes	Good	
1.12	45	2' x 2' Ceiling Tiles	Assumed asbestos containing	Yes	Good	
1.12	45	Pipe Fittings		Yes	Good	
102	15	2' x 4' Ceiling Tiles	Assumed asbestos containing	yes	Good	
103	16	2' x 4' Ceiling Tiles	Assumed asbestos containing	Yes	Good	
103	16	Pipe Fittings		Yes	Good	
104	18	2' x 4' Ceiling Tiles	Assumed asbestos containing	Yes	Good	
104A	18A	Pipe Fittings		Yes	Good	
104A	18A	2' x 4' Ceiling Tiles	Assumed asbestos containing	Yes	Good	
106	32	Pipe Fittings		Yes	Good	
106A	33	Pipe Fittings		Yes	Good	
106A	33A	Pipe Fittings		Yes	Good	
107	31	9" x 9" Floor tiles		No	Good	
107	31	Pipe Fittings		Yes	Good	
109	36	Pipe Fittings		Yes	Good	
112	25	2' x 4' Ceiling Tiles	Assumed asbestos containing	Yes	Good	
112	25	Pipe Fittings		Yes	Good	
112A	27	12" x 12" Floor tiles	Assumed asbestos containing	No	Good	
112A	27	2' x 4' Ceiling Tiles	Assumed asbestos containing	Yes	Good	
112A	27	Pipe Fittings		Yes	Good	
113	24	2' x 4' Ceiling Tiles	Assumed asbestos containing	Yes	Good	
114	23	2' x 4' Ceiling Tiles	Assumed Asbestos containing	Yes	Good	
115	22	2' x 4' Ceiling Tiles	Assumed asbestos containing	Yes	Good	
116	21	Pipe Fittings		Yes	Good	
118	20	12" x 12" Floor tiles	Assumed asbestos containing	No	Good	
119	17	2' x 2' Ceiling Tiles	Assumed asbestos containing	Yes	Good	
119	17	12" x 12" Floor tiles	Assumed asbestos containing	No	Good	



Environmental Services (Niagara) Ltd.

Tel: 905-984-3455

Fax: 905-984-3055

Email ~ info@gbenvironmental.net



Asbestos Audit

Notre Dame Elementary School

6559 Caswell St.

Niagara Falls, ON

Niagara Catholic District School Board



Date: February 4, 2004

Reassessment November 15, 2022

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Section 1



Environmental Services (Niagara) Ltd.

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Our Compliments: 1-888-431-3986

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ASBESTOS AUDIT

February 4th, 2004

GB Environmental Services (Niagara) Ltd. was retained by the Niagara Catholic District School Board to carry out an updated survey of the report completed by Q-Tech in 1990.

The purpose of this report is to update any remediation work completed, as well as to check on the condition of any identified asbestos materials. If any new materials were found, a sample was taken of this material to accept / deny their existence as ACM containing.

The areas surveyed inside of the school were within accessible areas of the structure. Several areas, such as areas above plaster ceilings, roofing felts on flat built up asphalt roofing, refractory materials inside operating boilers and binding agent (glue) used on the 1 x 1 ceiling tiles, were not tested at this time.

At Notre Dame Elementary School the following Asbestos Containing Materials (ACM) were identified.

1. 9" x 9" vinyl floor tiles (various colours)
2. 12" x 12" vinyl floor tiles (various colours)
3. Pipe elbows and joints
4. Transite Sheeting Blackboards

Summary & Recommendations

Since the last report was completed, the asbestos containing materials appear to be in relatively good shape.

The following areas should be addressed in the near future:

1. There is an ACM elbow in The SK Washroom (space #27) that is severely damaged it is recommended that this elbow be removed as soon as possible. (Picture #7)
2. There are numerous Asbestos cement covered elbow and fittings through out the school as identified in the Asbestos Building Survey Form. The elbows are in good condition, but care should be taken when working around or near them.

3. There are blackboards throughout the school. At one time various styles of blackboards were manufactured from transit sheeting, it has been decided that all blackboards will be assumed to be asbestos containing. At this time, the blackboards are in good condition. In the future, these materials should be sampled prior to any renovations to confirm / deny the presence of asbestos containing materials.
4. There are vinyl floor tiles throughout the school. It has been decided that all vinyl floor tiles will be assumed to be asbestos containing. At this time, the floor tiles are in good condition. In the future, these materials should be sampled prior to any renovations to confirm / deny the presence of asbestos containing materials.

The work of the investigators is considered sufficient to establish a general inventory of possible ACM on the site. All of the above work was completed at current industry standards however; GB Environmental staff cannot guarantee that ACM materials do not exist within the scope of this project.

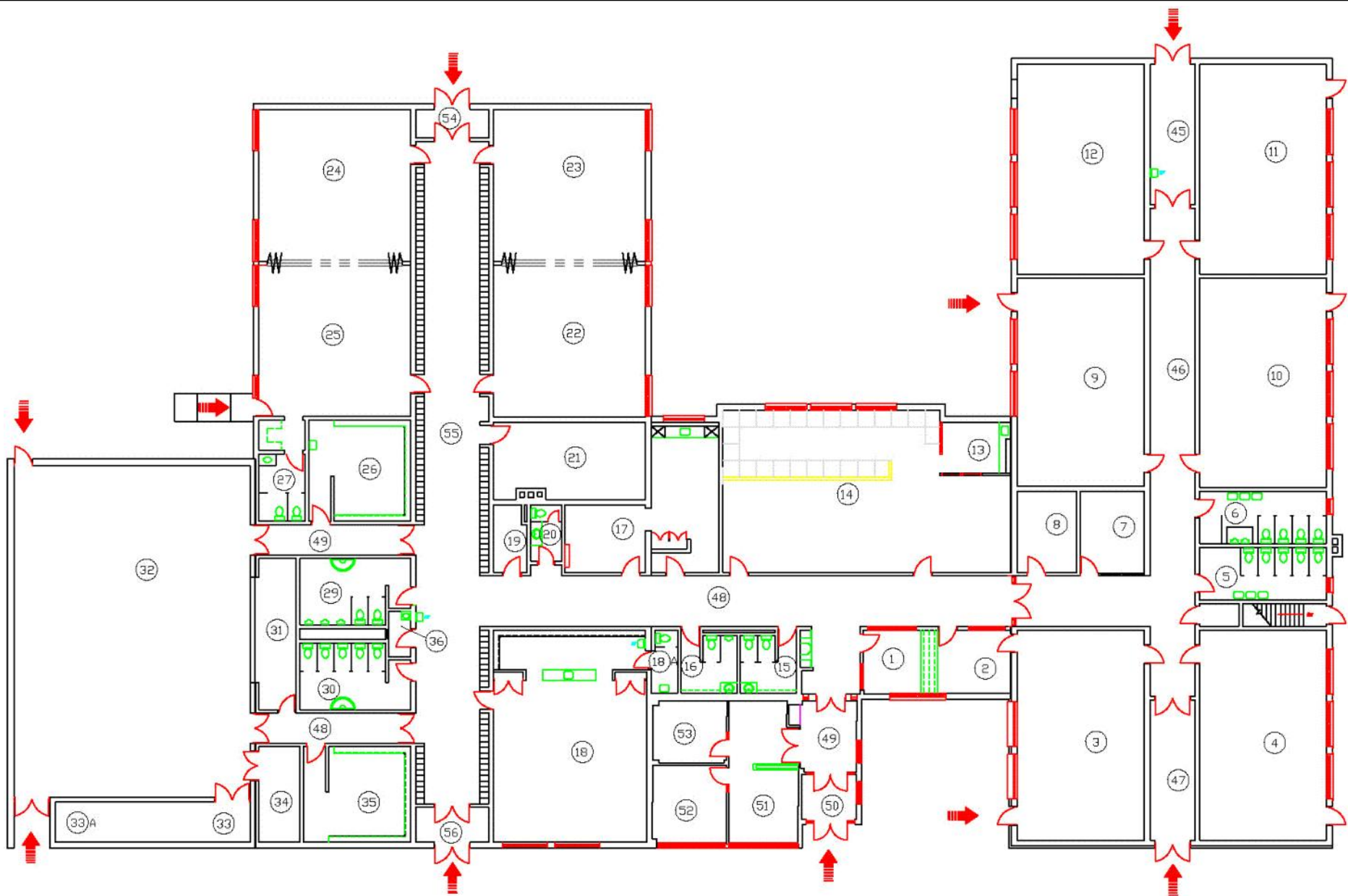
Thank you for the opportunity to provide our service and please feel free to call our office if you have any further questions.

Completed by:

Jim Anderson

Reviewed by:

Graeme Flett
President



Niagara Catholic District School Board
 Notre Dame Elementary School
 6559 Caswell St.
 Niagara Falls, ON

Ground Floor

Floor Plan Provided By
 NCDSB - nts

2004 Floor Plan



LEGEND:

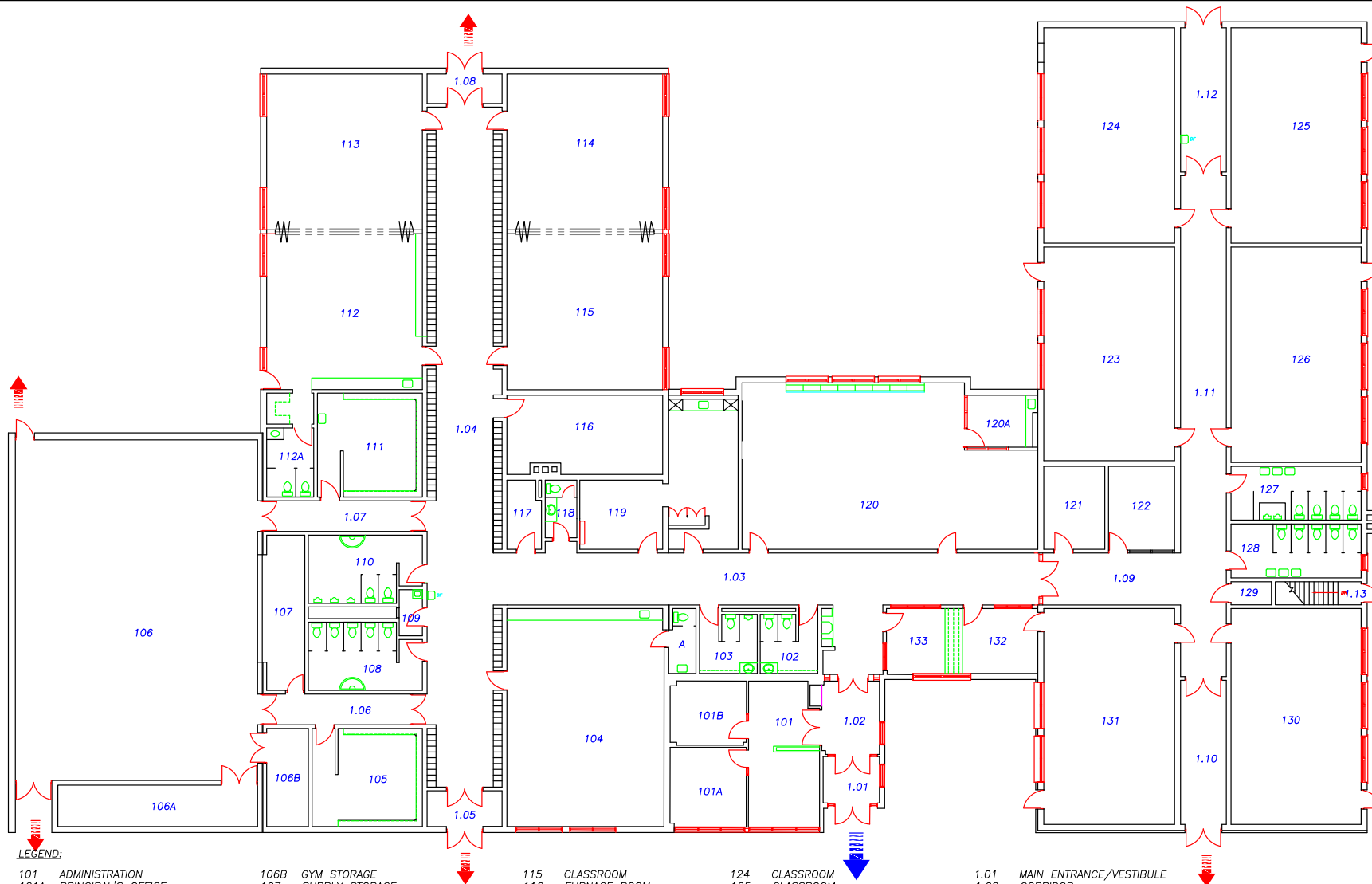
1. OFFICE	20. STAFF WASHROOM	40. PORTABLE 068—CLASSROOM
2. OFFICE	21. FURNACE ROOM	41. PORTABLE 069—CLASSROOM
3. CLASSROOM	22. CLASSROOM	42. PORTABLE 070—CLASSROOM
4. CLASSROOM	23. CLASSROOM	43. PORTABLE 071—CLASSROOM
5. GIRLS' WASHROOM	24. CLASSROOM	44. PORTABLE 072—CLASSROOM
6. BOYS' WASHROOM	25. KINDERGARTEN—SK	50. PORTABLE 073—CLASSROOM
7. PRINCIPAL'S OFFICE	26. BOYS' CHANGEROOM	45. CORRIDOR
8. E.R.T. OFFICE	27. SK WASHROOM	46. CORRIDOR
9. CLASSROOM	29. BOYS' WASHROOM	47. CORRIDOR
10. CLASSROOM	30. GIRLS' WASHROOM	48. CORRIDOR
		49. CORRIDOR
11. CLASSROOM	31. SUPPLY ROOM	50. VESTIBULE
12. CLASSROOM	32. GYMNASIUM	51. SECRETARY/RECEPTION
13. GUIDANCE OFFICE	33. FOLDING CHAIR STORAGE	52. PRINCIPAL'S OFFICE
14. LIBRARY/COMPUTER ROOM	33a. FURNACE ROOM	53. VICE—PRINCIPAL
15. LADIES' STAFF WASHROOM	34. GENERAL PURPOSE STORAGE	54. VESTIBULE
16. MENS' STAFF WASHROOM	35. GIRLS' CHANGE ROOM	55. CORRIDOR
17. STAFF ROOM	36. CARETAKER'S STATION	56. VESTIBULE
18. KINDERGARTEN—JK	37. PORTABLE 078—CLASSROOM	
18a. JK WASHROOM	38. PORTABLE 079—CLASSROOM	
19. CARETAKER'S OFFICE	39. PORTABLE 067—CLASSROOM	

Notre Dame Elementary School

6559 Caswell St.

Niagara Falls, ON

L2J 1C2



LEGEND:

- 101 ADMINISTRATION
- 101A PRINCIPAL'S OFFICE
- 101B MEETING ROOM
- 102 STAFF WASHROOM
- 103 STAFF WASHROOM
- 104 KINDERGARTEN-JK
- 104A KINDERGARTEN WASHROOM
- 105 GIRLS' CHANGE ROOM
- 106 GYMNASIUM
- 106A STORAGE

- 106B GYM STORAGE
- 107 SUPPLY STORAGE
- 108 GIRLS' WASHROOM
- 109 CARETAKER
- 110 BOYS' WASHROOM
- 111 BOYS' CHANGE ROOM
- 112 KINDERGARTEN-CLASSROOM
- 112A KINDERGARTEN WASHROOM
- 113 CLASSROOM
- 114 CLASSROOM

- 115 CLASSROOM
- 116 FURNACE ROOM
- 117 CARETAKER
- 118 STAFF WASHROOM
- 119 STAFF ROOM
- 120 LIBRARY/COMPUTERS
- 120A LIBRARY OFFICE
- 121 SENSORY ROOM
- 122 E.R.T. OFFICE
- 123 CLASSROOM

- 124 CLASSROOM
- 125 CLASSROOM
- 126 CLASSROOM
- 127 BOYS' WASHROOM
- 128 GIRLS' WASHROOM
- 129 JANITOR
- 130 CLASSROOM
- 131 CLASSROOM
- 132 READING RECOVERY
- 133 RESOURCE WITHDRAWAL

- 1.01 MAIN ENTRANCE/VESTIBULE
- 1.02 CORRIDOR
- 1.03 CORRIDOR
- 1.04 CORRIDOR
- 1.05 VESTIBULE
- 1.06 CORRIDOR
- 1.07 CORRIDOR
- 1.08 VESTIBULE
- 1.09 CORRIDOR
- 1.10 VESTIBULE

- 1.11 CORRIDOR
- 1.12 VESTIBULE
- 1.13 STAIRS TO BASEMENT

PORTABLE 091-STORAGE



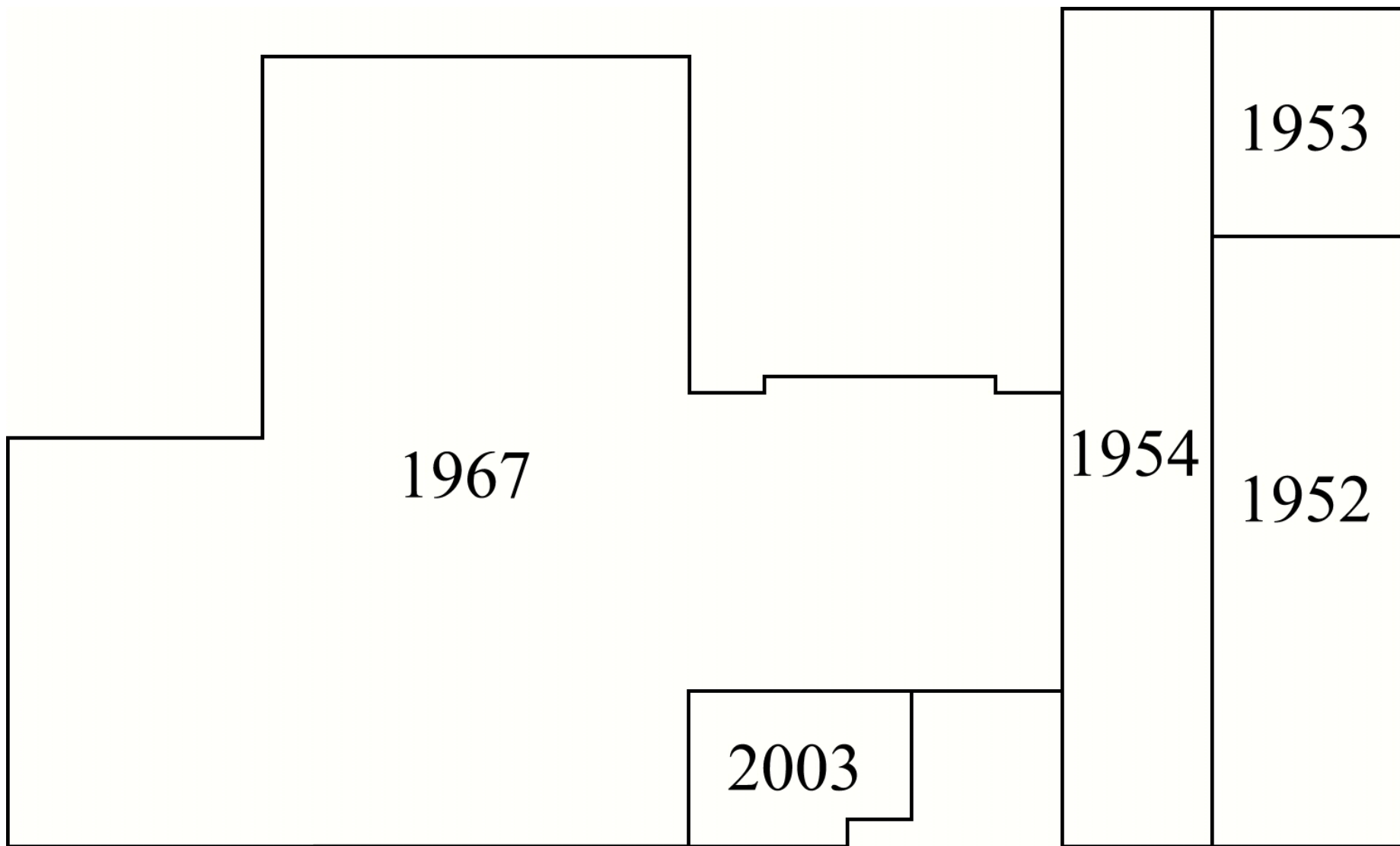
Niagara Catholic District School Board
 Notre Dame Elementary School
 6559 Caswell St.
 Niagara Falls, ON

Ground Floor

Floor Plan Provided By
 NCDSB - nts

Map October 2016



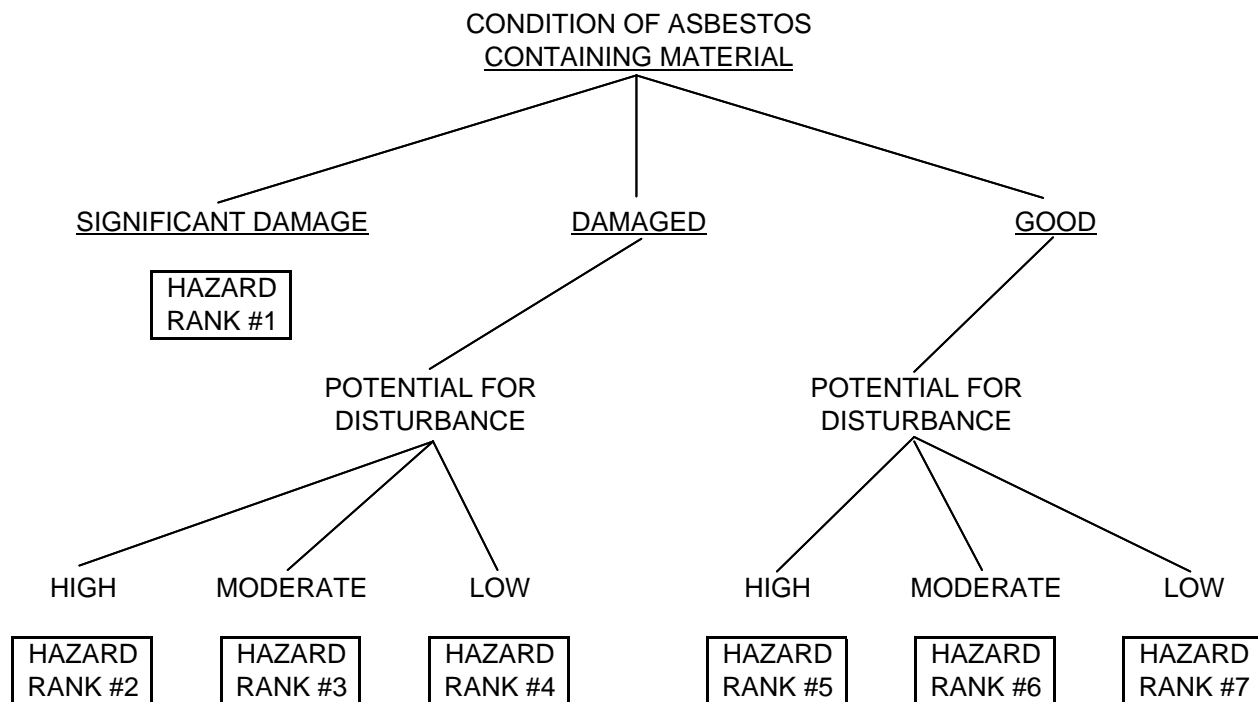


Notre Dame Elementary School
6559 Caswell St.
Niagara Falls, ON
L2J 1C2



FIGURE 1

**CLASSIFICATION FOR ASBESTOS HAZARD POTENTIAL
(DECISION TREE DISPLAY)**



****NOTE****

Significant Damage is:

10% if damage is evenly distributed or
25% if damage is localized

**CLASSIFICATIONS FOR THE LEVEL
OF POTENTIAL DISTURBANCE**

POTENTIAL FOR DISTURBANCE	FREQUENCY OF POTENTIAL CONTACT	INFLUENCE OF VIBRATION	POTENTIAL FOR AIR EROSION
HIGH (i.e. potential for significant damage)	ANY VALUE FOR ONE OF THESE FACTORS		
MODERATE (i.e. potential for damage)	ANY MODERATE FOR ONE OR MORE OF THESE FACTORS		
LOW (i.e. little potential for damage)	ALL LOW VALUES		



HOMOGENEOUS MATERIALS LIST OF SUSPECTED ASBESTOS CONTAINING MATERIALS

Client: Niagara Catholic District School Board
 School Name: Notre Dame Elementary School
 School Address: 6559 Caswell St., Niagara Falls, ON

Homogeneous Material Number	Description of Material	Type and Percent of Asbestos
1	9" x 9" vinyl Floor Tiles	
2	12" x 12" Vinyl Floor Tiles	
3	Vinyl Sheet Flooring	
4	Adhesive	
5	1' x 1' Ceiling Tiles	
6	2' x 2' Ceiling Tiles	
7	2' x 4' Ceiling Tiles	
8	Plaster	
8a		
9		
10	Fireproofing	
10a		
11	Gasket	
12	Pipe Insulation	
12a		
13	Pipe Elbows / T's	
14	Transite Pipe	
15	Insulating Paper	
16	Transite Sheeting	
17	Parging Cement	

Section 2

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/4/2004

Homogeneous Area: 1952

Functional Space Name: Basement

Functional Space Number: No I.D. #

Floor: Basement

Comments:

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH	Percent or Number Damaged	Condition	ACM	Hazard Rank	Prev Sample Taken	New Sample Taken	Picture Number	Response
	S T M	H M L				LF SF NQ		I D SD	NPD PD PSD	F N A	Yes No A	0 to 7		
Other	T	L	PIPE ELBOWS \ T's	13	5	EACH	>5%	I	PD	F	YES	6		Manage
Other	T	L	PIPE INSULATION	12	100	LF					NO			

S - Surfacing

T - Thermal

M - Miscellaneous

H - High

M - Moderate

L - Low

H.M. # - Homogeneous #

LF - Linear Feet

SF - Square Feet

NQ - Not Quantifiable

I - Intact

D - Damaged

SD - Severely Damaged

NPD - No Potential For Damage

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

A - Assumed

ND - Not Detected

NS - Not Sampled

✓ - Refer to 1990 Survey

ACC - Accessibility

NACC - Not Accessible

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1952

Functional Space Name: Custodian Room

Functional Space Number: between rooms 4 & 5 (New I.D. # 129) **Floor:** 1

Comments:

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH LF SF NQ	Percent or Number Damaged	Condition I NPD F D PD N SD PSD	ACM Yes No A	Hazard Rank 0 to 7	Prev Sample Taken	New Sample Taken #	Picture Number	Response
Other	T	M	PIPE INSULATION	12	30	LF			NO					

S - Surfacing

T - Thermal

M - Miscellaneous

H - High

M - Moderate

L - Low

H.M. # - Homogeneous #

LF - Linear Feet

SF - Square Feet

NQ - Not Quantifiable

I - Intact

D - Damaged

SD - Severely Damaged

NPD - No Potential For Damage

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

A - Assumed

ND - Not Detected

NS - Not Sampled

✓ - Refer to 1990 Survey

ACC - Accessibility

NACC - Not Accessible

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1967

Functional Space Name: Resource Withdrawl

Functional Space Number: 1 (New I.D. # 133)

Floor: 1

Comments: Red Back C.T.

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH	Percent or Number Damaged	Condition	ACM	Hazard Rank	Prev Sample Taken	New Sample Taken	Picture Number	Response
	S T M	H M L				LF SF NQ		I NPD F D PD N SD PSD	Yes No A	0 to 7		#		
Ceiling	S	M	2'x4' CEILING TILES	7	170	SF			A					

S - Surfacing

T - Thermal

M - Miscellaneous

H - High

M - Moderate

L - Low

H.M. # - Homogeneous #

LF - Linear Feet

SF - Square Feet

NQ - Not Quantifiable

I - Intact

D - Damaged

SD - Severely Damaged

NPD - No Potential For Damage

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

A - Assumed

ND - Not Detected

NS - Not Sampled

✓ - Refer to 1990 Survey

ACC - Accessibility

NACC - Not Accessible

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1967

Functional Space Name: Office

Functional Space Number: 2 (New I.D. # 132)

Floor: 1

Comments: Red Back C.T.

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH LF SF NQ	Percent or Number Damaged	Condition I NPD F D PD N SD PSD	ACM Yes No A	Hazard Rank 0 to 7	Prev Sample Taken	New Sample Taken #	Picture Number	Response
Ceiling	S	M	2'x4' CEILING TILES	7	170	SF			A					

S - Surfacing

H - High

H.M. # - Homogeneous #

LF - Linear Feet

I - Intact

A - Assumed

ND - Not Detected

T - Thermal

M - Moderate

SF - Square Feet

D - Damaged

NS - Not Sampled

M - Miscellaneous

L - Low

NQ - Not Quantifiable

SD - Severely Damaged

✓ - Refer to 1990 Survey

ACC - Accessibility

NPD - No Potential For Damage

NACC - Not Accessible

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1954

Functional Space Name: Classroom

Functional Space Number: 3 (New I.D. # 131)

Floor: 1

Comments: Red Back C.T.

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH	Percent or Number Damaged	Condition	ACM	Hazard Rank	Prev Sample Taken	New Sample Taken	Picture Number	Response
	S T M	H M L				LF SF NQ		I D SD	NPD PD PSD	F N	Yes No A	0 to 7		
Ceiling	S	M	2'x2' CEILING TILES	6	750	SF			A					
Floor	S	H	9"x9" VINYL FLOOR TILES											Removed
Other	T	L	PIPE INSULATION	12	15	LF			NO					
Other	S	H	TRANSITE BLACK BOARDS			NQ			A					

S - Surfacing

T - Thermal

M - Miscellaneous

H - High

M - Moderate

L - Low

H.M. # - Homogeneous #

LF - Linear Feet

SF - Square Feet

NQ - Not Quantifiable

I - Intact

D - Damaged

SD - Severely Damaged

NPD - No Potential For Damage

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

A - Assumed

ND - Not Detected

NS - Not Sampled

✓ - Refer to 1990 Survey

ACC - Accessibility

NACC - Not Accessible

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1952

Functional Space Name: Classroom

Functional Space Number: 4 (New ID #130)

Floor: 1

Comments: Red Back C.T.

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH	Percent or Number Damaged	Condition	ACM	Hazard Rank	Prev Sample Taken	New Sample Taken	Picture Number	Response
	S T M	H M L				LF SF NQ		I D SD	NPD PD PSD	F N	Yes No A	0 to 7		
Ceiling	S	M	2'x2' CEILING TILES	6	750	SF			A					
Floor	S	H	9"x9" VINYL FLOOR TILES	1	750	SF								Removed
Other	T	L	PIPE ELBOWS \ T's	13	2	EACH	>5%	I	PD	F	YES	6		Manage
Other	T	L	PIPE INSULATION	12	50	LF			NO		✓			
Other	S	H	TRANSITE BLACK BOARDS			NQ			A					

S - Surfacing

T - Thermal

M - Miscellaneous

H - High

M - Moderate

L - Low

H.M. # - Homogeneous #

LF - Linear Feet

SF - Square Feet

NQ - Not Quantifiable

I - Intact

D - Damaged

SD - Severely Damaged

NPD - No Potential For Damage

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

A - Assumed

ND - Not Detected

NS - Not Sampled

✓ - Refer to 1990 Survey

ACC - Accessibility

NACC - Not Accessible

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1952

Functional Space Name: Girl's Washroom

Functional Space Number: 5 (New I.D. # 128)

Floor: 1

Comments:

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH LF SF NQ	Percent or Number Damaged	Condition I NPD F D PD N SD PSD	ACM Yes No A	Hazard Rank 0 to 7	Prev Sample Taken	New Sample Taken #	Picture Number	Response
Ceiling	S	M	2'x2' CEILING TILES	6	230	SF			NO					
Other	T	L	PIPE INSULATION	12	50	LF			NO					

S - Surfacing

T - Thermal

M - Miscellaneous

H - High

M - Moderate

L - Low

H.M. # - Homogeneous #

LF - Linear Feet

SF - Square Feet

NQ - Not Quantifiable

I - Intact

D - Damaged

SD - Severely Damaged

NPD - No Potential For Damage

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

A - Assumed

ND - Not Detected

NS - Not Sampled

✓ - Refer to 1990 Survey

ACC - Accessibility

NACC - Not Accessible

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1952

Functional Space Name: Boy's Washroom

Functional Space Number: 6 (New I.D. # 127)

Floor: 1

Comments:

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH LF SF NQ	Percent or Number Damaged	Condition I NPD F D PD N SD PSD	ACM Yes No A	Hazard Rank 0 to 7	Prev Sample Taken	New Sample Taken #	Picture Number	Response
Ceiling	S	M	2'x2' CEILING TILES	6	230	SF			NO					
Other	T	L	PIPE INSULATION	12	45	LF			NO					

S - Surfacing

H - High

H.M. # - Homogeneous #

LF - Linear Feet

I - Intact

A - Assumed

ND - Not Detected

T - Thermal

M - Moderate

SF - Square Feet

D - Damaged

NS - Not Sampled

M - Miscellaneous

L - Low

NQ - Not Quantifiable

SD - Severely Damaged

✓ - Refer to 1990 Survey

ACC - Accessibility

NPD - No Potential For Damage

NACC - Not Accessible

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1954

Functional Space Name: E.R.T. Office

Functional Space Number: 7 (New I.D. # 122)

Floor: 1

Comments: Red Back C.T.

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH	Percent or Number Damaged	Condition	ACM	Hazard Rank	Prev Sample Taken	New Sample Taken	Picture Number	Response
	S T M	H M L				LF SF NQ		I NPD F D PD N SD PSD	Yes No A	0 to 7		#		
Ceiling	S	M	2'x2' CEILING TILES	6	225	SF			A					

S - Surfacing

H - High

H.M. # - Homogeneous #

LF - Linear Feet

I - Intact

A - Assumed

ND - Not Detected

T - Thermal

M - Moderate

SF - Square Feet

D - Damaged

NS - Not Sampled

M - Miscellaneous

L - Low

NQ - Not Quantifiable

SD - Severely Damaged

✓ - Refer to 1990 Survey

ACC - Accessibility

NPD - No Potential For Damage

NACC - Not Accessible

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1954

Functional Space Name: Staff Workroom

Functional Space Number: 8 (New I.D. # 121)

Floor: 1

Comments:

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH LF SF NQ	Percent or Number Damaged	Condition I NPD F D PD N SD PSD	ACM Yes No A	Hazard Rank 0 to 7	Prev Sample Taken	New Sample Taken #	Picture Number	Response
Ceiling	S	M	2'x2' CEILING TILES	6	150	SF			NO					
Floor	S	H	12"x12" VINYL FLOOR TILES											REMOVED
Other	T	L	PIPE INSULATION	12	10	LF			NO					

S - Surfacing

T - Thermal

M - Miscellaneous

H - High

M - Moderate

L - Low

H.M. # - Homogeneous #

LF - Linear Feet

SF - Square Feet

NQ - Not Quantifiable

I - Intact

D - Damaged

SD - Severely Damaged

NPD - No Potential For Damage

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

A - Assumed

ND - Not Detected

NS - Not Sampled

✓ - Refer to 1990 Survey

ACC - Accessibility

NACC - Not Accessible

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1954

Functional Space Name: Classroom

Functional Space Number: 9 (New ID # 123)

Floor: 1

Comments: Red Back C.T.

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH	Percent or Number Damaged	Condition	ACM	Hazard Rank	Prev Sample Taken	New Sample Taken	Picture Number	Response
	S T M	H M L				LF SF NQ		I D SD	NPD PD PSD	F N	Yes No A	0 to 7		
Ceiling	S	M	2'x2' CEILING TILES	6	750	SF			A					
Floor	S	H	9"x9" VINYL FLOOR TILES											Removed
Other	T	L	PIPE ELBOWS \ T's	13	4	EACH	>5%	I	PD	F	YES	6	✓	Manage
Other	T	L	PIPE INSULATION	12	50	LF			NO					
Other	S	H	TRANSITE BLACK BOARDS			NQ			A					

S - Surfacing

T - Thermal

M - Miscellaneous

H - High

M - Moderate

L - Low

H.M. # - Homogeneous #

LF - Linear Feet

SF - Square Feet

NQ - Not Quantifiable

I - Intact

D - Damaged

SD - Severely Damaged

NPD - No Potential For Damage

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

A - Assumed

ND - Not Detected

NS - Not Sampled

✓ - Refer to 1990 Survey

ACC - Accessibility

NACC - Not Accessible

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1954

Functional Space Name: Classroom

Functional Space Number: 10 (New I.D. # 126)

Floor: 1

Comments: Red Back C.T.

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH	Percent or Number Damaged	Condition	ACM	Hazard Rank	Prev Sample Taken	New Sample Taken	Picture Number	Response
	S T M	H M L				LF SF NQ		I NPD F D PD N SD PSD	Yes No A	0 to 7		#		
Ceiling	S	M	2'x2' CEILING TILES	6	750	SF			A					
Floor	S	H	9"x9" VINYL FLOOR TILES											Removed
Other	T	L	PIPE ELBOWS \ T's	13	4	EACH	>5%	I PD F	YES	6				Manage
Other	T	L	PIPE INSULATION	12	50	LF			NO					
Other	S	H	TRANSITE BLACK BOARDS			NQ			A					

S - Surfacing

T - Thermal

M - Miscellaneous

H - High

M - Moderate

L - Low

H.M. # - Homogeneous #

LF - Linear Feet

SF - Square Feet

NQ - Not Quantifiable

I - Intact

D - Damaged

SD - Severely Damaged

NPD - No Potential For Damage

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

A - Assumed

ND - Not Detected

NS - Not Sampled

✓ - Refer to 1990 Survey

ACC - Accessibility

NACC - Not Accessible

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1953

Functional Space Name: Classroom

Functional Space Number: 11 (New I.D. # 125)

Floor: 1

Comments: Red Back C.T.

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH LF SF NQ	Percent or Number Damaged	Condition I NPD F D PD N SD PSD	ACM Yes No A	Hazard Rank 0 to 7	Prev Sample Taken	New Sample Taken #	Picture Number	Response
Ceiling	S	M	2'x2' CEILING TILES	6	750	SF			A					
Floor	S	H	9"x9" VINYL FLOOR TILES											Removed
Other	S	H	TRANSITE BLACK BOARDS			NQ			A					

S - Surfacing
T - Thermal
M - Miscellaneous

H - High
M - Moderate
L - Low

H.M. # - Homogeneous #

LF - Linear Feet
SF - Square Feet
NQ - Not Quantifiable

I - Intact
D - Damaged
SD - Severely Damaged
NPD - No Potential For Damage
PD - Potential For Damage
PSD - Potential For Severe Damage
F - Friable
NF - Non-friable

A - Assumed

ND - Not Detected
NS - Not Sampled
✓ - Refer to 1990 Survey

ACC - Accessibility
NACC - Not Accessible

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1954

Functional Space Name: Classroom

Functional Space Number: 12 (New I.D. # 124)

Floor: 1

Comments: Red Back C.T.

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH	Percent or Number Damaged	Condition	ACM	Hazard Rank	Prev Sample Taken	New Sample Taken	Picture Number	Response
	S T M	H M L				LF SF NQ		I D SD	NPD PD PSD	F N	Yes No A			
Ceiling	S	M	2'x2' CEILING TILES	6	750	SF			A					
Floor	S	H	9"x9" VINYL FLOOR TILES											Removed
Other	T	L	PIPE ELBOWS \ T's	13	4	EACH	>5%	I	PD	F	YES			Manage
Other	T	L	PIPE INSULATION	12	50	LF				NO				
Other	S	H	TRANSITE BLACK BOARDS			NQ			A					

S - Surfacing

H - High

H.M. # - Homogeneous #

LF - Linear Feet

I - Intact

A - Assumed

ND - Not Detected

T - Thermal

M - Moderate

SF - Square Feet

D - Damaged

NS - Not Sampled

M - Miscellaneous

L - Low

NQ - Not Quantifiable

SD - Severely Damaged

✓ - Refer to 1990 Survey

ACC - Accessibility

NPD - No Potential For Damage

NACC - Not Accessible

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1967

Functional Space Name: Library Office

Functional Space Number: 13 (New I.D. # 120 A)

Floor: 1

Comments: Red Back C.T.

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH LF SF NQ	Percent or Number Damaged	Condition I NPD F D PD N SD PSD	ACM Yes No A	Hazard Rank 0 to 7	Prev Sample Taken	New Sample Taken #	Picture Number	Response
Ceiling	S	M	2'x4' CEILING TILES	7	120	SF			A					
Floor	S	H	9"x9" VINYL FLOOR TILES	1	120	SF	>5%	I PD NF	A	5				Manage

S - Surfacing

H - High

H.M. # - Homogeneous #

LF - Linear Feet

I - Intact

A - Assumed

ND - Not Detected

T - Thermal

M - Moderate

SF - Square Feet

D - Damaged

NS - Not Sampled

M - Miscellaneous

L - Low

NQ - Not Quantifiable

SD - Severely Damaged

✓ - Refer to 1990 Survey

ACC - Accessibility

NPD - No Potential For Damage

NACC - Not Accessible

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1967

Functional Space Name: Library \ Computer Room

Functional Space Number: 14 (New I.D. # 120)

Floor: 1

Comments:

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH	Percent or Number Damaged	Condition	ACM	Hazard Rank	Prev Sample Taken	New Sample Taken	Picture Number	Response
	S T M	H M L				LF SF NQ		I NPD F D PD N SD PSD	Yes No A	0 to 7		#		
Ceiling	S	M	2'x4' CEILING TILES	7	1350	SF			NO					

S - Surfacing

T - Thermal

M - Miscellaneous

H - High

M - Moderate

L - Low

H.M. # - Homogeneous #

LF - Linear Feet

SF - Square Feet

NQ - Not Quantifiable

I - Intact

D - Damaged

SD - Severely Damaged

NPD - No Potential For Damage

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

A - Assumed

ND - Not Detected

NS - Not Sampled

✓ - Refer to 1990 Survey

ACC - Accessibility

NACC - Not Accessible

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1967

Functional Space Name: Women's Staff Washroom

Functional Space Number: 15 (New I.D. # 102)

Floor: 1

Comments: Red Back C.T.

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH LF SF NQ	Percent or Number Damaged	Condition I NPD F D PD N SD PSD	ACM Yes No A	Hazard Rank 0 to 7	Prev Sample Taken	New Sample Taken #	Picture Number	Response
Ceiling	S	M	2'x4' CEILING TILES	7	100	SF			A					
Other	T	L	PIPE INSULATION	12	20	LF			NO					

S - Surfacing

T - Thermal

M - Miscellaneous

H - High

M - Moderate

L - Low

H.M. # - Homogeneous #

LF - Linear Feet

SF - Square Feet

NQ - Not Quantifiable

I - Intact

D - Damaged

SD - Severely Damaged

NPD - No Potential For Damage

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

A - Assumed

ND - Not Detected

NS - Not Sampled

✓ - Refer to 1990 Survey

ACC - Accessibility

NACC - Not Accessible

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1967

Functional Space Name: Men's Staff Washroom

Functional Space Number: 16 (New I.D. # 103)

Floor: 1

Comments: Red Back C.T.

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH	Percent or Number Damaged	Condition	ACM	Hazard Rank	Prev Sample Taken	New Sample Taken	Picture Number	Response
	S T M	H M L				LF SF NQ		I NPD F D PD N SD PSD	Yes No A	0 to 7		#		
Ceiling	S	M	2'x4' CEILING TILES	7	100	SF			A					
Other	T	L	PIPE INSULATION	12	40	LF			NO					
Other	T	L	PIPE ELBOWS \ T's	13	4	EACH	>5%	I PD F	YES	6				Manage

S - Surfacing

T - Thermal

M - Miscellaneous

H - High

M - Moderate

L - Low

H.M. # - Homogeneous #

LF - Linear Feet

SF - Square Feet

NQ - Not Quantifiable

I - Intact

D - Damaged

SD - Severely Damaged

NPD - No Potential For Damage

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

A - Assumed

ND - Not Detected

NS - Not Sampled

✓ - Refer to 1990 Survey

ACC - Accessibility

NACC - Not Accessible

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1967

Functional Space Name: Staff Room

Functional Space Number: 17 (New I.D. # 119)

Floor: 1

Comments: Red Back C.T.

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH LF SF NQ	Percent or Number Damaged	Condition I NPD F D PD N SD PSD	ACM Yes No A	Hazard Rank 0 to 7	Prev Sample Taken	New Sample Taken #	Picture Number	Response
Ceiling	S	M	2'x2' CEILING TILES	6	300	SF			A					
Floor	S	H	12"x12" VINYL FLOOR TILES	2	540	SF	>5%	I PD NF	A	5				Manage
Other	T	L	PIPE INSULATION	12	30	LF			NO					

S - Surfacing

H - High

H.M. # - Homogeneous #

LF - Linear Feet

I - Intact

A - Assumed

ND - Not Detected

T - Thermal

M - Moderate

SF - Square Feet

D - Damaged

NS - Not Sampled

M - Miscellaneous

L - Low

NQ - Not Quantifiable

SD - Severely Damaged

✓ - Refer to 1990 Survey

ACC - Accessibility

NPD - No Potential For Damage

NACC - Not Accessible

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/4/2004

Homogeneous Area: 1967

Functional Space Name: Kindergarten JK

Functional Space Number: 18 (New I.D. # 104)

Floor: 1

Comments: Red Back C.T.

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH LF SF NQ	Percent or Number Damaged	Condition I NPD F D PD N SD PSD	ACM Yes No A	Hazard Rank 0 to 7	Prev Sample Taken	New Sample Taken #	Picture Number	Response
Ceiling	S	M	2'x4' CEILING TILES	7	900	SF			A					
Floor	S	H	9"x9" VINYL FLOOR TILES											Replaced

S - Surfacing

T - Thermal

M - Miscellaneous

H - High

M - Moderate

L - Low

H.M. # - Homogeneous #

LF - Linear Feet

SF - Square Feet

NQ - Not Quantifiable

I - Intact

D - Damaged

SD - Severely Damaged

NPD - No Potential For Damage

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

A - Assumed

ND - Not Detected

NS - Not Sampled

✓ - Refer to 1990 Survey

ACC - Accessibility

NACC - Not Accessible

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/4/2004

Homogeneous Area: 1967

Functional Space Name: JK Washroom

Functional Space Number: 18a (New I.D. # 104 A)

Floor: 1

Comments: Red Back C.T.

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH	Percent or Number Damaged	Condition	ACM	Hazard Rank	Prev Sample Taken	New Sample Taken	Picture Number	Response
	S T M	H M L				LF SF NQ		I D SD	NPD PD PSD	F N A	Yes No A	0 to 7		
Ceiling	S	M	2'x4' CEILING TILES	7	120	SF			A					
Floor	S	H	9"x9" VINYL FLOOR TILES											Removed
Other	T	L	PIPE INSULATION	12	40	LF			NO					
Other	T	L	PIPE ELBOWS \ T's	1	15	EACH	>5%	I	PD	F	YES	6		Manage

S - Surfacing

T - Thermal

M - Miscellaneous

H - High

M - Moderate

L - Low

H.M. # - Homogeneous #

LF - Linear Feet

SF - Square Feet

NQ - Not Quantifiable

I - Intact

D - Damaged

SD - Severely Damaged

NPD - No Potential For Damage

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

A - Assumed

ND - Not Detected

NS - Not Sampled

✓ - Refer to 1990 Survey

ACC - Accessibility

NACC - Not Accessible

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1967

Functional Space Name: Caretaker's Office

Functional Space Number: 19 (New I.D. # 117)

Floor: 1

Comments: NO ACM APPARENT. CEILING SPACE INACCESSIBLE.

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH	Percent or Number Damaged	Condition	ACM	Hazard Rank	Prev Sample Taken	New Sample Taken	Picture Number	Response
	S T M	H M L				LF SF NQ		I NPD F D PD N SD PSD	Yes No A	0 to 7		#		

S - Surfacing

T - Thermal

M - Miscellaneous

H - High

M - Moderate

L - Low

H.M. # - Homogeneous #

LF - Linear Feet

SF - Square Feet

NQ - Not Quantifiable

I - Intact

D - Damaged

SD - Severely Damaged

NPD - No Potential For Damage

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

A - Assumed

ND - Not Detected

NS - Not Sampled

✓ - Refer to 1990 Survey

ACC - Accessibility

NACC - Not Accessible

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1967

Functional Space Name: Staff Washroom

Functional Space Number: 20 (New I.D. # 118)

Floor: 1

Comments:

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH LF SF NQ	Percent or Number Damaged	Condition I NPD F D PD N SD PSD	ACM Yes No A	Hazard Rank 0 to 7	Prev Sample Taken	New Sample Taken #	Picture Number	Response
Floor	S	H	12"x12" VINYL FLOOR TILES	2	78	SF	>5%	I PD NF	A	5				Manage

S - Surfacing

T - Thermal

M - Miscellaneous

H - High

M - Moderate

L - Low

H.M. # - Homogeneous #

LF - Linear Feet

SF - Square Feet

NQ - Not Quantifiable

I - Intact

D - Damaged

SD - Severely Damaged

NPD - No Potential For Damage

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

A - Assumed

ND - Not Detected

NS - Not Sampled

✓ - Refer to 1990 Survey

ACC - Accessibility

NACC - Not Accessible

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1967

Functional Space Name: Furnace Room

Functional Space Number: 21 (New I.D. # 116)

Floor: 1

Comments:

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH LF SF NQ	Percent or Number Damaged	Condition I NPD F D PD N SD PSD	ACM Yes No A	Hazard Rank 0 to 7	Prev Sample Taken	New Sample Taken #	Picture Number	Response
Other	T	M	PIPE INSULATION	12	200	LF			NO				6	
Other	T	M	PIPE ELBOWS \ T's	13	27	EACH	>5%	I PD F	YES	5	✓		5	Manage

S - Surfacing

T - Thermal

M - Miscellaneous

H - High

M - Moderate

L - Low

H.M. # - Homogeneous #

LF - Linear Feet

SF - Square Feet

NQ - Not Quantifiable

I - Intact

D - Damaged

SD - Severely Damaged

NPD - No Potential For Damage

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

A - Assumed

ND - Not Detected

NS - Not Sampled

✓ - Refer to 1990 Survey

ACC - Accessibility

NACC - Not Accessible

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1967

Functional Space Name: Classroom

Functional Space Number: 22 (New I.D. # 115)

Floor: 1

Comments: Red Back C.T.

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH	Percent or Number Damaged	Condition	ACM	Hazard Rank	Prev Sample Taken	New Sample Taken	Picture Number	Response
	S T M	H M L				LF SF NQ		I NPD F D PD N SD PSD	Yes No A	0 to 7		#		
Ceiling	S	M	2'x4' CEILING TILES	7	700	SF			A					

S - Surfacing

T - Thermal

M - Miscellaneous

H - High

M - Moderate

L - Low

H.M. # - Homogeneous #

LF - Linear Feet

SF - Square Feet

NQ - Not Quantifiable

I - Intact

D - Damaged

SD - Severely Damaged

NPD - No Potential For Damage

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

A - Assumed

ND - Not Detected

NS - Not Sampled

✓ - Refer to 1990 Survey

ACC - Accessibility

NACC - Not Accessible

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1967

Functional Space Name: Classroom

Functional Space Number: 23 (New I.D. # 114)

Floor: 1

Comments: Red Back C.T.

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH LF SF NQ	Percent or Number Damaged	Condition I NPD F D PD N SD PSD	ACM Yes No A	Hazard Rank 0 to 7	Prev Sample Taken	New Sample Taken #	Picture Number	Response
Ceiling	S	M	2'x4' CEILING TILES	7	700	SF			A					

S - Surfacing

H - High

H.M. # - Homogeneous #

LF - Linear Feet

I - Intact

A - Assumed

ND - Not Detected

T - Thermal

M - Moderate

SF - Square Feet

D - Damaged

NS - Not Sampled

M - Miscellaneous

L - Low

NQ - Not Quantifiable

SD - Severely Damaged

✓ - Refer to 1990 Survey

ACC - Accessibility

NPD - No Potential For Damage

NACC - Not Accessible

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1967

Functional Space Name: Classroom

Functional Space Number: 24 (New I.D. # 113)

Floor: 1

Comments: Red Back C.T.

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH	Percent or Number Damaged	Condition	ACM	Hazard Rank	Prev Sample Taken	New Sample Taken	Picture Number	Response
	S T M	H M L				LF SF NQ		I NPD F D PD N SD PSD	Yes No A	0 to 7		#		
Ceiling	S	M	2'x4' CEILING TILES	7	700	SF			A					

S - Surfacing

T - Thermal

M - Miscellaneous

H - High

M - Moderate

L - Low

H.M. # - Homogeneous #

LF - Linear Feet

SF - Square Feet

NQ - Not Quantifiable

I - Intact

D - Damaged

SD - Severely Damaged

NPD - No Potential For Damage

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

A - Assumed

ND - Not Detected

NS - Not Sampled

✓ - Refer to 1990 Survey

ACC - Accessibility

NACC - Not Accessible

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1967

Functional Space Name: Kindergarten SK

Functional Space Number: 25 (New ID #112)

Floor: 1

Comments: Red Back C.T.

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH	Percent or Number Damaged	Condition	ACM	Hazard Rank	Prev Sample Taken	New Sample Taken	Picture Number	Response
	S T M	H M L				LF SF NQ		I NPD F D PD N SD PSD	Yes No A	0 to 7		#		
Ceiling	S	M	2'x4' CEILING TILES	7	700	SF			A					
Other	T	L	PIPE FITTINGS	13	4	EACH	>5%	I PD F	YES	6				Manage

S - Surfacing

T - Thermal

M - Miscellaneous

H - High

M - Moderate

L - Low

H.M. # - Homogeneous #

LF - Linear Feet

SF - Square Feet

NQ - Not Quantifiable

I - Intact

D - Damaged

SD - Severely Damaged

NPD - No Potential For Damage

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

A - Assumed

ND - Not Detected

NS - Not Sampled

✓ - Refer to 1990 Survey

ACC - Accessibility

NACC - Not Accessible

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1967

Functional Space Name: Boy's Change Room

Functional Space Number: 26 (New I.D. # 111)

Floor: 1

Comments:

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH LF SF NQ	Percent or Number Damaged	Condition I NPD F D PD N SD PSD	ACM Yes No A	Hazard Rank 0 to 7	Prev Sample Taken	New Sample Taken #	Picture Number	Response
Other	T	M	PIPE INSULATION	12	10	LF			NO					

S - Surfacing

T - Thermal

M - Miscellaneous

H - High

M - Moderate

L - Low

H.M. # - Homogeneous #

LF - Linear Feet

SF - Square Feet

NQ - Not Quantifiable

I - Intact

D - Damaged

SD - Severely Damaged

NPD - No Potential For Damage

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

A - Assumed

ND - Not Detected

NS - Not Sampled

✓ - Refer to 1990 Survey

ACC - Accessibility

NACC - Not Accessible

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/4/2004

Homogeneous Area: 1967

Functional Space Name: SK Washroom

Functional Space Number: 27 (New ID #112A)

Floor: 1

Comments: Red Back C.T.

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Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH LF SF NQ	Percent or Number Damaged	Condition I NPD F D PD N SD PSD	ACM Yes No A	Hazard Rank 0 to 7	Prev Sample Taken	New Sample Taken #	Picture Number	Response
Ceiling	S	M	2'x4' CEILING TILES	7	180	SF			A					
Floor	S	H	12"x12" VINYL FLOOR TILES	2	180	SF	>5%	I PD NF	A	5				Manage
Other	T	L	PIPE ELBOWS \ T's	13	6	EACH	>5%	I PD F	YES	6			7	Manage
Other	T	L	PIPE INSULATION	12	60	LF			NO					

S - Surfacing

H - High

H.M. # - Homogeneous #

LF - Linear Feet

I - Intact

A - Assumed

ND - Not Detected

T - Thermal

M - Moderate

SF - Square Feet

D - Damaged

NS - Not Sampled

M - Miscellaneous

L - Low

NQ - Not Quantifiable

SD - Severely Damaged

✓ - Refer to 1990 Survey

ACC - Accessibility

NPD - No Potential For Damage

NACC - Not Accessible

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1967

Functional Space Name: Boy's Washroom

Functional Space Number: 29 (New I.D. # 110)

Floor: 1

Comments: NO ACM APPARENT. CEILING SPACE INACCESSIBLE.

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH	Percent or Number Damaged	Condition	ACM	Hazard Rank	Prev Sample Taken	New Sample Taken	Picture Number	Response
	S T M	H M L				LF SF NQ		I NPD F D PD N SD PSD	Yes No A	0 to 7		#		

S - Surfacing

T - Thermal

M - Miscellaneous

H - High

M - Moderate

L - Low

H.M. # - Homogeneous #

LF - Linear Feet

SF - Square Feet

NQ - Not Quantifiable

I - Intact

D - Damaged

SD - Severely Damaged

NPD - No Potential For Damage

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

A - Assumed

ND - Not Detected

NS - Not Sampled

✓ - Refer to 1990 Survey

ACC - Accessibility

NACC - Not Accessible

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1967

Functional Space Name: Girl's Washroom

Functional Space Number: 30 (New I.D. # 108)

Floor: 1

Comments: NO ACM APPARENT. CEILING SPACE INACCESSIBLE.

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH	Percent or Number Damaged	Condition	ACM	Hazard Rank	Prev Sample Taken	New Sample Taken	Picture Number	Response
	S T M	H M L				LF SF NQ		I NPD F D PD N SD PSD	Yes No A	0 to 7		#		

S - Surfacing

T - Thermal

M - Miscellaneous

H - High

M - Moderate

L - Low

H.M. # - Homogeneous #

LF - Linear Feet

SF - Square Feet

NQ - Not Quantifiable

I - Intact

D - Damaged

SD - Severely Damaged

NPD - No Potential For Damage

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

A - Assumed

ND - Not Detected

NS - Not Sampled

✓ - Refer to 1990 Survey

ACC - Accessibility

NACC - Not Accessible

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1967

Functional Space Name: Supply Room

Functional Space Number: 31 (New I.D. # 107)

Floor: 1

Comments:

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH	Percent or Number Damaged	Condition	ACM	Hazard Rank	Prev Sample Taken	New Sample Taken	Picture Number	Response
	S T M	H M L				LF SF NQ		I D SD	NPD PD PSD	F N A	Yes No A	0 to 7		
Floor	S	H	9"x9" VINYL FLOOR TILES	1	110	SF	>5%	I	PD	NF	A	5		Manage
Other	T	M	PIPE INSULATION	12	10	LF				NO			4	
Other	T	M	PIPE ELBOWS \ T's	13	1	EACH	>5%	I	PD	F	YES	5	4	Manage

S - Surfacing

T - Thermal

M - Miscellaneous

H - High

M - Moderate

L - Low

H.M. # - Homogeneous #

LF - Linear Feet

SF - Square Feet

NQ - Not Quantifiable

I - Intact

D - Damaged

SD - Severely Damaged

NPD - No Potential For Damage

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

A - Assumed

ND - Not Detected

NS - Not Sampled

✓ - Refer to 1990 Survey

ACC - Accessibility

NACC - Not Accessible

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1967

Functional Space Name: Gymnasium

Functional Space Number: 32 (New I.D. # 106)

Floor: 1

Comments:

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH LF SF NQ	Percent or Number Damaged	Condition I NPD F D PD N SD PSD	ACM Yes No A	Hazard Rank 0 to 7	Prev Sample Taken	New Sample Taken #	Picture Number	Response
Floor	S	H	9"x9" VINYL FLOOR TILES											Removed
Other	T	M	PIPE ELBOWS \ T's	13	5	EACH	>5%	I PD F	YES	5			1	Manage
Other	T	M	PIPE INSULATION	12	40	LF			NO					

S - Surfacing

H - High

H.M. # - Homogeneous #

LF - Linear Feet

I - Intact

A - Assumed

ND - Not Detected

T - Thermal

M - Moderate

SF - Square Feet

D - Damaged

NS - Not Sampled

M - Miscellaneous

L - Low

NQ - Not Quantifiable

SD - Severely Damaged

✓ - Refer to 1990 Survey

ACC - Accessibility

NPD - No Potential For Damage

NACC - Not Accessible

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1967

Functional Space Name: Folding Chair Storage

Functional Space Number: 33 (New I.D. # 106 A)

Floor: 1

Comments:

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH	Percent or Number Damaged	Condition	ACM	Hazard Rank	Prev Sample Taken	New Sample Taken	Picture Number	Response
	S T M	H M L				LF SF NQ		I D SD	NPD PD PSD	F N A	Yes No A	0 to 7		
Other	T	M	PIPE INSULATION	12	150	LF				NO				
Other	T	M	PIPE ELBOWS \ T's	13	17	EACH	>5%	I	PD	F	YES	5	✓	2 Manage

S - Surfacing

T - Thermal

M - Miscellaneous

H - High

M - Moderate

L - Low

H.M. # - Homogeneous #

LF - Linear Feet

SF - Square Feet

NQ - Not Quantifiable

I - Intact

D - Damaged

SD - Severely Damaged

NPD - No Potential For Damage

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

A - Assumed

ND - Not Detected

NS - Not Sampled

✓ - Refer to 1990 Survey

ACC - Accessibility

NACC - Not Accessible

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1967

Functional Space Name: Furnace Room

Functional Space Number: 33a (New I.D. # 106 A)

Floor: 1

Comments:

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH LF SF NQ	Percent or Number Damaged	Condition I NPD F D PD N SD PSD	ACM Yes No A	Hazard Rank 0 to 7	Prev Sample Taken	New Sample Taken #	Picture Number	Response
Other	T	M	PIPE INSULATION	12	20	LF			NO					
Other	T	M	PIPE ELBOWS \ T's	13	4	EACH	>5%	I PD F	YES	5			3	Manage

S - Surfacing

H - High

H.M. # - Homogeneous #

LF - Linear Feet

I - Intact

A - Assumed

ND - Not Detected

T - Thermal

M - Moderate

SF - Square Feet

D - Damaged

NS - Not Sampled

M - Miscellaneous

L - Low

NQ - Not Quantifiable

SD - Severely Damaged

✓ - Refer to 1990 Survey

ACC - Accessibility

NPD - No Potential For Damage

NACC - Not Accessible

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1967

Functional Space Name: General Purpose Storage

Functional Space Number: 34 (New I.D. # 106 B)

Floor: 1

Comments: NO ACM APPARENT

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH LF SF NQ	Percent or Number Damaged	Condition I NPD F D PD N SD PSD	ACM Yes No A	Hazard Rank 0 to 7	Prev Sample Taken	New Sample Taken #	Picture Number	Response
	S T M	H M L												

S - Surfacing

T - Thermal

M - Miscellaneous

H - High

M - Moderate

L - Low

H.M. # - Homogeneous #

LF - Linear Feet

SF - Square Feet

NQ - Not Quantifiable

I - Intact

D - Damaged

SD - Severely Damaged

NPD - No Potential For Damage

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

A - Assumed

ND - Not Detected

NS - Not Sampled

✓ - Refer to 1990 Survey

ACC - Accessibility

NACC - Not Accessible

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1967

Functional Space Name: Girl's Change Room

Functional Space Number: 35 (New I.D. # 105)

Floor: 1

Comments: NO ACM APPARENT

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH LF SF NQ	Percent or Number Damaged	Condition I NPD F D PD N SD PSD	ACM Yes No A	Hazard Rank 0 to 7	Prev Sample Taken	New Sample Taken #	Picture Number	Response
	S T M	H M L												

S - Surfacing

T - Thermal

M - Miscellaneous

H - High

M - Moderate

L - Low

H.M. # - Homogeneous #

LF - Linear Feet

SF - Square Feet

NQ - Not Quantifiable

I - Intact

D - Damaged

SD - Severely Damaged

NPD - No Potential For Damage

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

A - Assumed

ND - Not Detected

NS - Not Sampled

✓ - Refer to 1990 Survey

ACC - Accessibility

NACC - Not Accessible

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area:

Functional Space Name: Caretaker's Station

Functional Space Number: 36 (New I.D. # 109)

Floor: 1

Comments:

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH	Percent or Number Damaged	Condition	ACM	Hazard Rank	Prev Sample Taken	New Sample Taken	Picture Number	Response
	S T M	H M L				LF SF NQ		I NPD F D PD N SD PSD	Yes No A	0 to 7		#		
Other	T	M	PIPE INSULATION	12	4	LF			NO					
Other	T	M	PIPE FITTINGS	11	2	EA	>5%	I PD F	YES					

S - Surfacing

T - Thermal

M - Miscellaneous

H - High

M - Moderate

L - Low

H.M. # - Homogeneous #

LF - Linear Feet

SF - Square Feet

NQ - Not Quantifiable

I - Intact

D - Damaged

SD - Severely Damaged

NPD - No Potential For Damage

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

A - Assumed

ND - Not Detected

NS - Not Sampled

✓ - Refer to 1990 Survey

ACC - Accessibility

NACC - Not Accessible

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1952

Functional Space Name: Vestibule

Functional Space Number: 45 (New I.D. # 1.12)

Floor: 1

Comments: Red Back C.T.

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH	Percent or Number Damaged	Condition	ACM	Hazard Rank	Prev Sample Taken	New Sample Taken	Picture Number	Response
	S T M	H M L				LF SF NQ		I NPD F D PD N SD PSD	Yes No A	0 to 7		#		
Ceiling	S	M	2'x2' CEILING TILES	6	104	SF			A					
Floor	S	H	12"x12" VINYL FLOOR TILES											Removed
Other	T	L	PIPE INSULATION	12	50	LF			NO					
Other	T	L	PIPE ELBOWS \ T's	3	8	EACH	>5%	I PD	F YES	6				Manage

S - Surfacing

T - Thermal

M - Miscellaneous

H - High

M - Moderate

L - Low

H.M. # - Homogeneous #

LF - Linear Feet

SF - Square Feet

NQ - Not Quantifiable

I - Intact

D - Damaged

SD - Severely Damaged

NPD - No Potential For Damage

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

A - Assumed

ND - Not Detected

NS - Not Sampled

✓ - Refer to 1990 Survey

ACC - Accessibility

NACC - Not Accessible

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1952

Functional Space Name: Corridor

Functional Space Number: 46 (New I.D. # 1.11)

Floor: 1

Comments: Red Back C.T.

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH	Percent or Number Damaged	Condition	ACM	Hazard Rank	Prev Sample Taken	New Sample Taken	Picture Number	Response
	S T M	H M L				LF SF NQ		I NPD F D PD N SD PSD	Yes No A	0 to 7		#		
Ceiling	S	M	2'x2' CEILING TILES	6	704	SF			A					
Floor	S	H	12"x12" VINYL FLOOR TILES											Removed
Other	T	L	PIPE ELBOWS \ T's	13	20	EACH	>5%	I PD F	YES	6				Manage
Other	T	L	PIPE INSULATION	12	360	LF			NO					

S - Surfacing

T - Thermal

M - Miscellaneous

H - High

M - Moderate

L - Low

H.M. # - Homogeneous #

LF - Linear Feet

SF - Square Feet

NQ - Not Quantifiable

I - Intact

D - Damaged

SD - Severely Damaged

NPD - No Potential For Damage

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

A - Assumed

ND - Not Detected

NS - Not Sampled

✓ - Refer to 1990 Survey

ACC - Accessibility

NACC - Not Accessible

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1952

Functional Space Name: Vestibule

Functional Space Number: 47 (New I.D. # 1.10)

Floor: 1

Comments: Red Back C.T.

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH	Percent or Number Damaged	Condition	ACM	Hazard Rank	Prev Sample Taken	New Sample Taken	Picture Number	Response
	S T M	H M L				LF SF NQ		I NPD F D PD N SD PSD	Yes No A	0 to 7		#		
Ceiling	S	M	2'x2' CEILING TILES	6	104	SF			A					
Floor	S	H	12"x12" VINYL FLOOR TILES	2	104	SF								Removed
Other	T	L	PIPE ELBOWS \ T's		12	EACH	>5%	I PD F	YES	6				Manage
Other	T	L	PIPE INSULATION	12	50	LF			NO					

S - Surfacing

T - Thermal

M - Miscellaneous

H - High

M - Moderate

L - Low

H.M. # - Homogeneous #

LF - Linear Feet

SF - Square Feet

NQ - Not Quantifiable

I - Intact

D - Damaged

SD - Severely Damaged

NPD - No Potential For Damage

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

A - Assumed

ND - Not Detected

NS - Not Sampled

✓ - Refer to 1990 Survey

ACC - Accessibility

NACC - Not Accessible

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1967

Functional Space Name: Corridor

Functional Space Number: 48 (New I.D. # 1.03)

Floor: 1

Comments: Red Back C.T.

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH	Percent or Number Damaged	Condition	ACM	Hazard Rank	Prev Sample Taken	New Sample Taken	Picture Number	Response
	S T M	H M L				LF SF NQ		I NPD F D PD N SD PSD	Yes No A	0 to 7		#		
Ceiling	S	M	2'x4' CEILING TILES	7	950	SF			A					
Ceiling	S	M	2'x4' CEILING TILES	7	156	SF			A					
Other	T	L	PIPE ELBOWS \ T's	13	40	EACH	>5%	I PD F	YES	6				Manage
Other	T	L	PIPE INSULATION	12	130	LF			NO					
Other	T	L	PIPE ELBOWS \ T's	13	14	EACH	>5%	I PD F	YES	6				Manage
Other	T	L	PIPE INSULATION	12	450	LF			NO					

S - Surfacing

T - Thermal

M - Miscellaneous

H - High

M - Moderate

L - Low

H.M. # - Homogeneous #

LF - Linear Feet

SF - Square Feet

NQ - Not Quantifiable

I - Intact

D - Damaged

SD - Severely Damaged

NPD - No Potential For Damage

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

A - Assumed

ND - Not Detected

NS - Not Sampled

✓ - Refer to 1990 Survey

ACC - Accessibility

NACC - Not Accessible

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1967

Functional Space Name: Corridor

Functional Space Number: 49 (New I.D. # 1.07)

Floor: 1

Comments: Red Back C.T.

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH	Percent or Number Damaged	Condition	ACM	Hazard Rank	Prev Sample Taken	New Sample Taken	Picture Number	Response
	S T M	H M L				LF SF NQ		I D SD	NPD PD PSD	F N A	Yes No A	0 to 7		
Ceiling	S	M	2'x4' CEILING TILES	7	156	SF				A				
Other	T	L	PIPE ELBOWS \ T's	13	12	EACH	>5%	I	PD	F	YES	6		Manage
Other	T	L	PIPE INSULATION	12	60	LF				NO				

S - Surfacing

T - Thermal

M - Miscellaneous

H - High

M - Moderate

L - Low

H.M. # - Homogeneous #

LF - Linear Feet

SF - Square Feet

NQ - Not Quantifiable

I - Intact

D - Damaged

SD - Severely Damaged

NPD - No Potential For Damage

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

A - Assumed

ND - Not Detected

NS - Not Sampled

✓ - Refer to 1990 Survey

ACC - Accessibility

NACC - Not Accessible

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1967

Functional Space Name: Vestibule

Functional Space Number: 54 (New I.D. # 1.08)

Floor: 1

Comments: Red Back C.T.

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH	Percent or Number Damaged	Condition	ACM	Hazard Rank	Prev Sample Taken	New Sample Taken	Picture Number	Response
	S T M	H M L				LF SF NQ		I NPD F D PD N SD PSD	Yes No A	0 to 7		#		
Ceiling	S	M	2'x4' CEILING TILES	7	80	SF			A					
Other	T	L	PIPE INSULATION	12	15	LF			NO					
Other	T	L	PIPE ELBOWS \ T's	13	4	EACH	>5%	I PD F	YES	6				Manage

S - Surfacing

H - High

H.M. # - Homogeneous #

LF - Linear Feet

I - Intact

A - Assumed

ND - Not Detected

T - Thermal

M - Moderate

SF - Square Feet

D - Damaged

NS - Not Sampled

M - Miscellaneous

L - Low

NQ - Not Quantifiable

SD - Severely Damaged

✓ - Refer to 1990 Survey

ACC - Accessibility

NPD - No Potential For Damage

NACC - Not Accessible

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1967

Functional Space Name: Corridor

Functional Space Number: 55 (New ID #1.04)

Floor: 1

Comments: Red Back C.T.

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH	Percent or Number Damaged	Condition	ACM	Hazard Rank	Prev Sample Taken	New Sample Taken	Picture Number	Response
	S T M	H M L				LF SF NQ		I NPD F D PD N SD PSD	Yes No A	0 to 7		#		
Ceiling	S	M	2'x4' CEILING TILES	7	1060	SF			A					
Other	T	L	PIPE INSULATION	12	650	LF			NO					
Other	T	L	PIPE ELBOWS \ T's	13	40	EACH	>5%	I PD F	YES	6				Manage

S - Surfacing

H - High

H.M. # - Homogeneous #

LF - Linear Feet

I - Intact

A - Assumed

ND - Not Detected

T - Thermal

M - Moderate

SF - Square Feet

D - Damaged

NS - Not Sampled

M - Miscellaneous

L - Low

NQ - Not Quantifiable

SD - Severely Damaged

✓ - Refer to 1990 Survey

ACC - Accessibility

NPD - No Potential For Damage

NACC - Not Accessible

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

Form 1

ASBESTOS BUILDING SURVEY FORM

Client: Niagara Catholic District School Board

Inspector: Phil Smith \ James Plate

Building Name: Notre Dame Elementary

Inspection Date: 2/3/2004

Homogeneous Area: 1967

Functional Space Name: Vestibule

Functional Space Number: 56 (New I.D. # 1.05)

Floor: 1

Comments: Red Back C.T.

Surface	Type	ACC	Building Material	HM #	Total Amount	Units EACH	Percent or Number Damaged	Condition	ACM	Hazard Rank	Prev Sample Taken	New Sample Taken	Picture Number	Response
	S T M	H M L				LF SF NQ		I NPD F D PD N SD PSD	Yes No A	0 to 7		#		
Ceiling	S	M	2'x4' CEILING TILES	7	80	SF			A					
Other	T	L	PIPE INSULATION	12	15	LF			NO					
Other	T	L	PIPE ELBOWS \ T's	13	6	EACH	>5%	I PD F	YES	6				Manage

S - Surfacing

T - Thermal

M - Miscellaneous

H - High

M - Moderate

L - Low

H.M. # - Homogeneous #

LF - Linear Feet

SF - Square Feet

NQ - Not Quantifiable

I - Intact

D - Damaged

SD - Severely Damaged

NPD - No Potential For Damage

PD - Potential For Damage

PSD - Potential For Severe Damage

F - Friable

NF - Non-friable

A - Assumed

ND - Not Detected

NS - Not Sampled

✓ - Refer to 1990 Survey

ACC - Accessibility

NACC - Not Accessible

FORM 3

SAMPLING RECORD OF SUSPECTED ASBESTOS CONTAINING MATERIALS

Client: Niagara Catholic District School Board

Building Name: Notre Dame

Building Address: 6559 Caswell St., Niagara Falls, ON

Note: Sample coordinates are taken starting from the North West corner of the Functional Space.

Homogeneous Material Number	Functional Space I.D. Number	Location of Sample				Sample I.D. No.	Date of Sampling M/D/Y
		Description	Coordinates				
			Ft. South	Ft. East			
	No additional samples taken during this audit Refer to 1990 audit for samples						



Picture #1
Gymnasium (Space #32) ACM Elbows



Picture #2
Folding Chair Storage (Space #33) ACM Elbows



Picture #3
Furnace Room (Space #33a) ACM Elbows



Picture #4
Supply Room (Space #31) ACM Elbows



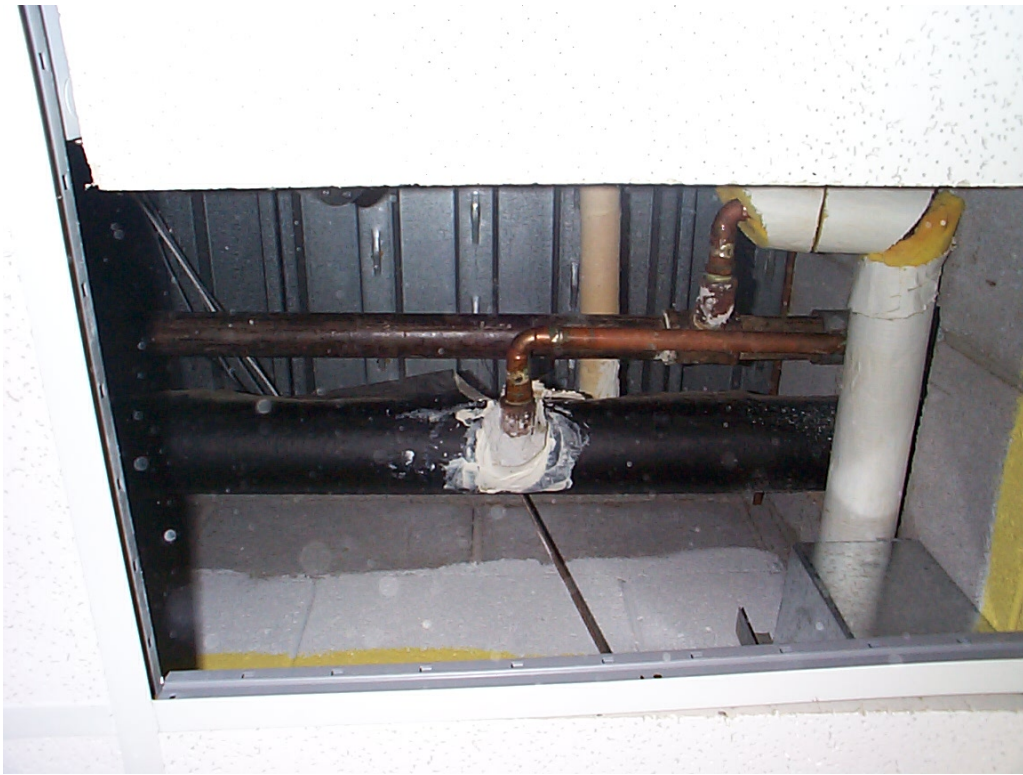
Picture #5

Furnace Room (Space #21) ACM Elbows



Picture #6

Furnace Room (Space #21) ACM Elbows



Picture #7

SK Washroom (Space #21) ACM Elbows Above Drop Ceiling

1. Hazardous Building Materials Assessment

1. A copy of a detailed designated substance survey report with respect to the identified portion of the Work is being made available as part of the Bid Documents; titled as follows:

.1 Titled: 2022 Asbestos Re-Assessment

 Prepared by: GB Environmental Services (Niagara) Ltd.

 File: GBE Project #04-087-2022

 Dated: November 15, 2022

 No. of Pages: 68

2. These reports provide detailed descriptions of the assessment criteria, findings, recommendations and limitations with respect to toxic or hazardous materials present at the identified property.
3. The reports, by their nature, cannot reveal all conditions that exist or can occur. Should conditions, in the opinion of the Consultant, be found to vary substantially from the report, changes in the scope of Work will be made, with resulting credits or expenditures to the Contract Price accruing to the Owner.
4. Direct questions pertaining to the designated substance survey reports to their respective authors.

End of Section

1. Definitions

1. The following Section of this Specification are of the abbreviated type and include incomplete sentences. Definite and indefinite articles have often been omitted and sentences are written in the form of direct instructions to the Contractor without using the phrase 'the Contractor shall.' Standard specifications and other quality references inserted govern materials and workmanship without using phrases 'conform with,' 'conformity therewith,' etc. Omitted words and phrases to be supplied in the same manner as they are when a note appears on the Drawings.
2. The Specifications are separated into Sections for reference convenience only. Such separation must in no instance make Owner or his Consultants arbiter to establish subcontract limits between Contractor and Subcontractor.
3. Provide all items, articles, materials, operations or methods listed, mentioned or scheduled on Drawings and/or in Specifications, including all labour, materials, equipment, tools, services, and incidentals necessary and required to complete the work. Responsibility for breakdown into and extension of subcontracts, including co-ordination of same, rests entirely with the Contractor.
4. Standard Specifications referred to are editions in force at Tender Closing Date.

2. Terminology

1. Consultants are the team of Architects, Engineers and other experts commissioned by the Owner, directly or indirectly, to execute design, contract documents and supervision for the project, including any of their agents or employees.
2. Prime Consultant is the Architect.
3. Contractor is the Firm or Corporation who, having signed the Agreement, has the sole legal responsibility to carry out the work shown or described in the Contract Documents for the Owner, whether contractually assigned to a Subcontractor or supplier, or not.

3. Minimum Standards

1. Unless otherwise specified, work and material to conform or exceed the minimum standards set out in the editions of the Canadian Government Specification Board, Canadian Standards Associations, the Ontario Building Code, Underwriters' Laboratories of Canada, the Canadian Electrical Code, the Local Building Code in force, whichever is applicable.
2. Copies of Standard Specifications referred to in this Specification to be kept on the site.
3. The use of the name (or its abbreviation) of any of the following bodies, accompanied by the reference number of a specification of that body to mean that the entire specification of the body to apply as noted:

AISC: American Institute of Steel Construction;
ASTM: American Society for Testing Materials;
CEC: Canadian Electric Code;
CGSB: Canadian Government Specification Board;
CISC: Canadian Institute of Steel Construction;
CRCA: Canadian Roofing Contractors' Association;
CSA: Canadian Standards Association;
OBC: Ontario Building Code;
ULC: Underwriters' Laboratories of Canada;
CLA: Canadian Lumbermen's Association.

4. Cooperation

1. Each trade to cooperate with the trades of adjacent or affected work. Supply in good time requirements effecting adjacent and underlying work in writing and items to be set or built in. Similarly, heed requirements and build-in items provided by other trades.
2. Take necessary precautions to protect work of other trades from contamination, marring or other damage due to application or installation processes, methods and activities.
3. General Contractor and each trade to cooperate with Contractors which may be assigned or selected by the Owner to perform work under Cash Allowances. Owner reserves the right to assign nonunionized labour to perform work under Cash Allowances, at Owners discretion.

5. Coordination

1. Coordinate the work of all trades in such a manner that each trade co-operates with the trade of adjacent work.
2. Organize weekly job site meetings and send out notices stating time and place to Consultants, subcontractors, Suppliers and all others whose presence is required at the meetings.
3. Take note of all persons attending these meetings and submit to Consultants and Owner, Minutes of these Meetings showing any major decisions made and instructions or information required.
4. Coordinate the Work in this Contract with the work of others awarded work under Cash Allowances.

6. Building Dimensions and Co-ordination

1. Ensure that all necessary job dimensions are taken and all trades are coordinated for the proper execution of the work. Assume complete responsibility for the accuracy and completeness of such dimensions, and for coordination.
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, particularly reflected ceiling plans and jointing patterns for paving, ceramic tile, or carpet tile layouts, which affect aesthetics, or which interfere with services, equipment or surfaces. DO NOT PROCEED without direction from the Consultant.
7. Ensure that each Subcontractor communicates requirements for site conditions and surfaces necessary for the execution of the Subcontractor's work, and that he provides setting drawings, templates and all other information necessary for the location and installation of material, holes, sleeves, insets, anchors, accessories, fastenings, connections and access panels. Inform other Subcontractors whose work is affected by these requirements and preparatory work.
8. Prepare interference drawings to properly co-ordinate the work where necessitated. Refer to Section 01340.

7. Use of Premises Before Substantial Performance

1. The Owner shall have the right to enter and occupy the building, in whole or in part, for the purpose of placing fittings and equipment, or for other use, before completion of the Contract if, in the opinion of the Consultant, such entry and occupancy does not prevent or interfere with the Contractor in the performance of the Contract. Such entry shall in no way be considered as an acceptance of the Work in whole, or in part, nor shall it imply acknowledgment that terms of the Agreement are fulfilled.

8. 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.

9. By-Laws and Regulations

1. Nothing contained in the Drawings and Specifications are to be so construed as to be knowingly in conflict with any law, by-law or regulation of municipal, provincial or other authorities having jurisdiction.
2. Perform work in conformity with such laws, by-laws and regulations and make any necessary changes or deviations from the Drawings and Specifications subsequently required as directed and at no cost to the Owner unless notification is given in writing before Tender Closing Date.
3. Furnish inspection certificates and/or permits as may be applicable as evidence, that installed work conforms with laws, by-laws, and regulations of authorities having jurisdiction.

10. Protection

1. Take necessary precautions and provide and install required coverings to protect material, work and finishes from contamination, damage, the elements, water and frost.
2. Make good any damage or replace damaged materials, as directed. Repairs to be made by the trade having originally installed or fabricated the damaged material, finish or item. Protect electrical equipment from water and the elements.
3. Protect adjacent private and public property from damage and contamination.
4. Protect curbs and sidewalks from damage from trucking by means of boards and the like. Repair, or pay or repair of damage to existing roads and sidewalks.
5. Mark glass after glazing in an acceptable manner, and leave in place until final clean-up.
6. Protect floor finishes from construction traffic and transport of construction materials and equipment by means of 6 mm plywood panels.

11. Delivery, Handling and Storage of Materials

1. Schedule material delivery so as to keep storage at site to the absolute minimum, but without causing delays due to late delivery.
2. Store materials which will be damaged by weather in suitable dry accommodation. Provide heat, as required, to maintain temperatures recommended by material manufacturer.
3. Store highly combustible or volatile materials separately from other materials, and under no circumstances, within the building. Protect against open flame and other fire hazards. Limit volume of supply on the site to minimum required for one day's operations.
4. Handle and store material so as to prevent damage to material, structure and finishes. Avoid undue loading stresses in materials or overloading of floors.

5. Do not store material and equipment detrimental to finished surfaces within areas of the building where finishing has commenced or has been completed. All material storage within the building is subject to relocation, as directed.
6. Deliver package material in original, and Storage of unopened and undamaged containers with manufacturer's labels and seals intact.

12. Debris

1. Assign clean-up duties to a crew with own Foremen which will be of sufficient size to prevent accumulation of debris and dirt in any part of the structure or on the site.
2. Remove construction debris on a daily basis and legally dispose of same.
3. Under no circumstances, should debris, rubbish or trash be burned or buried on the site.

13. Cutting, Fitting and Patching

1. Required cutting to be done by General Contractor. Patching and painting of work to be executed by the General Contractor.
2. All sub-trades are to notify the General Contractors bidding as to the extent of the cutting, patching, and painting of their respective trades.
3. Drilling, cutting, fitting and patching necessary due to failure to deliver items to be built-in time, or installation in wrong location to be executed, as directed, at no cost to the Owner.
4. Give written notification prior to commencement of drilling and cutting of load bearing structural members and finished surfaces.
5. Cut holes with smooth, true, clean edges, after they are approved by applicable trade. Size holes and openings for hot water and steam pipes, so as to allow for expansion and contraction of such pipes.

14. Fastenings

1. Supply all fastenings, anchors and accessories required for fabrication and erection or work.
2. Metal fastenings to be of the same material as the metal component they are anchoring, or of a metal which will not set up an electrolysis action which would cause damage to the fastening or metal component under moist conditions.
3. Exposed metal fastenings and accessories to be of the same texture, color, and finish as base metal on which they occur. Keep to a minimum; evenly space and lay out.
4. Fastenings to be permanent, of such a type and size and installed in such a manner to provide positive anchorage of the unit to be secured. Wood plugs are not acceptable. Install anchors at required spacing to provide required load bearing or shear capacity.

5. Power actuated fastenings not to be used without prior written approval for specific use.

15. Surplus Materials

1. Surplus materials specifically so specified, to remain property of the Owner and be neatly stockpiled or stored, as directed.
2. All other surplus materials to become property of the Contractor; to be removed from the site and legally disposed of.

16. Documents Required and General Duties

1. At Commencement of Contract

- .1 Supply Public Liability and Property Damage Insurance Certificates.
- .2 Supply Certificates of good standing from Workers' Compensation Board for the General Contractor and all Subcontractors.
- .3 Supply Contract Sum Breakdown of all sub-trades or parts of work and general expense items.
- .4 Supply Construction Schedule.
- .5 Supply Schedule of Shop Drawing Submissions.
- .6 The Owner has paid for the cost of the Building Permit. Mechanical Subcontractor will pay the cost of other Fees related to the Work Specified under Division 15. Electrical Subcontractor will pay the cost of all permits and fees related to the Work Specified under Division 16.
- .7 The General Contractor is to pay all other fees and refundable deposits if applicable.
- .8 Digital copies (in PDF format) of the approved building permit drawings and the building permit will be provided. The General Contractor shall provide and maintain one (1) hardcopy of the building permit drawings for use by the Building Inspector. The general contractor shall provide and display one (1) copy of the building permit.

2. During Construction

- .1 Adjust Allowances, as required.
- .2 Organize Job Meetings.
- .3 Supply Monthly Progress Reports and Construction Schedule.
- .4 Confirm that payments are being made to subcontractors and suppliers by submission of receipts with the second and subsequent Progress Payment Application. No payment will be made for unincorporated material on the site, unless Bill of Sale in proper format is provided.

3. Upon Completion

- .1 Upon completion of work before the Final Certificate of Payment is issued, the following to be observed, executed and submitted:
 - .1 All deficiencies to have been completed in a satisfactory manner.
 - .2 All final clean-up to have been executed.
 - .3 Finishing Hardware, Inspection and Verification.
 - .4 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.
- .5 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.
- .6 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.
- .7 Certificates of good standing from the Workers' Compensation board, for the General Contractor and all Subcontractors.
- .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 H.E.P.C. Inspection Certificate and all other Inspection Certificates required by Provincial, Municipal and other authorities having jurisdiction.
- .13 Balancing Reports.
- .14 As-Built Drawings - Hardcopy mark ups, digital pdf and digital AutoCAD v2018 or higher
- .15 One hard copy of Operation and Maintenance Manuals. A digital copy (pdf file) of all closeout documents to be provided on USB stick format.

17. Progress Reports

1. Submit to the Architect, Monthly Progress Reports consisting of a concise narrative and a marked-up summary schedule showing physical percentage complete by item and in total. These progress calculations must agree with the Progress Payment Claims.
2. Keep permanent written daily records on the site on the progress of work. Record to be open to inspection at reasonable times and copies to be furnished upon request. Records to show notes of commencement and completion of different trades and parts of work; daily high and low temperatures and other weather particulars; number of men engaged on the site (including sub-trades) broken down in groups for each type of construction work, and particulars about excavation and shoring; erection and removal of form work; pouring and curing of concrete; floor finishing; placing and compaction of backfill, masonry work; roofing;
3. Daily progress to give particulars on commencement and completion of each trade or part of work; form work erections and removal; concrete pouring and curing; floor finishing; masonry work; roofing; waterproofing; finishing trades, tests and inspection and the like.

18. Inspection and Testing

1. The Owner will retain the services of Inspection and Testing Companies. The cost of inspection and testing will be deducted from the Inspection and Testing Allowance specified under Section 01020, "Allowances".
2. Where tests or inspections reveal work not in accordance with Contract requirements, the Contractor shall pay costs for additional tests or inspections as the Architect may require to verify acceptability of corrected work.
3. The Inspection and Testing by the Owner's Testing Company does not relieve the Contractor of his responsibility to provide his own quality control in order to meet or exceed the requirements of specified standards, codes, design criteria and referenced documents.

End of Section

1. Selection of Products

1. If requested by the Consultant, provide the following services and/or information:
 - .1 Assist the Consultant in determining qualified suppliers.
 - .2 Obtain proposals from suppliers.
 - .3 Make appropriate recommendations for consideration of Consultant.
 - .4 Notify Consultant of any effect anticipated by selection of product or supplier under consideration, on construction schedule and contract sum.
2. On notification of selection, enter into purchase agreement with designated supplier.

2. Cash Allowance

1. Expend cash allowance only on the Consultant's written instructions.
2. Include in Contract price the Contractor's charges for handling at site, including uncrating and storage, protection from elements and damage, labour, installation and finishing, testing, adjusting and balancing, and other expenses including overhead and profit on account of Cash Allowance in accordance with General Conditions.
3. Credit the Owner with any unused portion of Cash Allowances in the statement for final payment.
4. If a test made under payment by a specific allowance proves that the material or system is not in accordance with the Documents, then the subsequent testing including Owner's testing of replacement materials or systems shall be Contractor's expense and not taken from Cash Allowance.
5. Add or deduct any variation in cost from the Cash Allowance. No adjustment will be made to Contractor's expense.
6. The amount of each allowance includes the net cost of the product or service, delivery and unloading at the site.
7. All refunds, trade and/or quantity discounts which the Contractor may receive in the purchase of goods under allowances, to be extended to the Owner.
8. Receipted invoices covering all disbursements made by the Contractor under Allowances, to be submitted to the Consultant for audit.
9. Where the Cash Allowance stipulates "Supply Only," the Contract Price and not the Cash Allowances include the installation and hook-up costs. The installation and hook-up of some equipment and materials are specified under other Sections of the Specifications. The General Contract includes the installation and hook-up not specified elsewhere.
10. Contractor's profit and overhead on all Cash Allowances to be carried in his lump sum amount, not in the Cash Allowances.

-
11. All Cash Allowances will be dealt with in accordance with General Conditions. All expenditures under Cash Allowances, must be approved by the Owner.
 12. Include in the Stipulated Price quoted, a Cash Allowance in the amount of **Thirty Thousand dollars, \$30,000.**
To be allocated as follows:
 - .1 Finish Hardware, supply only.
 - .2 Interior Signage, supply and installation
 - .3 Inspections and Testing
 13. H.S.T. Goods and Services tax is not included in Cash Allowance amount and is to be carried in the General Contractor's Stipulated Sum Amount.
 14. Refer to Section 01005 for co-operation with others assigned to this Section.

3. Contingency Allowance

1. Include in the Stipulated Price quoted, a Contingency Allowance in the amount of **Sixty Thousand Dollars, \$60,000.**
2. Costs of Change Orders to be applied to Contingency Allowance.
3. Credit the Owner with any unused portion of the Contingency Allowance in the statement for final payment.

End of Section

1. Project Meetings for Coordination

1. In consultation with the Consultant during the second week of construction, arrange for site meetings weekly or every 2 weeks as appropriate to the stage of construction, for project coordination. Such meetings shall fall at the same time each week the meeting is scheduled.
2. Responsible representatives of the Contractor's and Subcontractor's office and field forces and suppliers shall be obliged to attend.
3. Inform the Owner, Consultant, and those others whose attendance is obligatory, of the date of each meeting, in sufficient time to ensure their attendance.
4. Provide physical space for meetings, prepare an agenda, chair and record the minutes of each meeting. Relevant information must be made available to all concerned, in order that problems to be discussed may be expeditiously resolved. Identify "action by: _____".
5. Within three days after each meeting, distribute digital copies of the minutes to each invited person.

2. Pre-construction Meeting

1. Within 5 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
2. Include in the agenda the following:
 - .1 Appointment of official representative of participants in the Work.
 - .2 Scheduling of Work. Schedule to include a detailed breakdown of mechanical and electrical works.
 - .3 Interference with ongoing business.
 - .4 Work by other Contractors.
 - .5 Schedule of submission of shop drawings and samples.
 - .6 Requirements for temporary facilities, site sign, offices, storage sheds, utilities.
 - .7 Delivery schedule of specified equipment.
 - .8 Site security.
 - .9 Contemplated change notices, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
 - .10 Record drawings.
 - .11 Maintenance manuals.
 - .12 Take-over procedures, acceptance, warranties.
 - .13 Monthly progress claims, administrative procedures, photographs, holdbacks.
 - .14 Appointments of inspection and testing agencies or firms.
 - .15 Insurance, transcript of policies.
 - .16 Schedule for progress meetings.

3. Project Meetings for Progress of Work

1. Conduct progress meetings in accordance with the schedule and/or decisions made at Pre-construction meeting.
2. Inform the Owner, Consultant, project consultants, Subcontractors and suppliers and those whose attendance is obligatory, of the date of the meeting, in sufficient time to ensure their attendance.
3. Include in the agenda the following:
 - .1 Review, approval of minutes of previous meeting.
 - .2 Review of Work progress since previous meeting.
 - .3 Field observations, problems, conflicts.
 - .4 Problems which impede construction schedule.
 - .5 Review of off-site fabrication delivery schedules.
 - .6 Corrective measures and procedures to regain projected schedule.
 - .7 Revisions to construction schedule.
 - .8 Progress during succeeding work period.
 - .9 Review submittal schedules: expedite as required.
 - .10 Maintenance of quality standards.
 - .11 Pending changes and substitutions.
 - .12 Review proposed changes for effect on construction schedule and on completion date.
 - .13 Other business.

4. Progress Records

1. Maintain a permanent written record on the site of the progress of the work using standard OGCA form. This record shall be available to the Consultant at the site, and a copy shall be furnished to same on request. The record shall contain:
 - .1 Daily weather conditions, including maximum and minimum temperatures.
 - .2 Dates of the commencement and completion of stage or portion of the work of each trade in each area of the project.
 - .3 Conditions encountered during excavation.
 - .4 Dates of erection and removal of formwork, in each area of the project.
 - .5 Dates of pouring the concrete in each area of the project, with quantity and particulars of the concrete.
 - .6 Work force on project daily per trade.
 - .7 Visits to site by personnel of Consultant, Jurisdictional Authorities and testing companies.

End of Section

1. General

1. Submit to Architect, for review, shop drawings, product data and samples specified.
2. Until submission is reviewed, work involving relevant product must not proceed.

2. Shop Drawings

1. Drawings to be originals prepared by Contractor, Subcontractor, Supplier or Distributor, which illustrate appropriate portion of work; showing fabrication, layout, setting or erection details as specified in appropriate Sections.
2. Identify details by reference to sheet and detail numbers shown on Contract Drawings.
3. Maximum sheet size 24" x 36" as PDF.

3. Project Data

1. Certain specification Sections specify that manufacturer's standard schematic drawings, catalogue sheets, diagrams schedules, performance charts, illustrations and other standard descriptive data will be accepted in lieu of shop drawings.
2. Above will only be accepted if they conform to following:
 - .1 Delete information which is not applicable to project.
 - .2 Supplement standard information to provide additional information applicable to project.
 - .3 Show dimensions and clearances required.
 - .4 Show performance characteristics and capacities.
 - .5 Show wiring diagrams (when requested) and controls.

4. Coordination of Submissions

1. Review shop drawings, product data and samples prior to submission.
2. Verify:
 - .1 Field measurements.
 - .2 Field construction criteria.
 - .3 Catalogue numbers and similar data.
3. Coordinate each submission with requirement of work and Contract documents. Individual shop drawings will not be reviewed until all related drawings are available.
4. Contractor's responsibility for errors and omissions in submission is not relieved by Architect's review of submittals.
5. Contractor's responsibility for deviations in submission from requirements of Contract documents is not relieved by Architect's review of submission, unless Architect gives written acceptance of specified deviations.

6. Notify Architect, in writing at time of submission, of deviations from requirements of Contract documents.
7. After Architect's review, distribute copies.

5. Submission Requirements

1. Schedule submissions at least fourteen (14) days before dates that reviewed submissions will be required to be returned.
2. Submit a digital copy (PDF) of shop drawings, product data to Architect for review.
3. Accompany submissions with transmittal letter, containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Number of each shop drawing, product data and sample submitted.
 - .5 Other pertinent data.
4. Submissions must include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name of:
 - .1 Contractor.
 - .2 Subcontractor.
 - .3 Supplier.
 - .4 Manufacturer.
 - .5 Separate detailer when pertinent.
5. Identification of product or material.
 - .1 Relation to adjacent structure or materials.
 - .2 Field dimensions, clearly identified as such.
 - .3 Specification Section number.
 - .4 Applicable standards, such as CSA or CGSB numbers.
 - .5 Contractor's stamp, initialled or signed, certifying review of submission, verification of field measurements and compliance with Contract documents.
6. Interference Drawings
 - .1 Prepare interference drawings for all work in confined space ie: ceiling space.

End of Section

1. Construction Safety Measures

1. Observe and enforce construction safety measures required by the National Building Code; the O.B.C.; The Provincial Government; Workers' Compensation Board; and, Municipal authorities.
2. In particular, the Occupational Health and Safety Act (Ont. Re. 213/91), the Occupational Health and Safety Act, the regulations of the Ontario Ministry of Labour and Ontario Hydro Safety requirements shall be strictly enforced.
3. Contractor shall ensure that copies of all applicable construction safety regulations, codes and standards are available on the jobsite throughout the period of construction. All workers are to be informed that these documents are available for reference at any time.
4. The Contractor shall ensure that all supervisory personnel on the job-site are fully aware of the contents of the Occupational Health and safety Act (Ontario Regulation 213/91 - Construction Projects) the Workers' Compensation Act" and, Bill 208 (Chapter 7, Standards of Ontario) "An Act to Amend the Occupational Health & Safety Act and the Workers' Compensation Act", and, that they comply with all requirements and procedures prescribed therein. These documents include, but are not limited to, the following construction safety requirements:
 - .1 Contractor to register with the Director of the Occupational Health and Safety Division before or within 30 days of the commencement of the project, (O.Reg. 213/91, sec 5).
 - .2 File a notice of project with a Director before beginning work on the project, (O.Reg. 313/91, sec 6).
 - .3 Notification prior to trenching deeper than 1.2m, (O.Reg. 213/91, sec 7).
 - .4 Accident Notices and Reports, (O.Reg. 213/91, sec 8 through sec 12).
 - .5 General Safety Requirements, (O.Reg. 213/91, sec 13 through sec 19).
 - .6 General Construction Requirements, e.g. protective clothing, hygiene practices, housekeeping, temporary heat, fire safety, access to the job-site, machine and equipment guarding and coverings, scaffolds and platforms, electrical hazards, roofing, et al, (O.Reg. 213/91, sec 20 through sec 221).
 - .7 Establish a Joint Health and Safety Committee where more than 19 workers are employed for more than 3 months, (Bill 208, S.8(2) to S.8(14)).
 - .8 Establish a Worker Trades Committee for all projects employing more than 49 workers for more than 3 months, (Bill 208, S-8a(1) to S.8b(4)).
 - .9 Ensure that all activities arising out of (.07) and (.08) above are recorded and that minutes are available to an inspector of the Ontario Ministry of Labour.
5. The Contractor shall be considered as the "Constructor" in consideration of the rights and responsibilities for all construction safety requirements, procedures, facilities and inspection of all work performed by the Contractor, Subcontractors/Sub-trades and other Contractors engaged on this project.
6. In the event of a conflict between any of the provisions of the above authorities the most stringent provisions are to be applied.

2. Material Safety Data Sheet

1. Material safety Data Sheets (MSDS) must be available at the jobsite for any product listed on the Hazardous Ingredients List prior to being used, installed or applied inside of the building.
2. A Material Safety Data Sheet is to be submitted to the Architect for any product which is known to create, or suspected of creating, a health hazard or discomfort during construction or upon commissioning of the project including, but not limited to, the following:
 - .1 adhesives
 - .2 solvents
 - .3 sealants, (caulking, vapour seals, etc.)
 - .4 sprayed-on fireproofing
 - .5 resilient flooring
 - .6 carpet, paint, varnish or other coatings
 - .7 exposed membrane waterproofing
 - .8 special coatings, (terrazzo sealants, chafing coatings, etc.)
 - .9 solder, brazing and welding and other filler metal
 - .10 other products whose particles or vapours may become air borne after installation.
 - .11 any other product as directed by the Consultant.
3. Comply with WHMIS regulation, Workplace Hazardous Material Information System.

3. Fire Safety Requirements

1. Comply with requirements for Building Construction, the Ontario Building Code, the Ontario Fire Code, the requirements of Local Fire Authorities and of the requirements of the Office of the Fire Marshal.

4. Overloading

1. Ensure no part of Work is subjected to a load which will endanger its safety or will cause permanent deformation.

5. Falsework

1. Design and construct falsework in accordance with CSA S269.1-1975.

6. Scaffolding

1. Design and construct scaffolding in accordance with CSA S269.2-M1980.
2. Scaffolding to be designed by a Professional Engineer when required under the Occupational Health and Safety Act.

7. Materials Specifically Excluded

1. Asbestos and/or asbestos-containing products are not permitted. Submit Material Safety Data Sheets for any product suspected of containing asbestos if so requested by Consultant. Examples of some materials requiring close scrutiny and/or confirmation include:
 - .1 Transite drainage pipe - whether buried or above grade - not permitted.
 - .2 Composite floor tile containing asbestos - not permitted.
 - .3 Lay-in ceiling tiles containing asbestos - not permitted.
 - .4 Insulation and/or jacketing for pipes, ducts, motors, pumps, etc. - not permitted if any asbestos is present.
2. Solder for all piping is to be lead-free.
 - .1 "Lead Free" shall mean solder which contains less than 0.030% of lead when dissolved in fluoroboric and nitric acids and tested by inductively coupled argon plasma atomic emission spectroscopy. "Steelbond 281" and "Silverbrite" are acceptable solder products.
 - .2 The mechanical contractor shall provide an affidavit signed by the Principal of the company, on company letterhead, that all of the solder used on the project was either one of the two acceptable products or that the solder used (identified by brand name) meets or exceeds the testing criteria.
 - .3 The Owner shall undertake random testing of the soldered joints. Should testing prove that the solder used was not as specified, the Owner shall take action against the contractor to the full extent of the law.
3. All paint and finish coatings are to be lead and mercury-free. Submit Material Safety Data Sheets confirming that these products are free of all lead and/or mercury compounds.

End of Section

PART 1 - GENERAL

1.1 Related Work

1. These specifications apply to all 16 divisions of the 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. It is recognized that currently specified materials and methods may conflict with the basic intention of this section. Where reasonable alternate materials and methods exist that are not specified here, and that do not compromise quality or create additional cost for the owner, notify the Architect of such alternate materials or methods. Do not proceed to use alternate materials or methods to those specified without the express approval of the Architect.
3. Elsewhere, apply the provisions of this section to all work. Exceptions can only be made when signed off by the Architect. Suitability of all products used is the responsibility of the contractor.

1.2 Compliance Specifications

1. The contractor must comply with all applicable health, safety and environmental regulations.

1.3 Beyond Compliance Specifications

1. These specifications apply in addition to all applicable health, safety and environmental compliance regulations. They are incorporated here to reflect the Owner's intention to develop a specification which maximizes environmentally "friendly" materials and methods wherever possible within current technical and budget limitations.
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. The primary goal of beyond compliance specification is to reduce the use of products or methods which have negative health and environmental impacts both during and after construction. These considerations may include full life cycle impacts, associated with raw materials, manufacturing, transport, deconstruction and their eventual fate.
4. These specifications will specifically address primary categories of readily identifiable products, ingredients and methods.
5. These provisions apply to both indoor and outdoor applications equally.

1.4 Exceptions

1. These specifications recognize that not all substitutes are equal and therefore exceptions can be made based on substantive evidence of necessary and superior performance. Special considerations may be given to restricted substances when secondary provisions are made such as sealed in place (contained) applications. All such exceptions must be approved in writing by the Architect.

PART 2 - MATERIALS

2.1 Products or Substances to be Avoided or Limited in Use

1. No product containing the following substances may be used on this project when an equivalent product without or with a lower concentration of this substance is suitable and available. All products containing substances which are known to cause health effects including but not limited to cancer, mutagenic, neurological, or behavioral effects should be avoided if suitable substitutes not containing or containing lower concentrations are available. This provision shall be limited to information contained on Material Safety Data Sheets, therefore MSDS sheets must be reviewed for all products for which such sheets are required. Applications for exceptions must be accompanied by related MSDS and product application and performance sheets, clearly showing a need for the exception.

2.2 Volatile Organic Compounds

1. No product containing volatile organic compounds (in over simplified terms volatile petro chemical or similar plant derived solvents) may be used on this project when a suitable non-VOC or failing that a low VOC substitute is available. Manufacturers may refer to the U.S. EPA definition of VOC's for guidance or alternatively use the low molecular weight organic compound descriptor.

Example: Paints, Coatings, Primer, Adhesives, Chalks, Firestops, etc.

2. Waterborne equivalents are available for most of the solvent borne products used in construction and in most cases would be the preferred alternative. Waterborne products may in some instances have high VOC contents, therefore the fact that a product is waterborne does not automatically make it acceptable.

2.3 Chlorinated Substances

1. Poly Vinyl Chloride (vinyl) and other chlorinated products should be avoided if suitable substitutes are available.

2.4 Plasticizers

1. Plasticisers which offgass (low molecular weight) should be avoided.

2.5 Man Made Mineral Fibres

1. Products containing mineral fibres which can be emitted or abraded should be avoided.

Examples: duct liner, mineral fibre ceiling tiles, etc.

2.6 Radiation

1. Products or methods which result in the lowest emission of Electro Magnetic Fields are preferred.

2.7 Biocides

1. Products containing biocides (pesticides, miticides, mildewicides, fungicides, rodenticides, etc.) are not to be used if suitable alternatives are available. Highly stable, low human toxicity biocides such as Portercept may be acceptable substitutes. Biocide formulas which break down, emit powders or offgases should be avoided.

2.8 Heavy Metals

1. Heavy metals such as lead, cadmium, mercury etc. should be avoided.

2.9 Aluminum

1. Raw aluminum should be avoided, anodized or factory painted aluminum is acceptable. This is particularly applicable to surfaces which people can touch.

2.10 Ozone Depleting Substances

1. Products which contain, or which use Ozone Depleting Substances such as Bromide, Chlorofluorocarbons (CFC) or Hydrofluorocarbons (HFC) etc. should be avoided if suitable substitutes are available.

2.11 Greenhouse Gases

1. Products which contain, use or generate Greenhouse gases such as CO₂ should be avoided if suitable substitutes are available.

2.12 Bituminous (tar) Products

1. Products containing tar compounds should not be used if suitable substitutes are available.

2.13 Chemical Compounds

1. Products containing the following chemical compounds should not be used if suitable substitutes are available: Neoprene, Latex, Butyl, ABS, Formaldehyde.

2.14 Adhesives

1. Adhesives containing solvents or other non preferred ingredients should be avoided if suitable substitutes are available, including systems designs which do not need adhesives or can use mechanical etc. fastening alternatives

2.15 Composite Products

1. Some composite products contain adhesives such as formaldehyde which are not preferred, and some composites such as Fibre Reinforced Plastics are not practical for recycling. These products should be avoided if suitable substitutes are available.

2.16 Cleaners and Solvents

1. Products, equipment, and methods which require the use of cleaners and solvents are not preferred if suitable substitutes are available. Examples of preferred products would include No Wax floors, or primerless caulks and adhesives, or products not requiring caulks and adhesives.

End of Section

1. Fires

1. Fires and burning of rubbish on site is not permitted.

2. Disposal of Wastes

1. Do not bury rubbish and waste materials on site.
2. Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.

3. Asbestos and Hazardous Substances

1. General Contractor is to inform Architect in the event of encountering material suspected of containing asbestos or hazardous substances.
2. Architect will notify owner of such findings and owner to engage directly a certified Asbestos Abatement Contractor.

End of Section

1. General

1. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.
2. Store volatile wastes in covered metal containers and remove from premises daily.
3. Prevent accumulation of wastes which create hazardous conditions.
4. Provide adequate ventilation during use of volatile or noxious substances.

2. Materials

1. Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
2. Provide on-site dump containers for collection of waste materials, and rubbish.

3. Cleaning During Construction

1. Maintain project grounds, and public properties free from accumulations of waste materials and rubbish.
2. Remove waste materials, and rubbish from site.
3. Vacuum clean interior building areas when ready to receive finish painting and continue vacuum cleaning on an as-needed basis until building is ready for substantial completion or occupancy.
4. Schedule cleaning operations so that resulting dust and other contaminants will not fall on wet, newly painted surfaces.

4. Final Cleaning

1. At completion of Work, remove waste materials, rubbish, tools, equipment, machinery, and surplus materials, and clean all surfaces exposed to view; leave project clean and ready for occupancy.
2. Employ experienced workers, or professional cleaners, for final cleaning.
3. In preparation for Substantial Performance or Fitness for Occupancy status, whichever occurs first, conduct final inspection of interior and exterior surfaces exposed to view, and of concealed spaces.
4. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from all sight-exposed interior and exterior finished surfaces; polish resilient and ceramic surfaces so designated to shine finish. Vacuum carpet.
5. Clean and polish glass and mirrors.

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6. Repair, patch and touch-up marred surfaces to specified finish, to match adjacent surfaces.
 7. Broom-clean paved surfaces; rake clean other surfaces of grounds.
 8. Clean exposed ductwork and structure.
 9. Replace filters.
 10. Clean bulbs and lamps and replace those burned out.
 11. Clean diffusers and grilles.
 12. Clean sinks, faucets, and water closets and controls.
 13. Maintain cleaning until project, or portion thereof, is occupied by Owner.

End of Section

1. Requirements Included

1. Record documents, samples, and specifications.
2. Equipment and systems.
3. Product data, materials and finishes, and related information.

2. Quality Assurance

1. Prepare instructions and data by personnel experienced in maintenance and operation of described products.

3. Format

1. Organize data in the form of an instructional manual.
2. Binders: commercial quality, 8½" x 11" maximum 2½" ring size.
3. When multiple binders are used, correlate data into related consistent groupings.
4. Cover: Identify each binder with type or printed title "Project Record Documents", list title of Project, identify subject matter of contents.
5. Arrange content under Section numbers and sequence of Table of Contents.
6. Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
7. Drawings: provide with reinforced punched binder tab. Bind in with text, fold larger drawings to size of text pages.

4. Contents, Each Volume

1. Table of Contents: Provide title of project; names, addresses, and telephone numbers of Consultant and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.
2. For each Product or System: list names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
3. Product Data: mark sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.
4. Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
5. Typed Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

5. Submission

1. Submit for review a digital pdf file of completed closeout documents in final form 15 days prior to substantial performance. For equipment put into use with Owner's permission during construction, submit Operating and Maintenance Manuals within 10 days after start-up. For items of Work delayed materially beyond date of Substantial Performance, provide updated submittal within 10 days after acceptance, listing date of acceptance as start of warranty period.
2. Consultant comments will be returned and the contractor is to revise content of documents as required prior to final submittal.
3. Submit one (1) hard copy of revised volumes of data in final form within ten days after final inspection.
4. For contract drawings (architectural, landscaping, structural, mechanical, electrical), transfer neatly as-built notations onto second set and submit both sets.
5. Prepare digital pdf file for submission on USB of completed closeout documents.

6. Record Documents and Samples

1. In addition to requirements in General Conditions, maintain at the site for Owner one record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda
 - .4 Change Orders and other modifications to the Contract.
 - .5 Reviewed shop drawings, product data and samples.
 - .6 Field test records.
 - .7 Inspection certificates.
 - .8 Manufacturer's certificates.
2. Store Record Documents and Samples in Field Office apart from documents used for construction. Provide files, racks, and secure storage.
3. Label and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "Project Record" in neat, large, printed letters.
4. Maintain Record Documents in a clean, dry, and legible condition. Do not use Record Documents for construction purposes.
5. Keep Record Documents and samples available for inspection by Consultant.

7. Recording As-Built Conditions

1. Consultant will provide electronic copies of project drawings in PDF format. Make one (1) hardcopy of the project drawings for the purpose of recording as-built conditions. Mark and record changes on an on-going basis as construction proceeds. **Near the end of the construction period transfer all marks to the supplied electronic documents, and**

submit for consultant review as project record as-built documents. As an alternative, scan the record set in PDF format and submit for consultant review.

2. Refer to drawings/specifications for additional mechanical and electrical requirements.
3. Record information concurrently with construction progress. Do not conceal work until required information is recorded.
4. Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:
 - .1 Measure depths of elements of foundation in relation to finish first floor datum.
 - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .4 Field changes of dimension and detail.
 - .5 Changes made by change orders.
 - .6 Details not on original Contract Drawings.
 - .7 References to related shop drawings and modifications.
5. Specifications: legibly mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalog number of each project actually installed, particularly optional items and substitute items.
 - .2 Changes made by Addenda and Change Orders.
6. Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

8. Digital As-Built Drawings

1. After the consultant has found the Redlined As-Built drawings to be acceptable, transfer to digital file all information recorded on As-Built drawings. Layering of information as per consultant's instructions.
2. Retain the services of a CAD drafting company acceptable to the consultant to prepare digital CAD As-Built documents for all Architectural and Engineering drawings.

9. Equipment and Systems

1. Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
2. Panelboard Circuit Directories: provide electrical service characteristics, controls, and communications.
3. Include installed colour coded wiring diagrams.

4. Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shutdown, and emergency instruction. Include summer, winter, and any special operating instructions.
5. Maintain Requirements: include routine procedures and guide for troubleshooting; disassembly, repair and reassemble instructions; and alignment, adjusting, balancing, and checking instructions.
6. Provide servicing and lubrication schedule, and list of lubricants required.
7. Include manufacturer's printed operation and maintenance instructions.
8. Include sequence of operation by controls manufacturer.
9. Provide original manufacturer's parts lists, illustrations, assembly drawings, and diagrams required for maintenance.
10. Provide installed control diagrams by controls manufacturer.
11. Provide Contractor's co-ordination drawings, with installed colour coded piping diagrams.
12. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
13. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
14. Include test balancing reports as specified in mechanical specifications.
15. Additional Requirements: As specified in individual specification sections.

10. Materials and Finishes

1. Building Products, Applied Materials, and Finishes: include product data, with catalog number, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured products.
2. Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
3. Moisture-protection and Weather-exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommend schedule for cleaning and maintenance.
4. Additional Requirements: as specified in individual specifications sections.

11. Guarantees, Warranties and Bonds

1. Separate each warranty or bond with index tab sheets keyed to the List of Contents listing.

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2. List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principals. Use Guarantee/Warranty Form as provided in Section 01721 whenever standard preprinted trade or manufacturer's Guarantee/Warranty forms are not available.
 3. Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of the applicable item of work.
 4. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.
 5. Verify that documents are in proper form, contain full information, and are notarized.
 6. Co-execute submittals when required.
 7. Retain warranties and bonds until time specified for submittal.

End of Section

1. Maintenance Manual

1. On completion of project, submit to Owner one (1) copy of Operations Data and Maintenance Manual in English, made up as follows:
 - .1 Bind data in vinyl hard covered, 3 ring loose leaf binder for 8½" x 11" size paper.
 - .2 Enclose title sheet, labeled "Operation Data and Maintenance Manual", project name, date and list of contents.
 - .3 Organize contents into applicable sections of work to parallel project specification break-down. Mark each section by labeled tabs protected with celluloid covers fastened to hard paper dividing sheets.
 - .4 A digital copy of all documents in the operations and manuals must be provided on a USB, format to be PDF.
2. Include following information, plus data specified.
 - .1 Maintenance instructions for finished surface and materials.
 - .2 Copy of hardware and paint schedules.
 - .3 Description, operation and maintenance instructions for equipment and systems, including complete list of equipment and parts list. Indicate nameplate information such as make, size, capacity, serial number.
 - .4 Names, addresses and phone numbers of sub-contractors and suppliers.
 - .5 Guarantees, Warranties and bonds showing:
 - .1 Name and address of project.
 - .2 Guarantee commencement date (date of Final Certificate of Completion).
 - .3 Duration of guarantee.
 - .4 Clear indication of what is being guaranteed and what remedial action will be taken under guarantee.
 - .5 Signature and seal of Contractor.
 - .6 Additional material used in project listed under various Sections showing name of manufacturer and source of supply.
3. Neatly type lists and notes. Use clear drawings, diagrams or manufacturers' literature.
4. Include a complete set of final shop drawings indicating corrections and changes made during fabrication and installation.

End of Section

1. Standard Warranty

1. Refer to Supplementary Conditions and to Standard Contract Document CCDC No. 2, for warranty requirements and conditions for the standard warranty which is required for the work of this contract.

2. Extended Warranties

1. Refer to individual specifications sections for requirements of extended warranties required for particular sections or items of work.
2. Extended warranties are required to be issued by manufacturers, fabricators, suppliers and/or installers, sometimes jointly, due to their unique position in the construction process and their ability to guarantee a particular section of work. Refer to individual requirements of extended warranties requested.
3. Unless specifically noted otherwise, all extended warranties shall commence on the date of Substantial Performance of the Work as certified by the Consultant.
4. Listed below is a summary of extended warranties required for individual Sections. This list, if inconsistent with the specified requirements of individual extended warranties, shall be deemed correct with respect to length of extended warranties. Extended warranties required shall include, but not be limited to, the following:

Extended warranties (total warranty period listed, including entire building warranty)

Architectural Woodwork (06400)	2 years
Preformed Metal Siding (07615)	5 years
Caulking (Section 07900)	5 years
Commercial Steel Doors and Frames (08100)	refer to section
Glazing (Section 08800)	5 years
Wall Ceramic Tile (09310)	3 years
Floor Porcelain Tile (09330)	3 years
Acoustic Unit Ceiling (09510)	2 years
Elastomeric Sheet Flooring (09670)	2 years
Painting (09900)	2 years

End of Section

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

1. Not applicable

1.2 Existing Conditions

1. Take over structures to be demolished based on their conditions (on date that tender is accepted).

1.3 Demolition Drawings

1. Where required by authorities having jurisdiction, submit for approval drawings, diagrams or details clearly showing sequence of disassembly work or supporting structures.

1.4 Protection

1. Prevent movement, settlement or damage of adjacent grades. Provide bracing, shoring as required.
2. Prevent debris from blocking surface drainage inlets which must remain in operation.
3. Protect existing items designated to remain and materials designated for salvage. In the event of damage to such items, immediately replace or make repairs to approval of Owner and at not cost to Owner.

PART 2 - PRODUCTS

1. Not applicable.

PART 3 - EXECUTION

3.1 Work

1. Dispose of demolished materials except where noted otherwise.

3.2 Safety Code

1. Unless otherwise specified, carry out demolition work in accordance with Canadian Construction Safety Code 1980.
2. Should material resembling spray or trowel-applied asbestos be encountered, notify Architect. Any asbestos encountered will be removed by the Owner's Contractor.

3.3 Preparation

1. Disconnect electrical and telephone service lines entering areas to be demolished as per rules and regulations of authorities having jurisdiction. Post warning signs on electrical lines and equipment which must remain energized to serve other areas during period of demolition.
2. Inspect site and rectify with Architect items designated for removal and items to remain.
3. Disconnect and cap mechanical services in accordance with requirements of local authority having jurisdiction.
4. Natural gas supply lines to be removed by gas company or by qualified tradesman in accordance with gas company instructions.

3.4 Demolition & Field Work

1. Demolish areas as indicated on the drawings.
2. Remove existing equipment, services and obstacles, where required, for refinishing or making good of existing surfaces, and replace same as work progresses.
3. 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).
4. Demolish in a manner to minimize dusting. Keep dusty materials wetted.
5. Demolish masonry and concrete walls in small sections. Carefully remove and lower structural framing and other heavy or large objects.
6. Burning materials on site is not permitted.
7. Remove contaminated or dangerous materials from site and dispose of in safe manner.
8. Employ rodent and vermin exterminators to comply with health regulations.

3.5 Salvage

1. Carefully dismantle items containing materials for salvage and stock pile salvaged materials at locations as directed by Architect.

3.6 Restoration

1. Upon completion of work, remove debris, trim services and leave work site clean.
2. Reinstall areas and existing works outside areas of demolition to match condition of adjacent, undisturbed areas.

3.7 Scheduling

1. Demolition of areas adjacent to occupied spaces may not occur during occupancy of these spaces. Contractor to schedule the demolition of these areas to occur after school hours or weekends.

End of Section

PART 1 - GENERAL

1.1 Related Work

- | | |
|---|---------------|
| 1. Cast-In-Place Concrete: | Section 03300 |
| 2. Miscellaneous Metal Fabrication: | Section 05500 |
| 3. Air Vapour Barrier Membrane: | Section 07112 |
| Note: in order to maintain continuity and quality control, the supply and installation of the full project scope of vapour barrier membrane is to be carried by a single trade. | |
| 4. Building Insulation: | Section 07212 |

1.2 Reference Standards

- | | |
|----------------------------|---|
| 1. CSA-S304.1-04 | Design of Masonry Structures |
| 2. CSA- A370-04 (R2009) | Connectors to Masonry. |
| 3. CAN/CSA-A371-04 (R2009) | Masonry Construction for Buildings. |
| 4. CSA A179-04 (R2009) | Mortar and Grout for Unit Masonry |
| 5. CSA-A82-06 | Fired Masonry Brick From Clay or Shale |
| 6. CSA A165 Series-04 | CSA Standards for Concrete Masonry Units. |
| 7. CSA G30.18-09 | Carbon Steel Bars for Concrete Reinforcement |
| 8. CAN/CSA-A3000-08 | Cementitious Materials Compendium |
| 9. ASTM A951/A951M-06 | Standard Specification for Steel Wire for Masonry Joint Reinforcement |
| 10. ASTM C216-07a | Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale) |
| 11. ASTM C568-08a | Standard Specification for Limestone Dimension Stone |
| 12. ASTM A1064/A1064 | Standard Specification for Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete |
| 13. ASTM C331-05 | Standard Specification for Lightweight Aggregates for Concrete Masonry Units |
| 14. ASTM A153/A153M-09 | Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware |

1.3 Source Quality Control

1. Submit laboratory test reports certifying compliance of masonry units (and mortar ingredients) with specification requirements.

2. 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.
3. All masonry: mortar and grout is to be tested in accordance with CSA-S304.

1.4 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.
4. Store cement under cover. Keep dry and unfrozen.
5. Pile sand on platforms. Exclude foreign matter.
6. Materials stacked on floors of building shall not exceed structural design loads.

1.5 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.
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.
4. Make good any damage to masonry work until completion of the work.
5. Supplement CSA-A371 as follows:
 - .1 Maintain temperature of mortar between 5° C and 50° C until used.

PART 2 - PRODUCTS

2.1 Materials

1. Concrete Masonry Units:

Must be "Bubble Cure" or autoclave process, modular metric size conforming to CSA Standard A165 series.

Normal Weight - H/20/A/M, S/20/A/M.

Lightweight - H/20/C/M, S/20/C/M.

Use normal weight in below ground floor elevation. Use light weight for all above grade walls. All exposed corners to have bullnose units. All block to be uniform in color, shade and texture. Special shapes as required.

2. Portland Cement:

- .1 Type 10, in accordance with CSA A3001.

3. Masonry Cement:

- .1 Type "S" and shall comply with CSA A3002.

4. Hydrated Lime:

- .1 Type "S", in accordance with CSA A179.

5. Aggregate:

- .1 Fine grain aggregate, grading in accordance with CSA A179. When 6mm joints are specified, grain shall pass through a 1.18 mm sieve.

6. Water:

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

7. Horizontal Masonry Reinforcing:

- Welded truss type or ladder type, as specified from wire to ASTM A951, hot dipped galvanized after fabrication to ASTM A153-05, Class B2, minimum coating 457 G/m2, wire size 4.76 mm diameter. Reinforcing as per the following:
- Single wythe walls Dur-O-Wal DW 100;

8. Reinforcing Bars: billet steel to grade 400, deformed bars to CSA-G30.18.

9. Lateral Support Anchors:

.1 Vertical:

- .1 At intersection and abutting load bearing walls, use prefabricated corners and tees to match horizontal reinforcing.
- .2 At intersection of non-load bearing walls with load bearing or non-load bearing walls, use corrugated galvanized ties.
- .3 At wood parapet and similar conditions, use slotted Rap ties by Fero. Ensure ties extend a minimum of 50 mm into the brick or block outer wythe.
- .4 At connection with existing masonry, use joint stabilization anchors by Dur-O-Wall D/A 2200.
- .5 At control joints, use joint stabilization anchors by DUR-O-WALL D/A 2200.
- .6 At connection with steel structure use weld-on column assembly D/A 709 and D/A 701 by DUR-O-WALL. Supply welded anchor to steel trade for installation.

- .2 **Horizontal:** At underside of building structure use steel angles on both sides of partitions as specified in Section 05121 and detailed on structural drawings. Where not practical, use D/A 2200 joint stabilization anchors by DUR-O-WALL. Fasten to structure. Install at 800 mm O.C.

10. **Bolts and Anchors:** To CSA-A370.

11. **Natural 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 **Mixes:** Mix mortars as specified in CSA A179 using the Proportion Specification.
- .3 **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", portland cement, "S" type, hydrated lime as supplied by Daubois Inc., Jiffy Mortar Systems; Maxi-Mix 1-1-6 silo mortar; or approved equivalent. Mix on site with sand, water, and colour pigment.
 - .4 For all other masonry walls, use regular Type "N" mortar.
- .4 **Grout:** To CSA A179 Table 5.

PART 3 - EXECUTION

3.1 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. Set out and build masonry work to the respective dimensions called for on the drawings. Build and lay the block true to line, and level, align vertical joints. Keep angles, reveals, etc. square and plumb.
- 4. Assume complete responsibility for dimensions of this work.
- 5. Construct masonry fire rated assemblies in accordance with tested design specifications.
- 6. Make all joints uniform, in line, square and plumb, with mortar compressed to form joints as specified.
- 7. Course units to bring wall to required elevations using even, uniform, horizontal and vertical joints of maximum 10mm thickness. Horizontal joints brick soldier coursing to suit adjacent running bond.
- 8. Check and co-ordinate location of all anchors, connections and built-in items.
- 9. Bond units at intersection of walls by horizontal prefabricated "tee" or corner reinforcing units.
- 10. Lay each solid unit in full bed or mortar. Fill vertical joints. Slushing of joints not permitted.

11. Base course to be solid concrete masonry units laid in full mortar bed.
12. Lay each hollow unit in full bed or mortar for face shells. Butter vertical joints full. When laying closure units, butter vertical units already in place instead of units being placed.
13. Lay exposed masonry units using blocks having square, unbroken edges and corners.
14. Tolerances:
 - .1 Variation from mean plane: 6 mm when measured with 3000 mm straight edge.
 - .2 Variation from plumb: 6 mm on any vertical line up to 6000 mm high.
 - .3 Variation in wall opening sizes: 6 mm maximum.
 - .4 Variation of building lines from plan: in any bay or 6000 mm maximum – 12 mm or in 1200 mm or more, 20 mm.
15. Lay out masonry units carefully so as to run as often as possible in full and half unit dimensions. All exposed ends shall match the finish of the faces.
16. All units cut around pipes, ducts, openings, etc. shall be accurately and neatly cut with a power carborundum wheel, and remaining voids shall be slushed full with mortar.
17. Make joints flush and smooth on both sides excepts where they are to be exposed to view. When exposed to view, tool the joints concave, unless otherwise noted.
18. Lay and set up all units carefully so that both faces of the walls are true and even. Do not use chipped or cracked units where exposed to view, even where the defect would not impair strength or durability.

3.2 Tolerances

1. Clause 6.2 of CAN3-A371 applies except as follows: Walls to receive thinset ceramic tile: plumb within 1:600.

3.3 Exposed Masonry

1. Remove chipped, cracked, and otherwise damaged units in exposed masonry and replace with undamaged units.

3.4 Jointing

1. Concave joints, allow joints to set just enough to remove excess water, then tool with round jointer to provide smooth, compressed, uniformly concave joints.
2. Where joints are concealed in walls and where walls are to receive plaster, tile insulation, or other applied material, except paint or similar thin finish coating, strike flush.

3.5 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.

3.6 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.

3.7 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.

3.8 Support of Loads

1. Where concrete fill is used in lieu of solid units, use 20 MPa concrete to Section 03300.
2. Install building paper below voids to be filled with concrete; keep paper 25 mm back from faces of units.

3.9 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.

3.10 Loose Steel Lintels

1. Install loose steel lintels. Centre over opening width.

3.11 Control 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 07900.
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.

3.12 Horizontal Reinforcing

1. Horizontal reinforcing at 400 mm o.c. (every 2nd course), except solid walls greater than, or equal to 340 mm in width. At 340 mm, or greater, horizontal reinforcing at 200 mm o.c. (every course). Use prefabricated corners and tees at all intersecting load bearing walls.

3.13 Vertical Reinforcing

1. Install vertical reinforcing to size and spacing as shown on Drawings. Fill voids with 20MPa concrete.

3.14 Bonding

1. Walls of two or more widths: bond using metal ties in accordance with subsection 9.4 of CSA-A371.
2. Procedure approval by Architect.

3.15 Sound and Fire Separation

1. All load bearing and non-load bearing partitions shall carry to the underside of structure above, except for allowing for deflection of structure.
2. All openings in partitions, even above ceilings shall be patched to maintain sound and fire separation.
3. In fire separations and sound separations, spaces between partition and structures to be firestopped or sound sealed under Section 07270.
4. Use U.L.C. labeled mortar for all patching in fire separations.

3.16 Testing

1. Masonry units to be tested in accordance with S304.1, Clause 15.1, for engineered masonry design, and in conformance with clause 15.1.2.
2. Mortar testing to be in accordance with S304.1, clause 15.2.
3. Grout testing to be in accordance with S304.1, clause 15.3.

3.17 Blockwork - General

1. Do not wet concrete block before laying.
2. Lay block with thicker end of face shell upward.
3. Lay interior block in running bond, concave tooled joints.
4. Use solid block or hollow block filled with concrete for top 2 courses under point bearing loads extending minimum 200 mm each side of bearing and where indicated.
5. Install special shaped units where indicated.
6. In block walls install continuous trussed wire reinforcement, as noted.
7. Where resilient base is indicated, tool the joints to within 100 mm of the floor. Cut joints flush behind the base.
8. Extend all walls/partitions to underside of steel/concrete deck unless shown otherwise on drawings and as required. Co-ordinate wall locations with structure above and prior to commencing work, advise Consultant of interference.
9. When masonry walls are not built at once, the ends of the walls are to be raked back at an angle, or terminated at a control joint. Toothing will not be permitted.

3.18 Mortar

1. Measure loose damp ingredients accurately by volume. Place water in mixer, add half volume of sand, add cement, add remainder of sand, add water for plasticity. Mix for at least four minutes. Keep mixer clean.
2. Incorporate colour into mixes in accordance with manufacturer's instructions.
3. Use clean mixer for coloured mortar.
4. Prehydrate pointing mortar by mixing ingredients dry, then mix again adding just enough water to produce damp unworkable mix that will retain its form when pressed into a ball. Allow to stand for not less than 1 hour nor more than 2 hours then remix with sufficient to produce mortar of proper consistency for pointing.

3.19 Concrete Core Fill

1. All concrete block walls shall have vertical grout core fill each side of openings and where shown and as detailed on the drawings.
2. Core fill in walls shall extend from bottom bearing surface to underside of bond beams or structure.

3. Grout core fill shall be placed with a trunk or chute in maximum lifts 2000 mm. Compaction shall be by interior mechanical vibrator. All fill shall be placed in accordance with CSA A23.1.
4. Fill minimum ½ block core each side of frame from foundation to underside of lintels of all door openings over 1 metre wide.
5. Provide inspection openings in base of walls to be grouted. Make good to match adjacent block work after inspection and approval by Engineer.

3.20 Reinforced Block Lintels

1. Install reinforced concrete block lintels at all openings where steel lintels are not indicated in accordance with structural details.
2. Install shoring and bracing as required to openings prior to placing lintel units and concrete fill.

End of Section

PART 1 - GENERAL

1.1 Related Work

1. Finish painting: Section 09900

1.2 Scope

1. Provide all miscellaneous metal items except those listed above Under Article 1.1.

1.3 Reference Standards

- | | |
|------------------------|--|
| 1. ASTM A167-87 | Specification for Stainless and Heat-Resisting Chromium - Nickel Steel Plate, Sheet and Strip. |
| 2. ASTM A325-90 | Specification for High Strength Bolts for Structural Steel Joints. |
| 3. ASTM A143-74(1989) | Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement. |
| 4. ASTM A307-90 | Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength. |
| 5. ASTM A563M-90 | Specification for carbon and Alloy Steel Nuts. |
| 6. ASTM A780-90 | Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized coatings. |
| 7. CAN/CSA-S16.1-M89 | Limit States Design of Steel Structures. |
| 8. CSA W59-M1989 | Welded Steel Construction (Metal Arc Welding) |
| 9. CAN/CSA-G40.20-M92 | General Requirements for Rolled or Welded Structural Quality Steel. |
| 10. CAN/CSA-G40.21-M92 | Structural Quality Steels. |
| 11. CAN/CSA-G164-M92 | Hot-Dip Galvanizing of Irregularly Shaped Articles |
| 12. CISC/CPMA 2-75 | Canadian Institute of Steel Construction/Canadian Paint Manufacturers Association-A Quick Drying Primer for Use on Structural Steel. |
| 13. CAN/CGSB-1.40-M89 | Primer, Structural Steel, Oil Alkyd Type. |
| 14. CAN/CGSB-1.108-M89 | Bituminous Solvent Type Paint. |

1.4 Shop Drawings

1. Submit shop drawings in accordance with Section 01340 prepared and stamped by a Professional Engineer licensed to design structures in the Province of Ontario.
2. Clearly indicate materials, core thickness, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details and accessories.

PART 2 - PRODUCTS

2.1 Materials

1. Metals
 - .1 **Steel sections and plates:** to CAN3 G40.21-M81, Grade 50W for tubes and Grade 44W for plates and flat shapes.
 - .2 **Welding Materials:** to CSA W59-M1989.
 - .3 **Bolts and anchor bolts:** to ASTM A307, A325, and A563 as applicable.
 - .4 **Stainless Steel:** Type 302 or 304 alloy conforming to ASTM A167, No. 4 finish.
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.
 - .3 **Galvanizing** of structural steel components and loose lintels: refer to Section 5120.
 - .4 **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.
 - .5 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.
 - .6 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.
 - .7 Clean surfaces to be field welded; do not paint.
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.

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.

5. Pipe

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

6. Bituminous Paint

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

2.2 Fabrication

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

2.3 List of Miscellaneous Metal Fabrications

1. This Section includes but is not limited to the following list. 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.

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 Fabrication & Erection

1. Erect metal work square, plumb, straight, and true, accurately fitted, with tight joints and intersections.
2. Insulate metals, where necessary, to prevent corrosion due to contact between dissimilar metals and between metals and masonry or plaster. Use bituminous paint, butyl tape, building paper or other approved means.
3. Provide suitable and acceptable means of anchorage, such as dowels, anchor clips, bar anchors, expansion bolts and shields, toggles.
4. Make field connections with items specified in Articles 2.1.4 and 2.1.5 and 2.1.8 or weld to CSA S16-1969 and CSA S16S1-1975.
5. Hand items to be cast into concrete or built into masonry over to appropriate trades together with setting templates.
6. Touch-up rivets, field welds, bolts and burnt or scratched surfaces after completion of erection.
7. Touch-up galvanized surfaces with zinc 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 the surround galvanizing.

3.3 Wall Benches and Upper Shelf

1. Steel Angles, Steel Channel, Flat Bar Steel, Steel Rod as indicated on details.
2. Use secure round head fasteners or countersink holes for flat head screws.
3. Prime paint: Galvafruid.
4. Chamfer cut ends of Rod 2 mm

3.4 Railings and Guards

1. Provide railings and handrails, as shown on Drawings.
2. Galvanize all exterior railings after fabrication.

3. Wall brackets, as shown, at 1200 mm o.c. maximum.
4. Set railing standards in concrete with heated liquid sulphur to fill hole. Remove overflow immediately.

3.5 Vanity Brackets

1. Angle steel frame, as shown on drawings - shop prime painted.

3.6 Wall Brackets and Hooks

1. As shown on Drawings - prime paint.

3.7 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.

End of Section

PART 1 - GENERAL

1.1 Related Work

1. Not applicable.

1.2 Source Quality Control

1. Identify lumber by grade stamp of an agency certified by Canadian Lumber Standards Administration Board.

PART 2 - PRODUCTS

2.1 Materials

1. **Wood Materials:** Material, straight, sawn square, true, dressed four (4) sides properly sized, shaped to correct dimensions from nominal sizes indicated or specified.
2. **Lumber: Use only grade marked lumber. Where left exposed, use best brand of lumber available.** Lumber and moisture content to conform to official grading rules of NLGA, for particular lumber and grade, and structurally conform to latest requirements of Ontario Building Code. Conform to Grading Standards, CSA Standard Softwood Lumber 2005. Moist content not greater than 19% at time of installation.
3. **Blocking, Cants, Bucks, Grounds and Nailing Strips:** Douglas fir Graded 122-C, construction or No. 2 Pine, pressure treated in accordance with CSA 080 Series - 08.
4. **Plywood:** Douglas fir plywood to CSA 0121-08, good one side with waterproof adhesive.
5. **Rough Hardware:** Nails, screws, bolts, lag screws, anchors, special fastening devices and supports required for erection of all carpentry components. Use galvanized components where exposed to exterior atmosphere.

PART 3 - EXECUTION

3.1 General

1. Do all wood framing in accordance with the Ontario Building Code, CSA 086-01 and Engineering Design in Wood.
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.

3.2 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.

3.3 Rough Bucks, 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 1½" thick secured with 3/8" bolts located within 12" from ends of members and uniformly spaced at 48" between.
3. Countersink bolts where necessary to provide clearance for other work.

3.4 Pressure Treated Wood

1. Use wood pressure treated in accordance with CSA 080 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.

3.5 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 doorframes in accordance with requirements of National Fire Code Volume 4, produced by The National Fire Protection Association (NFPA 80).

3.6 Wood blocking for steel stud partitions

1. Supply and install ¾" plywood fastened to 2" x 4" wood studs (fastened to steel studs) to provide solid backing for fastening of toilet partitions, grab bars, millwork etc.

3.7 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.

End of Section

PART 1 - GENERAL

1.1 Related Work

- | | |
|---------------------|---------------|
| 1. Rough carpentry: | Section 06100 |
| 2. Painting: | Section 09900 |

1.2 Reference Standards

1. Do millwork to Millwork Standards of the Architectural Woodwork Manufacturers' Association of Canada (AWMAC) Premium Grade.

1.3 Samples

1. Submit duplicate 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.
2. Submit sample of each type of hardware specified in accordance with Section 01340.
3. Submit a typical prototype unit representative of the work of this section.

1.4 Shop Drawings

1. Submit shop drawings in accordance with Section 01340.
2. Clearly indicate details of construction, profiles, jointing, fastening and other related details.

1.5 Qualification

1. Millwork manufacturer to have not less than 5 years proven first class experience in institutional millwork and shall be a member of AWMAC.

1.6 Warranty

1. Submit a two (2) year warranty for the work of this section against defects in material and workmanship.

PART 2 - PRODUCTS

2.1 Materials

1. Softwood lumber: to CSA 0121-M1978 and National Lumber Grades Authority (NLGA) requirements, with maximum moisture content of 10% for interior work. Yard lumber select for natural finish of species, indicated to AWMAC premium grade.

2. Hardwood lumber: to National Hardwood Lumber Association (NHLA) requirements, moisture content of maximum 10% for interior work, of species indicated to AWMAC premium grade.
3. Hardwood plywood: to CSA 0115-1967 of thickness indicated, rotary cut face veneer, birch plywood, veneer core. Select veneers to provide book match veneer strips to be 240 mm wide minimum. Grade: Select White.
4. Nails and staples: to CSA B111-1974 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-M, Grade R, 720 kg/m³ density in thicknesses indicated.
6. Book Match Veneer: strips to be 240 mm wide minimum.

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. Finish shall be "Velvatex" or "Suede" by Arborite, or equivalent manufactured by Formica, Durolam Ltd., "Wilson Art" as distributed by Meteor Plywoods Ltd., "Micarta" distributed by Montego Forest Products Ltd., "Nevamar" distributed by Ceratec Inc., or approved equivalent by Octopus Products Limited. Selections to be confirmed by Consultant.

- .1 For base price of plastic laminate colour and pattern use the following colour – Formica Smoke Quarstone. Note, the colours are not finalized.

2.3 Edge Banding

1. Solid polyvinyl chloride (PVC), 3 mm thickness x full width of panel edge, 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."

2.4 Cabinet Hardware

1. Furnish and install all hardware to custom casework as follows:
 - .1 **Cupboard Doors - 19 mm thick:**

Hinges	200 Series 110° Salice
Roller Catches	807N 2G (SgDr) Onward
Elbow Catches	T03222 C15 (DhDr)
Door Pulls	CBH235-3 1/2" C32D

Cupboard Locks	8703/8704 14a National
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.2 Drawers - 19 mm thick.:

Drawer Slides	KV1300X length to suit
Drawer Pulls	CBH235-3 1/2" C32D
Drawer Locks	8703 - 14a National

.3 Shelving:

Plaster strips	KV255 Zinc Knappe & Vogt
Shelf Clips	KV256 Zinc Knappe & Vogt

2. 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.
3. Cabinet Keying: Key all cabinet and drawer locks alike in each room, and different from other rooms.

2.5 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.
2. Gables and panels shall be fabricated from 19 mm thick melamine surfaced panels with a P.V.C. edging applied to exposed edges.
3. Bottoms shall be fabricated utilizing the same materials and edge finish as gables. Front edge will be edged with P.V.C. edging. All other edges will be thoroughly sealed and moisture proofed prior to attachment to gables.
4. Rails shall be fabricated and machined to join the gables and form a rigid cabinet frame.
5. 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.
6. 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 OSB centre core gables do not come in contact with the floor.
7. Backs in base cupboards shall be fabricated from a 6 mm thick melamine surfaced panel.

8. Backs in wall and tall cabinets shall be fabricated from 6 mm thick melamine surfaced panels securely glued and screw nailed into the check out provided in the backs of gables, tops, and bottoms.
9. All shelves shall be adjustable at 13 mm increments and each will be supported by a shelf support resting in four pilaster strips attached to the gables.
10. Doors shall be fabricated from 19 mm thick melamine surfaced panels. All four edges shall be P.V.C. edging.
11. Drawer fronts shall be fabricated utilizing the same material and edge finish as doors. All four edges shall 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.
12. Drawer bodies shall consist of box construction fabricated from 13 mm birch plywood with solid birch edge, front, sides and back with a 6 mm hardboard bottom dadoed and glued into box members. Joint front, sides and back with carefully fitted glued and tenoned joints. Alternately, Blum Metabox drawer body and side can be used.
13. **Finish:**
 - .1 Melamine surfaced panels shall be finished both sides in the same colours, patterns, and grain as selected by the Consultant.
 - .2 Solid hardwood glazed doors and drawer bodies shall be sanded, then sealer coated, and sanded with two finish coats of catalytic type acid resistant varnish.
 - .3 Colour of all Melamine Cabinets to be **Hardrock Maple**.

2.6 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.

2.7 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.

2.8 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. Use acid resistant post-forming grade laminate, where indicated on drawings. Colour: black.
7. At all wall termination, provide backsplash return.

2.9 Moulding and Trims

1. Fabricate mouldings in maximum practical lengths to profile shown. Solid birch to receive varnish finish unless noted otherwise. Install with concealed fasteners.

PART 3 - EXECUTION

3.1 Installation

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

End of Section

PART 1 - GENERAL

1.1 Related Work

- | | |
|---|-------------------|
| 1. Masonry: | Section 04200 |
| 2. Rough Carpentry: | Section 06100 |
| 3. Gypsum Board: | Section 09250 |
| 4. Firestopping and Smoke Seals for Mechanical and Electrical Work: | refer to drawings |

1.2 Reference

1. ASTM E814 - Test Method of fire tests of through-penetration firestops, factory mutual.
2. CAN4-S101M - Standard Methods of Fire Endurance Tests of Building Construction and Materials.
3. CAN4-S115M - Standard Method of Fire Tests of Firestop Systems.
4. ULC - List of Equipment and Materials.

1.3 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 15 and 16 a competent, single source be responsible for the firestopping and smoke seals of the entire project.

1.4 Submittals

1. Submit a product data to requirements of Section 01340.
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, ULC design references.
3. Submit proposed type of fireproofing system for each location for approval by Architect. Fireproofing System must be appropriate to achieve expected appearance and finish.

1.5 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.

1.6 Regulatory Requirements

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

1.7 Delivery, Storage & 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.

1.8 Project & Site Conditions

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

1.9 Sequencing & 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 Fire-barrier 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 Fire-barrier Mineral Wool) by A/D Fire Protection Systems Inc.
3. Retainers: Clips to support mineral wool.
4. Firestopping Sealant: ULC labelled, single component silicone bases, A/D Silicone Firebarrier Sealant by A/D Fire Protection Systems Inc.
5. Firestopping Seal: ULC labelled, single component water-bases seal, A/D Firebarrier Seal by A/D Fire Protection Systems Inc.
6. Firestopping Foam: ULC labelled, two components silicone foam, A/D Firebarrier RTV Foam by A/D Fire Protection Systems Inc.
7. Firestopping Mortar: ULC labelled, 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 acceptable to authorities having jurisdiction.

PART 3 - EXECUTION

3.1 Examination

1. Examine surfaces to receive work of this Section and report any defects which may affect the Work of this Section.
2. Verify that openings are ready to receive the Work of this Section.
3. Confirm compatibility of surfaces to receive firestopping and smoke seal materials.
4. Beginning of installation means acceptance of existing surfaces and substrate.

3.2 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 firestopping materials and smoke seals to manufacturer's instruction.

3.3 Application

1. Install firestopping and smoke seal material and components in accordance with ULC listing and manufacturer's instructions.
2. 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.
3. Apply in sufficient thickness to achieve rating to uniform density and texture.
4. Provide temporary forming if required.
5. Tool or trowel exposed surfaces to a neat finish where required.
6. Remove excess material promptly as work progresses and upon completion.
7. Protect installed material until cured or set.

3.4 Cleaning

1. Clean adjacent surfaces of firestopping and smoke seal materials.

3.5 Field Quality Control

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

3.6 Scheduling

1. Firestop and smoke seal at:
 - .1 Penetrations through fire-separations: masonry, concrete, and gypsum board partitions and walls.
 - .2 Edge of floor slabs at curtain wall and precast concrete panels.
 - .3 Top of fire-separations: masonry and gypsum board partitions.
 - .4 Intersection of fire-separations: masonry and gypsum board partitions.
 - .5 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.
 - .6 Penetrations through fire-separations: floor slabs, ceilings and roofs.
 - .7 Openings and sleeves installed for future use through fire separations.

End of Section

PART 1 - GENERAL

1.1 Related Work

- | | |
|---------------------------------|---------------|
| 1. Rough Carpentry: | Section 06100 |
| 2. Masonry: | Section 04200 |
| 3. Air Vapour Barrier Membrane: | Section 07112 |
| 4. Building Insulation | Section 07212 |

1.2 Design Criteria

1. Design metal siding system to provide for thermal movement of component materials caused by ambient temperature range of 100 degrees C without causing buckling, failure of joint seals, undue stress on fasteners or other detrimental effects.
2. Include expansion joints to accommodate movement in wall system and between wall system and building structure, caused by structural movements, without permanent distortion, damage to infills, racking of joints, breakage of seals, or water penetration.
3. Design members to withstand dead load and wind loads calculated in accordance with NBC and applicable local regulations, to maximum allowable deflection of /180th of span.
4. Provide all necessary interior reinforcing girts to withstand all loads as described in item .3.
5. Design wall system to accommodate specified erection tolerances of structure.
6. Maintain following installation tolerances:
 - .1 Maximum variation from plane or location shown on approved shop drawings: 10mm/10m of length and up to 20mm/100m.
 - .2 Maximum offset from true alignment between two adjacent members abutting end to end, in line: 0.75mm.

1.3 Samples

1. Submit duplicate 300 x 300 mm samples of each siding wall system, representative of materials, finishes and colors, in accordance with Section 01340.

1.4 Shop Drawings

1. Submit shop drawings in accordance with Section 01340.

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.

1.5 Acceptable Manufacturers

1. Peerless Enterprises or VicWest Steel Inc., Flynn or Agway Metals Inc.

1.6 Extended Warranty

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

PART 2 - PRODUCTS

2.1 Materials

1. Prepainted Steel: Galvanized sheet steel minimum 0.76 mm (22 ga) thickness, complying with ASTM A526-80 with Z275 designation for zinc coating. Prepainted in Signature Series WXL Colour: selection by Architect.
2. Metal Roofing Profile VicWest Steel: Prestige 16 PR16 with rib seam lock profile and colour to match existing.
3. For copings and flashings, provide prefinished metal 24 gauge thickness, colour from standard colour selection group.
4. Screws: to CSA B35.3-1962, head color same as exterior sheet, dished to CSA B35.3-1962.
5. Powder actuated fasteners: galvanized, peened ballistic point, plastic cap of same color as exterior sheet.
6. Sealants: in accordance with Section 07900, paragraph 2.1.4, colour selected by Architect. Allow for one (1) colour from manufacturers full range to match adjacent metal.
7. Gaskets: soft pliable arctic grade vinyl, extruded profile.
8. Touch-up paint: as recommended by panel manufacturer and Baycoat, compatible with prefinished coating.
9. Isolation coating: alkali resistant bituminous paint or epoxy resin solution.

10. Insulation: Semi-rigid. Fiberglass AF 530.

2.2 Components

1. Exterior sheet: factory preformed coated metal, to profiles and thicknesses as indicated.
2. Exterior corners: of same profile, material and finish as adjacent siding material, shop cut and brake formed to required angle, concealed corner brace, hairline exposed joint, pop rivet connections with painted head to match siding.
3. Exposed joint ends of siding sheet shop cut clean and square, backed with tight fitting filler lapping back if joint, exposed components color matched to siding.
4. Accessories: cap flashings, drip flashings, internal corner flashings, copings and closures for head, jamb, eaves, soffits sill and corners, of same material and finish as exterior siding, brake formed to shape. Exposed cut edges of metal profiles will not be accepted.
5. Sub-girts: zinc coated to ASTM A525-78a, G90 coating designation, profile as indicated to accept exterior sheet with structural attachment to building frame.

PART 3 - EXECUTION

3.1 Preparation

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

3.2 Installation

1. Install sub-girts to masonry walls through air vapour barrier membrane.
2. Install exterior finish siding to internal sub-girts with concealed fasteners.
3. Install insulation using adhesive and ensure a continuous thermal barrier.
4. 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.
5. Provide alignment bars, brackets, clips, inserts, shims as required to securely and permanently fasten wall system to building structure.
6. Supply and install flashing at connection between roof and preformed 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. Wash down exposed surfaces using solution of mild domestic detergent in warm water, applied with soft clean wiping cloths.
2. Remove excess sealant with recommended solvent.

End of Section

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

1. Not applicable.

1.2 Environmental Conditions

1. Sealant and substrata materials to be minimum 5 deg. C.
2. Should it become necessary to apply sealants below 5 deg. C, consult sealant manufacturer and follow their recommendations.

1.3 Warranty

1. Contractor hereby warrants that caulking work will not leak, crack, crumble, melt, shrink, run lose adhesion or stain adjacent surfaces in accordance with General Conditions, but for five (5) years total.

PART 2 - PRODUCTS

2.1 Materials

1. Primers: type recommended by sealant manufacturer.
2. Joint Fillers:
 - .1 General: compatible with primers and sealants, oversized 30 to 50%.
 - .2 Polyethylene, urethane, neoprene or vinyl: extruded closed cell foam, Shore A hardness 20, tensile strength 140 to 200 kPa.
 - .3 Neoprene or butyl rubber: round solid rod, Shore A hardness 70.
 - .4 Polyvinyl chloride or neoprene: extruded tubing with 6 mm minimum thick walls.
 - .5 Bond breaker: pressure sensitive plastic tape which will not bond to sealants.
 - .6 Sealant Type A: One component, chemical curing, conforming to CAN2-19.13-M82, Class C-2-25-B-N; multi-component, chemical curing, conforming to CAN2-19.24-M80, Type 2, Class B.
 - .7 Sealant Type B: Multi-component, chemical curing mildew resistant conforming to CGSB 19-GP-22M.
 - .8 Sealant type C: Multi-component, acrylic emulsion base, conforming to CGSB 19-GP-17M.
 - .9 Sealant type D: One component, polyurethane base, chemical curing, conforming to CAN2-19.13-M82, Class C-1-25-B-N; or multi-component, chemical curing, conforming to CAN2-19.24-M80, type 1.
3. Color of Sealants: to be selected by Consultant. Allow for a total of three (3) colours for Type A, two colours for Type B, two colours for Type C and one colour for Type D. Locations as directed on site by Consultant.
4. Joint cleaner: xylol, methylethyl-ketone or non-corrosive type recommended by sealant manufacturer and compatible with joint forming materials.

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5. Vent tubing: 6 mm inside diameter extruded polyvinyl chloride tubing.

PART 3 - EXECUTION

3.1 New Work

1. Caulk where specified and everywhere required.
2. Remove dust, paint, loose mortar and other foreign matter. Dry joint surfaces.
3. Remove rust, mill scale and coatings from ferrous metals by wire brush, grinding or sandblasting.
4. Remove oil, grease and other coatings from non-ferrous metals with joint cleaner.
5. Prepare concrete, masonry, glazed and vitreous surfaces to sealant manufacturer's instructions.
6. Examine joint sizes and correct to achieve depth ratio 1/2 of joint width with minimum width and depth of 6 mm, maximum width 25mm.
7. Install joint filler to achieve correct joint depth.
8. Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.
9. Apply bond breaker tape where required to manufacturer's instructions.
10. Prime sides of joints to sealant manufacturer's instructions immediately prior to caulking.

3.2 Application

1. Apply sealants, primers, joint fillers, bond breakers, to manufacturer's instructions. Apply sealant, using gun with proper size nozzle. Use sufficient pressure to fill voids and joints solid. Superficial pointing with skin bead is not acceptable.
2. Form surface of sealant with full bead, smooth, and free from ridges, wrinkles, sags, air pockets, and embedded impurities. Neatly tool surface to a slight concave joint.
3. In masonry cavity construction, vent caulked joints from cavity to 3 mm beyond external face of wall by inserting vent tubing at bottom of each joint and maximum to 1500 mm o.c. vertically. Position tube to drain to exterior.
4. Clean adjacent surfaces immediately and leave work neat and clean. Remove excess sealant and droppings using recommended cleaners as work progresses. Remove masking after tooling of joints.
5. Use sealants specified in the following locations:

Type A: Joints between windows or door frames and adjacent building components; control and expansion joints and all other locations where sealing is

required, except in locations designated for Type B, C and D. Ensure that sealant chosen (from the several specified under "MATERIALS") for each location is recommended by manufacturer for use on surfaces encountered.

Type B: Joints between splash backs and walls.

Type C: Joints between interior metal doorframes and partitions.

3.3 Work Included

1. Work shall include but not limited to the following areas:
 - .1 Interior hollow metal frames; both sides;
 - .2 Exposed control and expansion joints in masonry walls, masonry corners, joints in front of steel lintels bearing on exterior brick jambs;
 - .3 Joints between masonry and concrete surfaces.
 - .4 Joints between gypsum board and masonry, or other materials. At all other locations on drawings, except as noted below.
2. Sealing of joints to the underside of exposed precast slab to be by precast installer.
3. Sealing of all joints at top of walls meeting exposed flat or sloped precast ceilings to be included in this section.

End of Section

PART 1 - GENERAL

1.1 General Notes

1. Door Schedule heading "DC" refer to "Door Contacts" used in the security system. Refer to Electrical Drawings and Specifications for locations, zoning and description of system.
2. Refer to drawings for door and frame types.

1.2 Door Schedule

1. Refer to door schedule shown on drawings.

End of Section

PART 1 - GENERAL

1.1 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 Architect.
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 Architect.
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 Architect.
6. Doors and frames shall be prepared for, but not limited to, preparation for continuous hinges, heavy weight hinges, cylindrical locks, rim and concealed vertical rod/ mortise lock case exit devices, surface door closers and concealed overhead stops.

1.2 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.
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.

1.3 Requirements of regulatory agencies

1. Install fire labeled steel door and frame product in accordance with NFPA-80, current edition, unless specified otherwise.

1.4 References

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|----------------------|--|
| 1. ANSI A115.IG-1994 | Installation Guide for Doors and Hardware |
| 2. ANSI A250.4-1994 | Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcings. |
| 3. ASTM A653-M97 | Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process. |
| 4. ASTM A924-M97 | Standard Specification for General Requirements for Sheet, Metallic-Coated by the Hot-Dip Process. |
| 5. ASTM B117-95 | Method of Salt Spray (Fog) Testing. |
| 6. ASTM C177-97 | Test Method for Steady-State heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus. |
| 7. ASTM C518-91 | Test method for Steady State Heat Flux Measurements and Thermal Transmission properties by means of the heat Flow Meter Apparatus. |
| 8. ASTM C578-95 | Specification for Rigid, Cellular polystyrene Thermal Insulation |
| 9. ASTM C665-95 | Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing. |
| 10. ASTM D1735-92 | Practice for Testing Water Resistance of Coating Using Water Fog Apparatus |
| 11. CAN4-S104-M80 | Fire Tests of Door Assemblies |

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- | | |
|---------------------|---|
| 12. CAN4-S105-M85 | Standard Specification for Fire Door Frames Meeting the performance required by CAN4-S104 |
| 13. CAN4-S106-M80 | Standard Method for Fire Tests of Window and Glass Block Assemblies |
| 14. CGSB 41-Gp-19Ma | Rigid Vinyl Extrusions for Windows and Doors |
| 15. CGSB 82.5-M88 | Insulated Steel Doors |
| 16. CSA A101-M83 | Mineral Fiber Thermal insulation for Buildings |
| 17. CSA W59-M89 | Welded Steel Construction (Metal Arc Welding) |
| 18. ISO 9001:1994 | Quality Systems – Model for Quality Assurance |
| 19. NFPA-80, 1999 | Fire Doors and Windows |
| 20. CSDMA | Dimensional Standards for Commercial Steel Doors and Frames |
| 21. | Manufacturers Standard and Galvanized Sheet Gauges |
| 22. | Fleming Fire Labeling Specifications |
| 23. | ULC List of Equipment and Materials, Volume 2 |

1.5 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 Architect 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.

1.6 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.

1.7 Submittals

1. Submit shop drawings in accordance with the General Conditions of the Contract.
2. Indicate each type of door, frame, steel, core, material thickness, mortises, reinforcements, anchorages, locations of exposed fasteners, openings (glazed, paneled or louvered) and arrangement of standard builders' hardware.
3. Include a schedule identifying each unit, with door marks or numbers referencing the numbering in Architect's schedules or drawings.
4. Provide confirmation in writing that all aspects to reinforcing, construction, and gauge of metal are met as written in this section.

1.8 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 five (5) 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 five (5) 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 Doors

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.
- .2 Door Cores:
Honeycomb:
Structural small cell (25.4 mm maximum) kraft paper "honeycomb". Weight: 36.3 kg per ream (minimum), density: 16.5 kg/m³ (minimum), sanded to the required thickness.
 - .1 Polystyrene:
Rigid extruded, fire retardant, closed cell board, density 16kg/m², thermal values: RSI 1.06 minimum, conforming to ASTM C578.
 - .2 Temperature Rise Rated (TRR):
Solid slab core of non-combustible, inorganic composite to limit temperature rise on the "unexposed" side of door to 250°C at 30 or 60 minutes, as required by governing building code requirements and determined and scheduled by the Architect.
- .3 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.
 - .2 Interlocking Edge Seams:
Resin reinforced polychloroprene (RRPC), fire resistant, high viscosity, sealant/adhesive or UL approved equivalent.
 - .3 Polystyrene Cores:
Heat resistant, epoxy based, low viscosity, contact cement.
- .4 Primer:
Rust inhibitive touch-up only.
- .5 Exterior Top Caps:
Rigid polyvinylchloride (PVC) extrusion.

2. Construction

- .1 General:

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- .1 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.
 - .2 Doors shall be swinging, 44.4 mm thick of the types and sizes indicated on the Architect's schedules or drawings.
 - .3 Exterior doors shall be lock seam, flush.
 - .4 Face sheets for exterior doors shall be fabricated from (16) gauge steel.
 - .5 Longitudinal edges of exterior doors shall be mechanically interlocked, fully welded, ground smooth with no visible seams. Do not fill seams.
 - .6 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.
 - .7 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.
 - .8 Interior doors shall be stiffened, insulated and sound deadened with honeycomb core laminated under pressure to each face sheet.
 - .9 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.
 - .10 Longitudinal edges of interior doors shall be mechanically interlocked, adhesive assisted with edge seams visible.
 - .11 Door faces of all steel doors shall be fabricated without visible seams, free of scale, pitting, coil brakes, buckles and waves.
 - .12 Formed edges shall be true and straight with a minimum radius for the thickness of steel used.
 - .13 Lock and hinge edges shall be beveled 3 mm in 50 mm unless builders' hardware or door swing dictates otherwise.
 - .14 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.
 - .15 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.
 - .16 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.
 - .17 Exterior 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/m3 density loose batt type fiberglass material to suit fully welded design.
- .2 Hardware Preparations:
- .1 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.
 - .2 Doors shall be factory blanked and reinforced only for mortised hardware that is not fully templated.

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- .3 Doors shall be factory reinforced only for surface mounted hardware.
 - .4 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.
 - .5 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.
 - .6 Hinge and pivot reinforcements shall be 10 gauge steel minimum high frequency type reinforcing.
 - .7 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.
 - .8 Lock, strike and flush bolt reinforcements shall be 12 gauge steel minimum.
 - .9 Reinforcements for concealed closers and holders shall be 12 gauge steel minimum.
 - .10 For surface mounted hardware, reinforcements shall be 16 gauge steel minimum.
 - .11 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.
 - .12 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.
 - .13 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.
 - .14 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.
 - .15 Doors and Frames shall be prepared for, but not limited to preparations for heavy weight Butt Hinges, Continuous Hinges, Cylindrical Locksets, Rim or Concealed Vertical Rod and Mortise Lock Case Exit Devices, Surface Door Closer and Concealed Overhead Stops.
- .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.

.4 Louver Preparations:

- .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.

.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.

2.2 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.

2.3 Frame Product

1. Materials

.1 Steel:

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:

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/m³ (minimum), conforming to ASTM C665

2. Construction

.1 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/m³ loose batt type fiberglass material.
- .5 Insulation of open sections (jamb, 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 Jamb, 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.
- .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 galvanized 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.

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- .17 Where required due to site access, as indicated on the Architects' schedules or details, when advised by the contractor responsible for coordination 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.
- .2 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 rabbet 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.

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- .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.
- .3 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 reinforcements 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.

.4 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.

2.4 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 ± 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 ± 1.2 mm.
 - .4 Manufacturing tolerances on formed frame profiles shall be ± 0.8 mm for faces, door stop heights and jamb depths. Tolerances for throat openings and door rabbet shall be ± 1.6 mm and ± 0.4 mm respectively. Hardware cutout dimensions shall be as per template dimensions, +0.4mm, -0.

2.5 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 1070mm 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 Landing.
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

1. Install doors and frames in accordance with the Door and Hardware Institute "Installation guide for doors and hardware".
2. Set frame product plumb, square, aligned, without twist at correct elevation.
3. 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° 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 $\pm 1.6\text{mm}$.
4. Fire labeled product shall be installed in accordance with NFPA-80.
5. Secure anchorages and connections to adjacent construction.
6. 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.
7. Frame product in unit masonry shall be fully grouted in place.

8. Install doors maintaining clearances outlined in Section 2.4.
9. Install louvers and vents.
10. Adjust operable parts for correct clearances and function.
11. Steel surfaces shall be kept free of grout, tar or other bonding materials or sealers.
12. Any grout or other bonding material shall be cleaned from products immediately following installation.
13. Exposed field welds shall be finished to present a smooth uniform surface and shall be touched-up with a rust inhibitive primer.
14. Exposed surfaces that have been scratched or otherwise marred during shipment, installation or handling shall be touched-up with a rust inhibitive primer.
15. Finish paint in accordance with Section 09900.
16. Install glazing materials and door silencers.

End of Section

PART 1 - GENERAL

1.1 Related Work

1. Commercial Steel Doors and Frames

Section 08100

1.2 Warranty

1. Contractor hereby warrants glass against defects and failure, including leakage, under normal conditions of use, in accordance with Division 1, but for five (5) years total

PART 2 - PRODUCTS

2.1 Material

1. Laminated Safety Glass: Two ¼" laminated fully tempered clear, complete with 0.035 inch inter layer clear. Safety glass to be Sentry Glass® by Dupont or approved equal.
2. Interior Tempered Safety Glass: ¼" tempered clear float glass complete with etched tempered glass designation visible.
3. Polished Plate or Float Glass: To CAN/CGSB-12.3 clear.
4. Wired Glass: to CAN2-12.11-M76, Georgian-wired, polished, 6 mm, wires running parallel to frames.
5. Setting blocks: neoprene, 80 durometer hardness, 4" x ¼" width to suit glass.
6. Glazing tape: preformed butyl with continuous spacer, 10-15 durometer, hardness, paper release, black color, 1/8" x 3/8".
7. Gasket: black neoprene "U" cavity type with lock strip.

PART 3 - EXECUTION

3.1 Installation

1. Non-sealed Glass types:
 - .1 Clean and dry surfaces.
 - .2 Apply glazing tape to fixed stops. Place setting blocks at 1/3 points.
 - .3 Set glass on setting blocks against tape.
 - .4 Apply glazing tape to glass.
 - .5 Install stops.
 - .6 Install glass in doors and screens with neoprene gasket.
 - .7 Clean glass prior to building occupancy.

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 Architect 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 Architect.
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 Architect.

1.2 Exterior Finish Notes

1. All exposed metal (doors, frames, lintels, stairs, handrails, mechanical equipment, etc.) to be painted except for prefinished metal louvers, stainless steel, and aluminum. Mechanical equipment is to be painted whether delivered to the site prepainted 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.

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 Architect. If prefinished equipment is damaged, it shall be re-painted. Painting to be by formulations specified in Section 09900.

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.

1.4 Abbreviations Legend

1. Refer to Room Finish Schedule for abbreviations Legend.

End of Section

PART 1 - GENERAL

1.1 Related Work

- | | |
|--------------------|---------------|
| 1. Gypsum Board: | Section 09250 |
| 2. Rough Carpentry | Section 06100 |

1.2 Reference Standards

1. Do work to CSA A82.31-1977, except where specified otherwise.

PART 2 - PRODUCTS

2.1 Materials

1. Metal Studs: non-load bearing channel stud framing to ASTM C645-09a, roll formed from 0.59 mm thickness electro-galvanized steel sheet for screw attachment of gypsum lath and metal lath, and with service access holes.
2. Structural Metal Studs: CSA-S13-01 and hot-dipped galvanized to ASTM A525M-87, minimum 1.22 (18ga.) use thicker materials where required to suit structural requirements. Framing shall be designed by a licensed professional engineer registered in the province of Ontario. Follow fabrication standards ASTM C955.
3. Floor and ceiling tracks: to ASTM C645-09a in width to suit stud sizes, 30 mm legs for floor track, 50 mm for ceiling track.
4. Metal channel stiffener: 38 mm size, 2 mm thick cold rolled galvanized steel.
5. Furring channels (channels, hangers, tie wire, insert, anchor): CGSB 7.1-98-CAN/CGSB.
6. Touch-up Zinc Rich Paint: CAN/CGSB-1.181-92.

PART 3 - EXECUTION

3.1 Stud Partitions

1. Align partition tracks at floor and underside of structure above and secure at 24" o.c. maximum. All partitions to extend to underside of structure above.
2. Place studs vertically at 16" o.c. and not more than 2" 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 1:1000.
4. Attach studs to bottom track using screws.

5. Coordinate 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 84" high and a minimum of four (4) anchors per jambs for jambs over 84" 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.
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 structure 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

1. Install runners level to tolerance of 1/8" over 11'-8". 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. Furring for bulkheads within or at termination or ceilings.
4. Install furring channels at 16" o.c. maximum.

3.3 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.

3.4 Fire-rated Assemblies

1. Where required, install Metal Stud System and Furring in accordance with appropriate ULC Design and with supplement to the National Building Code of Canada 1985.

End of Section

PART 1 - GENERAL

1.1 Related Work

- | | |
|--------------------------|--|
| 1. Masonry | Section 04200 |
| 2. Metal Stud System: | Section 09111 |
| 3. Acoustic Unit Ceiling | Section 09510 |
| 4. Painting: | Section 09900 |
| 5. Access Doors: | refer to related mechanical and electrical |

1.2 Reference Standards

1. Do work to CSA A82.31-1977, except where specified otherwise.

PART 2 - PRODUCTS

2.1 Gypsum Board

1. Plain: to CSA A82.27-M1977 standard, 5/8" thick or as indicated, tapered edges.
2. Plain: to CSA A82.27-M1977, Fire-rated Type X, 5/8" thick or as indicated, tapered edges.
3. Plain: to CSA A82.27-M1977, Washroom walls 5/8" dens-shield or as indicated, tapered edges.

2.2 Fastenings and Adhesives

1. Screws: to CSA A82.31-1977.
2. Adhesive: to CGSB 71 GP 25M.
3. Laminating Compound: to CSA A82.31-1077.
4. Concrete Anchors: Phillips Red Head TW-614 or equivalent. Do not use powder activated fasteners for ceiling support.
5. Tie Wire: #16 ga. galvanized soft annealed steel wire.

2.3 Accessories

1. Casing Beads and Corner Beads: 0.5 mm base thickness commercial sheet steel with G90 zinc finish to ASTM A 525-78 A.
2. Joint compound: to CSA A82.31-1977, asbestos-free.
3. Caulking: Acoustical sealant.

PART 3 - EXECUTION

3.1 Gypsum Board Application

1. Do not apply gypsum board until bucks, anchors, blocking, electrical and mechanical work are approved.
2. Apply single and double layers gypsum board to metal furring or framing, using screw fasteners and laminating adhesive. Maximum spacing of screw 12" oc.
3. Apply gypsum board to concrete block surfaces, where indicated, using laminating adhesive.
4. 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.

3.2 Accessories

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 secure. Mitre and fit corners accurately, free from rough edges.
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.

3.3 Access Doors

1. Install access doors to electrical and mechanical fixtures specified in respective Sections.
2. Rigidly secure frames to furring or framing systems.

3.4 Taping and Filling and Sound Seal

1. Seal with acoustical sealant at ceilings, floors, wall intersections and all penetrations such as electrical outlets.
2. 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.
3. Finish corner beads, control joints and trim as required with two (2) coats of joint compound and one (1) coat of taping compound, feathered out onto panel faces.
4. Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after painting is completed.

-
5. Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.
 6. Completed installation to be smooth, level or plumb, free from waves and other defects and ready for painting.

End of Section

PART 1 - GENERAL

1.1 Related Work

- | | |
|-----------------|---------------|
| 1. Sealants | Section 07900 |
| 2. Gypsum Board | Section 09250 |

1.2 Reference Standards

1. Do tile work to Installation Manual 200-1979, "Ceramic Tile," produced by Terrazzo Tile and Marble Association of Canada (TTMAC).

1.3 Environmental Conditions

1. Main minimum 13 deg. C air temperature at tile installation area for 24 hr. prior to, during and 48 hr. after installation. Do not proceed without the correct tiles or if substrate conditions are not suitable.

1.4 Maintenance Material

1. Provide one full box of each type and color of tile required for project for maintenance use. Store where directed. Clearly identify each box.
2. Maintenance material to be of same production area as installed material.

1.5 Extended Warranty:

1. Submit a warranty for entire wall tile installation, covering materials and labour and the repair or replacement of defective work for a period of three (3) years total.

PART 2 - PRODUCTS

2.1 Thin-Set Mortar

1. Mortarcrete Latex Mortar conforming to ANS1A118.4-1973, manufactured by L & M Ceramo Inc.

2.2 Wall Tile

1. **Ceramic Wall Tile (CWT):** to CAN2-75, 1-M77, Type 5, Class MR-4, Colour & Dimension Collection, 75 x 150 x 6 mm size, cushion edges, glazed surface. Colours as selected by Consultant up to a maximum of two (2) colours; Olympia Tile.
 - .1 Acceptable Materials: Equal as supplied by Daltile – Semi-Gloss Group 1 and American Oleon equal.

2. Tile walls – see drawings for extent. Patterns and accent stripes to be selected by Architect.
3. Tile colors to be selected by Architect from Standard Color List. Total of four (4) colours. Accent stripes colors to be selected separately by Architect from "Accent Color" List. Total of two (2) colours.

2.3 Grout

1. Epoxy Grout: "Latapoxy SP-100" Stainless, chemical resistant epoxy grout by Laticrete International. Colour from manufacturer's full range.

PART 3 - EXECUTION

3.1 Workmanship

1. Apply tile to clean and sound surfaces.
2. Fit tile around corners, fitments, fixtures, drains and other built-in objects to maintain uniform joint appearance. Cut edges smooth, even and free from chipping. Edges resulting from splitting, not acceptable.
3. Maximum surface tolerance 1:800 for walls, floors.
4. Make joints between tile uniform, plumb, straight, true, even and flush with adjacent tile. Ensure sheet layout not visible after installation. Align patterns.
5. Lay out tiles so perimeter tiles are minimum 1/2 size.
6. Sound tiles after setting and replace hollow-sounding units to obtain full bond.
7. Make internal angles square, external angles rounded.
8. Use round edged tiles at termination of wall tile panels, except where panel butts projecting surface or differing plane.
9. Install soap dishes into block recess. Fit tiles around soap dishes.
10. Allow minimum 24 h after installation of tiles, before grouting.
11. Clean installed tile surfaces after installation and grouting cured.

End of Section

PART 1 - GENERAL

1.1 Related Work

1. Caulking: Section 07900

1.2 Reference Standards

1. Do tile work to Installation Manual 200-1979, "Ceramic Tile," produced by Terrazzo Tile and Marble Association of Canada (TTMAC), except where specified otherwise.

1.3 Maintenance Material

1. Provide maintenance data for tile work for incorporation into Maintenance Manual specified in Section 01720.
2. Provide 12 additional tiles of each type and color of tile required for project for maintenance use. Store where directed. Clearly identify each box.
3. Maintenance material to be of same production area as installed material.

1.4 Environmental Requirements

1. Air temperature and structural base temperature at tile installation area must be above 13 degrees C for 24 hours before, during and 24 hours after installation.

1.5 Extended Warranty:

1. Submit a warranty for entire flooring tile installation, covering materials and labour and the repair or replacement of defective work for a period of three (3) years total.

PART 2 - PRODUCTS

2.1 Tiles

1. Designation PT: 200 mm x 200 mm porcelain tile to CAN 2-75-1M77.
 - .1 Acceptable material: Spectra series, distributed by Olympia Tile. Size 200 mm x 200 mm, plus trim and 200 mm x 100 mm bullnosed base, slate finish. Allow 2 colors from manufacturer's full line.
 - .2 Acceptable Alternates: Fiandre Graniti by Savoia Canada
Cross Colors-porcelain stone by Crossville Group 2

2.2 Accessories

None

2.3 Setting Materials

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, "Kerapoxy" by Mapei, distributed by Midgley and West, Hamilton Ontario.
 - .1 Acceptable Alternates: "Laticrete 4237 distributed by Ceratec Inc., or Flextile 52 thin set.
 - .2 Latex Additive: "Cemtex" by Master Builders, Laticrete 2022" distributed by Ceratec Inc.

2.4 Grout

1. Sanded, Portland cement based with Plastijoints acrylic additive, Kerncolour / Floor by Mapei or similar by Laticrete. Colour as selected by Architect.

PART 3 - EXECUTION

3.1 Workmanship

1. Apply tile to clean and sound surfaces.
2. Fit tile units around corners, fitments, fixtures, drains and other built-in objects to maintain uniform joint appearance. Make cut edges smooth, even and free from chipping. Edges resulting from splitting not acceptable.
3. Maximum surface tolerance: 1:800.
4. Make joints between tiles uniform and approximately 3 mm wide, (maximum 4 mm) plumb, straight, true, even and with adjacent units flush. Align patterns.
5. Lay out units so perimeter tile are minimum 1/2 size.
6. Install floor tiles as per pattern. Pattern will be supplied by architect at a later date.
7. Sound tiles after setting and replace hollow sounding units to obtain full bond.
8. Make internal angles square, external angles chamfered at 45° with narrow tile strip.

-
9. Construct base, as indicated on drawings, with rounded top edge.
 10. Use bullnose edged tiles at termination of wall tiles, except where tiles abut projecting surface or differing plane.
 11. Seal grouted joints with sealer.
 12. Clean installed tile surfaces after installation cured.
 13. Keep building expansion joints free of mortar or grout.

3.2 Setting System

1. Install porcelain floor tiles in accordance with TTMAC applicable thinset detail.

End of Section

PART 1 - GENERAL

1.1 Reference Standards

1. Fabrication: to ASTM 365-78 and CAN/GSB-92.1-M77.
2. Installation: to ASTM C636-76, except where specified otherwise.

1.2 Design Criteria

1. Maximum deflection 1/360 of span to ASTM 365-78 deflection test.

1.3 Samples

1. Submit two each 300 x 300 mm samples of each individual tile and grid type in accordance with Section 01340.

1.4 Warranty

1. Submit an extended warranty covering materials and labour and the repair or replacement of defective work but for two (2) years total.

PART 2 - PRODUCTS

2.1 Materials

1. **Ceiling Type (ACT-1):** Panels: 610 mm x 610 mm x 15mm, medium textured non directional fissured, square lay-in, Cortega #824 by Armstrong. Suspension system: 15/16" Prelude ML, white, by Armstrong.

Equivalent ceiling types by CGC and Celotex are acceptable.

2. **Hangers:** 2.6 mm galvanized soft annealed steel wire.
3. **Accessories:** splices, clips, retainers, etc., to complement suspension system components.

2.2 Installation

1. Co-ordinate suspension system with related components.
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. Provide for Owner one FULL (1) complete carton of each type of ceiling tile.

End of Section

PART 1 - GENERAL

1.1 Related Work

1. Not applicable

1.2 Maintenance Data

1. Provide data for maintenance of resilient flooring for incorporation into Maintenance Manual.

1.3 Environmental Requirements

1. Maintain minimum 20 deg. C air temperature at flooring installation area for three (3) days before, during and for seven (7) days after installation.

PART 2 - PRODUCTS

2.1 Materials

1. **Vinyl composition tile (VCT):** to ASTM F 1066-1995 a, Type A design, asbestos free, 3 mm thick, 300 mm x 300 mm size Standard Excelon, Imperial Texture for field and Multicolour for accent and pattern by Armstrong.
Acceptable Alternate: Tarkett VCTII Series, full range.
2. **Resilient rubber wall base (RB):** 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 Traditional Rubber Wall Base with toe as manufactured by Tarkett (Johnsonite). Colours: Two (2) from full Tarkett colour line.
3. **Base Accessories:** Pre-moulded end stops and external corners, of same material, size, and colour as base.
4. **Transition Strips:** thermoset vulcanized rubber, smooth, purpose made to accommodate wheeled traffic and prevent tripping; tapered designs to suit nature of transition; colour as selected by Consultant.
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.

PART 3 - EXECUTION

3.1 Inspection

1. Ensure concrete floors are dry, by using test methods recommended by tile manufacturer, and inspect for negative alkalinity, carbonization or dusting.
2. Commencement of work indicates acceptance of conditions by flooring installer.

3.2 Subfloor Treatment

1. Remove subfloor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with subfloor filler.
2. Clean floor and apply filler; trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler cured.
3. Ensure of smooth transition between any raised surfaces at door ways. Prepare subfloor with leveling compound to ensure smooth transition. Typical where VCT meets PT floors.

3.3 Tile

1. Apply adhesive uniformly using recommended notched 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 or as indicated by drawings and Finish Schedule.
3. Cut tile and fit neatly around fixed or excessively heavy objects.
4. Install flooring in pan type floor access covers and all clean out covers, where applicable. Maintain floor pattern.
5. Terminate flooring at center line of door in openings where adjacent floor finish or color is dissimilar.
6. Install metal edge strips at unprotected or exposed edges where flooring terminates.

3.4 Base Application

1. Set base in adhesive tightly against wall and floor surfaces. Use lengths as long as practicable and not less than minimum 500 mm long.
2. Install straight and level to variation of 1:1000.
3. Scribe and fit to door frames and other obstructions. Use premoulded end pieces at flush door frames.
4. 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.
5. 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 Architect.

3.5 Initial Maintenance 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.

3.6 Protection of 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.

3.7 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

PART 1 – GENERAL

1.1 Section Includes

1. Supply and installation of the indoor resilient multipurpose surfacing.
2. Application of the game lines.
3. References for the correct construction and preparation of concrete slabs to receive resilient flooring.

1.2 Submittals

1. Product Data: Manufacturer's promotional brochures, specifications and installation instructions
2. Samples:
 - .1 Submit for selection and approval two (2) sets of the indoor resilient multipurpose surfacing, manufacturer's brochures, samples or sample boards of all of the available colors, textures and styles.
 - .2 Submit color samples of all the available game line paint colors for selection and approval.
3. Closeout Submittals:
 - .1 Submit two (2) copies of the indoor resilient multipurpose surfacing and manufacturer's maintenance instructions.
 - .2 Submit two (2) copies of the material and installation warranties as specified.

1.3 Quality Assurance

1. The installer of the indoor resilient multipurpose surfacing shall have a minimum of five (5) years experience in the field installing the specified indoor resilient multipurpose surfacing and have worked on at least five (5) projects of similar size, type and complexity.

1.4 Delivery, Storage and Handling

1. Delivery: Material shall not be delivered until all related work is in place and finished and/or proper storage facilities and conditions can be provided and guaranteed stable according to Tarkett Sports' recommendations.
2. Storage: Store the material in a secure, clean and dry location. Maintain temperature between 18° and 30° Celsius. Store the indoor resilient athletic surfacing rolls in an upright position on a smooth flat surface immediately upon delivery to jobsite. Rolls shipped in rigid protective cardboard containers can be laid horizontally prior to unpacking and installation.

1.5 Project / Site Conditions

1. It is the responsibility of the general contractor/construction manager to maintain project/site conditions acceptable for the installation of the indoor resilient multipurpose flooring.
2. The area in which the indoor resilient multipurpose surfacing will be installed shall be dry and weather tight. Permanent heat, light and ventilation shall be installed and operable.
3. All other trades shall have completed their work prior to the installation of the resilient athletic flooring. The general contractor or Construction Manager shall maintain a secure and clean working environment before, during and after the installation. Suspension of other trades' work may be authorized providing their work will not damage the new flooring.
4. Maintain a stable room temperature of at least 18°C for a minimum of one (1) week prior to, during and thereafter installation.
5. An effective low-permeance vapor barrier is placed directly beneath the concrete subfloor. For "on" or "below grade" installations, it is recommended to provide a permanent vapor barrier resistant to long term hydrostatic pressure/moisture exposure. Protrusions should be sealed to prevent moisture migration into the slab. Moisture should not be allowed to enter the slab after the completed construction.
6. Concrete subfloor surface pH level within the 7 to 9 range dependent upon installation type.
7. Concrete subfloor should be no greater than 3 mm within a 3050 mm diameter. This tolerance can be measured in accordance with ASTM E1155. A specified (F_F) of 50 and an (F_L) of 30 should reach this degree of floor flatness and floor level. There is no numerical correlation between F numbers and the deviation from the straight edge, however the above specified numbers should achieve a flat floor with minimal deviation in the slab. Reference ACI 117 and ACI 302.1R. The general contractor should provide a certificate of compliance with the above recommendations.
8. Concrete subfloor must be clean and free of all foreign materials or objects including, but not limited to, curing compounds and sealers.
9. Fill cracks, grooves, voids, depressions, and other minor imperfections with Ardex (or equal) cement-based patching/leveling compounds. Follow the manufacturer's directions. Moveable joints must be treated utilizing specific transitioning joint devices depending upon the architect's recommendations. Follow current ASTM F710 guidelines for the preparation of concrete slabs to receive resilient flooring.
10. Refer to ACI 302.2R "Guidelines for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials" for concrete design and construction.

11. Concrete slab shall be fortified with continual steel reinforcement. Fiber reinforcement alone shall not be considered adequate fortification.

1.6 Warranty

1. Submit an extended system warranty in accordance with the General Conditions of the Contract.
2. Extended Warranty: for a period of two (2) years, including coverage against punctures, tears, delamination, and excessive wear.

PART 2 - PRODUCTS

2.1 Manufacturers

1. Sheet Flooring (Type SP. FLR.): The basis of the design for the indoor resilient athletic surfacing is Omnisports MultiFlex as manufactured by Tarkett Sports.
Acceptable Alternate: Gerflor Multi-Use.

2.2 Materials

1. Omnisports MultiFlex – prefabricated heterogeneous sports floor with wood flooring design and slightly textured embossed surface as supplied by Tarkett Sports. Embossing of wood design and solid colours must be the same; varying embossing or surface textures will not be allowed. Printing of wood design shall closely resemble standard wood strip flooring in size, colour, board length, and grain appearance. The wood design shall be protected by a clear a layer of pure PVC (Polyvinyl Chloride) and Top Clean, a factory applied UV cured urethane treatment. Intermediate layers shall be fortified with a non-woven fiberglass grid for increased dimensional stability. The foam force reduction layer shall be high-density closed cell PVC foam with honeycomb embossing and is applied in one continuous manufacturing process. Laminated or adhered foam layers will not be allowed. Field constructed products will not be accepted. Flooring will contain anti-fungal treatment.
 - .1 Physical properties of the indoor resilient athletic surfacing shall conform to the following minimums:
 - .1 Total Thickness, Wear Layer: 6.5 mm, 2.0 mm
 - .2 Width: 2 m
 - .3 Length: 20.5 m approx.
 - .4 Vertical Deformation: 1.0 (EN 14809)
 - .5 Rolling Load: 0.22 (EN 1569 {11/1999})
 - .6 Friction: 100 (EN 13036-4)
 - .7 Fungus Resistance: Treated for permanent resistance.
 - .8 Abrasion Resistance: 0.13 (EN ISO 5470-1 {06/1999})
 - .9 Shock Absorption: ASTM F2772 Class 2
 - .2 Colour: As available from the indoor resilient athletic surfacing manufacturer's standard range.
 - .3 Hardwood Design Series: A wood look design as available from the indoor resilient athletic surfacing manufacturer's standard range.

- .4 Texture: Texture to remain consistent between solid colours and wood design when blending colours.
2. Welding Rod: As supplied by the manufacturer or supplier. Colour to blend with the product color or design. All seams shall be welded to create a monolithic and impermeable surface.
3. Adhesive: As approved by the manufacturer.
4. Game Line Paint Primer: As approved by the indoor resilient athletic surfacing manufacturer.
5. Game Line Paint: As approved by the indoor resilient athletic surfacing manufacturer. Colours are to be selected from the manufacturer's standard range.

PART 3 – EXECUTION

3.1 Examination

1. It is the responsibility of the general contractor/construction manager to ensure that project/site conditions are acceptable for the installation of the indoor resilient athletic flooring.
2. Verify that the area in which the indoor resilient athletic surfacing will be installed is dry and weather tight. Verify that permanent heat, light and ventilation is installed and operable.
3. Verify that all other work that could cause damage, dirt and dust or interrupt the normal pace of the indoor resilient athletic flooring installation is completed or suspended.
4. Verify that there is a stable room temperature of at least 18° C.
5. Verify that there are no foreign materials or objects on the subfloor and that the subfloor is clean and ready for installation.
6. Direct Full Spread Adhering to Concrete Subfloor: moisture content less than 6 pounds/1,000 sq.ft./24 hours when tested using calcium chloride per ASTM F 1869 or no more than 83% RH when tested per ASTM F2170.
7. If both tests are performed, use the highest value. Do not average the results of the tests. Report all field test results in writing to the General Contractor, Architect, and End User prior to installation.
8. Verify that the concrete subfloor surface pH level is within the 7-9 range.
9. Document the results indicating the slab is within manufacturer's tolerances for slab deviation.

3.2 Preparation of Surfaces

1. Grind the entire surface of the concrete slab.
2. Sweep the concrete slab so as to remove all dirt and dust. If a sweeping compound is to be used it must be a sweeping compound that does not contain oil or other items that may inhibit the adhesive bond.
3. Slab must be dust free. In the event that dust impairs adhesive bond, priming the slab prior to application of adhesive may be necessary. Follow installation guidelines.

3.3 Options for Moisture Mitigation

1. For projects with moisture conditions higher than the specified tolerances TARKOLAY may be used for conditions that do not exceed 12lbs per ASTM F1869 and/or 92% per ASTM F2170. Use only approved two component urethane adhesives as directed by the manufacturer.

3.4 Installation

1. The installation area shall be closed to all traffic and activity for a period to be set by the indoor resilient athletic surfacing installer. The indoor resilient athletic surfacing installation shall not begin until the installer is familiar with the existing conditions.
2. All necessary precautions should be taken to minimize noise, smell, dust, the use of hazardous materials and any other items that may inconvenience others.
3. Install the indoor resilient athletic surfacing in strict accordance with the indoor resilient athletic surfacing manufacturer's written instructions.
4. Install the indoor resilient athletic surfacing minimizing cross seams. Provide a seam diagram during the submittal process for approval prior to installation.
5. Paint game lines using approved game line paint primer and game line paint in strict accordance with the game line paint manufacturer's instructions.
6. Install appropriate threshold plates or transition strips where necessary.

3.5 Cleaning

1. Remove all unused materials, tools, and equipment and dispose of any debris properly. Clean the indoor resilient athletic surfacing in accordance with the manufacturer's instructions.

3.6 Protection

1. If required, protect the indoor resilient athletic surfacing from damage using coverings approved by the manufacturer until acceptance of work by the customer or their authorized representative.

3.7 Related Standards and Guidelines

1. ASTM F1869 "Standard Test Method for Measuring Moisture Evaporation Rate of Concrete Subfloor Using Anhydrous Calcium Chloride"
2. ASTM F2170 "Standard Test Method for Determining Relative Humidity In Concrete Floor Slabs Using In-Situ Probes"
3. ASTM F170 "Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring"
4. ACI 302.2R-06 "Guideline for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials"

End of Section

PART 1 - GENERAL

1.1 Related Work

- | | |
|---|-------------------|
| 1. Shop painting miscellaneous metals: | Section 05500 |
| 2. Door Schedule | refer to drawings |
| 3. Shop priming of ferrous doors and door frames: | Section 08100 |
| 4. Room Finish Schedule | refer to drawings |

1.2 Reference Standard

1. 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.

1.3 Product Data

1. Submit to Architect, for review, product data for all formulas, including manufacturer's trade names.
2. Paint Manufacturer will provide periodic reviews and reports to Architect regarding work in this Section and if Contractor is adhering to manufacturer's product specifications.

1.4 Environmental 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 Health and Environmental Specifications.

1.5 Extent of Painting

1. For new construction, for rooms shown in room finish schedule to have painted walls, paint all non prefinished surfaces unless indicated otherwise, and repaint prefinished surfaces where indicated.
2. For existing construction, for rooms shown in room finish schedule to have repainted walls:
 - Paint all non prefinished new surfaces unless indicated otherwise.
 - Repaint prefinished surfaces where indicated.
 - Repaint all previously painted surfaces unless indicated otherwise.

1.6 Finishes and Colours

1. Review the requirements outlined in Finish and Colour Notes.
A separate colour schedule will be issued after contract award.

1.7 Warranty

1. Provide a two (2) year warranty on completion stating that the work has been performed with respect to the standards and requirements incorporated in the OPCA specification manual latest edition

PART 2 - PRODUCTS

2.1 Materials

1. Acceptable products: Per Chapter 5 OPCA Manual as listed.
2. Paint materials for each paint system to be products of a single manufacturer.
3. Use low-VOC and low-odour paints only.

PART 3 - EXECUTION

3.1 Preparation of Surfaces in new Construction

1. Prepare surfaces to receive paint per Chapter 3 OPCA Manual.
2. Prepare wood surfaces to CGSB 85-GP-1M.
 - .1 Use CGSB 1-GP-126M vinyl sealer over knots resinous areas.
 - .2 Apply wood paste filler to nail holes and cracks.
 - .3 Tint filler to match stains for stained woodwork.
3. Touch up shop paint primer on steel with CGSB 1-GP-40M to CGSB 85-GP-14M.
4. Prepare galvanized steel and zinc coated surface to CGSB 85-GP-16.
5. Prepare wallboard surfaces to CGSB 85-GP-33M. Fill minor cracks with plaster patching compound.

3.2 Preparation of Previously Painted Surfaces

1. Remove screws, bolts, nails, etc. from all surfaces to be painted
2. Remove all peeling and scaling paint by scraping and sanding.
3. Remove loose and broken pieces. Fill all holes, cracks and crevices with appropriate patching compound and match surrounding texture. Touch-up with appropriate primer.

4. Remove all dirt, grease, oil, wax and other contaminants by scrubbing with a detergent solution such as trisodium phosphate. Rinse with clean water.
5. All metal surfaces must be washed with mineral sprits. Change solvent and rags frequently. Remove all rust by sanding. Prime with rust inhibitive paint.
6. Dull all glossy surfaces by sanding.
7. Wash with solvent surfaces that have been subject to writing with marking pens, crayons, or lipsticks. Prime to stop bleeding.
8. For joints within or adjacent to exterior areas to be painted or cleaned, remove old cracked and loose caulking and replace with a high quality caulking compound.

3.3 Application

1. Sand and dust between each coat to remove defects visible from distance up to 60".
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.

3.4 Mechanical and Electrical Equipment

1. 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
2. Paint gas piping standard yellow where visible on roof or in service spaces.
3. Paint surfaces inside of ductwork and elsewhere behind grilles where visible using primer and one coat of matte black paint.
4. Paint both sides and edges of plywood backboards for equipment before installation.
5. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

3.5 Paint Systems

1. System references listed are based on Chapters 4A and 4B of OPCA Manual and are OPCA Premium Grade, unless noted otherwise.

3.6 Interior Finishes

1. Wood, where applicable: INT. 1-A, Alkyd Semi-Gloss Finish, Premium Grade.
2. Gypsum board - Ceilings and bulkheads - INT. 4-A, Alkyd Flat Finish, Premium Grade.
3. Gypsum board – walls: JNT4A, Alkyd eggshell, Premium Grade.
4. Concrete Block: INT. 8-B, Alkyd Semi-Gloss Finish, Premium Grade.
5. Galvanized metal: INT. 13-A, Alkyd Semi-Gloss Finish, Premium Grade.

3.7 Refinishing of Previously Painted Surfaces

1. Apply two (2) finishing coats of paint materials listed in Section 3.5 and 3.6 for the type of surface considered.
2. When satisfactory coverage can be achieved by only one (1) coat, the second coat is not required.
3. Apply additional coats if necessary to cover accent colours, graphics, etc.

End of Section

PART 1 - GENERAL

1.1 Shop Drawings

1. Submit shop drawings in accordance with Section 01340.

PART 2 - PRODUCTS

2.1 Fixtures

1. **Acoustical Wall Panel**

Manufactured by Armstrong Ceiling and Wall. Item No. 8181T10 Class A fire rating. 1220mm high, 610mm wide and 1220mm wide, adjust width to suit location; 38 mm thick panels of wood fibers bonded with inorganic hydraulic cement; long edge of panel to be beveled and the short edge is to be square; Tectum Direct-attached acoustical wall panels by Armstrong World Industries, Inc.

Location: Gymnasium See drawings for location and spacing.

Mounted: 25mm x 90mm wood furring on 610mm center painted to wood to match walls. Use Manuf. Mounting Detail C-20 with 19mm furring strips with 25mm density fiberglass to be ROXUL and no substitute.

Note: Allow for up to 4 colours for ACWP units and in a random pattern of sizes and colours, as noted on plans.

PART 3 – EXECUTION

3.1 Installation

1. Install where indicated on drawings and as per manufacturer's instructions.

3.2 Demonstration and Training

1. Provide demonstration of operation to the Owner and his representatives.
2. Provide training for operation, maintenance and repairs.

End of Section

PART 1 - GENERAL

1.1 Related Work

1. Not applicable.

1.2 Submittals

1. Submit shop drawings in accordance with Section 01340. Details of attachment to the building structure (walls and roof structure) must bear stamp of a professional engineer licensed to design structures in the Province of Ontario certifying their strength and safety.
2. Clearly indicate fabrication details, plans, deviations, hardware and installation details.
3. Take measurements on site of spaces and conditions to which work must conform.
4. At completion of installation provide written certification from professional engineer that the installation is structurally safe and in accordance with approved shop drawings.

1.3 Protection

1. Protect work from damage during storage, handling, installation and until building is turned over to the Owner.

1.4 Reference Standards

1. All gymnasium equipment shall meet all regulatory requirements of the International Amateur Athletics Federation (I.A.A.F.) for official tournament play as well as all safety standards as set forth by CSA and/or CGSB for the applicable equipment item and/or category, as well as all local codes and regulations.
2. This specification section is based on equipment by Gymnasium and Health Equipment Limited. Similar equipment by Forum Athletic, Porter Athletic Equipment Co., Sheridan, Centaur Products Inc., or Hussey Seating is also acceptable.

PART 2 – PRODUCTS

2.1 Adjustable Height Basketball Backstops at Cross-Courts

1. Wall mounted cross courts: total of four complete assemblies, two for each cross court.
2. Backstops – Cross Courts (BB-1): BB-1-I 12", interior practice wall mounted backstop with BB3 height adjustable unit. Install RED shot box to all locations. By Gymnasium and Health Equipment, Markham.
3. Backboard, Goal and Nets: Model BB-22 backboard, Model BB-30 goal, net and hardware all by Gymnasium and Health Equipment, Markham

4. Supply all framing, wall anchor bolts, stringers, mounting hardware for a complete operating installation. Framing finish: enamel paint, standard white colour.

2.2 Co-ordination for Items 2.1

1. Provide Section 04200 with all mounting locations, types and hardware for wall-mounted backstops.
2. Prepare all wall mounted units for installation in hollow concrete masonry walls.

PART 3 - EXECUTION

3.1 Fabrication

1. Fix and assemble work in shop where possible.
2. File and grind exposed welds, smooth and flush. Make exposed welds continuous.
3. Workmanship shall be best grade of modern shop and field practice known to recognized manufacturers specializing in this work. Accurately fit joints and intersecting members and made in true planes with adequate fastening.

3.2 Installation

1. Install work square, plumb, straight, true and accurately fitted.
2. Included anchors, dowels and fastenings necessary to anchor work together or to work of other trades.
3. Where installing in masonry, centre equipment between masonry block joints unless indicated otherwise on details. Verify location mounting heights, and dimensions of all units before installation. Anchor in accordance with manufacturer's printed instructions.
4. Insulate where necessary to prevent electrolysis between dissimilar materials.
5. Co-ordinate installation of floor sockets with Section 09660.
6. Install, connect, make operational and adjust all electrically operated components for proper function.
7. Deliver to Owner all special tools, accessories, controls, spare parts, etc. which are related to the work of this Section.

3.3 Demonstration and Training

1. Provide demonstration of operation to the Owner and his representatives.
2. Provide training or maintenance and repairs to the Stage Rigging and Drapery.

End of Section

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PART 1 - GENERAL

1.1 General Requirements

- .1 The Specifications of Section 15010 apply to and govern all Work of Division 15.
- .2 Comply with the Instructions to Bidders, the General Conditions of the Contract Documents and all amendments and supplements thereto, and with Division 1.
- .3 Include Ontario Harmonized Sales Tax as outlined in General Conditions and Tendering Instructions.
- .4 Whenever the word "Mechanical Consultant" is indicated in all Sections under Division 15 this to be defined as the "Mechanical Engineer" unless specifically indicated otherwise.

1.2 Scope of Specifications

- .1 The listing hereinafter of any article, material, operation or method requires that this Division is to Provide each item listed of the quality and subject to the qualifications noted, and this Division is to perform each operation prescribed according to the condition stated, providing therefore, all necessary labour, equipment and incidentals.

1.3 Related Work

- .1 It is the intent of these Specifications to supply and install all materials and equipment as hereinafter Specified and/or shown on the Drawings in such a manner as to leave each of the systems of the mechanical trades complete and in a satisfactory condition.

1.4 Definitions

- .1 Where used, words "Section" and "Division" shall also include other Sub-Contractors engaged on site to perform Work to make building and site complete in all respects.
- .2 Where used, word "supply" shall mean furnishing to site in location required or directed complete with accessory parts.
- .3 Where used, word "install" shall mean secured in place and connected up for operation as noted or directed.
- .4 Where used, word "Provide" shall mean supply and install as each is described above.
- .5 Where used, words "municipality" or "authorities" shall mean agencies that enforce applicable laws, ordinances, rules, regulations or code of the Place of the Work.
- .6 Where used, the word "Consultant" shall mean the Project Prime Consultant (Architect).
- .7 Where used, word "Work" shall mean all equipment, permits, materials and labour to Provide a complete mechanical installation as required and detailed in the Drawings and Specifications.
- .8 Where the words "Drawing" and "Specifications" are referred to, it means the "Contract Documents".
- .9 Where used, words "Prime Mechanical Contractor" shall mean supervisory Mechanical Contractor of all Mechanical sub-Contractors.

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- .10 The terms "instructions" or "as instructed" or "where instructed" mean as instructed by the Consultant, including Supplemental Instruction notices; job site instruction notices; job site instructions by a field representative/ inspector appointed by the Consultant and including all comments made regarding submittal of Shop Drawings and samples for review.
- .11 The term "exposed" means within the line of sight of any person standing or sitting in the occupied space, unless defined otherwise in the following sections.
- .12 The term "concealed" means not exposed.
- .13 The term "listed" means that the materials or equipment are tested in accordance with applicable standards, and are approved and listed for their intended use by a testing company approved by the Authorities having jurisdiction.
- .14 The term "approved", "approvals", means approved by Authorities having jurisdiction as conforming to the requirements of the Contract Documents.
- .15 The term "acceptable" or "acceptance", means acceptable to the Consultant as conforming to the requirements of the Contract Documents.
- .16 The term "submit for review" or "submit notice", means submit to the Consultant.
- .17 The term "subject to review" means Work or materials laid out for review by the Consultant. Obtain instruction from the Consultant before proceeding with the Work. Submit further information, Shop Drawings, samples, as specified and/or as may be reasonably requested by the Consultant.
- .18 The term "accessible" used alone means readily accessible by a person using tools as required without cutting or breaking out materials.
- .19 The term "noted" means noted on the Drawings, the Detail Drawings and on the Schedules.

1.5 Scope of Work

- .1 Related Work Specified Elsewhere
 - .1 Electrical Division 16
- .2 This Division is to include the supply of all labour, tools, equipment and materials for the installing, testing and putting into proper operation the complete system as herein specified, as shown on the Drawings, or as is reasonably inferable from either or both.
- .3 Equipment items that are supplied as packaged units under this Division are to include all internal wiring, relays, contactors, switches, transformers, motor starters, controls and ancillaries as required for the intended operation, and to be complete with all necessary terminals suitable for connection to power source, and external devices at a single location.

1.6 Intent of Specifications & Drawings

- .1 Any specific item or Work omitted from one and which is mentioned or reasonably implied in the other is to be considered as properly and sufficiently specified and must be provided by this Division.

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- .2 Should any discrepancy or conflict appear between these Specifications and the Drawings which leave this Division in doubt as to the true meaning and intent of the Drawings and Specifications, a ruling is to be obtained from the Consultant **BEFORE SUBMITTING THE TENDER**. If clarification is not sought prior to the closing of tender, the Consultant's decisions are final, conclusive and binding on this Division.

1.7 Regulation & Permits

- .1 All Work to be carried out in accordance with the latest editions of all relevant authorities, codes, or regulations including but not limited to Ontario Building Code (OBC), including Part 7, Plumbing; Canadian Regulations for the Construction and Inspection of Pressure Vessels; Ontario Fire Code (OFC); Ministry of Labour Guidelines; Occupational Health and Safety Act; Ontario Electrical Safety Code; Gas Utilization Code; Canadian Heating, Ventilating and Air Conditioning Code; National Fire Protection Association (NFPA); Canadian Standards Association (CSA); and American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE) Standards.
- .2 All authorized code inspections required by above mentioned laws, rules and regulations, inclusive of any fees, obtaining of permits, issuance of notices are to be arranged and paid for by this Division.
- .3 Furnish all necessary certificates as evidence that Work installed complied with aforementioned laws and regulations of all governing authorities, prior to acceptance of the Work and before the final certificate of payment is issued.
- .4 Any deviations from the plans or Specifications requested by an official representing one or any of the authorities having jurisdiction over that portion of the Work must be brought to the attention of the Consultant prior to proceeding with the change. Any additional costs incurred for extra Work performed without instruction from the Consultant will not be considered.

1.8 Examination of Site & Documents

- .1 This Division and related sub-trades, before tendering, are to examine the site and all Drawings and Specifications of other trades and familiarize himself with local conditions, building construction and finishes affecting the Work under this section. No allowances are to be made for any extra expense incurred by him through his failure to do so.

1.9 Contract Drawings

- .1 The Contract Drawings are not intended to be Shop or Working Drawings and all measurements are to be taken from the Architectural dimensioned Drawings or in the field. This Division shall make, without any extra expense or credit to the Owner, any necessary changes or additions to the Work to accommodate the Architectural or Structural conditions.
- .2 Where Shop or Working Drawings are required, this Division shall provide them and submit them to the Consultant for review.
- .3 The Contract Drawings show the minimum standard acceptable regardless of any lesser standards set by any codes or regulations having jurisdiction.
- .4 The Architectural, Structural and Electrical Contract Drawings are to be examined to ensure that the Work of this Division may be satisfactorily completed.

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- .5 Notify the Consultant upon discovery of any conditions, which adversely affect the Work of this Division. No allowances are to be made after awarding Contract for any expenses incurred through failure to do so.
- .6 The Drawings upon which this Contract is based show the arrangement, general design and extent of the piping, ductwork and other systems. These systems are suitably outlined on the Drawings with regard to size, location, general arrangement and installation details. The mains and connections thereto are shown more or less in diagram, except where in certain cases, the Drawing may include details giving the exact locations and arrangements required. All piping and ductwork shall be concealed unless shown otherwise.
- .7 Where any parts of the system and/or pieces of equipment are located by dimensions of the Drawings, said dimensions shall be checked and verified in the field. Each Division shall make, without additional charge or expense to the Owner, any necessary changes, additions or offsets to the runs to accommodate structural conditions. The Consultant shall be modified immediately and his authority secured in writing for such revisions before proceeding with the Work.

1.10 Storage & Protection of Materials

- .1 Proper facilities for storage and protection of material and equipment are to be provided at the job site by this Division.
- .2 All pipe to be used on the job to be carefully stacked off the floor with ends capped or suitably plugged to prevent the entry of dirt and debris until such time the piping is being installed. Similarly all openings in pressure vessels, tanks, etc., to be kept closed until ready for use. Any piping not suitably protected to be removed from the site and replaced with new.
- .3 Equipment located on site must also be suitably protected to prevent damage from abuse or misuse. Protect all bearings and motors from damage due to moisture and dust. Equipment not yet in operation shall be turned over at least monthly to prevent bearing deterioration. Equipment and/or materials damaged after delivery to site is to be replaced or repaired to the satisfaction of the Consultant.
- .4 Make known any hazardous or flammable materials to be used and method of application, before using. This Division shall be responsible for proper storage and all necessary safety requirements in the storage and use of all hazardous and flammable materials used in the execution of their Work.

1.11 Delivery

- .1 Transport and handle the material in conformance with the Manufacturers instructions.
- .2 Deliver the materials to the job site in their original packaging. The name and address of the manufacturer must be labelled on the packaging.
- .3 Packing Waste Management:
 - .1 Recover the packaging waste so that it may be reused, recycled or reclaimed by the Manufacturer. This includes, but is not limited to, pallets, packing, and other packing material.

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1.12 Co-Operation of Trades

- .1 The Prime Mechanical Contractor is to co-operate with all other trades on the job so that all equipment can be satisfactorily installed, and so that no delay is caused to any other trade. Any reworking of installed equipment, piping, or ducting to accommodate the installation of other trades Work shall be performed at no extra cost.

1.13 Warranty

- .1 The Prime Mechanical Contractor to Warrant Products and execution of Work under this Division against defects of material and workmanship for one (1) full year after date of Substantial Performance.
- .2 Repair defects that are discovered or develop during this period and make good any resulting damage to equipment or building. Repairs to be carried out at no cost to Owner.
- .3 Provide extended warranties where indicated in other sections of this Division. Extended warranties to commence on termination of the standard one year warranty and to be an extension of these same provisions.

1.14 Charges for Extras & Credits

- .1 Extras and credits for Division 15 Contractors and Sub-Contractors shall be charged on the following basis:
 - .1 Materials - trade price¹ plus overhead plus profit as outlined in the General Conditions.
 - .2 Labour - Journeyman's and foreman's labour at current local union rates plus worker's compensation plus unemployment insurance plus overhead plus profit as outlined in the General Conditions.
 - .3 Labour hour charges shall be within 10% of the unit prices in the National Labour Calculator.
- .2 Credits shall be the same as above, except no overhead and profit.
- .3 Disputes shall be settled by arbitration.
- .4 All submittals must include a detailed breakdown showing lengths, sizes, quantities of materials, unit labour charges with labour rates, mark ups, overhead and profits with totals. Submittals that do not include a detailed breakdown cannot be reviewed.

1.15 Local Utilities

- .1 The Prime Mechanical Contractor, before tendering, to contact all utilities to determine the local procedures and policies concerning services, and portions of that service which would be supplied or available through the utilities and incur any cost. The Prime Mechanical Contractor to ensure no delays in construction or service connections.

1.16 Existing Services

- .1 Where Work involves breaking into or connecting existing services, carry out Work at times directed by governing authorities, with minimum of disturbance to the premises and its operation.

¹ Trade price means the price at which the Contractor or his Sub-Contractor pays for the materials including all discounts.

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- .2 Before commencing Work, establish location and extent of service lines in area of Work and notify Consultant of finding.
- .3 Where unknown services are encountered, immediately advise Consultant and confirm findings in writing.
- .4 Remove abandoned service lines. Cap or otherwise seal lines at cut-off points, in manner approved by authorities having jurisdiction over service.
- .5 Record locations of maintained, re-routed and abandoned service lines. The sub-Contractors concerned shall provide this Division with all necessary dimensions required to accurately locate those services.
- .6 Where the location of any of these utilities has been shown on the plans, such information is not guaranteed. It is the responsibility of this Division to verify locations and elevations, immediately after they move on the site. If for any reason the information obtained necessitates changes in procedures or design, they must advise the Consultant at once. If this verification of existing conditions is not done at the outset and any problems arise, the responsibility for same is entirely this Contractor's.
- .7 Where it is necessary to temporarily shut down equipment or services serving essential areas, this Division shall include premium costs to ensure the Work force is scheduled for "round the clock" operation in order to minimize disruption and equipment downtime.

1.17 Interference Sketches

- .1 Before shop fabrication begins or undertaking installation Work inside the building, prepare an integrated set of mechanical interference sketches, where indicated on the Drawings.
- .2 These sketches shall be prepared by Prime Mechanical Contractor with the co-operation of other trades and shall show the location or space allocated for the Work of each trade.
- .3 Submit two (2) copies of detailed interference sketches showing structural members, electrical conduits, devices and all mechanical elements to the Consultant for review and general approval before proceeding with the Work.
- .4 Copies of these reviewed interference sketches shall be submitted to all trades, the General Contractor, the Architect, and the Consultant, and general approval shall be obtained before the space allotment.
- .5 As a minimum, interference sketches shall be made for the Gymnasium and adjacent room ceiling spaces.
- .6 Work that has been installed before review of interference sketches and has been determined that it is in conflict with the building shall be removed from the site at no extra cost to the Owner. The Work, reviewed by the Consultant, shall be installed at no extra cost to the Owner.

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1.18 Record Drawings

- .1 This Division will provide an extra set of whiteprints to be marked up by this Division, in red ink, as the job progresses, showing all changes and deviations from the plans, so that on completion of the job, the Consultant will have a record of the exact location of all piping, ductwork and equipment. These Drawings shall be available during construction at all times and will be reviewed monthly by the Consultant. Submit updated Mechanical Drawings in AutoCAD format to the Consultant with the Maintenance Manuals.
- .2 Electronic AutoCAD files will be made available to the Prime Mechanical Contractor for this purpose. Contractor will be required to complete the release form "Transfer of Electronic Media" in order to receive the files. See below.
- .3 Record Drawings shall locate all concealed shut-off valves, dampers, control valves, coils and concealed air vents.
- .4 Before Substantial Completion of the Project, the Contractor shall provide CD containing all updated Record Drawing information, as specified herein.
- .5 Record location of concealed mechanical services and components. Dimension and reference all concealed and buried mechanical services from visible and accessible permanent features of structure.

1.19 Liability

- .1 Each Section and Trade shall:
 - .1 Assume full responsibility for laying out his Work and for any damage caused to other Sections or Owner by improper location or carrying out of same.
 - .2 Be responsible for prompt installation of Work in advance of concrete pouring, ceiling installation or similar Work.
 - .3 Protect finished and unfinished Work of this Division and Work of other Sections from damage due to Work of this Division.
 - .4 Be responsible for condition of material and equipment supplied. Be responsible for protection and maintenance of Work completed until termination and acceptance.

1.20 Permits & Fees

- .1 Pay all permit and inspection fees as required to complete the Work of Division 15.

1.21 Maintenance & Maintenance Manuals

- .1 Refer to Section 15011 - Submittals.

1.22 Electrical Wiring & Wiring Diagrams

- .1 All motors for equipment under this Division will be by this Division. All starters, switches and power wiring will be provided by Division 16, except where noted. Where electrical requirements for equipment exceeds the provisions described in the Electrical Specifications, this Contractor shall provide labour and materials as required to complete with installation. All motors, switches and equipment shall be of Canadian manufacture: Westinghouse Canada, Canadian General Electric, Allen-Bradley, Square 'D', Robins & Meyers, Lincoln, Tamper.

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- .2 Provide with shop drawings, a comprehensive wiring diagram for all mechanical equipment requiring review. Shop drawings will not be reviewed unless accompanied by the wiring diagrams.

1.23 Protection

- .1 Protect work from damage. Securely plug or cap open ends of conduits, pipes, ducts or equipment to prevent entry of dirt, dust, debris, water, snow or ice. Clean all piping, ducting, conduits and equipment inside and outside before testing.

1.24 Co-Ordination

- .1 The Prime Mechanical Contractor is responsible for co-ordinating the mechanical Work herein to suit Project Phasing Schedule.
- .2 Co-ordinate all Mechanical Work with the Work of any other Divisions to avoid conflicts. Be responsible for modifying the Work of this Division to accommodate space conflicts.
- .3 Failure to coordinate will result in installed Work being removed and new Work put in place at no cost to the Owner.
- .4 Refer to Architectural Specification for Project phasing plans and description.

1.25 Fire Stopping

- .1 The Prime Mechanical Contractor is responsible for all fire stopping related to the Work of Division 15 including, but not limited to, the ductwork, piping and control wiring. Fire Stopping shall be in accordance with the Architectural Specifications.

1.26 Sheave & Belt Changes

- .1 The Prime Mechanical Contractor to carry the costs to supply and install pump impellor, fan sheave and belt changes. See Section 15013 - Systems Balancing.

PART 2 - PRODUCTS

2.1 Materials

- .1 Materials and equipment are specifically named and described in this Specification to establish a standard that this Division is to adhere to.
- .2 The term "**Acceptable Product**" is used to indicate a Product or Manufacturer which, in the Consultant's opinion, meets the basic performance and quality of the specified Product or Manufacturer, subject to all the requirements so specified being met. Dimensions, weights, electrical requirements, are not always equal to the specified item. Except where a Product or Manufacturer is "**basis of design**", an "Acceptable Product" or Manufacturer(s) is named, this Division may supply and install the "Acceptable Product" but must be prepared to bear any and all costs incurred by its use. The Prime Mechanical Contractor is responsible to pay for all Mechanical, Electrical, and Structural changes to suit the selected Acceptable Product, all associated consulting fees, and to identify the impact of the Project schedule.

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- .3 The terms "Base Bid" and "Alternate Products" are used to indicate a **preferred Product (base bid)** and a list of potential substitutes (Alternate Product). "Alternate Products" are the only possible alternates for the Base Bid Product. The Prime Mechanical Contractor will list on his tender form, the saving associated with the Alternate Product. The Prime Mechanical Contractor is responsible to pay for all Mechanical, Electrical, and Structural changes to suit the suggested Alternate Product, all associated consulting fees, and to identify the impact of the Project schedule.
- .4 Any equipment installed without the Consultant's written approval is to be removed and the correct equipment installed at this Division's expense. No consideration is to be allowed for claims of delay of schedule in this case.
- .5 In the event the approved equipment is not available for any reason, the specified equipment is to be installed; any and all costs incurred are the responsibility of this Division.
- .6 The Consultant reserves the right to accept or reject an alternate without explanation.
- .7 Unsolicited Alternates:
 - .1 Additional Manufacturers wishing to bid Products other than the Product specified herein, are to submit to Consultant 10 (ten) days prior to tender close a list of three past installations of Products similar to those listed. Complete catalogue data along with deviations from the Product specified are to be noted in the submittal to the Consultant. The Manufacturer guarantees the proposed substitute Product to comply with the Product specified and as detailed on the Drawings, unless the deviations are so noted in the submittal for approval.
 - .2 The Prime Mechanical Contractor is responsible to pay for all Mechanical, Electrical, and Structural changes required to suit the alternate Product.

2.2 Access Doors

- .1 The Prime Mechanical Contractor to supply access doors of adequate size and with appropriate clearances, wherever any equipment, cleanouts, valves, dampers and fire dampers, which require service, maintenance or removal and are built in or concealed behind walls, or ceiling. Doors to be installed by the General Contractor. Coloured thumb tacks are to be used in acoustic tile ceilings.
- .2 Access doors to be 14 U.S.S. gauge prime coated steel with concealed hinges, anchor straps, screwdriver operated lock, rounded safety corners and dust tight doors that open 180 degrees. Doors are to be adequately sized to suit equipment, which is to be accessed, but in no case smaller than 8" x 8" (200 mm x 200 mm).
- .3 In acoustic tile ceiling, where access cannot be achieved through tile, install access doors to suit tile. Markers are to be approved colour-coded markers to indicate type of valve or equipment concealed.
- .4 Where access doors are to be installed in a fire rated assembly, the access door must have a fire rating equal to or greater than the assembly fire rating. Fire rated access doors to be ULC rated and in accordance with NFPA-80.
- .5 Acceptable Products:
 - .1 Acudor
 - .2 Le Hage
 - .3 Mi-Fab

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2.3 Hangers & Inserts

- .1 All inserts shall be Powers Fasteners or Hilti and shall be firmly secured to the framework before concrete is poured. Supply and install these inserts and be responsible for their correct locations. There shall be no flame cutting of structure unless approval is received from the Consultant.
- .2 Any additional supports required from concrete floors or walls for piping or ducts shall be provided by:
 - .1 Drilling same and using steel anchor shield and bolt
 - .2 Toggle or expansion bolt
- .3 Hangers shall be secured to concrete block by:
 - .1 Steel anchor shield and bolt
 - .2 Toggle or expansion bolt
- .4 Hangers shall be secured to steel structures by:
 - .1 Punching flanges for bolt
 - .2 Friction lug or flange
 - .3 'C' clamp or beam clamp
 - .4 Tack welding as conditions require
- .5 Steel deck shall not be used to support ducts, pipes, fixtures and equipment except on written permission of the Structural Consultant.
- .6 Ensure that load on building structure does not exceed maximum mechanical loading per square foot (metre) shown on Structural Drawings or as directed by the Architect. Take special care to avoid introduction of undue reaction forces into structure of building, to flanges of pumps and equipment, to expansion joints and to piping.
- .7 Take special care to avoid introduction of undue reaction forces into the structure of the building, to flanges of pumps and equipment, to expansion joints, and to piping.

2.4 Factory Installed Controls

- .1 Equipment with factory installed controls shall have transient (surge) suppression installed in parallel with the holding coils of all starters and relays as protection for equipment sensitive to surges and spikes, when required.

PART 3 - EXECUTION

3.1 Installation

- .1 Each piece of equipment or material to be checked against the Specification and reviewed Shop Drawing before installation, all clearances and installation instructions are to be strictly adhered to. Failure to comply with the instructions shall result in removal and proper reinstallation of the equipment at no cost to the Owner.
- .2 Where mechanical equipment is installed in a fire rated assembly, Provide fire dampers, drywall enclosure or other as required to maintain the assembly fire rating to the approval of this Division. Include all costs.

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3.2 Sleeves, Holes & Patching

- .1 All cutting and patching to be as specified under the General Conditions and Supplementary Conditions bearing in mind that the integrity of the fire separations are to be maintained at all times.
- .2 All holes, pipe chases, and openings through walls and floors that are not fire separation are to be large enough to accommodate the thickness of insulation specified.
- .3 All cutting and patching, sleeves, grouting, painting and drywall required by this Division is to be performed by fully qualified craftsmen of that respective trade. All cutting and patching required by this Division to be provided by this Division, unless indicated otherwise.
- .4 All holes, pipe chases and openings through walls and floors that are fire separations are to be 1/2" (13 mm) larger in diameter than the pipe and the void will be properly fire stopped as specified.
- .5 Holes through masonry walls are to be sleeved with schedule 40 steel pipe, all other holes to be sleeved with light gauge metal sleeves, unless indicated otherwise.
- .6 Holes through exterior walls and roof are to be properly flashed and made weatherproof. Refer to Architectural Drawings for details.
- .7 Holes through structural steel are to be reinforced with steel plates welded each side as detailed in the Structural Engineer's Drawings and Specifications or to meet their approval.
- .8 Sleeves for uninsulated pipes are to be sized to allow 1/2" (13 mm) clearance between the pipe and the sleeve. The space between the pipe and sleeve to be sealed with rockwool insulation to avoid smoke, sound and dust transmission and fire stopped.
- .9 Pipes are not to be in direct contact with plaster, concrete or any other finishing material.
- .10 Sleeves for all piping penetrating mechanical room floor to extend 2" (50 mm) above the finished floor and sealed at the floor.
- .11 Sleeves in potentially wet floor areas to extend at least 1" (25 mm) above the finished floor.
- .12 Ensure no contact between copper tube or pipe and ferrous sleeve.
- .13 The Prime Mechanical Contractor to provide detailed dimensioned Drawings prior to pouring floors, erecting masonry, or installing roof deck. Drawings to indicate size and location of all openings to ensure correct bridging installed as indicated under Division 5.
- .14 The Prime Mechanical Contractor is responsible to install sleeves for piping and ducts and frames for openings for grilles, and louvres, as the construction progresses. If these sleeves and frames are not installed by this Division during construction the cost of cutting openings, chases and installing the sleeves and frames is to be at This Division's expense by the respective trade involved.
- .15 Provide sleeves for all ducting penetrating floors and masonry or concrete walls

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- .16 Ducts penetrating fire separations to have any voids between the duct sleeve and fire separation properly fire stopped as specified. Ducts penetrating non fire separations to have any voids between the duct sleeve and separation filled with rockwool insulation to avoid smoke, sound and dust transmission.
- .17 Supply and set all necessary sleeves for this Work prior to pouring of concrete.
- .18 Approval of the location, size and proposed method of cutting through structural components must be received before proceeding.
- .19 Where pipe and ducts pass through walls in the existing building, the cutting and patching is by the Prime Mechanical Contractor.
- .20 Where pipes and ducts pass through fire separations (walls, floor and partitions) pack space with ULC listed and/or approved fire stopping mineral fibre insulation and seal with approved fire-retardant sealing compounding. Sealing compound to be installed to Manufacturer's Specifications and detail. Fire stopping shall comply with the Ontario Building Code and approved by local Building Department. Obtain written approval from Local Building Department before commencing with Work.

3.3 Workmanship

- .1 Employ an experienced, responsible tradesperson to supervise the Work and retain this supervisor on the job throughout the construction period until completion of Work, and all mechanical systems are fully operational and have been commissioned and demonstrated to the Owner unless otherwise approved or directed by the Consultant.
- .2 Employ only skilled licensed pipe fitters for execution of Work. Workmanship to be first class not only as regards durability, efficiency and safety, but also as regards to neatness of detail.
- .3 Set equipment accurately, plumb and level and align hanger rods and steel supporting structures.
- .4 Products and installations in the opinion of the Consultant found to be defective; not in accordance with Specifications; damaged or defaced; or of poor workmanship to be rejected.
- .5 Rejected Work is to be repaired or replaced at no cost to the Owner.

3.4 Use of HVAC Fans

- .1 While construction is still in progress, the use of or running of system ventilation fans for the purposes of ventilation, drying of plaster, sanding, painting, etc., will not be permitted.

3.5 Belt Drives, Sheaves & Guards

- .1 Provide all belt driven equipment with V-belt drive, designed for at least 150 percent of motor nameplate horsepower rating and in accordance with Manufacturer's recommendations for type of service intended. Belt drives to be at least 95 percent efficient. Balance and properly align all drives. Provide matched sets of belts for multiple belt assemblies. Select belts to suit starting torque of driver. Use single belt drives only for motors 2 HP (1492 watt) and smaller.

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- .2 Provide motor sheaves for one and two belt drives of variable pitch type, with Dodge key adjustments. Supply one set of fixed drive sheaves for drives with two or more belts. Install fixed motor sheaves to obtain the originally specified rpm. After initial test and preliminary adjustment, supply and install a second set of fixed sheaves if necessary, to provide the design flow quantities as established on the job. Obtain correct total flow rate for fans through speed changes and not by throttling.
- .3 All equipment that is belt driven must be a complete installation including a sturdy, firmly supported, removable belt guard to give full protection and safety from any rotating part.

3.6 Piping

- .1 All piping for this Division is to be run concealed where possible and grouped so that valves, etc., are accessible through as few access panels or doors as possible, while still maintaining adequate working space.
- .2 Piping that does not present a neat workmanlike appearance, in the opinion of the Consultant, is to be reworked according to his instructions without extra cost to the Owner. Arrange piping within pipe chases that have been designed for access of personnel to ensure that access is not impeded.
- .3 In specifically designated unfinished areas such as mechanical rooms or existing areas, run pipes neatly parallel or in banks and group valves. Piping may run exposed in these designated areas. The crossing over of pipes must be kept to a minimum.
- .4 The piping shown on the Drawings is located diagrammatically in the space in which it is intended to run. Co-operate and co-ordinate with the Work of other Divisions, also installing pipes, conduits, ducts, etc., within the same area. No extras are to be paid for any relocation of piping to suit the Work of other Divisions.
- .5 Separation by approved dielectric unions is to be applied to all ferrous and non-ferrous domestic water piping. Separation of ferrous and non-ferrous piping on closed loop systems to be accomplished with the use of brass or bronze fittings and/or valves. All connecting or touching metals that could give rise to electrolytic action to be separated by insulation.
- .6 All piping is to be installed with adequate change of direction, expansion joints and anchors, so that the piping and equipment will in no way be strained or distorted by expansion and contraction.
- .7 If on the job circumstances require additional change of direction and expansion loops, furnish and install same at no extra cost.
- .8 All take-offs from the mains to be made using swing joints wherever possible.
- .9 Hydronic branches serving down feed risers are to be taken from lower sides or bottom of mains and grade down slightly to risers. Branches which serve units above the mains are to be taken from the top or sides of mains.
- .10 Anchors are to be provided where necessary to protect equipment and to generally be made from 1/2" (13 mm) M.S. plate with structural steel angle and channel sections.
- .11 Suitable anchors and guides are to be provided where shown or where necessary for all vibration devices.

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- .12 Expansion loops are to be located midway between anchors except where shown otherwise. All expansion loops to be cold sprung 50% in accordance with the latest edition of the ASHRAE Guide.
- .13 Install all water piping so that lines can be drained. Provide drip tee with 3/4" (19 mm) ball valve with cap and chain.
- .14 All exposed plumbing piping in finished area to be chrome plated unless indicated otherwise.

3.7 Identification of Piping

- .1 Identify all visible piping whether fully exposed or in accessible spaces such as above acoustic tile ceilings.
- .2 Identify all concealed piping mains in concealed areas such as drywall ceilings and pipe trenches etc. prior to these areas being enclosed.
- .3 Identify the medium in the piping with wrap-around pipe markers including direction-of-flow arrows.
- .4 All piping identification to be done on clean surfaces.
- .5 Size all wrap-around labels for the pipe being labelled.
- .6 Location:
 - .1 Locate markers and classifying colour on piping systems so they can be seen from floor or platform.
 - .2 Identify piping runs at least once in each room.
 - .3 Do not exceed 50 ft. (15 m) between identifications in open areas and above T bar ceilings.
 - .4 Identify both sides where piping penetrates walls, partitions and floors.
 - .5 Where piping is concealed in pipe chase or other confined space, identify at point of entry and leaving, and at each access opening.
 - .6 Identify piping at starting and ending points of runs and at each piece of equipment.
 - .7 Identify piping at major manual and automatic valves immediately upstream of valves. Where this is not possible, place identification as close to valve as possible.
 - .8 Identify branch, equipment or building served after such valve.
 - .9 Identify piping in concealed spaces prior to spaces being enclosed.
- .7 Labels shall comply with WHMIS and ANSI Specifications.
- .8 Acceptable Products:
 - .1 Brimar Industries
 - .2 Seton Inc.

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3.8 Valve Tags

- .1 All valves installed under this Division to have securely affixed to them an approved valve tag bearing an engraved number which shall be used to identify the valve on an indexed valve list prepared and mounted in a glazed frame in the mechanical or boiler room.
- .2 Beside each number on the list of valves to be listed, identify the function normal position, and location of valve so tagged.
- .3 Valve tags shall be either engraved lamacoid or plastic valve tags (Brimar B11101-39) with 8 mm (1/4") tall lettering of a colour to contrast with the label colour.
- .4 Valve tags shall be colour coded as follows:

System	Tag Colour	Lettering Colour
Domestic piping systems	Green	White
Heating water piping systems	Yellow	Black

- .5 **Identification Charts:** The Prime Mechanical Contractor shall provide three (3) copies of typewritten identification charts identifying the tag numbers, location and service of each valve, and part number. One (1) copy is to be framed in glass in each Mechanical Room. Mount 6'-0" (1800 mm) above floor to bottom. The remaining charts shall be placed in the Maintenance Manuals.
- .6 **Valves:** Only normally closed valves and special valves shall be identified. Nameplate shall spell out requirement, i.e. "Normally Closed".
- .7 Control valves shall be identified as to their service.
- .8 Acceptable Products:
 - .1 Brimar Industries
 - .2 Seton Inc.

3.9 Identification of Ductwork

- .1 Stencil over final finish only.
- .2 Use 2" (50 mm) high black stencilled letters, e.g. "Supply", "Return", "Washroom Exhaust", "General Exhaust" with directional flow arrows.
- .3 Maintain 50' (15 m) maximum distance between markings, with at least one identification per run.
- .4 Identify ducts each side of dividing walls or partitions and beside each access door.

3.10 Identification of Equipment

- .1 Provide laminated plastic plates with black face and white centre of minimum size 3-1/2" x 1 1/2" x 1/16" (90 x 38 x 2 mm) nominal thickness, engraved with 1/4" (6 mm) high lettering. Use 1" (25 mm) lettering for major equipment.
- .2 Include Electrical circuit designation on the label.
- .3 Mechanically fasten nameplates securely in conspicuous place. Where nameplates cannot be mounted on cool surface, provide standoffs or hang from equipment on short metal chain.

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- .4 Identify equipment type, number, and service or areas or zone of building served.
- .5 Submit the wording for the labels for review prior to engraving and installation.

3.11 Painting

- .1 All field priming and finishing to be performed by Division 9.
- .2 Provide field surface preparation, priming and finishing of the Work of this Division including exposed bare (or insulated) pipework, fittings, ductwork, miscellaneous metals, supports, and equipment, in accordance with Division 9.
- .3 All exposed structural members required for supporting piping, ductwork, and equipment shall be painted one (1) base coat and one (1) finish coat. Colour to be determined by the Architect. Where threaded rods are used, they shall be cadmium plated including washers and nuts.
- .4 The Prime Mechanical Contractor shall paint flat black all relief and drain pipes serving mechanical equipment.
- .5 The Prime Mechanical Contractor shall paint pipe sleeves one coat primer.
- .6 Leave all work in a clean, paintable condition.

3.12 Placing In Operation

- .1 Prior to acceptance and on completion of Work make a complete operational test of systems and Work carried out under Division 15.
- .2 At all fixtures, adjustments for correct water flow to be made; this is to include hot and cold water systems and flush valves.
- .3 At all drains, covers and gratings are to be removed and cleaned, traps cleaned out and drains thoroughly flushed.
- .4 All filters in HVAC equipment are to be removed, thoroughly cleaned and stored for future use, install new filters in units. Bird and insect screens on all louvres to be cleaned. All coils to be combed out where necessary and vacuumed out.
- .5 Balancing will be carried out and systems set to designed values, and a report of final actual performance of all equipment and balancing for final space conditions on cooling and heating to be carried out when relative climatic conditions exist. Refer to Section 15013 - Systems Balancing for more details.
- .6 During the one (1) year guarantee period, commencing after Substantial Completion letter issued by the Architect's office, maintain all equipment installed as part of this Division. This agreement shall be part of the written guarantee. This Work shall be carried out in the presence of the building custodian, and a letter shall be sent to the Consultant stating that this Work was carried out. Three (3) maintenance inspections must be carried out by the Contractor during this one (1) year period (three months, six months, and twelve months after Substantial Completion letter issued). Submit written report to Owner and Consultant after each inspection.

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3.13 Clean-Up

- .1 Avoid accumulation of scrap and debris resulting from the operations of this Division and at all times help maintain the working site in a neat and clean condition. On completion of the Contract, remove all scrap and debris resulting from the Work of this Division and clean all equipment installed by this Division.

3.14 Start-Up Service

- .1 Provide services of a qualified technician responsible for assisting the Owner's staff in becoming familiar with operating of systems, co-ordinating Work of control Manufacturer, acting on any complaints from the Owners, or Consultant regarding operation of any of the systems, installed under this Division.
- .2 Provide start-up of major pieces of mechanical equipment or systems, by representative of equipment Manufacturer or person qualified and recognized by the equipment Manufacturer.
- .3 Submit start-up reports on all mechanical equipment and systems verifying correct installation and operating parameters in all modes of operation. Include service reports in operating and maintenance manuals.
- .4 Notify Consultant prior to start-up on any piece of mechanical equipment or system. Demonstrate operation of all or any mechanical system or equipment as directed by the Consultant in his presence.
- .5 The start-up procedure shall include the completion of the enclosed Equipment Start-Up and Acceptance Check List, which shall be signed by the Mechanical foreman, the Sheet Metal foreman, and Controls foreman where applicable and Electrical foreman certifying they have verified the equipment is ready for acceptance by the Consultant and Owner. When all of the Check Lists have been signed off, the Mechanical foreman and his Sub-Contractors shall demonstrate the operation of the equipment to the Consultant and Owner for sign off acceptance. The Contractor will make any alterations or corrections deemed necessary by the Consultant. There shall be an individual Check List sheet for each individual piece of equipment.
- .6 When the sign off procedure is complete, the Prime Mechanical Contractor shall instruct the Owner's designated representative in the operation and maintenance of all equipment.

3.15 Completion

- .1 Keep the premises in a clean and orderly condition during construction. All waste and unusable materials shall be promptly removed from the site.
- .2 Upon completion of this Work, go over the entire installation, clean and polish all fixtures and equipment, and remove all surplus materials and rubbish of every description incidental to this Work, leaving the installation neat and orderly.
- .3 Before final payment is made, the following items must be completed:
 - .1 Present to the Consultant "Maintenance Manuals" complete with air and water balancing reports, wiring diagrams and certified equipment prints (approval Drawing submissions).
 - .2 Present to the Consultant an as-built record set of Drawings and CAD disk.

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- .3 Instruction of Owner's personnel in the maintenance and operation of all new equipment.
- .4 Present to the Consultant completed Equipment Start-up and Acceptance Checklists.
- .5 Present to the Consultant plumbing Test Certificates and results.
- .6 Present to the Consultant Valve Tag Charts.
- .7 New spare filters and frames labelled and located where directed by the Owner.
- .8 Present to the Consultant Rooftop Equipment Start-Up Reports.
- .9 Pay all permit and inspection fees.
- .4 A value of 2% of the total Contract price shall be withheld until points 3.15.3.1 to .9 are completed to the satisfaction of the Consultant.

3.16 Rigging of Equipment

- .1 Provide all rigging, hoisting and handling of equipment as necessary in order to place the equipment in the designated area in the building.
- .2 Direct this Work by qualified people normally engaged in rigging, hoisting and handling of equipment.

3.17 Field Welding

- .1 Only persons who have passed welding tests to the satisfaction of the Authorities having jurisdiction and who are certified by them to be qualified welders, shall be permitted to do any welding on this Contract.

3.18 Cold Weather Work

- .1 Wherever Work is performed in surrounding air temperatures below 40°F (4°C) special approved precautions shall be taken to prevent damage to mortar, concrete or materials. All such materials used at such times shall be heated. Right is reserved to suspend Work at any time should climatic conditions be deemed unsuitable for proper execution of Work.

3.19 Rights Reserved

- .1 Rights are reserved to furnish any additional Detail Drawings which, in the judgement of the Consultant, may be necessary to clarify the Work and such Drawings shall form a part of the Contract.

3.20 Superintendence

- .1 Maintain at this job site, at all times, qualified personnel and supporting staff with proven experience in erecting, supervising, testing and adjusting projects of comparable nature and complexity.

3.21 Special Cleaning

- .1 Vacuum clean and remove debris from the inside of fans, ducts, coils, terminal units, etc.
- .2 Comb all bent fins to proper configuration on all coils in air handling units, fan coil units, entrance heaters, etc., on finned radiation elements.

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3.22 Moving, Hoisting & Scaffolding

- .1 The Prime Mechanical Contractor is responsible for moving, hoisting and demurrage for all equipment and materials to be furnished and installed under this Division. Include for the cost of dismantling and reassembling equipment, where required, to the Manufacturer's approval.

3.23 Time For Completion

- .1 Review the general Contract requirement for completion dates. Identify at the time of tender any items which may affect the time for completion.
- .2 Advise the Architect and Consultant if materials and equipment involves longer delivery times than indicated in the schedule.
- .3 Monitor and expedite delivery of equipment and materials. If necessary, inspect at source of manufacture.
- .4 Be responsible for failure of, or delay in, the delivery of specified equipment.

3.24 Testing & Adjusting

- .1 Test all piping systems for leaks providing gauges, materials and labour as required. Equipment furnished as part of the permanent installation shall not be used for testing purposes. Before testing, remove all equipment which is not designed to withstand the test pressures. All piping is to be tested before covering is applied, and before backfilling or concealing.
- .2 **Hydrostatic Tests:** All pressure pipe is to be tested as described in each Section. Test pressure shall be maintained for the times noted, during which time the pressure test shall remain constant without pumping.
- .3 **Gravity Piping:** All gravity drainage piping shall be given a ball test and a water test, which must be supervised and inspected by the local Plumbing Inspector.
- .4 All testing shall be done to the satisfaction and approval of the Consultant and the Division shall notify the Consultant forty-eight (48) hours prior to testing.
- .5 Before final payment, test the operation of each system and all equipment installed, make all necessary adjustments and replacements, and demonstrate to the satisfaction of the Consultant that all equipment is operating as intended and without undue noise and vibration.
- .6 When work is complete and systems are in operations, adjust valves, belt drives, controls and thermostats so that there is an even distribution of cooling and heating throughout. Turn over to Owner necessary keys, handles, and operating devices for each system.
- .7 Test for both heating and cooling design days.
- .8 All tests must be witnessed by the Owner Authorised Representative. Failure to do so will result in a re-test.

3.25 Seismic Bracing (Mechanical Systems)

- .1 All mechanical systems shall be installed to comply with the requirements of the Ontario Building Code, Paragraph 4.1.8.18 and Table 4.1.8.18.

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- .2 Provide seismic bracing for all mechanical systems to meet the requirements of Table 4.1.8.18.
- .3 For the purposes of calculating seismic forces, the following is to be used:
Fa = 1.14
Sa (0.2) = 0.321
IE (importance factor) = 1.3
- .4 Provide flexible pipe and duct connections at the inlet and outlet connections for mechanical equipment as required.
- .5 For all floor mounted equipment, Provide lateral seismic resistance.
- .6 Division 15 shall retain a Professional Structural Engineer and/or a qualified Company specializing in seismic constraints to design, supply and install seismic bracing as required. Engineer/Company shall review the installation of seismic support for all mechanical equipment and provide documentation (Drawings, calculations and details) to the Consultant which states that the installation complies with the requirements of Ontario Building Code 4.1.8.18. Reports to be issued by a Structural Engineer licensed in Ontario.
- .7 Prime Mechanical Contractor to provide Supplier Shop Drawings of all mechanical equipment and co-ordinate fully with seismic restraint installation.
- .8 Acceptable Products:
 - .1 Vibro Acoustics
 - .2 E.H. Price

3.26 Flashing

- .1 The Prime Mechanical Contractor shall Provide flashings for the Work of this Division. If not specified, a description is to be supplied for approval.
- .2 Generally, all pipes and small ducts or stacks passing through the roof shall be flashed with a 18-gauge steel sleeve soldered watertight and fastened to the roof deck before the roofing is applied, with a minimum of 8" (200 mm) overlap along the roof deck and extending 8" (200 mm) up the pipe or duct, sealed with a weather skirt.
- .3 Vent stacks may be flashed with patented flashing cones provided with the equipment.
- .4 Where large ducts pass through the roof, curbs and flashing shall be by the General Division where shown on the roofing plan. If not shown, all curbs, flashings, and counter flashing are by the Prime Mechanical Contractor.

3.27 Temporary or Trial Usage

- .1 Do not use any permanent Mechanical Systems during construction unless specific written approval is obtained from the Architect.
- .2 Temporary or trial usage of any mechanical device, machinery, apparatus, equipment or materials shall not be construed as evidence of acceptance of same and no claim for damage shall be made for injury to or breaking of any part of such Work which may so be used.

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- .3 Where the Owner permits the use of a system the Prime Mechanical Contractor shall be in charge of and maintain all equipment in accordance with Manufacturers instruction at all times the systems are in operation.
- .4 The use of permanent systems shall not invalidate the guarantee or warranty.
- .5 Prior to final acceptance, return all equipment to as new condition and provide Supplier certification of same.

3.28 Provision for Future

- .1 Provide valves and piping as shown or required to extend plumbing and heating systems in future. Valves and piping shall be arranged so extensions can be made without shutting off existing systems.



Transfer of Files on Electronic Media

Consultant of Record ("Consultant"): EXP Services Inc.

Contractor ("Contractor"): []

Re: Notre Dame Elementary School, 6559 Caswell St, Niagara Falls ON L2J 1C2 ("Owner"): Niagara Catholic District School Board

The Contractor hereby acknowledges requesting from the Consultant, electronic data containing graphic (electronic) representation of Engineering Drawings as per attached list of Drawings, subject to the condition that the said Drawings are to be used only for information and reference in connections with the Owner's use and occupancy of the Project. The Contractor shall be responsible for checking and verifying all dimensions and details, or quantities of materials and for the co-ordination of architectural, structural, mechanical and electrical elements as required to facilitate complete and accurate fabrication and installation. Any omissions and discrepancies shall be reported to the Consultant. The Contractor hereby warrants to the Consultant that the Drawings will only be used for development of Shop Drawings/Record Drawings. The Drawings shall not be used for any other project **or purpose** either by the Contractor or others. The Contractor further warrants not to alter the electronic data or the information contained therein, in any way except for the above noted purposes, and acknowledges that such unauthorized use or alteration of the original work is protected in accordance with the Copyright Act and subject to penalties prescribed therein.

The Contractor hereby acknowledges that the said electronic data contain information which may be updated or altered at any time by the Consultant, and that it is the responsibility of the Contractor to make themselves aware of these changes, in a timely manner. In the event of a conflict between the Drawings issued to the Contractor and the sealed Contract Drawings, the sealed Contract Drawings shall govern.

By accepting the Drawings, the Contractor has in no way purchased the Drawings or any rights to the Drawings or the information contained therein, and the Contractor may only alter the Drawings for the purposes noted above.

The electronic files will be provided in AutoCAD format (Version 2000 or more recent). The Consultant makes no representation as to the compatibility of these files with the Contractors hardware or software beyond the specified release of the referenced software.

The Contractor shall, to the fullest extent permitted by law, indemnify, defend and hold harmless the Consultant, and its Sub-Consultants from all claims, damages, losses, expenses, penalties and liabilities for any kind, including attorney's fees, arising out of, or resulting from the use of the electronic data by the Contractor, or by third party recipients of the electronic data from the Contractor.

The Consultant believes that no licensing or copyright fees are due to others on account of the transfer of the electronic media, but to the extent any are, the Contractor will pay the appropriate fees and hold the Consultant harmless from such claims.

Any purchase order number provided by the Contractor is for Contractor's accounting purposes only. Purchase order terms and conditions are void and are not part of this agreement.

The laws of the Province of Ontario shall govern this agreement.

The conditions and undertakings expressed wherein apply to partners, employees, agents, successors, assigns and legal or other representatives of the Contractor.

Dated at _____ this _____ day of _____, 20____.

**Authorized Acceptance
by Consultant**

Signature _____

Print Name and Title _____

Date _____

By Contractor

Signature _____

Print Name and Title _____

Date _____

**NOTRE DAME ELEMENTARY SCHOOL
6559 CASWELL ST, NIAGARA FALLS ON L2J 1C2
MECHANICAL**

General Provisions

Section 15010
Page 23

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EQUIPMENT START-UP AND ACCEPTANCE CHECK LIST			
UNIT:		UNIT #	
LOCATION:		SERIAL #	
MANUFACTURER:		SERIAL #	
MOTOR MANUFACTURER:		SERIAL #	
MOTOR NAMEPLATE:			
MODEL NO./TYPE:			
HORSEPOWER/kW:			
OVERLOAD HEATER/FUSES:			
PRE START-UP INSPECTION		NOTES: (N/A, NOT APPLICABLE)	
1	POWER WIRING COMPLETE		
2	CONTROL WIRING COMPLETE		
6	INSTRUMENTATION INSTALLATION COMPLETE		
9	CHEMICAL TREATMENT ADDED		
5	BELT DRIVE TENSION ADJUSTED		
7	VERIFY LUBRICATION IS COMPLETE		
8	VERIFY VIBRATION ISOLATION IS COMPLETE		
3	VERIFY PROPER OVERLOAD HEATER/FUSE SIZES		
4	VERIFY ALIGNMENT MOTORS & DRIVES		
11	VERIFY PROPER DIRECTION OF ROTATION		
12	VERIFY LOCAL SAFETY & OPERATING CONTROL		
13	CHECK ABNORMAL/EXCESSIVE VIBRATION		
14	CHECK LEAKING PACKING GLANDS		
10	TEMPORARY STICKERS, TAGS, ETC. REMOVED		
DESIGN:		ACTUAL:	
VOLTAGE:	PH 1: _____	PH 1:	_____
	PH 2: _____	PH 2:	_____
	PH 3: _____	PH 3:	_____
AMPERAGE:	PH 1: _____	PH 1:	_____
	PH 2: _____	PH 2:	_____
	PH 3: _____	PH 3:	_____
COMMENTS: _____			
CHECKED BY _____	COMPANY _____	DATE _____	
CHECKED BY _____	COMPANY _____	DATE _____	
CHECKED BY _____	COMPANY _____	DATE _____	
CHECKED BY _____	COMPANY _____	DATE _____	
ACCEPTED BY _____	OWNER'S REP _____	DATE _____	
ACCEPTED BY _____	CONSULTANT _____	DATE _____	

**NOTRE DAME ELEMENTARY SCHOOL
6559 CASWELL ST, NIAGARA FALLS ON L2J 1C2
MECHANICAL**

Submittals

EXP Project No. ALL-23008484-A0

Section 15011
Page 1

PART 1 - GENERAL

1.1 Requirements Included

- .1 Shop Drawings and Product data.
- .2 Working/Interference Drawings.
- .3 As-built Drawings.
- .4 Operating and maintenance manuals including extended warranties.

1.2 Related Work Specified Elsewhere

- | | | |
|-----|---|---------------|
| .1 | System Balancing | Section 15013 |
| .2 | Electric Motors | Section 15054 |
| .3 | Sound & Vibration Control | Section 15160 |
| .4 | Plumbing Fixtures & Trim | Section 15401 |
| .5 | Air Distribution - General Provisions | Section 15800 |
| .6 | Air Distribution - Ductwork Accessories | Section 15802 |
| .7 | Air Distribution - Grilles & Diffusers | Section 15804 |
| .8 | Air Distribution - Commercial Fans | Section 15808 |
| .9 | Air Distribution - Rooftop Units | Section 15817 |
| .10 | Controls & Instrumentation | Section 15900 |

1.3 Administrative

- .1 Submit to Consultant submittals listed for review before fabrication of any materials and/or equipment. Submit with reasonable promptness and in an orderly sequence so as to not cause delay in the construction schedule. Failure to submit in ample time is not considered sufficient reason for an extension of the Construction Schedule and no claim for extension by reason of such default is allowed.
- .2 Work affected by the submittal is not to proceed until the review is complete unless an approval is obtained from the Consultant.
- .3 Review submittals prior to submission to the Consultant. This review represents that necessary requirements have been determined and verified, and that each submittal has been checked and co-ordinated with the requirements of the Contract Documents.

1.4 Shop Drawings

- .1 Submit Shop Drawings as required in various sections of these Specifications and on the Drawings.
- .2 Shop Drawings to be submitted listing the following information:
 - .1 Project:
 - .2 Owner/Client:

**NOTRE DAME ELEMENTARY SCHOOL
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MECHANICAL**

Submittals

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Page 2

- .3 Mechanical/Electrical Consultant:
- .4 Mechanical Contractor:
- .5 Supplier
- .6 Specification Section
- .7 Materials or Equipment submitted
- .3 Include space for review stamps by Consultant, General Contractor, and the Prime Mechanical Contactor.
- .4 Prepare and submit for review, where specified, shown or considered necessary by the Consultant, Shop Drawings showing details of Work as follows:
 - .1 Fabrication and erection dimension.
 - .2 Sections, arrangements and details which indicate complete construction as well as interconnections with other Work.
 - .3 Location and type of anchors and fastenings.
 - .4 Materials including gauges, thickness, sizes and finishes.
 - .5 Descriptive names of equipment and mechanical and electrical characteristics when applicable.
 - .6 Data verifying that superimposed loads will not affect function, appearance, and safety of Work shown on Shop Drawings as well as other Work interconnected.
 - .7 Assumed design loadings, dimensions of elements and materials Specification for load bearing members.
 - .8 Complete composite wiring diagrams as required by Division 16 of each mechanical system. Indicate all electrical requirements both internal and external for review and co-ordination of other trades.
 - .9 Indicate all accessories and clearances for operation and servicing.
- .5 Manufacturer's printed data sheets for standard items are acceptable providing pertinent characteristics are identified and relate to specified items. Submit data sheets in electronic format except where specified otherwise.
- .6 Check Shop Drawings and data sheets, before submission, as follows:
 - .1 Against Contract Documents and other applicable Shop Drawings, to ensure that Work adjacent to and affecting other Work is accurately detailed.
 - .2 To ensure that Work shown on Shop Drawings conforms to requirements of Contract Documents.
 - .3 Enclose **NOTICE IN WRITING** of any variations from requirements of Contract Documents.
- .7 Indicate on Shop Drawings that they have been checked by applying stamp "reviewed and certified correct for construction", including date and signature. Drawings and details submitted without such stamp or whenever it is evident that Drawings have not been checked (despite approval stamp) are not to be reviewed and are to be returned to this Division.
- .8 The Consultant's review of Shop Drawings and data sheets pertain to general design only. Errors in dimensions, quantities or interference are to be marked if noticed, but is not in any way to relieve the Contractor from the responsibility to complete the Work as shown and specified.

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MECHANICAL**

Submittals

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- .9 All Shop Drawings are to be submitted in metric dimensions.
- .10 Shop Drawings are to be returned with "No Exception Taken", "Make Corrections Noted. Resubmission Not Required", "Revise and Resubmit", and "Rejected, Submit Compliant Product System".
 - .1 **No Exception Taken** - Drawings conform to the general design concept.
 - .2 **Make Corrections Noted** - Resubmission Not Required - Drawings conform to the general design concept except for noted items.
 - .3 **Revise and Resubmit** - Drawings conform to the general design concept subject to the corrections noted. Drawings to be corrected and resubmitted for final review and incorporation into maintenance manuals. Such submission is not to hold up manufacture.
 - .4 **Rejected, Submit Compliant Product System** - Drawings are rejected and manufacture of this equipment is not to proceed. Drawings are to be resubmitted with required corrections on equipment.
- .11 All Shop Drawings must be submitted promptly.
- .12 The Prime Mechanical Contractor is to keep track of the Shop Drawings and the subsequent equipment delivery using a Review Summary Form similar to the form shown below. This form is to be updated and presented at each job meeting until all the equipment is on the job.

1.5 Record Drawings

- .1 Record Drawings are to be maintained in accordance with the general requirements of Section 15010 - General Provisions.

1.6 Maintenance Data & Operating Instructions

- .1 Submit **three (3)** hard copies of Operation and Maintenance Manual individually bound in suitable sized hard backed three-ring binders.
- .2 Front cover of each binder to be suitably lettered, as follows:
OPERATION AND MAINTENANCE
MANUAL FOR
(Project Name)
(Owners Name)
(Date)
- .3 Provide plastic tab indices for all sections of the manual. Provide separate sections for each major piece of equipment and for groups of smaller Products.
- .4 Provide master index at the beginning of each binder indicating all items included in each section.
- .5 Provide list of names, addresses and telephone numbers of equipment Suppliers, Installing Contractors, General Contractors, Architect and Consulting Engineer.
- .6 Provide final review Shop Drawings of each manufactured item in addition to the operating and maintenance instructions.
- .7 Operating instructions to include:
 - .1 General description of each mechanical unit and system.

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- .2 Step by step procedure to follow in commissioning each piece of equipment, including start up, break-in, and routine normal operating instructions and sequences. Include regulation control stopping, shutdown, and emergency instructions. Include summer, winter and any special operating instructions.
- .3 Schematic control diagrams for each separate system. Each diagram to indicate locations of start-stop switches, insertion thermostats, thermometers, freezestats, firestats, pressure gauges, automatic valves, and accessories. Correct operating settings for each control device to be indicated on diagram.
- .4 Drawings of each control panel identifying all components on the panels and their function and sequence of operation.
- .5 All mechanical equipment wiring and control diagrams as installed.
- .6 Provide original Manufacturers illustrations, Shop Drawings, assembly Drawings and diagrams required for maintenance.
- .8 Maintenance instructions are to include:
 - .1 Manufacturer's printed maintenance instructions for each item of mechanical equipment installed under this Division. Instructions are to include installation instructions, description of the unit or system and component parts numbers and lists, name of Supplier and maintenance and lubrication instructions. Include complete nomenclature and commercial number of replacement parts.
 - .2 Summary list of each item of mechanical equipment requiring servicing and lubrication, indicating the name of the equipment item, location of all points of lubrication, type of lubricant recommended, and frequency of lubrication.
 - .3 Include routing procedures and guide troubleshooting, disassembly, repair and reassembly instructions, alignment, adjusting, balancing and checking instructions.
 - .4 Provide list of Manufacturers spare parts, current prices and recommended quantities to be maintained in storage.
 - .5 Balancing and testing reports.
- .9 During the one (1) year guarantee period, commencing after Substantial Completion letter has been issued by the Architect's Office, maintain all equipment installed as part of this Division. This is to include lubrication of bearings, cleaning of strainers, etc., except the replacement of air filters and water treatment. This agreement shall be part of the written guarantee. This Work shall be carried out in the presence of the building custodian, and a letter shall be sent to the Consultant stating that this Work was carried out. Three (3) maintenance inspections must be carried out by the Prime Mechanical Contractor during this one (1) year period (three months, six months and twelve months after substantial completion letter issued from architect office). Submit written report to Owner and Consultant after each inspection.
- .10 This maintenance shall continue up to the date of instruction of the Owner's designated representatives, at which time each piece of equipment is to be lubricated and checked in the presence of the Owner's representative(s).
- .11 Not later than three (3) weeks prior to application for inspection by Consultant for Substantial Performance, submit records and maintenance manuals to Consultant.

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- .12 Maintenance Manuals shall contain dimensioned certified prints of each piece of mechanical equipment and Manufacturer's recommended maintenance instructions, air balancing reports, and wiring diagrams. Tabulated at the front of this binder is to be a maintenance schedule for each piece of equipment, and lubricant to be used, and a tabulation of things to be checked at each piece of equipment. Maintenance Manuals shall be presented in ASHRAE GPC4 format. Submit two (2) three-ring, hard-back, black binders
- .13 Maintenance manuals will be requested by the Consultant shortly after the final submission of Shop Drawings. Maintenance manuals must be submitted and approved before training of the Owner's personnel and before a final inspection will be carried out.
- .14 Provide written warranty on this Division's letterhead addressed to the Owner, copied to the General Contractor.

1.7 Extended Warranties

- .1 This Division is to submit extended warranties for specific materials and/or Work specified in their respective sections.
- .2 Extended warranties are to be issued on the Manufacturers or respective Contractor's letterhead, under seal, and issued in the name of the Owner.

[illegible]

'A' - No Exception Taken
'C' - Make Corrections Noted, Resubmission Not Required

'B' - Revise & Resubmit
'D' - Rejected, Submit Compliant Product/System

**NOTRE DAME ELEMENTARY SCHOOL
6559 CASWELL ST, NIAGARA FALLS ON L2J 1C2
MECHANICAL**

Systems Balancing

EXP Project No. ALL-23008484-A0

Section 15013
Page 1

PART 1 - GENERAL

1.1 Requirements Included

- .1 The Mechanical Contractor shall engage a qualified Testing Company to perform the air and water balance specified. The Contractor is to be responsible for ensuring that all systems are operating prior to the balancing agency arriving on site and assisting the balancing agency providing any necessary information, repairing failed equipment, providing proper access to equipment etc. In addition, any additional drive changes, pulleys, etc. necessary to achieve the specified values is to be the responsibility of Division 15 and not of the Balancing Agency. Only one Company will be engaged for both air and water balancing.
 - .1 Dynamic Flow Balancing Ltd., Oakville, Ontario (Phone: 905-338-0808)
 - .2 Air Audit, Cambridge, Ontario (Phone: 519-740-0871)
 - .3 Flowset Balancing, Oakville (Phone: 416-410-9793)
 - .4 Clark Balancing & Hydronic Testing & Balancing, Milton (Phone: 905-693-1518)
- .2 Conform to the requirements of Section 15010, Mechanical General Provisions.
- .3 The Balancing Agency is to be fully qualified and recognized firm having established a reputation with the Consultant for this type of Work. Members of AABC, NEBB or operating under the direction of a registered professional engineer will be considered.
- .4 Perform this Work in accordance with procedures and standards described in SMACNA "Balancing and Adjusting Manual".

1.2 Description of Systems

- .1 Balance air system serving the Gymnasium and adjoining Rooms.
- .2 Balance the exhaust systems serving the revised Washrooms.
- .3 Balance new hot water convectors.

1.3 Scope of Work

- .1 Provide water and air balance for the hydronic and ventilation systems, to achieve the water and air quantities shown on the Drawing.

PART 2 - PRODUCTS

2.1 General

- .1 Furnish all test equipment. All equipment will remain the property of the testing and balancing company. Instruments required for the balancing are to have been calibrated within a period of six months prior to balancing. Types, serial numbers, and dates of calibration of all instruments are to be listed in the balancing reports hereinafter specified.

**NOTRE DAME ELEMENTARY SCHOOL
6559 CASWELL ST, NIAGARA FALLS ON L2J 1C2
MECHANICAL**

Systems Balancing

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2.2 Materials

- .1 Use materials specified herein, or as defined in Section 15010, Mechanical General Provisions, Clause 2.1.
- .2 Calibrated orifices and portable flow meters are to be used to balance water flow at all points indicated on Drawings.

2.3 Duct Holes for Air Transverse Readings

- .1 All holes in ductwork made by the Balancing Contractor must be sealed with duct plugs or high velocity sealant.

PART 3 - EXECUTION

3.1 General

- .1 Include all labour, engineering and test equipment required to adjust and balance all mechanical systems installed under this Division, and described herein.
- .2 Prior to proceeding with the balancing the Balancing Agency is to provide the Consultant with a submission report with a working agenda on procedures employed for testing and balancing each system, including all test and balance report forms that are to appear in the final report with all design data already filled in. Testing is not to proceed until submission is reviewed by Consultant.
- .3 Review Drawings, Specifications, Addenda, Change Notices, etc., and installed Work to ensure that systems may be properly balanced in accordance with Drawings. Advise this Division of any additional requirements for effective balancing.
- .4 Ensure that all control devices and equipment interlocks are operating in the manner required for the correct performance of the systems.
- .5 Ensure equipment is lubricated as per Manufacturers instructions and filters are clean.
- .6 Meet with the Prime Mechanical Contractor to discuss location of all balancing and testing devices before construction starts.
- .7 Meet with the Prime Mechanical Contractor on site to review Work in progress.
- .8 Test and adjust mechanical equipment and controls. Demonstrate to the Commissioning Agent.
- .9 Visit the Project one (1) time after Substantial Completion Letter has been issued by the Architect's office, to make adjustment to air and water distribution as required by the Consultant and/or Owner's Representative.

3.2 Prime Mechanical Contractor Responsibility

- .1 Provide to the Testing Agency a set of Mechanical Drawings, Specifications, all Addenda and Change Orders, and Shop Drawings of all equipment to be tested and balanced.
- .2 Supply and install all balancing devices where required by the testing agency.
- .3 Provide to the testing agency a set of all Approval Drawings reviewed by the Consultant with wiring diagrams.

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MECHANICAL**

Systems Balancing

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- .4 The respective trades shall provide a journeyman, tools, ladders and scaffolding to assist the Balancing and Testing Agency. He shall open and replace ceilings and install additional devices such as baffles, dampers, valves, etc., as required and requested. Sheave and belt changes to be supplied and installed by Division 15 as required by the Testing Agency. Pump impeller changes/modifications to be supplied and installed by the Prime Mechanical Contractor as required by the Testing Agency.
- .5 The Monitoring & Control System shall check all control operation before balancing and testing is started. Assist the Balancing and Testing Agency in final adjustment of air and water systems to provide comfortable space conditions.
- .6 Prime Mechanical Contractor shall be in charge of the plant during tests. He shall assume responsibility for damages in the event of injury to the personnel, building or equipment, and shall bear all costs for liability, repairs and restoration in this connection.

3.3 Job Conditions

- .1 Schedule this Work in cooperation with other trades involved.
- .2 Do not begin testing and balancing until the systems have been completely installed, tested and put in running order, with clean filters. Correct operation of equipment and system components and cleanliness of piping and ductwork is the responsibility of this Division.

3.4 Submittals

- .1 Record all test data and submit an electronic copy of completed reports to the Consultant.
- .2 Use data sheets which have been reviewed by the Consultant to record measurements. Include schematic diagrams of all systems identifying branches, inlets, outlets and equipment.
- .3 Submit report in hard cover 3-ring binder, complete with indexing tabs and cover identification at front and side.

3.5 Final Inspection & Acceptance

- .1 After submission of balancing report, arrange an inspection with the Commissioning Authority and the Consultant.
- .2 At the inspection recheck points or areas selected by the Commissioning Authority and the Consultant.
- .3 For each system, if more than 10% of the measurements at the selected recheck stations deviate by 10% or more from those in the Report, then the Report for that system is to be rejected as unacceptable.
- .4 If Report is rejected, rebalance systems deemed to be unacceptable, submit new Reports, and make re-inspection at no extra cost to the Owner.
- .5 After acceptance of the Report by the Commissioning Authority and the Consultant, permanently mark settings of valves, splitters, dampers and other adjustment devices so that adjustment can be restored if disturbed. Type of marking and method of application to be approved by the Consultant.

**NOTRE DAME ELEMENTARY SCHOOL
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MECHANICAL**

Systems Balancing

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3.6 Adjustments

- .1 The Balancing and Testing Agency shall return three (3) times during the first year guarantee period to make adjustments to water and air systems as required to provide comfort to the occupants.

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MECHANICAL**

Basic Materials & Methods

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Page 1

PART 1 - GENERAL

1.1 Related Instructions

- .1 Conform to General Provisions, Section 15010.

1.2 Related Work Specified Elsewhere

- | | | |
|----|----------------------------|---------------|
| .1 | Painting | Section 09900 |
| .2 | Insulation | Section 15180 |
| .3 | Plumbing | Section 15400 |
| .4 | Plumbing Fixtures & Trim | Section 15401 |
| .5 | Air Distribution | Section 15800 |
| .6 | Controls & Instrumentation | Section 15900 |
| .7 | Electrical | Division 16 |

1.3 Quality Assurance

- .1 Conform to the latest edition, including Amendments of the following Codes and Standards.
- .2 Local and district by-laws, regulations and published engineering standards.
- .3 Ontario Building Code (OBC) Compendium containing the Building Code Act, and Ontario Regulation 332/12 including all amendments.
- .4 ACNBC Canadian Plumbing Code.
- .5 Regulations for Construction Project, Ontario Regulation 659 under the Occupational Health and Safety Act.
- .6 Natural Gas Installation Code CSA-B149

PART 2 - PRODUCTS

2.1 Pipe & Pipe Fittings

.1 Heating Water Piping:

- .1 Steel pipe 2" (50 mm) and smaller: Schedule 40, electric weld or seamless ASTM Specification A-53.
- .2 Steel pipe 2-1/2" (65 mm) and larger: Schedule 40, electric weld or seamless ASTM Specification A-53 with butt welding ends.
- .3 Copper pipe 3/4" (19 mm) and smaller: Type "L" hard drawn copper with wrought copper solder type fittings to ASTM B88-03.
- .4 Dielectric unions to be used between copper and steel pipe.
- .5 Steel pipe fittings up to and including 2" (50 mm) are to be threaded joints malleable iron type.

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Basic Materials & Methods

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- .6 Steel pipe fittings 2-1/2" (65 mm) and larger are to be forged steel butt welding type with all joints welded.
- .7 Grooved Mechanical Joints:
 - .1 1-1/2" (40 mm) pipe and larger to be standard steel pipe. Light wall pipe is not acceptable.
 - .2 The grooves and gaskets must be installed according to Manufacturer's installation instructions. The groove must be clean and true. The gasket seat pipe surface must be free of indentations, roll marks and projections.
 - .3 The gaskets shall be standard Type EHP -30°F (-34°C) to 250°F (120°C) or E -30°F (-34°C) to 230°F (110°C) and 300 psig (2065 kPa). Gaskets shall be suitable for use with 40% ethylene glycol or of a grade suitable for the intended service.
 - .4 The couplings shall consist of two ductile iron housing segments and be a combination of rigid joints in risers, Mechanical Rooms, and where flexibility is not desired; and flexible couplings for controlled pipe movement and flex-connector elimination.
 - .1 Rigid Type: Housings shall be cast with offsetting angle-pattern bolt pads to provide rigidity and system support and hanging in accordance with ANSI B31.1 and B31.9.
 - .1 2" (50 mm) through 8" (200 mm): Installation-Ready, for direct stab installation without field disassembly, with grade EHP gasket rated to +250 deg F / 120 deg C. Victaulic Style 107H.
 - .2 Victaulic Zero-Flex Style 07.
 - .2 Flexible Type: Victaulic Installation-Ready Style 177 or Style 77 and Style 75.
 - .3 14" (350 mm) through 24" (600 mm): Victaulic AGS series with lead-in chamfer on housing key and wide width FlushSeal® gasket.
 - .1 Rigid Type: Housing key shall fill the wedge shaped AGS groove and provide rigidity and system support and hanging in accordance with ANSI B31.1 and B31.9. Victaulic Style W07.
 - .2 Flexible Type: Housing key shall fit into the wedge shaped AGS groove and allow for linear and angular pipe movement. Victaulic Style W77.
 - .5 Valves and Fittings - Grooved end fittings, grooved end valves, and specialties may be used as part of the mechanical joint system.
 - .1 Fittings shall be cast of ductile iron to ASTM A536, wrought steel to ASTM A234, or factory fabricated from steel pipe to ASTM A53.
- .8 All elbows are to be long radius type.
- .9 Copper pipe fittings to be cast copper alloy solder joint pressure fittings to ANSI B16.18-2001 or wrought copper and copper alloy solder joint pressure fittings to ANSI/ASME B16.22-2001.
- .10 Design based on Victaulic
- .11 Acceptable Products:
 - .1 Victaulic

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Page 3

- .2 Shurjoint
 - .3 Grinnell
- .2 **Sanitary Drain and Vents:**
 - .1 Soil and waste pipe 3" (75 mm) and over to be medium weight cast iron type MJ, unless indicated otherwise; 2-1/2" (65 mm) and under copper DWV pipe and fittings when above floor and Type L copper when buried.
 - .2 Vent pipe 3" (75 mm) and up is to be medium weight cast iron type MJ; 2-1/2" (65 mm) and under galvanized steel pipe with cast iron drainage fittings or copper type DWV.
 - .3 Below grade piping only:
 - .1 ABS piping in accordance with CAN/CSA-B181.1-02 for 4" (100 mm) pipe sizes and smaller.
 - .2 PVC gravity sewer piping SDR28 for 6" (150 mm) pipe sizes and smaller to CAN/CSA-B182.1-02.
 - .3 PVC gravity sewer piping SDR35 for 8" (200 mm) pipe sizes and above to CAN/CSA-B182.2-02.
- .3 **Domestic Water Piping and Cold Condensate Piping:**
 - .1 Domestic water lines (cold, hot and re-circulating) above grade shall be type L Copper to ASTM B88-03.
 - .2 Domestic water lines (cold, hot and re-circulating) below grade shall be type K Copper to ASTM B88-03.
 - .3 Exposed piping in finished areas shall be chrome plated unless noted otherwise.
 - .4 Air conditioning condensate lines above grade to be Type M copper to ASTM B88
- .4 **Fittings:**
 - .1 Solder end wrought copper. As an option, tee fittings may be eliminated by using the T-Drill system for branches 1/2" to 2" (15 mm to 50 mm) for maximum run pipe diameter to 4" (100 mm). All joints must be brazed to Copper Development Association Handbook Specifications using B-cup series filler metal. Soft solder joints are not permitted.
 - .2 Brass or bronze pipe flanges and flange fittings shall conform to ANSI B16.24.
- .5 **Gas Piping:**
 - .1 Schedule 40:
 - .1 Pipe to be schedule 40 welded or seamless steel pipe.
 - .2 Valves to be CGA certified plug-cock type or ball valves installed where shown or required, with one for each appliance.
 - .3 Fitting to be black malleable iron screwed up to 2" (50 mm) and steel welded 2-1/2" (65 mm) and larger.

2.2 Hangers & Supports

- .1 Hangers shall be carbon steel with copper or plastic coating for direct support of copper tubing, and shall be carbon steel with black corrosion resistant finish for all other piping.

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- .2 Use Anvil Fig. 65, 69, 97, CT-99, 260, or 269 hangers for individual support of all horizontal piping.
- .3 Provide Anvil Fig. 168 pipe covering protection saddles at each hanger where pipes are insulated.
- .4 Provide Anvil Fig. 171 single pipe rollers complete with Fig. 160 protection saddles on all heating mains where identified.
- .5 Clevis hangers shall outside pipe insulation.
- .6 All hanger rods shall be rust resistant galvanized dipped.
- .7 All vertical piping shall be supported at each floor with riser clamps, Anvil Fig. 261 welded to the pipe. Vertical branch piping shall be supported at least every 10' 0" (3000 mm) with solid post ring hangers.
- .8 Use 4" x 1-1/2" (100 mm x 40 mm) minimum steel channel for joint support of horizontal piping.
- .9 Use welded beam attachments or beam clamps for support of horizontal pipe from steelwork. DO NOT SUPPORT FROM METAL DECK.
- .10 Perforated pipe hangers are not acceptable.
- .11 Determine spacing between pipe rack supports using smallest pipe size.
- .12 Provide Anvil Fig. 262 pipe saddles on each pipe where trapeze hangers are used.
- .13 Hangers supporting plastic pipes shall be complete with a galvanized "V" bottom equal to Taylor Pipe Supports Model 12V V-Channel.
- .14 Acceptable Products:
 - .1 Anvil
 - .2 Myatt
 - .3 Economec

2.3 Valves & Accessories

- .1 **Domestic Water:**
 - .1 Ball:
 - .1 1/2" to 2-1/2" (15 mm to 65 mm) brass or bronze body, full port, TFE seats, double O-ring design or TFE packing, chrome plated solid bronze ball, lever handle.
Acceptable Products:
 - .1 ITT
 - .2 Victaulic
 - .3 Kitz
 - .4 Toyo
 - .5 Apollo

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- .2 Butterfly:
 - .1 3" to 12" (50 mm to 300 mm) wafer type, iron or ductile iron body, type 416 stainless steel stem, replaceable Buna 'N' seat, aluminum bronze disc and suitable for mounting between ANSI 125 or 150 flanges.
Acceptable Products:
 - .1 Crane
 - .2 Milwaukee
 - .3 Bray
 - .4 Kitz
- .3 Gate:
 - .1 1/2" to 2" (15 mm to 50 mm) bronze body, solder ends, solid wedge disc and non-rising stem.
Acceptable Products:
 - .1 Crane 300 psi (2068 kPa)
 - .2 Milwaukee
 - .3 Bray
 - .4 Kitz
 - .5 Toyo
 - .2 2-1/2" to 8" (65 mm to 200 mm) iron body, flanged O.S. & Y. gate valve with bronze trim.
Acceptable Products:
 - .1 Crane 200 psi (1379 kPa)
 - .2 Milwaukee
 - .3 Bray
 - .4 Kitz
- .4 Globe:
 - .1 1/2" to 2" (15 mm to 50 mm) bronze body, solder ends and Teflon disc.
Acceptable Products:
 - .1 Crane 300 psi (2068 kPa)
 - .2 Milwaukee
 - .3 Kitz
 - .2 2-1/2" to 8" (65 mm to 200 mm) iron body, flanged and bronze trim.
Acceptable Products:
 - .1 Crane 200 psi (1379 kPa)
 - .2 Milwaukee
 - .3 Kitz
- .5 Check:
 - .1 1/2" to 3" (15 mm to 80 mm) steam bronze, swing check valve and 'Y' pattern.
Acceptable Products:
 - .1 Crane 300 psi (2068 kPa) (solder), (screwed)
 - .2 Milwaukee (solder); (screwed)
 - .3 Kitz
 - .4 Toyo
- .6 Valve installed in domestic hot water recirculation pipe system shall be equal to Griswold Controls Speed Set manual balance valve complete with a memory stop.

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.7 Strainers:

- .1** 1/2" to 3" (15 mm to 80 mm) bronze body, stainless steel screen type 304 and .125" (3.2 mm) perforations.

Acceptable Products:

- .1 Sarco
- .2 Watts
- .3 Colton
- .4 Mueller
- .5 SureFlow

.2 Heating:

- .1** All insulated valves shall have extended necks or shafts where the thickness of the insulation interferes with the operating handle.

.2 Ball:

- .1** 1/2" to 2" (15 mm to 50 mm) 150 psig/600HOG, full port, bronze body, bronze fitted screwed ends, PTFE seats and packing to 400°F (204°C), lever handle.

Acceptable Products:

- .1 Sure Flow
- .2 Milwaukee
- .3 Victaulic
- .4 Kitz
- .5 Toyo

.3 Butterfly:

- .1** 2-1/2" (65 mm) and larger 200 psi, ductile iron, wafer type body for ANSI 150 flanges, bronze disc, stainless steel shaft, EPDM seat. Lug pattern body shall be used for dead-end or isolation service. Lever handle up to 4" (100 mm), gear operator 6" (150 mm) and larger.

Acceptable Products:

- .1 Crane/Jenkins
- .2 Kitz
- .3 Sure Flow
- .4 Bray
- .5 Keystone
- .6 Milwaukee

.4 Check:

- .1** 1/2" to 2-1/2" (15 mm to 65 mm) Class 125 bronze body, screwed ends, swing disc, screw-in cap.

Acceptable Products:

- .1 Crane/Jenkins
- .2 Grinnell
- .3 Milwaukee
- .4 Sure Flow
- .5 Kitz

- .2** 3" (80 mm) and larger wafer-type ANSI 125 CI body, stainless steel disc, stainless hinge and shaft, Viton seat.

Acceptable Products:

- .1 Proquip
- .2 RitePro Inc.

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- .3 Moygro
- .4 Crane
- .5 Sure Flow
- .6 Kitz
- .5 Strainers:
 - .1 1/2" to 2" (15 mm to 50 mm) cast iron 'Y' body pattern, screwed ends and cap with brass plug, stainless steel screen with 0.125 perforations for water service.
Acceptable Products:
 - .1 Sarco
 - .2 ITT
 - .3 Mueller
 - .4 Kitz
 - .5 Sure Flow
 - .2 2-1/2" (65 mm) and larger cast iron 'Y' body, flanged ends and cap with full plug size ball valve blow-off, stainless steel screen with full plug size ball valve blow-off, stainless steel screen with 0.125" (3.2 mm) perforations for water services.
Acceptable Products:
 - .1 Sarco
 - .2 Mueller
 - .3 Gruvlok
- .6 All Radiators, Convectors and Coil-type Heating Units:
 - .1 1/2" to 1-1/4" (15 mm to 32 mm) Dahl Model No. 11042.

2.4 Fire Stopping

- .1 The Prime Mechanical Contractor is responsible for all fire stopping related to the Work of Division 15 including, but not limited to, the ductwork, piping and control wiring. Fire stopping shall be in accordance with Architectural Specifications.
- .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 rating not less than the fire protection rating required for closures in a fire separation.
- .5 The fire stopping materials are not to shrink, slump or sag and to be free of asbestos, halogens and volatile solvents.
- .6 Firestopping materials are to consist of a component sealant applied with a conventional caulking gun and trowel.
- .7 Fire stop materials are to be capable of receiving finish materials in those areas which are exposed and scheduled to receive finishes.
- .8 Acceptable Products:
 - .1 Fyresleeve Industries Inc.
 - .2 General Electric Pensil Firestop Systems
 - .3 International Protective Coatings Corp.

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- .4 Rectorseal Corporation (Metacaulk)
- .5 3M Fire Protection Systems

2.5 Backflow Preventer - DESIGNATED BFP

- .1 Supply and install backflow preventer where shown on the Drawings and where required by Code on potable water connections to equipment. Supply and install for each backflow assembly, a by-pass assembly complete with isolation valve and pipe, size equal to assembly.
- .2 Valve shall be complete with bronze body, check seals, stainless steel trim, durable tight-seating rubber discs and bronze valve test cocks.
- .3 Severe hazard connections such as trap seal primer shall have an air gap "AG".
- .4 Minor hazard connections such as hose bibbs and flexible shower heads, shall have atmosphere vacuum breaker "AVB".
- .5 Moderate hazard connections such as vending machines and ice making machines, shall have pressure vacuum breaker "PVB".
- .6 Acceptable Products:
 - .1 Watts
 - .2 Apollo
 - .3 Zurn Williams

2.6 Escutcheons

- .1 Supply and install 1-piece chromium plated escutcheon plates on all piping passing through finished walls, floors and ceilings. Where sleeves project above the floor in potentially wet areas, Provide chromium plated box type escutcheon.
- .2 Escutcheon plates shall be installed over the insulation and shall have set screws or clamping devices to keep the escutcheon plate in place.
- .3 Acceptable Products:
 - .1 Watts
 - .2 Fire Sprinkler Products and Accessories, Stoney Creek

2.7 Roof Flashings

- .1 Roof flashings for conduit and refrigeration piping serving the air cooled condensing units shall be copper, 450 mm (18") high, pre-insulated with E.P.D.M. grommets for multiple penetrations, compatible with E.P.D.M. roof membrane, as manufactured by Thaler Metal Industries, Model No. MEF-AG4-6.
- .2 Roof flashings for conduit serving outdoor fan units shall be copper, 450 mm (18") high, pre-insulated with E.P.D.M. grommets for multiple penetrations, compatible with E.P.D.M. roof membrane, as manufactured by Thaler Metal Industries, Model No. MEF-AG2-3.

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PART 3 - EXECUTION

3.1 Piping Installation

.1 Heating Piping:

- .1 Make all piping connections to coils, fan coil units, etc. Unions and valves to be located so that removal of units and equipment is possible without disconnecting more than a minimum of pipework, and without shutting down any other pieces of equipment.
- .2 Where branch pipes are welded into mains without the use of "T" connections, torch cut openings must be cut true, bevelled and filed smooth. Branch pipes must not be allowed to project inside of main pipe. Openings must not be cut large enough to permit entry of welding metal and slag within the pipe.
- .3 Grade horizontal water distribution piping 1" per 30 ft. (2.78 mm per meter) rising in direction of flow, wherever possible. Provide ball valves with cap and chain for draining at all low points and vent valves at high points of systems.
- .4 Provide adequate space around piping to facilitate application of insulation.
- .5 All reductions in pipe size to be made with eccentric fittings. Minimum size of run out shall be 3/4" (19 mm).
- .6 Install piping to clear other piping, lights, obstructions, access doors and controls. Take branches off mains with fittings and 45° or 90° elbows. Locate valves and special devices for easy operation. Locate valves in accessible locations to approval and to suit access.
- .7 Do not use ferrous piping, fittings, bushings, nipples or plugs in copper piping.
- .8 Make reductions in hot water heating system piping so that air cannot collect in piping except at air vents.
- .9 Install systems so that they can be thoroughly drained and all air eliminated.
- .10 During welding or soldering procedures, Provide a fire retardant cloth, mat or blanket to protect the structure, and adequate fire protection equipment at all locations where Work is being done. Close off shaft or confined areas with a fire retardant mat or cloth to prevent sparks or pieces of hot metal from falling down the shaft or area way.
- .11 Plug and/or cap all pipe openings/fittings during construction.
- .12 DO NOT USE copper pipe connections between runtal heating units and steel pipe.

.2 Sanitary and Vent Piping:

- .1 Install sanitary drains and connect to fixtures where shown. Connect up all drains to drain, open hub or other approved locations. Connect to drainage system all drains from equipment supplied under other Sections.
- .2 Horizontal sanitary drains shall have the following minimum slopes:
 - .1 Fixture waste or drains 1/4" per ft. (20 mm per meter)
 - .2 Drains up to and including 3" (75 mm) 1/4" per ft. (20 mm per meter)
 - .3 Drains over 3" (75 mm) 1/8" per ft. (10 mm per meter)

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- .3 All fixtures are to be vented in accordance with Local and Provincial Regulations. Vents are to be run as directly as possible and to be properly graded so as to drain back to fixture connection. Vents are to be concealed in walls, and ceilings; vent stacks are to be built into pipe chases, concealed areas, and walls, with particular attention paid to building frame construction.
- .4 Vent stacks are to be connected to the vent extensions Provided by Division 7 and installed by the General Contractor. The only exposed vent pipe or vent stack allowed will be in the areas provided in pipe spaces, mechanical room, etc. Maintain a minimum of 10'-0" (3000 mm) from outside air intakes to location of vent stack.
- .5 Connect vent lines to soil and vent stacks above highest fixture or separately carry through roof. End vent stacks and vent piping 16" (400 mm) above roof or to vent flashing.
- .6 Supply and install a cleanout at each sanitary pipe change of direction.
- .3 **Domestic Water Piping and Cold Condensate Piping:**
 - .1 Connect cold water to all fixtures, hose bibs, as required and as shown. This is to include all connections to equipment and units supplied under other Sections.
 - .2 All equipment is to have unions or flanged connection for equipment removal, and where possible piping is to run concealed in all walls and ceiling, but may run exposed in mechanical rooms and warehouse.
 - .3 Install shock absorbers ahead of all solenoid valves, flush valves or other quick closing valves and where shown. Vacuum breakers are to be installed on all fixtures where required by the Ontario Plumbing Code, or Local Plumbing Inspector.
 - .4 Connect condensate piping to all drain pans and run to nearest drain.
 - .5 Where it is necessary to offset piping to avoid obstructions, only use 45 degree elbows, NOT 90 degree elbows.
- .4 **Gas Piping:**
 - .1 Schedule 40:
 - .1 Complete installation to conform to the latest edition of the gas code including the colour coding of the pipe which is to be by the Contractor and to the satisfaction of the Consultant.
 - .2 Slope the piping towards low points or risers, low point drips to have tee, nipple and cap.
 - .3 Use soap solution and compressed air to test all joints and fittings for leakage. Repair as required.
- .5 **Equipment Connection:** Install unions and/or flanges to connect piping to all pieces of equipment. All equipment is to have isolating valves for equipment removal.
- .6 **Flashing:** All vent stacks and soil stacks are to connect to insulated stack vents. Stack vents are supplied and installed through the roof by Division 7. All holes through roof are to be properly flashed and made weatherproof by roofer as required under Division 7.

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.7 Thermal Expansion and Contraction of Piping:

- .1 The Contractor to be responsible for expansion and contraction of all pipework. Erect all pipe in such a manner that the strain and weight does not come upon pipe connections of apparatus. Provide bends, or swing joints except where corrugated bellows type expansion joints are shown or required.
- .2 On steel piping up to 2" (50 mm) size, use stainless steel bellows, screwed, compensator type, 150 lb (1035 Pa) design (similar for brass or copper pipe, except all-bronze construction).
- .3 Piping 2-1/2" (65 mm) and larger 150 lb (1035 kPa) flanged, self-equalizing, corrugated packless, stainless steel bellows, tie rods.
- .4 Select for expansion between anchor points plus 25% safety factor with 0°F (-18°C) ambient temperature and applicable fluid temperature.
- .5 Flexible hose, where called for, shall be Type 'RW'.
- .6 In wall fin, all runs over 40'-0" (12000 mm) shall have Flexonics Type 'L' in middle of run.
- .7 Pipe anchors and guides shall be fabricated of structural steel channels, angles or plates well secured to the building structure. Cylindrical type guides to be sized for full pipe insulation.
- .8 Acceptable Products:
 - .1 Flexonics
 - .2 Adsco
 - .3 United Flexible

- .8 Air Elimination and Drainage:** All low points to be installed with a ball valve with a screwed connection suitable for connecting a hose. Install air vents at all high points in system.

3.2 Piping Joints

.1 Threaded Joints:

- .1 Pipe is to be cut at right angles and reamed to full bore.
- .2 Threads are to be carefully cut with sharp dies and proper cutting oil.
- .3 All chips and other foreign matter are to be removed from the pipe before installation into system.
- .4 Proper joint compound is to be used on male threads only. A good grade of hemp fibre is to be used on threads.
- .5 Connections to be made with proper wrench to suit pipe size, additional leverage not to be allowed.
- .6 If threaded joints leak after assembly by normal methods, they are to be disconnected and corrected if possible, or replaced. Over tightening or caulking is not considered a proper correction.

.2 Solder Joints:

- .1 Pipe is to be cut at right angles, reamed, de-burred and sized.
- .2 End of pipe and inside of fittings to be cleaned with steel wool to a bright metallic finish.

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- .3 Flux to be applied to outside of pipe and inside of fittings; fitting to be revolved on pipe to ensure proper distribution of flux.
- .4 Using solder wire, heat assembly with torch until solder has flowed completely around fittings. Wipe off excess solder. Solder used on potable water systems to consist of 0.2% maximum lead composition or alternatively use 90/5/5 tin/silver/antimony. Larger size pipe joints are to be completely tinned before assembly.
- .3 **Cast Iron Joints:**
 - .1 Mechanical joint cast iron piping and fittings will be assembled in accordance with Manufacturer's recommendations.
- .4 **PVC, Polypropylene and ABS Piping Joints:**
 - .1 Install PVC, Polypropylene and ABS joints as per Manufacturer's recommendations, using approved joining methods, compounds and materials.
- .5 **Mechanical Couplings:**
 - .1 Couplings shall be cast of ductile iron conforming to ASTM A-536, Grade 65-45-12.
 - .2 Installing Contractor to obtain on-site and off-site installation training and inform Consultant in writing that the training is complete.
 - .3 Installing Contractor to complete manufacturer "Inspection Form" and forward to the Consultant for review.

3.3 Firestopping

- .1 Confirm location and extent of fire separations from Architectural Drawings.
- .2 Inspect surface to be firestopped. Report unsatisfactory conditions to Consultant in writing prior to commencement. Initiation of Work to be deemed as acceptance of conditions and surfaces.
- .3 Store all materials in accordance with Manufacturers recommendations as to acceptable ambient temperatures. Damaged or deteriorated materials are not to be used and are to be removed from the site.
- .4 Install firestopping and smoke seal material and components in accordance with ULC certification and Manufacturers instructions in all piping, tubing, chimney and duct etc. penetrations in new or existing fire separation to provide temperature, flame and smoke rated seals not less than the fire resistance rating of the assembly, or separation.
- .5 Seal all holes made by through-penetrations and unpenetrated openings to ensure continuity and integrating of fire separation, including where existing component or device has been removed.
- .6 Notify Consultant and/or Authority having jurisdiction for inspection prior to concealing or enclosing fire stopping materials and service penetrations.
- .7 Remove excess material and debris and clean adjacent surfaces immediately after application. Leave in a tidy condition.

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3.4 Welded Joints

- .1 Where the location of butt welded piping joints is left to the discretion of this Division, such joints shall be minimum 3'-0" (900 mm) from other welded piping joints.
- .2 Joint areas shall be thoroughly cleaned to remove all slag, oil, grease, rust, scale and moisture prior to commencement of welding. Slag and spatter shall be removed completely from each welding pass before the next pass is deposited.

3.5 Flanged Joints

- .1 Flanges and other attachments shall be square with the indicated axis and shall not deviate from this position measured across any diameter by more than 3/64" per foot (4 mm per m.) of diameter. Maximum allowable dish of a flange facing shall be 1/64" (0.4 mm).
- .2 Bolt holes shall be aligned within a tolerance of $\pm 1/16$ " (2 mm) of the required position.
- .3 Flanges shall be installed with the bolt holes straddling the vertical and horizontal centre lines or as required for proper valve position. Use box wrenches to pull up flanges.
- .4 Unless otherwise specified, lengths of studs shall be 1/4" (6 mm) longer than specified in ANSI B16.5.

3.6 Hangers & Supports

- .1 Horizontal piping is to be supported as close as practical to the connected equipment and intermediate hangers are to be spaced as follows:

Pipe Size	Single Rod Dia.	Double Rod Dia.	Maximum Spacing	
			Copper	Steel
Up to 3/4" (Up to 19 mm)	3/8" (10 mm)	3/8" (10 mm)	5'-0" (1500 mm)	6'-0" (1800 mm)
1" - 1-1/4" (25 mm to 32 mm)	3/8" (10 mm)	3/8" (10 mm)	5'-0" (1500 mm)	8'-0" (2400 mm)
1-1/2" - 2" (38 mm & 50 mm)	3/8" (10 mm)	3/8" (10 mm)	10'-0" (3000 mm)	10'-0" (3000 mm)
2-1/2" & 3" (65 mm & 75 mm)	1/2" (13 mm)	1/2" (13 mm)	10'-0" (3000 mm)	12'-0" (3700 mm)
4" (100 mm)	5/8" (16 mm)	5/8" (16 mm)	-	15'-0" ft. (4600 mm)
6" (150 mm)	3/4" (19 mm)	5/8" (16 mm)	-	17'-0" (5200 mm)

- .2 Cast Iron Piping is to be supported at intervals not exceeding 5'-0" (1500 mm) with clevis hanger securely anchored to building.
- .3 Cast Iron Fittings are to be supported at intervals not exceeding 3'-0" (900 mm).
- .4 Cast iron pipes are to be supported at every floor.
- .5 No support or hanger securing device is to penetrate waterproofing roof membrane above steel deck.

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- .6 Provide roller supports, floor stands, wall brackets, etc. for all lines running near the floor or near the walls, which can be properly supported by the floors or walls.
- .7 All pipe support arrangements are to be adjustable for proper support and grading.
- .8 Suspend piping using malleable iron or wrought steel hangers suspended from hanger rods threaded each end not more than 1-1/2" (38 mm). Continuous threaded hanger rod is to be used in concealed locations only.
- .9 Hanger rods are to be attached to concrete inserts, beam clamps, welded brackets or similar device. Co-ordinate location and method of pipe support in building with Structural Engineer.
- .10 Provide hangers for chilled water and cold water piping with the hanger around the insulation.

3.7 Backflow Preventers

- .1 All new backflow preventer installations must be tested, tagged, and the proper city or municipality form shall be filled out by the Contractor at time of installation, one copy will go to the city or municipality and one copy to the Owner.
- .2 The local authorities forms need to be properly filled out, providing the date of installation as well as all appropriate boxes checked on the form, determining initial or renewal testing.
- .3 This document is required for the initial installation and to provide a record so that proper yearly testing can be scheduled and completed on an annual basis as required by the Ontario Plumbing Code and the CAN/CSA B64.10-01 Manual for the Selection and Installation of Backflow Prevention Devices/ Manual for the Maintenance and Field Testing of Backflow Prevention Devices.
- .4 Where possible, installations of the device should be from a solid work area (floor or platform) to ensure testing and servicing is not from ladders.
- .5 All removals of existing backflow prevention devices must be reported in this manner.
- .6 Supply and install for each backflow preventer assembly, a by-pass assembly complete with isolation valves and pipe, size equal to assembly.

3.8 Inspection & Testing

- .1 Make tests that are required, by any authority having jurisdiction, in the presence of the Authority's Authorized Inspector. Tests are to be certified by him.
- .2 Test all piping at the completion of roughing-in before connecting to new systems, and prior to concealment, insulation or covering of piping.
- .3 Notify the Consultant in writing at least forty-eight (48) hours prior to start of tests. Failure to do so may require test to be re-done.
- .4 Ball test drains to Subsection 7.3.6.7 of the 2012 Ontario Building Code.
- .5 All new drainage and vent piping is to be tested using water test method before connection of fixtures and maintain the required water level for 24 hours. Pressure test science room and prep room piping in accordance with Manufacturer's instructions.
- .6 Final air test drains, waste and vent piping to Part 7 of the Ontario Building Code (latest edition).

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- .7 Heating water piping to be tested by filling the system with water and applying a hydrostatic pressure of 125 psig (860 kPa) which is to be maintained for at least 24 hours. If a freezing hazard exists the Consultant may permit a compressed air test to be substituted.
- .8 Perform tests before application of pipe covering. Test buried and concealed piping before backfilling or concealing in structure. Protect equipment and parts not capable of withstanding test pressure during tests.
- .9 Any leaks found are to be properly repaired and test reapplied until results satisfactory to the Consultant are obtained.
- .10 Gas pipe joints and fittings to be checked with soap and water solution during air test. Disconnect system during tests. DO NOT USE OXYGEN FOR TESTING.
- .11 Test piping systems to the following pressures for four (4) hours without drop in pressure or as otherwise noted.
 - .1 Hot water heating: 150 psig (1035 kPa)
 - .2 Condensate: 150 psig (1035 kPa)
 - .3 Domestic water: Hydrostatically to 150 psig (1035 kPa) for one hour [OR] Air to 100 psig (690 kPa) for two hours
 - .4 Gas: Air to 50 psig (350 kPa) for twenty-four hours

3.9 Placing In Operation

- .1 Upon completion of the Work and before turning over the job, the Contractor is to make a complete test of the various systems.
- .2 Flush and sterilize domestic water mains in accordance with the procedures established by AWWA Specification C601.
- .3 Flush all other domestic water piping in accordance with Local and Provincial Codes.

3.10 Pipe Grading

- .1 Piping: Heating water piping is to run level. Domestic water piping is to grade to low points. Branch piping to heating units below the main shall be off the bottom, and off the top to units above.
- .2 Condensate piping to be graded down in direction of flow 1" in 20'-0" (25 mm in 6,000 mm).
- .3 Equipment drain piping to be graded down in the direction of flow 1" in 4'-0" (25 mm in 1,200 mm).

3.11 Venting

- .1 Vent fixtures and traps according to Ontario Building Code (Chapter 7) and local authorities regulations. Increase vents smaller than 3" (80 mm) diameter to 3" (80 mm) diameter before same passes through roof to outdoors.
- .2 Connect vent lines to soil and vent stacks above highest fixture or separately carry through roof to outdoors. End vent stacks and vent piping 16" (400 mm) above finished roof or to vent flashing.

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3.12 Equipment Drains

- .1 Supply and install drain piping from all relief valves, and backflow preventers. Piping to be installed to spill into hub drains or funnel floor drains. Provide traps as required.

3.13 Excavation, Trenching, Backfilling & Bedding (Indoors)

- .1 This Division shall do all excavation, trenching, backfilling and bedding in connection with this Work. Refer to the soil reports for details on rock relief, water table and soil material. Excavation is to be based on soil with random pieces up to 12" (300 mm) diameter. Foundations, large concrete pieces, slabs, rock layers and unstable soils that are not shown on the Drawings or soils reports will be treated as a site condition. Blasting is not permitted, except by permission of the Consultant. Rock material is to be broken by a hydraulic ram. All trenching and excavation shall be done in strict accordance with the Occupational Health and Safety Act latest revision thereof.
- .2 All excavations shall be protected with fencing, timber sheeting, bracing or shoring as required.
- .3 Remove all timber and protective devices before backfilling or when the necessity of protection ceases. Keep excavated areas free of water by providing pumps, hoses, strainer, other appurtenances, power, labour and maintenance as required. All piping and equipment shall be tested, inspected and approved before backfilling.
- .4 All piping and equipment shall have adequate bedding. Trenches shall be excavated 6" (150 mm) below the intended grade of the piping. The pipe bedding granular 'A' of which at least 50% will pass a 1/4" (8 mm) sieve and 100% will pass a 1/2" (15 mm) sieve, backfilled by hand from the centre line of the pipe to 6" (150 mm) above up to 18" (450 mm) diameter, and 12" (300 mm) above for larger diameter pipes. Compact in 6" (150 mm) layers by tamping. The subgrade beneath the pipe shall be within .03 ft. (9 mm) of a straight line between joints. Bell holes shall be made at each joint to permit the joint to be properly made. Debris is to be kept out of the piping. No backfill is permitted until the test is witnessed. Bedding shall be compacted to 95% modified Proctor test.
- .5 Backfill shall be non-cohesive ballast material of which at least 50% will pass a 1/4" (8 mm) sieve and 100% will pass a 1/2" (15 mm) sieve. The backfill shall be placed in layers not exceeding 12" (300 mm) loose measurement.
- .6 Compaction of the backfilled material shall be to 95% Proctor density. Where Proctor tests are called for, these will be paid for out of the allowance in Division 2. Proctor tests as a result of re-testing shall be paid for by this Division. Protect the pipe during backfilling and compaction so that damage or a movement of the pipe is avoided. The pipe must be protected with a minimum of 20" (500 mm) of compacted cover before backfill by mechanical means.
- .7 The backfill shall be compacted by mechanical hand compaction equipment to achieve the specified density. Water may be used as an aid to compaction, but not as the sole means of compaction. Backfilling shall not be done in freezing weather, except by permission of the Consultant.
- .8 Carefully backfill both sides of piping and equipment simultaneously to prevent movement or displacement. All excess materials shall be removed from the premises as directed and legally disposed of by this Division. In no case shall piping be installed over backfill. Special supports, bridges etc. are to be provided.

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3.14 Drain Valves

- .1 Supply and install 3/4" (20 mm) ball valve and hose end at main low points to drain each water type system, at pumps, coils, strainers and at each piece of equipment.

3.15 Gas Service

- .1 Install at each appliance and gas cock, a union, dirt leg and shut-off cock. Pipe up completely.

3.16 Dirt Accumulation Under All Valves

- .1 If dirt accumulates under the seat of valves (including automatic control valves) during the first years operation, remove the collected materials under the valve seats and if the seat is damaged, replace same at no additional cost to the Owner.

3.17 Affidavit

- .1 Submit an affidavit verifying to the use of non-lead bearing solder in all potable water copper piping system to the Consultant and insert in the Maintenance Manual.

3.18 Roof Flashings

- .1 Turn over flashings to the roofer for installation, Provide flashings for each roof penetration.
- .2 Provide a flashing for each air cooled condensing unit, 4 openings, one for power wiring conduit (by Division 16), one for control wiring conduit, one each for liquid and suction refrigerant piping.
- .3 Ensure that the flashing grommets are not cut or otherwise damaged during installation. Cut or damaged grommets must be replaced; caulking of the flashings to repair leaks will not be accepted.

3.19 Dielectric Couplings

- .1 Provide wherever pipes of dissimilar metals are joined.
- .2 Provide insulating unions for pipe sizes 2" (50 mm) diameter and smaller, and flanges for pipe sizes 2-1/2" (65 mm) diameter and larger. Brass adaptors and bronze valves will not be accepted.
- .3 Provide an isolating separation wherever piping may touch dissimilar metal studs, joists, concrete or other material.

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PART 1 - GENERAL

1.1 Related Instructions

- .1 Conform to General Provisions, Section 15010.
- .2 Electric motors for all driven equipment supplied by this Division shall be provided and installed by this Division.

1.2 Submittals

- .1 Submit Shop Drawings for all electrical motors in accordance with the Section 15011 - Submittals and shall incorporate the following information.
 - .1 Horsepower
 - .2 Voltage
 - .3 Frequency
 - .4 Speed
 - .5 Starting current and torque characteristics
 - .6 Full load current
 - .7 Class of insulation
 - .8 Enclosure type
 - .9 Service factor
 - .10 Ambient temperature reference
 - .11 Type of bearings
 - .12 Locations of connection box
 - .13 Manufacturer

PART 2 - PRODUCTS

2.1 Materials

- .1 Unless otherwise specified motors shall be squirrel cage induction type with standard drip proof enclosure.
- .2 Motors unless otherwise specified shall meet all requirements of EEMAC and CSA standards for electrical motors and where possible shall be of Canadian Manufacturer.
- .3 Generally, all motors shall have starting current-torque characteristics in accordance with EEMAC, Design 8 unless otherwise specified or unless load characteristics require a higher starting torque. Each motor shall have sufficient starting torque to start the driven equipment and to accelerate it to full speed within 10 seconds. Motor horsepower's shown are minimums. Submit starting times for review.
- .4 All motors shall be nominal 1750 rpm, unless otherwise specified.
- .5 Unless noted otherwise, all motors shall have Class 8 insulation and shall be designed for continuous operation at 40 deg. C. (deg. F.) Motors controlled from variable speed drives shall have Class H windings and Class F insulation.

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- .6 Motor connection boxes shall be located on side of motor most easily accessible for maintenance and remote from belts, gears or driven equipment. If boxes are factory installed on wrong side of motor they shall be relocated.
- .7 Each multi-speed motor and associated switching device shall be circuited such that the overload device in the starter protects the motor on each step of the multi-speed switch. As an alternative to this requirement, the motor may have integral overload protection. Multi-speed motors shall be single winding variable torque for 50% motor speed reduction and double winding, two speed for all other speed reductions.
- .8 Motors shall have the following electrical characteristics:
 - .1 For 0.375 kW (1/2 HP) and larger 600 Volt, 3 phase, 60 cycle
 - .2 For 0.25 kW (1/3 HP) and smaller 120 Volt, 1 phase, 60 cycle
- .9 Single phase motors 0.25 kW (1/3 HP) and smaller shall be capacitor start.
- .10 All motors 22.4 kW (30 HP) and larger shall have heat detector protection embedded in the windings for connection into the motor control circuit. Protection shall be Siemens thermistor.
- .11 Motor enclosures shall be as follows:
 - .1 If protected from the weather and entraining moisture, use open drip-proof, service factor 1.15.
 - .2 Motors located in air streams shall be selected to operate satisfactorily at maximum temperature and moisture levels of surrounding air.
 - .3 For all other locations, use totally-enclosed fan-cooled, service factor 1.0.
 - .4 Use explosion proof motors where scheduled.
- .12 High efficiency motors shall be T frame, A.C., three phase, meet or exceed the Ontario Hydro Enermark Motor Efficiency Levels as tested to either CSA 390M or IEEE-1128, meet or exceed ASHRAE Standard 90.1 (latest edition) motor high efficiency level and be approved under the Canadian Electrical Safety Code:
 - .1 High efficiency motors shall be used on all fans and pumps having motors 0.75 kW (1 HP) or larger.
- .13 Each electric motor shall be complete with a lamacoid nameplate securely fastened in a conspicuous place on the motor. The nameplate shall be a minimum of 2 mm (3/32") thick laminated phenolic plastic 100 mm (4") long x 50 mm (2") wide with black face and white centre, 5 mm (7/32") high letters shall be engraved through to the white lamination with the following:
 - .1 Motor No.
 - .2 Mechanical Equipment Driven
 - .3 Circuit No.
 - .4 Panel No.
 - .5 Panel Location
- .14 Electric motors shall be manufactured by Canadian General Electric, Westinghouse, Lincoln, U.S. Motors, Baldor or Weg.

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PART 3 - EXECUTION

3.1 Installation

- .1 Drive between any motor and driven equipment shall be provided with a guard, except where casing acts as a guard. Guards for belt-driven equipment shall have a hole for tachometer reading on each shaft.

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Demolition & Renovation

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PART 1 - GENERAL

1.1 General Provisions

- .1 This Project is one of a retrofit nature in part or in whole, and which will require some demolition.
- .2 The Prime Mechanical Contractor shall allow for all remedial work in the areas indicated on the Drawings and as generally defined in the relevant sections of the Specifications.
- .3 **Note:** This Division should be aware that the Owner(s) may intend to retain some equipment being removed for spare parts, etc. Care must be exercised in the removal of equipment to ensure no damage occurs.

1.2 Related Work Specified Elsewhere

- .1 Electrical Division 16

PART 2 - PRODUCTS

2.1 General

- .1 This Division is to liaise with the Owner(s) or Consultant for equipment being removed that may be suitable for reuse to that specified or handed over to the owner.
- .2 All mechanical and electrical equipment and other material that is to be turned over to the Owner is to be removed in a careful manner so as to avoid any damage and stored on site in a secure and lockable area, until such time as it is eventually turned over to the Owner.
- .3 This Division to take full responsibility for any special tools or equipment required to disassemble or remove material from building.
- .4 All mechanical systems equipment, materials and ancillaries, etc., being removed and not designated as remaining the property of the Owner, to be disconnected and properly disposed of by this Division.

PART 3 - EXECUTION

3.1 General

- .1 The General Requirements are indicated on the Drawings and in the Specification in Division 1.
- .2 The general execution of the demolition is to be carried out in a clean and efficient manner.
- .3 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.
- .4 All new holes and openings to facilitate mechanical systems are to be patched to match surrounding surfaces.

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- .5 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.
 - .6 Any damage to existing roofing membrane as a result of this work to be repaired to ensure waterproofing integrity of roof is maintained. Advise Consultant for suitable instructions.
 - .7 As part of the demolition of the air handling system, the existing refrigerant is to be completely evacuated and stored in a suitable storage container. The stored refrigerant is to be handed over to the Owner for processing.
 - .8 Evacuation of the existing refrigerant to be completed by licensed refrigeration mechanics knowledgeable in the proper handling of this type of refrigerant, with use of the proper equipment and in compliance with all guidelines as stated under the Province of Ontario Ministry of Environment and Climate Change.

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Noise & Vibration Control

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PART 1 - GENERAL

1.1 Related Instructions

- .1 Conform to General Provisions, Section 15010.

1.2 Related Work Specified Elsewhere

- | | | |
|----|---------------------------|---------------|
| .1 | Basic Materials & Methods | Section 15050 |
| .2 | Liquid Heat Transfer | Section 15700 |
| .3 | Air Distribution | Section 15800 |

1.3 Submittals

- .1 Submit Shop Drawings in accordance with Section 15011 - Submittals for the following equipment:
 - .1 Vibration Isolators
 - .2 Silencers

1.4 Scope of Work

- .1 Supply all vibration and sound isolation equipment as indicated on the Drawings and as outlined in the Specifications.
- .2 Isolation is not required for sewage and sump pumps, propeller fans, curb mounted roof fans, or packaged equipment with integral vibration isolation.
- .3 The vibration and sound isolation Manufacturer to visit the site after all equipment has been installed and provide a report to the Consultant verifying that the equipment has been installed and is operating properly.
- .4 The vibration and sound control Manufacturer to submit to the Consultant for approval a list of equipment to be isolated and the selected isolator type for each piece of equipment.
- .5 The vibration and sound control Manufacturer to provide all necessary installation Drawings showing isolator location, base dimensions, etc.
- .6 This Division to provide to the vibration and sound control Manufacturer all the necessary data required for the proper selection of the vibration isolation and sound control equipment. Verify all final dimensions for bases, and plenums.
- .7 Isolators and restraining devices which are factory supplied with equipment to meet the requirements of this Section.
- .8 Include in this Division the supply of all concrete inertia pads (where required) or structural steel bases located between all vibrating equipment and the vibration isolation elements (unless indicated elsewhere).
- .9 Select isolators at the Supplier's optimum recommended loading, and do not load beyond the limit specified in the Manufacturer's literature.
- .10 Provide hot dipped galvanized housings and neoprene coated springs for all spring isolators located out of doors or in areas where moisture may cause corrosion.

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- .11 Supply of all of the noise control and vibration isolation equipment to be by one approved Supplier with the exception of those components which are factory installed and are standard equipment with the machinery.

PART 2 - PRODUCTS

2.1 Vibration Isolation

- .1 The work under this Section shall be carried out by a firm specializing in vibration and sound isolation. Isolate fans, piping and ductwork to provide a minimum noise transmission into occupied areas. All vibration isolation material shall be supplied by one (1) Manufacturer directly to this Trade Contractor, except for the chiller units and rooftop units.
- .2 Supply to the Isolation Manufacturer, a copy of Shop Drawings showing equipment weights, isolator locations, concrete slab dimensions, anchor positions, etc. The Isolation Manufacturer shall supply installation instructions and supervision where required to obtain optimum results.
- .3 On system start-up, the Isolation Manufacturer shall inspect the complete installation and report in writing to the Consultant any changes necessary to prevent short circuit transmission.
- .4 All piping connected to isolated equipment shall be suspended with Type 'SH' spring hangers for the first four (4) points of support. Isolate muffler and exhaust pipe of electrical generator.
- .5 All piping supported from floor shall be mounted on Type 'KIP' pads.
- .6 Sleeves through walls and floors of Mechanical Room for ducts and pipes are to be tightly packed with Consolidated Kinetics Corporation low density fibreglass Type 'LB' packing and sealed with 1/2" (12 mm) deep resilient sealant.
- .7 All floor-mounted fans and cabinet-type fan units shall be mounted or suspended on open spring mounts, having a ratio of one between horizontal and vertical constants and a minimum deflection of 1" (25 mm).
- .8 Acceptable Products:
 - .1 Vibro Acoustics
 - .2 Korfund
 - .3 Masdom
 - .4 Kinetics Noise Control
 - .5 IAC Acoustics

PART 3 - EXECUTION

3.1 Vibration Isolators

- .1 Execute the work in accordance with the Specification and, where applicable, in accordance with the Manufacturer's instructions and only by tradespersons experienced in this type of work.

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- .2 For all equipment mounted on vibration isolators, provide a minimum clearance of 2" (50 mm) to other structures, piping, equipment, etc.
- .3 Co-ordinate with Section 15800 - Air Distribution flexible connections for all ductwork connections to fans or plenums.

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Insulation

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PART 1 - GENERAL

1.1 Related Instructions

- .1 Conform to General Provisions, Section 15010.

1.2 Related Work Specified Elsewhere

- | | | |
|----|---------------------------|---------------|
| .1 | Basic Materials & Methods | Section 15050 |
| .2 | Plumbing Fixtures & Trim | Section 15401 |
| .3 | Air Distribution | Section 15800 |

1.3 Clarification

- .1 Insulation may extend through fire rated separations when used in conjunction with firestopping material specifically tested for this purpose.

PART 2 - PRODUCTS

2.1 General

- .1 For adhesives and mastics for applications noted equal Products of the following Manufacturers will be accepted: Flintkote; Benjamin Foster; Minnesota Mining and Manufacturing; Pronto.
- .2 Insulation shall conform to ASHRAE Standard 90.1 (latest edition).
- .3 All insulation and covering materials are to be non-combustible, and asbestos free. Vapour barrier jacket, and adhesive to be fire retardant to approved standards of fire hazard classification for building materials. Flame spread rating not to exceed 25 and smoke rating not to exceed 50.
- .4 "Koolphen K" phenolic foam insulation with a thermal conductivity of 0.13 BTU.in/Hr.Ft Sq.°F and factory applied ASJ jacket is acceptable, except where piping is exposed then PVC jacketing is required. Thickness of insulation shall provide equivalent or better thermal resistance (R-factor) than specified.
- .5 Acceptable Products:
 - .1 Manson Insulation
 - .2 Knauf
 - .3 Owens Corning

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2.2 Materials

.1 Domestic Cold Water:

- .1 Piping: Fibreglass heavy density fibreglass insulation with factory applied all service vapour barrier jacket lapped and adhered with Flintkote 203 adhesive or equal. Insulation conductivity shall be in the range of 0.22 - 0.28 BTU in/(h.ft³.°F) with mean temperature of 100°F. Seal all joints with 4" (100 mm) wide strip of all service jacket material. Finished with a smooth layer of asbestos free finishing cement and covered with canvas.
- .2 Fittings and valves: Moulded or fabricated mitred segments of a thickness equal to that of the pipe insulation and finished with a layer of asbestos free finishing cement, trowelled smooth and covered with canvas.
- .3 Alternative method for insulating fittings: Pre-moulded high impact PVC fitting covers with fibreglass inserts, end joints sealed with PVC tape.
- .4 Exposed insulation: Finish with PVC vapour barrier jacket and adhere with cement adhesive. Seal all joints with 4" (100 mm) wide strip of PVC tape. Colour of tape to match PVC cover.
- .5 Insulation shall be of thicknesses as follows:

Pipe Size	Insulation Thickness
1/2" (13 mm) - 1-1/4" (32 mm) Ø pipe	1/2" (15 mm)
1-1/2" (40 mm) - 8" (200 mm) Ø pipe	1" (25 mm)

.2 Domestic Hot Water, Tempered, Domestic Hot Water Recirculation Piping:

- .1 Piping: Fibreglass heavy density fibreglass insulation with factory applied all service jacket lapped and adhered with Flintkote #203 adhesive or equal. Seal all joints with 4" (100 mm) wide strip of all service jacket material. Insulation conductivity shall be in the range of 0.22 - 0.28 BTU in/(h.ft³.°F) with mean temperature of 100°F (38°C).
- .2 Fittings and Valves: Moulded or fabricated mitred segments of a thickness equal to that of the pipe insulation and finished with a layer of asbestos free finishing cement, trowelled smooth and covered with canvas.
- .3 Alternative method for insulating fittings: Pre-moulded high impact PVC fitting covers with fibreglass inserts, end joints sealed with PVC tape.
- .4 Exposed Insulation: Finish with PVC vapour barrier jacket and adhere with cement adhesive. Seal all joints with 4" (100 mm) wide strip of PVC tape.
- .5 Insulation shall be of thicknesses as follows:

Pipe Size	Insulation Thickness
1/2" (15 mm) - 1-1/4" (32 mm) Ø pipe	1" (25 mm)
1-1/2" (40 mm) - 4" (100 mm) Ø pipe	1-1/2" (40 mm)

.3 Cold Condensate Piping:

- .1 Piping: 1/2" (15 mm) Fibreglass heavy density fibreglass insulation with factory applied all service vapour barrier jacket lapped and adhered with Flintkote 203 adhesive or equal. Seal all joints with 4" (100 mm) wide strip of all service jacket material.

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- .2 Base of roof hoppers insulated with moulded segments of a thickness equal to that of the pipe insulation finish with cement and wrapped with canvas.
- .3 Alternative method for insulating fittings: Pre-moulded high impact PVC fitting covers with fibreglass inserts, end joints sealed with PVC tape.
- .4 Exposed Insulation: Finish with PVC vapour barrier jacket and adhere with cement adhesive. Seal all joints with 4" (100 mm) wide strip of PVC tape.

.4 Heating Supply and Return Piping:

- .1 Piping: Fibreglass heavy density fibreglass insulation with factory applied all service jacket lapped and adhered with Flintkote #203 adhesive or equal. Seal all joints with 4" (100 mm) wide strip of all service jacket material. Insulation conductivity shall be in the range of 0.25 - 0.29 BTU. in./(h.ft.³°F) with mean temperature of 125°F.
- .2 Fittings Valves and Flanges: Moulded or fabricated segments of a thickness equal to that of the pipe insulation and finished with a layer of asbestos free finishing cement, trowelled smooth and covered with canvas.
- .3 Alternative method for insulating fittings: Pre-moulded high impact PVC fitting covers with fibreglass inserts, end joints sealed with PVC tape.
- .4 Exposed Insulation: Finish with PVC vapour barrier jacket and adhere with cement adhesive. Seal all joints with 4" (100 mm) wide strip of PVC tape.
- .5 Insulation shall be of thicknesses as follows:

Pipe Size	Insulation Thickness
1/2" (15 mm) - 1-1/4" (32 mm) Ø pipe	1-1/2" (40 mm)
1-1/2" (40 mm) - 8" (200 mm) Ø pipe	2" (50 mm)

- .6 Unions and piping between shutoff valve and coil not exceeding 4'-0" (1200 mm) do not have to be insulated.
- .5 Hot Water and Drain Piping at Handicapped Fixtures:**
- .1 Armstrong Armaflex 2000 self seal pipe insulation, closed cell elastomeric and flexible, 1/2" (15 mm) thickness. Secure joints with 3M #471 tape.
 - .2 Exposed Insulation: Finish with one (1) piece PVC vapour barrier jacket and adhere with adhesive.
- .6 Fire Separations:**
- .1 Where ducts pass through fire separations (walls, floor and partitions) pack space with ULC listed and/or approved fire stopping mineral fibre insulation and seal with approved fire-retardant sealing compounding. Sealing compound to be installed to Manufacturer's Specifications and detail. Fire stopping shall comply with the Ontario Building Code and approved by local Building Department. Obtain written approval from Local Building Department before commencing with Work.
 - .2 It is the responsibility of this Division to determine the locations of all fire separations, as shown on the Architectural Contract Documents.

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- .3 Pipes complete with insulation, passing through a fire rated separation must be complete with fire stop mineral wool insulation type RXL-Safe as supplied by ROXUL Inc. Sealant shall be Fyre-Sil for vertical separations and Fyre-Sil SL for horizontal separations. Insulation shall extend a minimum 600 mm (24") beyond face, both sides of the separation.
- .7 **Ductwork:**
 - .1 External (Rigid) Larger than 17" x 13" (425 mm x 325 mm): Fibreglass rigid vapour seal type (AF530) 3.0 PCF (48 kg/m³) in exposed areas finish with 8 oz. (227 gm) canvas adhered with welding pins on 12" (305 mm) to 18" (457 mm) centres, secured with clips. Apply to outside of ductwork. (Min R - Value of 4.0/in.).
 - .2 External (Flexible) Up to 16" x 12" (400 mm x 300 mm): Fibreglass all service faced flexible duct insulation 0.75 PCF (12 kg/m³) with factory applied reinforced foil facing. In exposed areas finish with 8 oz. (227 gm) canvas, adhere with fire retardant adhesive, applied in strips 6" (150 mm) wide and 12" (305 mm) on centres applied to outside of ductwork. (Min R-Value of 2.5/in).
 - .3 Internal (Acoustic Duct Liner): 1" (25 mm) thick fibreglass duct liner or thickness as indicated, with neoprene coating. Adhere with minimum 50% covering of fire retardant adhesive, and supplement with welding pins. (Min R - Value of 4.0/in.). Designated on Drawings by diagonal hatching or where noted.
- .8 **Plenums:**
 - .1 Insulate plenums with insulation board, 2" (50 mm) thick, 6.0 lb/ft³ (96 kg/m³) density.
 - .2 Seal all breaks with Bakor. Cover with foil-faced tape.
 - .3 All insulation shall be secured to flat sheet metal surface by means of welded pins or perforated base metal fasteners adhered with Bakor #230-35 and speed washers. These shall be located on maximum 12" (300 mm) centres. When the insulation has been placed on the metal spike, the speed washers shall be attached, and the excess spike cut off flush with the washer. Corners of insulation shall be Provided with a preformed, protective edge applied to insulation before canvassing. See Section 15801.
 - .4 On completion, surfaces shall be canvas covered with 6 oz. (.17 kg) fireproof canvas and finished with two (2) coats of Bakor #120-09.

PART 3 - EXECUTION

3.1 General

- .1 Do not apply insulating materials until equipment to be insulated has been properly cleaned, dried and tested to the satisfaction of the Consultant.
- .2 Apply all insulation, wrapping, vapour barrier, adhesives, coatings, and cement in strict accordance with Manufacturer's recommendations.
- .3 Do not apply any insulation or finishing when the ambient temperature in the space is less than 50°F (10°C).
- .4 Supply and install on all insulated piping a protection saddles similar to Anvil Fig. 160.

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3.2 Installation Application

- .1 Apply all covering in a neat and workmanlike manner to present a clean appearance upon completion of the job.
- .2 Apply all insulation in a manner to facilitate replacing and/or servicing of equipment.
- .3 Make good and refinish cracks, undulations or any other deficiencies occurring in the insulation or vapour barrier.
- .4 On all piping, equipment and ductwork, terminate the insulation neatly around all openings and items requiring periodic access. Insulate separately with removable 16 gauge galvanized sheet steel panels lined with rigid slab insulating materials providing equivalent insulation to that on the adjoining surface.
- .5 Provide metal corners concealed within the canvas finish on all exposed rigid duct insulation.
- .6 Do not use staples on vapour barriers.
- .7 Provide the following insulation Work:
 - .1 Do not insulate exposed ductwork in Gymnasium.
 - .2 Do not insulate return air ductwork.
 - .3 Do not insulate pre-insulated flexible ducts.
 - .4 All new heating supply and return piping.
 - .5 Domestic hot water and drain at each handicapped fixture 1/2" (13 mm) pipe insulation.
 - .6 Repair or replace any existing insulation damaged as a result of the Work, or where indicated to be reinsulated. Match existing for thickness and finish, unless exposed, then finish to match new.
 - .7 Ductwork where indicated on the Drawings with diagonal hatching - 1" (25 mm) internal (by Sheet Metal Contractor, refer to Section 15800).
- .8 On all piping having vapour barrier jacket, the adjoining section of insulation is to be butted firmly together and the longitudinal seams of the vapour jacket to be sealed with vapour barrier adhesive. End joints are to be sealed with 4" (100 mm) factory furnished vapour barrier strips.
- .9 Apply insulation over clean dry surfaces butting and adjoining sections firmly together and sealing or taping smoothly over joints.
- .10 Where the pipe hanger is around the insulation, Provide a 6" (150 mm) length at equal thickness of moulded thermo - 12 insulation, protected with a saddle, within the pipe support. Coordinate with Contractor installing hangers referenced in Section 15050 - Basic Materials & Methods.
- .11 Extend pipe and duct insulation and covering through sleeves, walls, floors, ceilings, and structural beams, unless indicated otherwise on Drawings, or other sections of this Specification.
- .12 Cover angles and standing seams which extend beyond face of applied insulation with 1/2" (15 mm) thick blanket of glass fibre insulation fitted with factory applied facing of fire resistant kraft paper. Provide 3" (80 mm) overlap on each side of angle or seam. Apply strips of 1" (25 mm) thick glass fibre insulation board over blanket type insulation, allowing extended portion of angle or seam to project through Work.

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Insulation

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- .13 Seal holes, corners, and joints with 3" (80 mm) wide scrim foil tape immediately following application of insulating materials.
- .14 Refer to Section 15800 for Installation of internal duct liner.
- .15 Exposed Pipe Finish (Indoors):
 - .1 All exposed insulated piping and fittings shall be finished with a fire retardant PVC jacket.
 - .1 PVC cover shall be minimum 0.02 gauge, hot rolled complete with self seal lap.
 - .2 All seams to be fused by Shurweld reinforcement. DO NOT USE TAPE.
 - .3 Provide PVC end caps for piping 1-1/2"Ø (40 mm Ø) and larger. Caulk end fittings with silicone sealant equal to Dow Corning 999-A on piping 1-1/4"Ø (32 mm Ø) or less.
 - .4 Joints for pipe fitting connections (Tees, Wyes, etc.) shall be sealed with silicone sealant as above.
 - .2 PVC fittings do not require jacketing.
 - .3 No additional finish need be applied to the concealed piping.
 - .4 No PVC finish shall be applied until the Consultant has inspected the insulation for type, adhesive and cracks.
 - .5 Pipe insulation concealed within structure, all joints and edges shall be taped with reinforced foil faced tape.
- .16 PVC Fitting Cover:
 - .1 The factory pre-molded, one-piece PVC insulated fitting cover shall have the proper factory pre-cut insulation applied to the exposed fitting.
 - .2 The ends of the insulation shall be tucked snugly into the throat of the fitting and the edges adjacent to the pipe covering tufted and tucked in, fully insulating the pipe fitting.
 - .3 The one-piece PVC fitting cover is then sealed with Dow-Corning 999A silicone sealant.

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MECHANICAL**

Plumbing

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PART 1 - GENERAL

1.1 Related Instructions

- .1 Conform to General Provisions, Section 15010.

1.2 Related Work Specified Elsewhere

- | | | |
|----|---------------------------|---------------|
| .1 | Roofing | Division 07 |
| .2 | Miscellaneous Specialties | Section 10800 |
| .3 | Basic Materials & Methods | Section 15050 |
| .4 | Insulation | Section 15180 |
| .5 | Plumbing Fixtures & Trim | Section 15401 |

1.3 Quality Assurance

- .1 Conform to the latest edition, including Amendments, of the following Codes and Standards.
- .2 Local bylaws and standards.
- .3 Ontario Electrical Safety Code.
- .4 2012 Ontario Building Code (OBC) Compendium containing the Building Code Act, and Ontario Regulation 332/12 including all amendments.
- .5 ACNBC Canadian Plumbing Code.

PART 2 - PRODUCTS

2.1 Cleanouts - DESIGNATED CO

- .1 Provide at the base of each vertical stack and rainwater leader, Zurn Z-1445.
- .2 Provide on exposed wall areas, accessible pipe chases, and outside grade, Zurn Z-1440.
- .3 Provide on plaster walls, Zurn Z-1446-Z-VP.
- .4 Provide on finished floor areas, Zurn ZN-1602-T, square nickel bronze access cover and frame to suit floor finish.
- .5 Provide in ceramic or quarry tile floor areas, Zurn ZN-1602-T square nickel bronze access cover and frame.
- .6 Provide on unfinished floor areas, Zurn Z-1602-T with cast iron scoriated top.
- .7 Provide on vinyl tile floor areas, Zurn ZN-1614 with nickel bronze top recessed for tile.
- .8 Provide for terrazzo floor areas, Zurn ZN-1607-ST with nickel bronze top recessed for terrazzo.
- .9 Cleanouts installed in water-proofed areas shall be supplied with flashing flange and clamp collar.

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- .10 Provide for urinals, Zurn ZSS-1666-1-VP with round stainless steel access cover and neoprene plug.
- .11 Provide in carpeted floor areas, Zurn ZN-1602 CM round nickel bronze top and carpet marker.
- .12 Cleanouts installed in vinyl sheet flooring shall be Enpoco E3000R5FC.
- .13 Acceptable Products:
 - .1 Zurn
 - .2 Watts
 - .3 Jay R. Smith
 - .4 Enpoco
 - .5 Mifab
- .14 Before construction begins, the Prime Mechanical Contractor shall obtain from the General Division the "Room Finish Schedule" for the Project. The Prime Mechanical Contractor and the cleanout manufacturer and/or vendor shall coordinate the type and installation of the various cleanouts listed in the Specifications for each Room. If there is a discrepancy, advise the Consultant before submitting the approval drawings for review. Failure to do so will result in the Prime Mechanical Contractor bearing the total cost for replacing the cleanouts and repairing the floor to match the existing conditions.

2.2 Dielectric Unions

- .1 Provide wherever pipes of dissimilar metals are joined.
- .2 Provide insulating unions for pipe sizes 2" (50 mm) and under and flanges for pipe sizes 2-1/2" (65 mm) and over.
- .3 Cast brass adapters may be used where approved by the Consultant.
- .4 Provide an isolating separation wherever piping may touch dissimilar metal studs, joists, concrete, etc.

2.3 Roof Vent Caps

- .1 Pre-insulated aluminum stack-jack flashing with vandal proof cap.
- .2 All new roof vent caps to be Provided with insulated vent stacks supplied by Division 15 and installed by Division 7. This Division to connect new vents to stacks.
- .3 Acceptable Products:
 - .1 Thaler Metal Industries Inc., Model SJ-26 EPDM (or PVC) with SJ-33 stainless steel vandal proof cap.
 - .2 Lexcor Flash-Tile, Vandal proof Model VSC-V.

2.4 Shock Absorbers

- .1 At each group of fixtures supply and install shock absorber, Zurn Model Z-1700. Contractor shall guaranteed no water hammer for one (1) year. For shock absorbers concealed in walls Provide access door for servicing.

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.2 Acceptable Products:

- .1 Zurn**
- .2 Watts**
- .3 J.R. Smith**
- .4 PPP Inc.**
- .5 Mifab**

PART 3 - EXECUTION

3.1 Plumbing Specialties

.1 Cleanouts:

- .1** Before construction begins, the Prime Mechanical Contractor shall obtain from the General Division the "Room Finish Schedule" for the Project. The Prime Mechanical Contractor and the cleanout manufacturer and/or vendor shall coordinate the type and installation of the various cleanouts listed in the Specifications for each Room. If there is a discrepancy, advise the Consultant before submitting the approval drawings for review. Failure to do so will result in the Prime Mechanical Contractor bearing the total cost for replacing the cleanouts and repairing the floor to match the existing conditions.
- .2** Cleanouts to be the same size as pipe up to 4" (100 mm) and not less than 4" (100 mm) for larger pipes.
- .3** Provide cleanouts at the end of mains and branches, at changes in directions, in long straight runs, at the base of all soil stacks and rainwater leaders and where required by code.
- .4** Use extended cleanouts for piping installed below grade and in furred ceiling spaces.
- .5** Co-ordinate final cleanout elevation and configuration with floor finishes.

.2 Hub Drains:

- .1** Before construction begins, the Prime Mechanical Contractor shall obtain from the General Division the "Room Finish Schedule" for the Project. The Prime Mechanical Contractor and the floor drain manufacturer and/or vendor shall coordinate the type and installation of the various floor drains listed in the Specifications for each Room. If there is a discrepancy, advise the Consultant before submitting the approval drawings for review. Failure to do so will result in the Prime Mechanical Contractor bearing the total cost for replacing the floor drains and repairing the floor to match the existing conditions.
- .2** Reference shall be made to the Architectural Drawings for slopes of floors and locations of floor drains with regard to furniture, benches, etc. and on specific placing.
- .3** Provide drains, complete with traps, where shown on Drawings.
- .4** Provide trap seal primers and supply lines to each drain. All trap seal primers shall be accessible, Provide suitable access doors where necessary.
- .5** Co-ordinate final drain elevation and configuration with floor finishes.

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.3 Water Hammer Arrestors:

- .1 Provide 24" (610 mm) air chambers fabricated from Type L, copper tubing, with capped end, or water hammer arrestors, at each plumbing fixture or fixture group, and wherever else necessary to prevent water hammer.

.4 Fixture Carriers:

- .1 Fasten carriers securely to the building structure with 1/2" (13 mm) bolts and necessary anchors.
- .2 Verify fixture mounting heights, refer to Section 15401.

.5 Roof Vent Cap:

- .1 Plumbing Contractor shall determine the required number and size of roof vent caps required to Provide proper venting of the plumbing systems.
- .2 Plumbing Contractor shall Provide all roof cap vents and hand them over to Roofing Contractor for installation. Locations to be coordinated with Roofing Contractor.

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Plumbing Fixtures & Trim

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PART 1 - GENERAL

1.1 Related Instructions

- .1 Conform to General Provisions, Section 15010.

1.2 Related Work Specified Elsewhere

- | | | |
|----|---------------------------|---------------|
| .1 | Miscellaneous Specialties | Section 10800 |
| .2 | Basic Materials & Methods | Section 15050 |
| .3 | Insulation | Section 15180 |
| .4 | Plumbing | Section 15400 |

1.3 Quality Assurance

- .1 Conform the latest edition, including Amendments, of the following Codes and Standards.
- .2 Local bylaws and standards.
- .3 Ontario Electrical Safety Code.
- .4 2012 Ontario Building Code (OBC) Compendium containing the Building Code Act, and Ontario Regulation 322/12 including all amendments.
- .5 ACNBC Canadian Plumbing Code.

1.4 Submittals

- .1 Submit Shop Drawings in accordance with Section 15011 for the following equipment:
 - .1 Plumbing Fixtures and Trim
 - .2 Submit inspection certificates obtained from local inspection authorities.
 - .3 Submit certificates indicating that all required testing has been completed.

PART 2 - PRODUCTS

2.1 Plumbing Fixtures

- .1 Plumbing fixtures shall be as indicated and specified with all required supports, accessories, drainage, vent and water connections to make the fixture complete.
- .2 The flow rates of fittings that supply water to a fixture shall not exceed the maximum flow rates listed in Part 7 of the OBC under the water efficiency section.
- .3 All plumbing fixtures shall be Acceptable Products: Steel Queen, Franke, Kindred, Aristaline manufacture, except where specifically noted as a special manufacture. Designations are Steel Queen. All plumbing fixtures shall be supported level and square.
- .4 Plumbing fixture mixing valve shall be Powers, Alternate Products: Moen (Commercial)
- .5 Faucets serving all stainless steel sinks shall be Base Bid: Delta/Teck, Alternate Products: Crane, Chicago Faucet, Moen (Commercial).

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Plumbing Fixtures & Trim

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- .6 All fittings shall be "no lead" brass alloy, chrome plated finish. Plastic fittings are not acceptable. Delta fittings are specified. Fittings and trim serving stainless steel sinks shall be certified to CAN/CSA-B125.
- .7 Provide each fixture with waste and trap, vent and water, as shown or required in accordance with the following schedule:

Fixture	Trap (mm)	Vent (mm)	Cold (mm)	Hot (mm)	Tempered (mm)
Sink	1-1/2" (40)	1-1/4" (32)	1/2" (15)	1/2" (15)	
Floor Drain	3" (80 min.)	1-1/2" (40)	3/8" (10)	--	

Note: Exposed drain pipe serving sink, is to be finished chrome plate complete with deep cup escutcheon.

- .8 **Sink - DESIGNATED KS-1 (Double Bowl)**
- .1 Bowl - STEEL QUEEN QDLA2233-8-3 complete with basket strainer and tailpiece
 - .2 Bowl Size - 2@15" x 17" x 8" (380 mm x 430 mm x 200 mm)
 - .3 Trap - 40 mm (1-1/2") cast brass P-trap complete with cleanout
 - .4 Supplies - ball valves
 - .5 Faucet - Delta Teck 26C3124

PART 3 - EXECUTION

3.1 Plumbing Fixtures

- .1 For precise location and mounting heights of the fixtures and trim, refer to the Architectural Drawings.
- .2 Co-ordinate the Work of this Division with that of other Divisions with regard to all openings in wall and floors for any fully or semi-recessed fixtures.
- .3 Conform with detailed Architectural and Electrical Drawings countertop installation with regard to sink size and location in countertop to ensure clearance with counter structural components and possible interference with countertop electrical outlets.
- .4 Fixtures are to be carefully stored until ready for placing. After placing, they are to be protected by pasting on paper, or other methods, from danger. When job is ready for service all fixtures and fittings are to be properly cleaned. Any scraped, chipped or permanently stained fixtures are to be replaced by the Contractor.
- .5 All Manufacturers labels are to be left on fixtures until after Final Inspection and then removed.
- .6 Each fixture to have compression type shut-off valves at the fixture in addition to the faucets on each fixture. These valves are to be adjusted to prevent excessive flow.
- .7 Where fixtures connections pass into walls, floors, ceilings or through millwork they are to be fitted with proper escutcheons.

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MECHANICAL**

Plumbing Fixtures & Trim

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-
- .8 All visible parts of trim of the fixtures including faucets, escutcheons, wastes, strainers, traps, supplies stops, etc., are to be chrome plated.
 - .9 When installing chrome plated trim and accessories, proper care is to be taken. Any wrench or other tool marks on the plating is to be sufficient cause for rejection.
 - .10 All exposed pipe and fittings and fixtures are to be rigidly supported. All fastenings to walls and partitions are to be firmly made without damage to wall finish.
 - .11 Connect all services to plumbing fixtures.
 - .12 At the beginning of the job, obtain from the General Division approval Drawings of the millwork. Co-ordinate the installation of stainless steel sinks and lavatories with the millwork. If there is a discrepancy advise the Consultant before submitting approval Drawings. Failure to do this will result in the Contractor bearing the total cost for replacing sinks that do not fit properly in counter tops.

**NOTRE DAME ELEMENTARY SCHOOL
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MECHANICAL**

Liquid Heat Transfer

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PART 1 - GENERAL

1.1 Related Instructions

- .1 Conform to General Provisions, Section 15010.

1.2 Quality Assurance

- .1 Conform the latest edition, including Amendments of the following Codes and Standards.
- .2 ASHRAE 90.1.
- .3 Local and district by-laws, regulations and published engineering standards.
- .4 2012 Ontario Building Code (OBC) Compendium containing the Building Code Act, and Ontario Regulation 332/12 including all amendments.

1.3 Related Work Specified Elsewhere

- | | | |
|----|----------------------------|---------------|
| .1 | Basic Materials & Methods | Section 15050 |
| .2 | Insulation | Section 15180 |
| .3 | Air Distribution | Section 15800 |
| .4 | Controls & Instrumentation | Section 15900 |
| .5 | Electrical Work | Division 16 |

1.4 Submittals

- .1 Submit Shop Drawings in accordance with Section 15011 - Submittals, for the following equipment:
 - .1 Wall Fin Heating Units

PART 2 - PRODUCTS

2.1 Terminal Units

- .1 **General:**
 - .1 All terminal units shall have element lengths and capacities as indicated on Drawings. Capacities shall be based on 180°F (82.2°C) entering and 160°F (71.1°C) leaving water temperature, and 60°F (18.3°C) entering air temperature.
 - .2 All heating elements shall be aluminum fins mechanically bonded to seamless copper tubing.
 - .3 All terminal heat transfer units shall be treated to multi-step preparation before the addition of an electrostatically applied powder coat paint finish, colour chosen from Manufacturer's standard colours.
 - .4 All finned tube radiation components shall be cleaned and phosphatised to prevent corrosion.
 - .5 Provide for noiseless expansion of all components.

**NOTRE DAME ELEMENTARY SCHOOL
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MECHANICAL**

Liquid Heat Transfer

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Page 2

.2 Wall Fin Convection Radiation - Designated WF-1, WF-2, etc.:

- .1 Copper-Aluminum Element - Tubing shall be 1-1/4" (32 mm) nominal I.D. (1-3/8" (35 mm) O.D.) or 3/4" (19 mm) seamless copper. Fins shall be aluminum 4-1/4" x 4" (108 mm x 102 mm), 0.016" (0.4 mm) thick with a stamped pattern for strength and rigidity. They shall have integral collars to provide even spacing and maximum heat transfer. Fins shall be firmly bonded to the tube by mechanical expansion. All copper-aluminum elements shall have 49 fins/ft. (164 fins/m). Tube ends shall be suitable for connecting with sweat fittings.
- .2 Enclosures - Enclosures shall be constructed of 18 gauge premium cold rolled steel. The enclosures shall be supported at the top by a 1/2" (13 mm) joggle strip mounted on wall and at bottom by support brackets which shall be wall mounted on not more than 3'-0" (1.0 meter) centres. Enclosures shall have factory installed gusset plates to maintain enclosure shape during shipment and installation. Gusset plates shall be welded to enclosure.
- .3 Element Brackets - Element brackets shall consist of a steel cradle mounted on a lexan slide plate which will allow free and quiet element expansion. Element brackets shall be securely fastened to wall brackets on not more than 4'-0" (1200 mm) centres.
- .4 Accessories - Provide all necessary filler pieces, end caps, etc. as required, refer to Drawings.
- .5 Acceptable Products:
 - .1 Trane
 - .2 Engineered Air
 - .3 Sigma

PART 3 - EXECUTION

3.1 Terminal Units

.1 Wallfin Radiation:

- .1 Mounting heights of wall mounted units shall be as recommended by the Manufacturer and shall be closely co-ordinated with all other trades to avoid interferences.
- .2 Support terminal units from structural elements of wall, and not from wall finishes.
- .3 Comply with Manufacturer's installation instructions.
- .4 Provide 12" (305 mm) wide section of removable enclosure at each end for valve access.

**NOTRE DAME ELEMENTARY SCHOOL
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MECHANICAL**

Hot Water Heating Devices

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Section 15701

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PART 1 - GENERAL

1.1 Related Instructions

- .1 Conform to General Provisions, Section 15010.

1.2 Related Work Specified Elsewhere

- | | | |
|----|---------------------------|---------------|
| .1 | Basic Materials & Methods | Section 15050 |
| .2 | Air Distribution | Section 15800 |
| .3 | Electrical Work | Division 16 |

PART 2 - PRODUCTS

2.1 Air Vents

- .1 Automatic air vents shall be used in exposed areas where they can be obviously seen to be leaking. In concealed areas, ceiling spaces, etc., manual vents shall be used. All automatic vents to have pet cock before vent.
- .2 High points in the mains where air will accumulate shall be Provided with a 3/4" x 6" long (20 mm x 150 mm long) air chamber and an Armstrong No. 7 automatic air vent with overflow connector and isolating pet cock.
- .3 Each bottom-fed convector, continuous convector, fan coil unit and cabinet heater shall have a manual air vent assembly consisting of a 3/4" x 6" long
- .4 (20 mm x 150 mm long) chamber and a flexible 1/4" (6 mm) air tube to a manual vent in the end panel or front face, or a rigid iron pipe to the outlet grille with a manual slot head screw.
- .5 Acceptable Products:
 - .1 Armstrong
 - .2 Braukman
 - .3 Amtrol
 - .4 ITT

2.2 Terminal Unit Valves

- .1 All radiators, convector, radiant panels and coil-type heating units shall have shut-off valves on the supply branch at the unit. Valves 1-1/4" (32 mm) in diameter and larger, and for heating units without tapped ends, shall be Crane No. 440 and No. 365-1/2, or Milwaukee 148 and F-2885-M. Smaller radiator-type valves shall be Dahl No. 11042 wheel handle.

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Hot Water Heating Devices

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- .2 Balance Valves: All radiator, convector and coil-type heating units shall have balance valves on the return branch pipe at the unit. Balance valves to 1-1/4" (32 mm) diameter for tapped end heating unit, shall be Dahl 13013. Larger valves shall be Crane No. 7 with No. 1 disc.
- .3 Drain Valves: All low points of heating units and system shall have hose bibb type drains for draining system, Dahl Model #2345 with cap and chain..

PART 3 - EXECUTION

3.1 Valves & Accessories

- .1 Use valves of line size unless noted otherwise or being used for balancing purposes.
- .2 Provide isolating valves in each branch from the main line and where shown.
- .3 Provide isolating valves for all fixtures, appliances etc. including the following:
 - .1 On each branch serving more than three fixtures.
 - .2 At the base of each main riser.
 - .3 Note: Valves are not necessarily shown on the Drawings.
- .4 Unless indicated otherwise Provide radiation circuit balancing valves at each terminal unit and in locations where valve is to be used for regulating purposes. Ball valves are not acceptable for balancing purposes.
- .5 Provide 1/2" (13 mm) ball valve with cap and chain at any low point of the system not drainable through the main supply piping.
- .6 All valves are to be tagged and a chart showing location and equipment controlled to be turned over to the Owner upon completion of the job.
- .7 Escutcheon plates are to be installed at all walls and floors where pipes are exposed to view.
- .8 Install auto air vents at all high points in system.
- .9 Install drain cup at each backflow preventer vent and drain opening and pipe to nearest floor drain.
- .10 All insulated valves shall have extended necks or shafts where the thickness of the insulation interferes with the operating handle.

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Air Distribution - General Provisions

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PART 1 - GENERAL

1.1 Related Instructions

- .1 Conform to the General Provisions, Section 15010.

1.2 Quality Assurance

- .1 Conform to the latest edition, including Amendments of the following Codes and Standards.
- .2 Local and district by-laws, regulations and published engineering standards.
- .3 2012 Ontario Building Code (OBC) Compendium containing the Building Code Act, and Ontario Regulation 332/12 including all amendments.
- .4 SMACNA Standards.
- .5 ASHRAE Recommendations.
- .6 ASHRAE 90.1.

1.3 Related Work Specified Elsewhere

- | | | |
|----|----------------------------|---------------|
| .1 | Painting Colour Coding | Division 9 |
| .2 | Basic Materials & Methods | Section 15050 |
| .3 | Insulation | Section 15180 |
| .4 | Plumbing & Drainage | Section 15400 |
| .5 | Controls & Instrumentation | Section 15900 |
| .6 | Electrical | Division 16 |

1.4 Submittals

- .1 Submit certificates indicating that all required testing has been successfully completed.

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Air Distribution - Duct Construction

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PART 1 - GENERAL

1.1 Related Instructions

- .1 Conform to General Provisions, Section 15010.
- .2 Conform to Air Distribution - General Provisions, Section 15800.

1.2 Quality Assurance

- .1 Conform the latest edition, including Amendments of the following Codes and Standards.
- .2 Local and district by-laws, regulations and published engineering standards.
- .3 2012 Ontario Building Code (OBC) Compendium containing the Building Code Act, and Ontario Regulation 332/12 including all amendments.
- .4 SMACNA Standards.
- .5 ASHRAE Recommendations.
- .6 ASHRAE 90.1.

PART 2 - PRODUCTS

2.1 Rectangular Low Pressure Duct Materials

- .1 For the purpose of this specification low pressure ductwork is to be ducted for systems below 2" (500 Pa) static pressure. This includes all ductwork indicated on the Drawings with the exception of that indicated in other parts of this section. Duct shall be fabricated to SMACNA Duct Construction Standards, Section No. 1, and as follows:
 - .1 HVAC Duct Construction Standards - Metal and Flexible - latest edition.
 - .2 HVAC Duct Leakage Test Manual - latest edition.
- .2 Ductwork shall be constructed to withstand 1-1/2 times the working static pressure with a leakage rate of 5% maximum and designed to operate at 1-1/2" w.g. (373 pa) maximum pressure.
- .3 Fabricate ducts from smooth finish prime grade, new, open hearth, soft steel sheet, galvanized, conforming to manufacturer's standard thickness as specified herein.
- .4 All sides of ducts over 10" (254 mm) in either dimension, to have all sides cross-broken or beaded at 12" (300 mm) spacing, except area of the duct where outlets are to be installed.

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.5 Thickness & Reinforcing of Sheet Metal Ductwork, Material & Thickness:

Largest Duct Dimension	Steel Thickness Gauge (mm) Duct	Steel Thickness Gauge (mm) Slip	Aluminum Thickness Gauge (mm) Duct	Recommend Construction Transverse Joints Slip
Up to 12" (300 mm)	26 (0.551)	26 (0.551)	24	Flat drive cleat on side, flat S cleat on top and bottom. Joints on 96" (2440 mm) centres max.
13" to 20" (330 mm to 508 mm)	24 (0.701)	26 (0.551)	22	Flat drive cleat on side, 1" (25 mm) standing S cleat on top and bottom. Joints on 72" (1819 mm) centres max.
21" to 30" (533 mm to 762 mm)	24 (0.701)	26 (0.551)	22	Flat drive cleat on sides up to 20" (508 mm), and 1" (25 mm) standing drive slip over 20" (508 mm). Top and bottom 1" (25 mm) standing S cleat. Joints on 48" (1219 mm) centres maximum.
31" to 48" (787 mm to 1219 mm)	22 (0.853)	22 (0.853)	20 (1.01)	Flat drive cleat on sides up to 20" (508 mm), and 1" (25 mm) standing drive slip up to 30" (762 mm), and 1" gasketted and bolted formed flange over 30". Top and bottom 1" (25 mm) standing S cleat. Joints on 48" (1219 mm) centres maximum. (* Stays if required.)
49" to 60" (1245 mm to 1529 mm)	20 (1.01)	20 (1.01)	18 (1.16)	Flat drive cleat on sides up to 20" (508 mm), and 1" (25 mm) standing drive slip up to 30" (762 mm), and 1" gasketted and bolted formed flange over 30". Top and bottom 1-1/2" (40 mm) gasketted and bolted formed flange. Joints on 48" (1219 mm) centres maximum.

- .6** The Contractor at his own discretion may also use flange duct joints; Ductmate or Nexus.
- .7** All bends or elbows shall be made with a radius of not less than 1-1/2 times the width of the duct. Where this is not possible, turning vanes shall be used. Vanes shall be of single vane construction with 1-1/2" (40 mm) space up to 24" (600 mm) width, and 3" (80 mm) spacing over 24" (600 mm).
- .8** Branch mains shall be connected to the main duct as specified for ductwork. "T" connection shall be made using a clinch lock.

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- .9 Acoustical Liner: Ducts are to be increased in size by thickness of insulation added to maintain inside dimensions as per indicated duct sizes and to ensure no increase in duct design velocity.

2.2 Circular Duct & Fittings, Single-Wall

- .1 For the purpose of this specification low pressure ductwork is to be ducted for systems below 2" (500 Pa) static pressure. This includes all ductwork indicated on the Drawings with the exception of that indicated in other parts of this section. Duct shall be fabricated to SMACNA Duct Construction Standards Section No. 1 (latest edition).
- .2 All round duct through 26" (660 mm) diameter shall be United Sheet Metal Spiral lock-seam Uni-Seal duct manufactured from galvanized steel meeting ASTM A-527-71 in the following gauges:

Diameter	Metal Thickness	
3" - 7" (76 - 175 mm)	28 ga.	0.01" (0.40 mm)
8" - 14" (203 - 350 mm)	26 ga.	0.022" (0.551 mm)
15" - 26" (381 - 660 mm)	24 ga.	0.028" (0.701 mm)
27" - 35" (685 - 875 mm)	22 ga.	0.022" (0.851 mm)
36" - 52" (900 - 1325 mm)	20 ga.	0.016" (1.0 mm)

- .3 All fittings shall be United Sheet Metal standard Uni-Form fittings manufactured from galvanized steel meeting ASTM A-527-71 with continuous weld or standing seam construction with fitting gauge and thickness equal to or thicker than the downstream duct section with which they are mated.
- .4 All 90 degree T Connections shall have machine formed radiused entrances (laminar flow) on tees to 16" (406 mm) diameter taps off of 18" (457 mm) diameter bodies and machine-rolled (pull-through) entrances on tees to 24" (600 mm) diameter taps off of 24" (600 mm) diameter bodies.
- .5 All 45 degree laterals shall have machine rolled (pull through) entrances on laterals to 12" (300 mm) diameter taps.
- .6 Elbows shall be fabricated to a centre-line radius of 1.5 times the cross-section diameter.
- .7 Sleeve couplings to be used for pipe-to-pipe joints. Insertion length of sleeve couplings and fitting collar shall be 2" (50 mm) for ducts up to 9" (225 mm) diameter and 4" (100 mm) for ducts 10" (250 mm) and over in diameter.
- .8 Longitudinal joints shall be lapped and pressure rolled air tight. All seams, end joints and fittings are to be sealed with duct sealer. Duct sealer to be "United" duct sealer, 3-M, Tough Bond or Duro Dyne S-2.
- .9 All elbows, not die-stamped, shall be fabricated according to the following schedule:

Elbow Angle	Number of Gores
Less than 35 deg.	2
36 deg. through 71 deg.	3
Over 71 deg.	5

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- .10 Acceptable Products:
 - .1 Alpha Sheet Metal
 - .2 Flexmaster

2.3 Flexible Duct

- .1 Flexible duct shall be acoustic type complete with perforated aluminum core, 1" (25 mm) insulation and outer mylar sleeve.
OR
- .2 The flexible duct shall be rated for a maximum working velocity of 2500 FPM (12.7 m/s) and 4" (1500 Pa) W.C. pressure and be listed by Underwriters Laboratories under their UL-181 Standards as Class I, Air Duct and shall comply with NFPA Standard No. 90A.
- .3 Flexible duct shall be maximum 6'-0" (1800 mm) and minimum 3'-0" (900 mm). Install with a minimum number of bends.
- .4 Connection to branch ducts shall be made with spin-in collars. Joints shall be sealed duct type and secured to the duct with metal screw-type bands. Spin-on collars shall be complete with balancing damper.
- .5 Flexible ductwork sizes shall match diffuser neck size.
- .6 Design based on Flexmaster Nova Flex Group - Type T/L-A
- .7 Acceptable Products:
 - .1 Alpha-Flex
 - .2 Cana-Flex
 - .3 Automation Industries
 - .4 Nova Flex Group - Flexmaster

2.4 Flexible Duct

- .1 Flexible duct shall be medical grade insulated (fibreglass blanket shall be totally isolated from the air stream) acoustic type complete with perforated aluminum core, 1" (25 mm) insulation and outer mylar sleeve.
- .2 The flexible duct shall be rated for a maximum working velocity of 2500 FPM (12.7 m/s) and 4" (1500 Pa) W.C. pressure and be listed by Underwriters Laboratories under their UL-181 Standards as Class I, Air Duct and shall comply with NFPA Standard No. 90A.
- .3 Flexible duct shall be maximum 6'-0" (1800 mm) and minimum 3'-0" (900 mm). Install with a minimum number of bends.
- .4 Connection to branch ducts shall be made with spin-in collars. Joints shall be sealed duct type and secured to the duct with metal screw-type bands. Spin-on collars shall be complete with balancing damper.
- .5 Flexible ductwork sizes shall match diffuser neck size.
- .6 Design based on Nova Flex Group - Flexmaster Type T/L-A/Flexmaster Type T/L-AM8
- .7 Acceptable Products:
 - .1 Alpha-Flex

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- .2 Cana-Flex
- .3 Automation Industries
- .4 Nova Flex Group - Flexmaster

2.5 Duct/Plenum Protective Edge

- .1 Supply and install on all edges a pre-formed, galvanized 1-1/2" x 1-1/2" (40 mm x 40 mm) x 16 gauge, 90 degree protective edge.
- .2 Protective edges to be installed after insulation has been applied and before canvas covering.
- .3 See Duct Insulation.

2.6 Hangers

- .1 Horizontal ductwork up to 29" (740 mm) wide shall be supported by galvanized 1" (25 mm) 16 gauge or heavier hangers placed not over 6'-0" (1800 mm) apart, with ends turned under the duct. Secure to duct with sheet metal screws, two (2) per side, and one (1) in bottom.
- .2 Horizontal ductwork 30" (760 mm) wide and over shall rest on galvanized angle iron supports or Unistrut channels, with rod hangers at 6'-0" (1800 mm) spacing as follows:

Duct Size	Rod	Angle
30" to 48" (750 mm to 1200 mm)	1/4" (6 mm)	1-1/2" x 1-1/2" x 1/8" (40 mm x 40 mm x 3 mm)
49" to 72" (1225 mm to 1825 mm)	3/8" (9 mm)	1-1/2" x 1-1/2" x 1/8" (40 mm x 40 mm x 3 mm)
73" to 84" (1850 mm to 2130 mm)	3/8" (9 mm)	1-5/8" x 1-5/8" x 3/16" (45 mm x 45 mm x 5 mm)

- .3 Flexible duct shall be hung as per horizontal ductwork up to 29" (740 mm) wide.

2.7 Duct Sealing

- .1 All duct joints shall be sealed during manufacture with high velocity sealer, equal to Baker Duct-Seal or Duro Dyne DWN high velocity sealer and on the faces of the joints after cleats are installed.
- .2 **DUCT TAPE IS NOT ACCEPTABLE.**

PART 3 - EXECUTION

3.1 Duct Installation - General

- .1 In general, all ducts to be constructed that they may be dismantled and cleaned. All visible internal portions of duct outlets behind grilles and registers to be painted dull black.

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- .2 Before installing ductwork, registers, grilles and diffusers, this Contractor shall check for interference with the work of others, so that grouped ducts, pipes and conduits will not interfere with each other, and that registers, grilles and diffusers are correctly located. See Architect's Reflected Ceiling Plans for final location of grilles, diffusers and sprinkler heads. Prepare interference Drawings as described in Section 15010 before fabricating ductwork. DO NOT USE FLEXIBLE DUCT IN ROOMS WITH NO CEILING.
- .3 Install ductwork essentially as shown, in strict adherence to the ceiling heights indicated on the Architectural Drawings. Architect reserves the right to vary run and shape of ducts and make offsets during the progress of the work as required, to avoid structural or other interferences.
- .4 Ductwork concealed in building construction shall be installed in time so as not to cause delay to the work of other trades, and in ample time to perform tests as required. Concealed ducts shall not be built-in until approval for them has been obtained from the Consultant. Make sheet metal connections to masonry as required for air inlets and exhaust, airtight and weathertight.
- .5 Prepare Shop Drawings, dimensions and locating wall, floor and roof slab openings in ample time to meet the building construction schedule. Field check and approve the size and locations of openings prior to placement of concrete or masonry. Openings required at a later date shall be at this Contractor's expense.
- .6 Interference Drawings shall be provided when the Contractor is supplying alternate equipment in lieu of the specified items in areas shown as Mechanical and Boiler Rooms, etc. He shall provide dimensioned Drawings of the equipment location, showing clearances to walls, ceiling, ducts etc., and also indicate clearances for filter and coil removal etc.

3.2 Ductwork

- .1 Supply and install ductwork and plenums shown and required to complete duct systems and put each in operating condition. Mechanical Drawings indicate general location and route of ductwork to be installed. General layout of ducts may be taken from Drawings, but this Section is responsible for avoiding interferences with other Sections not specifically shown on Mechanical Drawings. Actual measurements shall be taken at building before ductwork is fabricated.
- .2 Make without additional charge, any necessary changes or additions to layout of ductwork to accommodate structural, duct, piping, ceilings, electrical or equipment conditions. Where openings in walls for ductwork have been Provided by others, make full use of such openings by fabricating ductwork to fit them, or if necessary, Provide offsets and transitions to suit. Location of ducts may be altered if change is made before installation is approved by the Consultant, and does not cause Owner or other Sections any extra expense.
- .3 Install in ductwork where shown or required, controls, motorized dampers, coils, filters, fire dampers, etc., in accordance with installation instructions supplied by Equipment Supplier.

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- .4 Supply and install where required to suit system balancing, Lawson-Taylor Pitot Tube openings covers in ductwork for each supply, return and exhaust system. Provide openings at all supply fan discharges and exhaust fan inlets. Locate 15 mm (1/2") openings in straight duct runs to facilitate entry of pitot tube. Provide a minimum of three (3) holes per duct at each of the above locations, and at not more than 18" (450 mm) centres. Openings shall be concealed after tests by this Division.
- .5 After final adjustments are made for air handling systems, lock each control device in position and visually indicate required setting. For balancing dampers, Provide additional locking screw or bolt to approval.
- .6 During construction, temporarily seal open ends of ductwork to exclude entry of foreign material and construction dust.
- .7 Supply and install fire rated smoke sealant in gap between sheetmetal duct wall and finished wall.

3.3 Hangers

- .1 Low pressure ductwork shall have substantial hangers attached to the structure with concrete inserts to secure the ducts in place and prevent vibration. No caddy clips or plumber's tape permitted for hanging ducts. DO NOT SUPPORT FROM METAL DECK.

3.4 Quiet Operation

- .1 Each system has been designed to be quiet in operation, N.C. 35 maximum. It is the responsibility of this Section to supply equipment and to install same, ductwork, etc., to ensure noise levels will be maintained to the satisfaction of the Consultant.

3.5 Outdoor/Exhaust Air Wall Plenums

- .1 Reinforce and brace plenums to SMACNA Duct Construction Standard.
- .2 Form bottom of plenum without seams or with a minimum number of seams. Weld bottom side joints. Weld transverse joints and caulk.
- .3 Slope bottom of plenum down towards louvre/block vent to allow water to drain out of plenum.

3.6 Ductwork Construction

- .1 Ducts up to 24" (600 mm) in either dimension to have reinforcing ribs, spaced not more than 8'-0" (2400 mm) apart.
- .2 Ducts over 24" (600 mm) in either dimension to have reinforcing ribs, spaced not more than 4'-0" (1200 mm) apart. Ducts shall have supplemental stiffening as required to prevent drumming and provide a structurally sound assembly.

3.7 Changes in Shape or Dimension

- .1 Slope requirements for transformations that either increase or decrease duct area to a minimum of 1:7.

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- .2 The angle of transformation at connections to heaters or other equipment is not to exceed 30 degrees from a line parallel to the airflow on the approaching side of the equipment, and 45 degrees on the leaving side of the equipment. The angle of approach may be increased to meet space conditions when the transformation section is provided with vanes.

3.8 Changes In Direction

- .1 Changes in direction and shape shall be kept to the minimum, permitted by distribution requirements and building conditions. Turns to be made with these elbows as required in the following order of preference on all supply, return and exhaust ductwork.
- .2 Unvaned elbow, throat radius 3/4 width of duct and full heel radius.
- .3 Elbows with inside radius less than 3/4 width of duct but not less than 3" (80 mm) and full heel radius and single thickness turning vanes
- .4 Square elbow with single thickness turning vanes spaced at 1-1/2" (40 mm) centres up to 24" (600 mm) duct and 3" (80 mm) centres over 24" (600 mm).

3.9 Balancing Dampers

- .1 Splitter or opposed blade dampers for adjustment of air distribution to respective branches to be located as indicated on Drawings, or as described in other parts of this specification.

3.10 Seams

- .1 Sections to be assembled with Pittsburgh lock or grooved longitudinal seams, fully closed for tightness and appearance.

3.11 Joints & Reinforcement

- .1 Duct sections to be jointed by flat "S" or Standing "S" cleats which conform to following general requirements:
 - .1 Ducts up to 18" (450 mm) in width to have flat "S" cleats on top and bottom and drive cleats on sides.
 - .2 Ducts over 18" (450 mm) width to have standing "S" cleat on top and bottom and drive cleat on sides.
 - .3 Where length of drive cleat exceeds 24" (600 mm), a standing "S" or standing "T" cleat to be used and corners taped for tightness.

3.12 Supporting of Ducts

- .1 All ducts to be adequately supported. For ducts up to 18" (457 mm) in width, hangers to be placed on not more than 8'-0" (2400 mm) centres; ducts 19" (475 mm) and above in width on not more than 48" (1200 mm) centres. Hangers to be placed plumb and present a neat appearance.

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- .2 Hangers on ducts up to 36" (900 mm) in width to be constructed from galvanized band iron 1" x 16 gauge (25 mm x 1.6 mm). On ducts 37" (925 mm) and above in width, hangers to be constructed from galvanized iron angles not less than 1-1/2" x 1-1/2" x 1/8" (40 mm x 40 mm x 3 mm). Hangers to extend down the sides of the ducts to bottom of duct with angle bent around bottom for support. Fasten to duct with sheet metal screws on sides and bottom. Hangers on ducts to be of same material as ductwork. Supply and install high velocity sealant on all sheetmetal screws.
- .3 Hangers bands to extend the full depth of duct with bottom of hanger being toed in under duct. Hangers to be attached to the duct using not less than three rivets or metal screws. Supply and install high velocity sealant on all sheetmetal screws.
- .4 On reinforced concrete, all hangers for ductwork to be fastened to the concrete by Ram-Set studs or expansion shields and lag bolts.
- .5 Ducts cannot in any location, be supported from the furring, ceiling construction, piping, conduit or other ducts.
- .6 The use of perforated band iron for supporting of ducts is not permitted.
- .7 In Mechanical Rooms, at approved locations where ducts are supported from the floor, install galvanized angle irons with base plates anchored to floor slab. Supports to be placed so as not to interfere with access to or around equipment and be attached to the floor slab.

3.13 Reinforcing of Sheet Metal

- .1 All ductwork 12" (300 mm) and over in either dimension to be cross broken except those to which internal rigid board insulation is applied. Where drive cleat is used, top and bottom corners to be caulked before cleat is turned over to make duct air tight.
- .2 All other joints to be caulked at all corners before and after joint is made to make duct completely air tight.
- .3 All standing "S" cleats referred to are to be machine made for purposes of extra reinforcing.
- .4 All longitudinal seams are to be Pittsburgh lock seam hammered over and made air tight.
- .5 Where a duct falls into certain maximum duct size classification the entire duct, sides top and bottom, is to be of the gauge specified.
- .6 Sheet metal screws to be used on sides of ducts where standing "S" cleat is used or reinforcing angle on 12" (300 mm) centres or minimum 2 screws per side.

3.14 Sheet Metal Installation

- .1 During installation, the open ends of ducts shall be protected to prevent debris and dirt from entering. The Prime Mechanical Contractor to install this work in accordance with the overall approved progress schedule and in co-operation with all other Contractors so there is no delay to other trades.

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- .2 All necessary allowances and provisions to be made in the installation of the ducts for the structural conditions of the building and other trades, and ducts to be transformed or divided as may be required. Ductwork to be altered or modified so as to give an effective sectional area equal to that originally shown without exceeding an aspect ratio of 4:1. All of these changes, however, must be approved and installed as directed at the site, or as approved on shop or erection Drawings, and at no additional cost.
- .3 All exposed spiral ducting to be installed in a neat manner with each section overlapping the next and all exposed edges sealed.
- .4 All exposed ducting to be supported from a single hanger rod with support plate on inside of duct.

3.15 Special Bracket

- .1 Where the method of support specified above is not applicable, vertical risers and other duct runs, in general, to be supported by substantial angle brackets designed to meet field conditions.

3.16 Ducts at Masonry

- .1 Where ducts are shown connecting to or terminating at masonry openings, and/or along the edges of all plenums at floors, walls, ceilings, etc. Provide a continuous 1-1/2" x 1-1/2" x 1/8" (40 mm x 40 mm x 6 mm) galvanized angle iron bolted to the construction and made air tight to same by applying approved caulking compound on the angle before they are drawn down tight. The sheet metal at these locations to be bolted to the continuous angle iron.

3.17 Location of Outlets

- .1 The position of all outlets shown on the Drawings are approximate only and this Contractor is to check the location of all outlets with the Consultant and make such adjustments in position as are necessary to conform with architectural features, acoustic tile pattern, etc. and the outlets required by other trades without extra charge. Ceiling outlets and their assemblies to be constructed so that they fit the spacing and manufacture of the removable acoustic ceiling.

3.18 Outside Openings

- .1 Unless specifically noted otherwise, openings in the outside walls, roof, etc. to be left for this Contractor, where shown and required for fresh air intakes and exhausts.
- .2 Louvres, birdscreens, etc. for these intakes and exhausts, to be supplied by Division 10 and installed by this Division. Supply and install all necessary ductwork and plenums for intakes and exhausts and patch around same to make a weather tight job. Co-operate with all other trades on exact location of these openings, ducts, and louvres, serving the air systems. Supply and install 14 ga. insulated louvre blank-offs where shown for blanking off unused portion of louvres.

3.19 Duct Access Doors

- .1 Install access doors to fire or other dampers, for service, inspection, any other normal maintenance requirements, and for cleanouts where required on specialty systems. Ensure that such access doors are of a size that equipment to be attended is accessible.

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- .2 Install an access door on the upstream side of each duct mounted heating coil.

3.20 Fire Dampers

- .1 Fire dampers are to be installed in all locations shown or where required by the Fire Marshal and to local Authority. Fire dampers are to be labelled by Underwriter's Laboratories, Canada.
- .2 Generally where any duct or any outlet passes through any required fire wall, fire separation with a fire resistance rating, or fire rated ceiling the duct to be Provided with an approved automatic fire damper built into the wall. Dampers to be supported from the structure and not from the ducts or grilles, to allow duct drop off under fire conditions.
- .3 In addition, install in all systems where ducts service two or more stories, at each floor level approved dampers, leaf dampers, fitted with fusible links of an approved temperature rating to close air tight on linkage failure. Provide access to dampers for linkage replacement.
- .4 The complete fire damper installation to be in strict accordance with manufacturers recommendations, NFPA-90A and meet the approval of all authorities having jurisdiction. All smoke and fire damper locations to be shown on Record Drawings.

3.21 Fan-Duct Connections

- .1 Install Duro Dyne, Grip-Lock, Durolon duct connectors unless specified otherwise to suit system pressure between ductwork and all fan equipment on both sides to isolate where indicated and on all fan equipment.

3.22 Watertight Duct

- .1 Provide watertight ductwork for all exterior ductwork.
- .2 Form bottom of duct without longitudinal seams. Solder or weld joints of bottom sheets and sides. Solder or weld transverse joints and caulk.

3.23 Supply, Return & Exhaust Fans

- .1 All connections to fans to be made utilizing canvas connections as specified under this Section.
- .2 All fan systems are to be equipped with all accessories indicated in schedule.
- .3 Refer to Section 15900 Controls and Instrumentation and Section 16700 Wiring for Mechanical Equipment, and co-ordinate work.

3.24 Curbs

- .1 All new prefabricated insulated roof curbs supplied by this Division. All curbs flashed by Roofing Contractor. Refer to details on Drawings.

3.25 Sealing of Ducts

- .1 Seal all seams and joints in all duct systems for an air-tight installation.
- .2 Duct sealer shall be high pressure, high velocity water based duct sealer. Apply sealer with either brush or caulking tube.

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- .3 On exposed duct scheduled for painting, seal only with Product from caulking tube, taking care to maintain a neat finished appearance to the duct.

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PART 1 - GENERAL

1.1 Related Instructions

- .1 Conform to General Provisions, Section 15010.
- .2 Conform to Air Distribution - General Provisions, Section 15800.

1.2 Quality Assurance

- .1 Conform the latest edition, including Amendments of the following Codes and Standards.
- .2 Local and district by-laws, regulations and published engineering standards.
- .3 2012 Ontario Building Code (OBC) Compendium containing the Building Code Act, and Ontario Regulation 332/12 including all amendments.
- .4 SMACNA Standards.
- .5 ASHRAE Recommendations.
- .6 ASHRAE 90.1.

1.3 Submittals

- .1 Submit Shop Drawings in accordance with Section 15011 - Submittals for the following equipment:
 - .1 Fire Dampers
 - .2 Roof Intake Penthouse

PART 2 - PRODUCTS

2.1 Fan Duct Connections

- .1 **Regular Low Pressure Duct:** Provide flexible duct connectors Duro-Dyne "Durolon" woven glass fibre 24 oz. per sq. yd. (814 gm per sq.m), tensile strength of not less than 450 lb., coated both sides with Du Pont Hypalon, with 3" (80 mm) metal to 6" (150 mm) Durolon to 6" (150 mm) metal "Grip-Lok" duct connections.
- .2 **Stainless Steel Fume Exhaust Duct:** Provide flexible duct connectors Duro-Dyne "Neoprene" woven glass fibre 30 oz. per sq. yd. (1017 g per sq. m), tensile strength not less than 450 lbs., coated both sides with Polychloroprene, secured to ducts and fans with 1" x 0.12" (25 mm x 3 mm) SS type 316L flat bars or bands using type 316L SS screws or bolts at 4" (100 mm) intervals.

2.2 Splitters & Balancing Dampers

- .1 Splitters to be made of at least the same thickness metal as the duct (minimum thickness 20 ga. (1.006 mm). They are to be securely hinged at the air leaving edge, and made of two thicknesses so the entering edge presents a rounded surface to air flow. Minimum length of splitter is 12" (305 mm). Splitter length is 1-1/2 times the width of the smaller duct when duct width is from 8" to 24" (200 mm to 600 mm). Splitter length for duct widths greater than 24" (600 mm) is 1-1/4 times the width of the smaller duct.

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- .2 Splitters to be anchored at the air entering edge by a SRP-40 Duro Dyne fitting and a 1/8" (3 mm) adjustable rod that passes thru a Duro Dyne SRP-14 ball joint damper casting, on the outside of the duct.
- .3 Balancing dampers for round duct shall be blade style, constructed of 22 U.S. gauge (1.613 mm) thick steel, trimmed for a proper fit within the duct and securely mounted in the duct. Manufactured components such as Nailor 1890 series are considered equal.
- .4 Balancing dampers for square duct shall be multi-blade opposed blade balancing dampers, Nailor 1820 series or equal; 16 gauges galvanized steel blades mounted on 1/2" Celcon bearings in a 16 gauge galvanized frame.
- .5 All balancing dampers to be controlled manually and able to lock in place with damper quadrant or other suitable device. Damper rod end to be marked indicating blade position.
- .6 All dampers serving group Washroom Exhaust systems shall be stainless steel.

2.3 Fire Dampers & Fire Stop Flaps - DESIGNATED FD AND/OR FSF

- .1 Fire dampers to be shall manufactured, tested and labelled in accordance with CAN/ULC-S112, and to be ULC listed and labelled for 1-1/2 hour fire rating. Fire dampers are to meet all requirements of NFPA 90, NBC and OBC.
- .2 Fire dampers to be galvanized steel channel frame curtain type galvanized steel interlocking blades, minimum 22 gauge (0.853 mm) galvanized steel enclosure, and 165°F (70°C) fusible link standard. Fusible links for 135°F (57°C), 212°F (100°C), or 284°F (140°C) shall be Provided if indicated on Drawing as such.
- .3 Fire dampers for horizontal installation in vertical ductwork to be operated by a stainless steel closure spring and latch.
- .4 Fire damper configuration to be low resistance type B with blades located outside of the air stream (unless detailed otherwise) for rectangular ductwork, and type C for round or oval ductwork.
- .5 All fire dampers are to be DYNAMIC rated.
- .6 Fire damper serving ceiling diffuser (FSF) to be butterfly type blade complete with spring type fusible link and thermal resistant blank.
- .7 Acceptable Products:
 - .1 Ruskin
 - .2 Controlled Air
 - .3 Nailor

2.4 Access Panels

- .1 Ductwork to be fabricated from 20 gauge (1.006 mm) galvanized steel, hinged to 20 gauge (1.006 mm) galvanized mounting frame complete with fastening devices and felt gasket. Doors in insulated ducts to be double panel construction with 1/2" (13 mm) rigid insulation between metal.

Acceptable Products:
 - .1 Nailor

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- .2 Controlled Air
- .2 Finished walls and ceilings to be steel as manufactured by Le Hage, and to be as recommended by the Manufacturer for each particular installation.
- .3 Access panels in walls, shafts or ceilings having a fire rating or forming part of a fire rated assembly or fire separation to have ULC 1-1/2 hour B label equal to Le Hage L-1010 with cylinder lock and interior latch release.

Acceptable Products:

- .1 Acudor Acorn Ltd
- .2 Nailor
- .3 Mifab

2.5 Turning Vanes

- .1 Install small arc air foil vanes in ducts at elbows where centre-line radius is less than 1-1/4 times turning dimension of duct.
- .2 Square elbows with turning vanes equal to Duro Dyne single thickness vanes spaced at 1-1/2" (40 mm) centres up to 24" (600 mm) duct and 3" (80 mm) centres over 24" (600 mm).
- .3 Acceptable Products:
 - .1 Duro-Dyne "Duro Vane Rail"
 - .2 Hart & Cooley "Ducturn"

2.6 Access Doors

- .1 **Mandoors:**
 - .1 Access doors in the size range of 12" x 12" (300 mm x 300 mm) to 24" x 24" (600 mm x 600 mm) to be constructed as per SMACNA Low Pressure Duct Standards - Fifth Edition - Fig. 2-14 (Page 2-17). Door Type "C".
 - .2 Factory fabricated access doors equal to Ventlok stamped, hinged, insulated door with #100 latch will be accepted.
 - .3 Note: Mandoors shall open against the air pressure to allow the air pressure to seal the door against the door sealing gasket
 - .1 Positive pressure duct - door opens inward
 - .2 Negative pressure duct - door opens outward

2.7 Acoustic Duct Liner

- .1 Liner shall be flexible, edge coated, tightly bonded, mat-faced and shall be made from lead free inorganic glass fibres bonded by a thermosetting resin.
- .2 Liner shall be 1" (25 mm) thick, 1.4 lb/ft³ (22 kg/m³) density, where designated on the Drawings by diagonal hatching or where specified.
- .3 Liner shall be treated so that the maximum flame spread rating is 25 or less and the smoke development is 50 or less according to local bylaws.

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2.8 Round Spin-In/Spin-On Duct Collars Complete With Balancing Damper

- .1 **Spin-on Collar:** Round duct connection to rectangular duct:
 - .1 Type A: Complete with insulation guard for connect to duct with internal insulation.
 - .2 Type B: For connection to duct without internal insulation.
- .2 **Spin-on Collar:** Take-off connection from rectangular duct to round or flexible duct for air diffusers, troffers etc.
 - .1 Model 1801 (without damper)
 - .2 Model 1802 (with damper)
- .3 Design is based on Flexmaster (NovaFlex Group)
- .4 Acceptable Products:
 - .1 Ductmate Industries
 - .2 Flexmaster

2.9 Round Spin-In Duct Collars

- .1 Spin-In Collar: Take-off connection from rectangular duct to round or flexible duct for air diffusers, troffers etc.
 - .1 Model 1801 (without damper)
 - .2 Model 1802 (with damper)
- .2 Design based on Flexmaster

2.10 Volume Extractor - DESIGNATED SD

- .1 Supply and install volume extractor, where on Drawings, equal to E.H. Price Model AE1S.

2.11 Fan Sheaves

- .1 Supply as requested by the Balancing Agency, replacement sheaves and fan belts for each supply, return, and exhaust fan blower as required during the system air balancing.
- .2 Replacement of sheaves and belts shall be by Division 15800 as requested by the Balancing Agency and Consultant.

2.12 Backdraft Dampers - DESIGNATED BDD

- .1 Supply and install backdraft dampers where indicated on the Drawings, as supplied by E. H. Price (Model BDD-2X) with angle frame for surface mounting and channel frame for in-duct mounting. Provide access door for access to duct mounted units.

PART 3 - EXECUTION

3.1 Balancing Dampers

- .1 Splitter or opposed blade dampers for adjustment of air distribution to respective branches to be located as indicated on Drawings, or as described in other parts of this Specification.

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3.2 Ducts at Masonry

- .1 Where ducts are shown connecting to or terminating at masonry openings, and/or along the edges of all plenums at floors, walls, ceilings, etc. Provide a continuous 1-1/2" x 1-1/2" x 1/8" (38 mm x 38 mm x 3 mm) galvanized angle iron bolted to the construction and made air tight to same by applying approved caulking compound on the angle before they are drawn down tight. The sheet metal at these locations to be bolted to the continuous angle iron.

3.3 Location of Outlets

- .1 The position of all outlets shown on the Drawings are approximate only and this Contractor is to check the location of all outlets with the Consultant and make such adjustments in position as are necessary to conform with architectural features, acoustic tile pattern, etc. and the outlets required by other trades without extra charge. Ceiling outlets and their assemblies to be constructed so that they fit the spacing and manufacture of the removable acoustic ceiling.

3.4 Outside Openings

- .1 Unless specifically noted otherwise, openings in the outside walls, roof, etc. to be left for this Contractor, where shown and required for fresh air intakes and exhausts.
- .2 Louvres, birdscreens, etc. for these intakes and exhausts, to be supplied by Division 10 and installed by this Division. Supply and install all necessary ductwork and plenums for intakes and exhausts and patch around same to make a weather tight job. Co-operate with all other trades on exact location of these openings, ducts, and louvres, serving the air systems. Supply and install 14 ga. insulated louver blank-offs where shown for blanking off unused portion of louvres.

3.5 Duct Access Doors

- .1 Install removable access doors to fire dampers or other dampers, humidifier manifolds, heating coils (both sides), main ducts for cleaning purposes, for service, inspection, any other normal maintenance requirements, and for cleanouts where required on specialty systems. Ensure that such access doors are of a size that equipment to be attended is accessible.
- .2 Access doors are to be fully accessible.

3.6 Turning Vanes

- .1 Install as per manufacturers instructions and/or Detail on the Mechanical Drawings.

3.7 Supply, Return & Exhaust Fans

- .1 All connections to fans to be made utilizing canvas connections as specified under this Section.
- .2 All fan systems are to be equipped with all accessories indicated in schedule.
- .3 Refer to Section 15900 Controls and Instrumentation and Division 16 Wiring for Mechanical Equipment, and co-ordinate Work.

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3.8 Curbs

- .1 All new prefabricated roof curbs supplied by this Division. All curbs flashed by Roofing Contractor. Refer to details on Drawings.

3.9 Motorized Dampers

- .1 Install all motorized dampers supplied by Section 15900 in all locations indicated on the Drawings and described in this Specification, except those dampers supplied as part of a packaged unit.

3.10 Acoustic Duct Liner

- .1 Install acoustic duct liner in all ducts shown diagonally-hatched, or otherwise specified with duct liner.
- .2 Apply adhesive to the interior of the duct and supplement the adhesive with welding pins and clips, the pins shall be spaced no further than 12" apart, no more than 4" in from a corner or edge of the duct. Duct 8" wide and smaller does not require adhesive supplement.
- .3 Trim all pieces of liner such that all corners and joints fit tight, without bulges.
- .4 Apply liner adhesive to all joints, seams, and exposed edges, including all traverse joints as the duct is assembled.
- .5 At the upstream leading edge of exposed liner, Provide a step collar or insulation stop to cover the entire edge of the exposed liner.
- .6 Interrupt the duct liner installation at fire dampers.
- .7 Where dampers (motorized or manual), turning vane, or other interior duct device is to be mounted, Provide a metal hat section or other build out to secure the damper or device. Fire dampers may not be mounted to a hat section, oversize fire dampers to the outside duct dimensions or Provide step collars on either side of the fire damper.

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PART 1 - GENERAL

1.1 Related Instructions

- .1 Conform to General Provisions, Section 15010.
- .2 Conform to Air Distribution - General Provisions, Section 15800.

1.2 Quality Assurance

- .1 Conform the latest edition, including Amendments of the following Codes and Standards.
- .2 Local and district by-laws, regulations and published engineering standards.
- .3 2012 Ontario Building Code (OBC) Compendium containing the Building Code Act, and Ontario Regulation 332/12 including all amendments.
- .4 SMACNA Standards.
- .5 ASHRAE Recommendations.
- .6 ASHRAE 90.1.

1.3 Submittals

- .1 Submit Shop Drawings in accordance with Section 15011 for the following equipment:
 - .1 Grilles
 - .2 Diffusers

PART 2 - PRODUCTS

2.1 Grilles & Diffusers

- .1 Supply and install grilles and diffusers of the type and size shown in the Schedule.
- .2 All grilles and diffusers are designated on the Drawings according to type and CFM. The Manufacturer shall check the Architectural Drawings and Provide the proper frame to suit ceiling or wall construction.
- .3 The Manufacturer shall provide a room schedule showing diffuser type, frame, CFM, and outlet velocity with his approval Drawings.
- .4 **Grilles:** Grilles shall have mounting frame and volume dampers. Dampers shall be key operated through the face. The finish shall be prime coat white enamel.
- .5 **Diffusers:** Diffusers shall have an equalizing grid and opposed blade damper in the supply collar. Finish shall be prime coat white enamel. Trim shall be panel type, overlapping, or interlocking type, as designated and to suit the construction.
- .6 Acceptable Products:
 - .1 Krueger
 - .2 Titus
 - .3 Nailor

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.4 E. H. Price

PART 3 - EXECUTION

3.1 Grilles & Diffusers

- .1 **Location:** Note that the grilles and diffusers are to be carefully centred in the tile or block work. The duct runouts and collars are to be carefully located and adjusted after the ceiling grid is installed. Abrupt offsets in the ductwork will not be accepted.
- .2 Review carefully with Sprinkler Contractor, the Architect's reflected ceiling plans and co-ordinate diffuser, sprinkler heads and light fixtures. Advise Consultant of any interferences.
- .3 Visible portions behind grilles shall be painted flat black by this Section.

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PART 1 - GENERAL

1.1 Related Instructions

- .1 Conform to General Provisions, Section 15010.
- .2 Conform to Air Distribution - General Provisions, Section 15800.

1.2 Section Includes

- .1 Package roof top unit.
- .2 Heat exchanger.
- .3 Refrigeration components.
- .4 Roof curb.
- .5 Electrical power connections.
- .6 Operation and maintenance service.

1.3 Related Sections

- .1 Section 15054 - Electric Motors.
- .2 Section 15160 - Noise & Vibration Control.
- .3 Section 1518 - Insulation.
- .4 Section 15900 - Controls and Instrumentation.
- .5 Division 16: Equipment Wiring Systems.

1.4 References

- .1 NFPA 90 A & B - Installation of Air Conditioning and Ventilation Systems and Installation of Warm Air Heating and Air Conditioning Systems.
- .2 ANSI/ASHRAE 15 - Safety Code for Mechanical Refrigeration.
- .3 AHRI 340/360- 2015 - Commercial and Industrial Unitary Air Conditioning Equipment testing and rating standard.
- .4 ANSI/ASHRAE 37 - Testing Unitary Air Conditioning and Heat Pump Equipment.
- .5 ANSI/ASHRAE/IESNA 90.1-1999 - Energy Standard for New Buildings Except Low-Rise Residential Buildings.
- .6 ANSI Z21.47/UL1995 - Unitary Air Conditioning Standard for safety requirements and testing requirements for commercial warm air furnaces.
- .7 California Energy Commission Administrative Code - Title 20/24 -
- .8 AHRI 210/240 - Unitary Air-Conditioning Equipment and Air- Source Heat Pump Equipment.
- .9 AHRI 270 - Sound Rating of Outdoor Unitary Equipment.

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- .10 AHRI 370 - Sound Rating of Large Outdoor Refrigerating and Air Conditioning Equipment.

1.5 Submittals

- .1 Submit unit performance data including: capacity, nominal and operating performance.
- .2 Submit Mechanical Specifications for unit and accessories describing construction, components and options.
- .3 Submit shop drawings indicating overall dimensions as well as installation, operation and services clearances. Indicate lift points and recommendations and center of gravity. Indicate unit shipping, installation and operating weights including dimensions.
- .4 Submit data on electrical requirements and connection points. Include recommended wire and fuse sizes or MCA, sequence of operation, safety and start-up instructions.
- .5 Shop drawings submitted for approval shall be accompanied by a copy of the purchase agreement between the Contractor and an authorized service representative of the manufacturer for check, test and start up and first year service.

1.6 Delivery, Storage & Handling

- .1 Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.
- .2 Protect units from physical damage. Leave factory shipping covers in place until installation.

1.7 WARRANTY

- .1 Provide parts warranty for one year from start-up or 18 months from shipment, whichever occurs first.
- .2 Provide five-year extended warranty for compressors.
- .3 Provide five-year heat exchanger limited warranty.
- .4 OEM provides several extended warranty options to include:
 - .1 1 Year Labour Warranty-Whole unit

1.8 Maintenance Service

- .1 All work on units shall be accomplished by OEM factory trained and authorized servicing technicians.

1.9 Regulatory Requirements

- .1 Units are cULus listed and labeled.

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PART 2 - PRODUCTS

2.1 Summary

- .1 The contractor shall furnish and install package rooftop unit(s) as shown and scheduled on the contract documents. The unit(s) shall be installed in accordance with this specification and perform at the specified conditions as scheduled.
- .2 Manufacturers
 - .1 Basis of design: Trane Impack
 - .2 Acceptable Products
 - .1 Trane
 - .2 Carrier
 - .3 Daikin

2.2 General

- .1 All units shall be 208V/1Ph/60Hz Packaged Dual Fuel Heat Pump.
- .2 All units shall be factory assembled, piped, internally wired and fully charged with refrigerant. All units shall be designed to operate at outdoor ambient temperatures as high as 115°F. Cooling capacities shall be rated in accordance with A.H.R.I. standards. The unit design is certified to UL Standard 1995 and ANSI 221.47/CSA 2.3, specifically for outdoor applications using natural gas or propane. All units shall be designed for outdoor rooftop or ground level installation. Unit casing is constructed of heavy gauge, galvanized steel and painted with a weather-resistant powder paint.

2.3 Casings

- .1 All panels shall be heavy gauge steel, gasketed and insulated. Foil-faced insulation shall be in the heat exchanger section. Foil-faced insulation shall be in the evaporator section. Base pan shall be heavy gauge steel. WEATHERGUARD™ exterior corrosion resistant screws shall be used for added resistance to rust and corrosion.

2.4 Controls

- .1 Refrigeration cycle controls shall include condenser fan, evaporator fan and compressor contactors. Compressors shall be equipped with a combination internal winding thermostat/current overload. Internal high pressure relief shall also be provided.

2.5 Refrigeration System

- .1 Compressors-The Climatuff® compressor features internal over temperature and pressure protector, total dipped hermetic motor. Other features include: centrifugal oil pump, and low vibration and noise.
- .2 Evaporator Coil-Internally enhanced 3/8-inch OD seamless copper tubing mechanically bonded to aluminum fins, factory pressure and leak tested at 250 to 300 psig. All units have TXV to control refrigeration flow.

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- .3 Condenser Coil - The SpineFin™ condenser coil shall be continuously wrapped, corrosion resistant all aluminum with minimum brazed joints. This coil is 3/8 inch OD seamless aluminum tubing glued to a continuous aluminum fin. Coils are lab tested to withstand 2,000 pounds of pressure per square inch. The outdoor coil provides low airflow resistance and efficient heat transfer. The coil is protected on all four sides by louvered panels.

2.6 Indoor Air Fan

- .1 Direct-drive, forward-curved, centrifugal wheel in a Composite Vortica® Blower housing. Motor shall have thermal overload protection. Permanently lubricated motor bearings. Motor/blower assembly isolated from unit with rubber mounts.

2.7 Condenser Fan

- .1 Direct-drive, draw through propeller type. Weather-proofed permanent split capacitor fan motor shall have built-in thermal overload and permanently lubricated motor bearings.

2.8 Ambient Operation

- .1 Standard refrigerant system operation down to 55°F.

2.9 Gas-Fired Heating System

- .1 Models shall provide completely assembled, wired and piped gas fired heating systems within unit. Design certified by UL, specifically for outdoor application. Threaded gas connection on the unit.
- .2 Electronic Ignition System-Main burner is lit each time thermostat calls for gas heat. Flame sensor proves flame and keeps the main burners on. Should a loss of flame occur, the main valve closes and the spark recurs within 0.8 second. When thermostat is satisfied, main burner is extinguished.
- .3 Forced Combustion Blower-Insures flame stability under varying wind conditions. Gives higher combustion efficiency and location flexibility.
- .4 Heat Exchanger - Stainless steel tubes. Free floating design.
- .5 Burners - Stainless steel. Multi-port inshot.

2.10 Accessories

- .1 24" High Roof Curb-The roof curb shall be designed to mate with the unit and provide support and complete weather-tight installation when properly installed. Curb shall ship knocked down for field assembly and include wood nailer strips.
- .2 Modulating Economizer-This accessory shall be field installed and be composed of the following items: 0-100% fresh air damper, damper drive motor fixed dry bulb enthalpy control, and low voltage polarized plug for electrical connections. A barometric relief damper shall be standard with the economizer and provide a pressure operated damper that shall be gravity closing and prohibit entrance of outside air on equipment "off" cycle.
- .3 2" Filter Frame - Field Installed

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- .4 2" MERV13 Filter - Field Installed

PART 3 - EXECUTION

3.1 Examination

- .1 Contractor shall verify that roof is ready to receive work and opening dimensions are correct.
- .2 Contractor shall verify that proper power supply is available.

3.2 Installation

- .1 Contractor shall install in accordance with manufacturer's instructions.
- .2 Mount units on factory built roof mounting frame providing watertight enclosure to protect ductwork and utility services. Install roof mounting curb level.
- .3 Power wiring by Division 16. Control wiring by Section 15900.
- .4 Unit start-up is to be by Manufacturer's Service Representative. Submit start-up report to Consultant.
- .5 Supply comprehensive wiring diagrams to Division 16. Wiring diagrams shall be specific to this Project and shall be submitted with approval Drawings.

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PART 1 - GENERAL

1.1 Related Sections

- .1 The following sections constitute Related Work:
 - .1 Section 15010 - Mechanical General Provisions
 - .2 Section 15011 - Submittals
 - .3 Section 15013 - Systems Balancing
 - .4 Section 15050 - Basic Materials & Methods
 - .5 Section 15800 - Air Distribution
 - .6 Section 16010 - Electrical General Provisions
 - .7 Section 16300 - Electrical Basic Materials & Methods

1.2 Description

- .1 **General:** The control system consists of standalone controls for each HVAC system as well as various hard-wired interlocks. The system will not include a BAS.

1.3 Codes & Standards

- .1 Work, materials, and equipment shall comply with the most restrictive of local, provincial, and federal authorities' codes and ordinances or these plans and Specifications. As a minimum, the installation shall comply with current editions in effect 30 days prior to receipt of bids of the following codes:
 - .1 Ontario Electrical Safety Code (OESC)
 - .2 Conform to the 2012 Ontario Building Code (OBC) Compendium containing the Building Code Act, and Ontario Regulation 332/12 including all amendments.

1.4 Warranty

- .1 Warrant work, as follows:
 - .1 Warrant labour and materials for specified control system free from defects for a period of 12 months after final acceptance. Control system failures during warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to Owner.

PART 2 - PRODUCTS

2.1 Materials

- .1 Use new Products that the Manufacturer is currently manufacturing.

2.2 Wiring & Raceways

- .1 General: Provide copper wiring, plenum cable, and raceways as specified in the applicable sections of Division 16.
- .2 All insulated wire to be copper conductors, UL labelled for 90°C minimum service.

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PART 3 - EXECUTION

3.1 Examination

- .1 The Project plans shall be thoroughly examined for control device and equipment locations. Any discrepancies, conflicts, or omissions shall be reported to the Consultant for resolution before rough-in Work is started.
- .2 The Contractor shall inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the Consultant for resolution before rough-in Work is started.
- .3 The Contractor shall examine the Drawings and Specifications for other parts of the work. If head room or space conditions appear inadequate -or if any discrepancies occur between the plans and the Contractor's Work and the plans and the Work of others -the Contractor shall report these discrepancies to the Consultant and shall obtain written instructions for any changes necessary to accommodate the Contractor's Work with the Work of others. Any changes in the Work covered by this Specification made necessary by the failure or neglect of the Contractor to report such discrepancies shall be made by, and at the expense of, this Contractor.

3.2 Protection

- .1 The Contractor shall protect all Work and material from damage by his/her Work or employees and shall be liable for all damage thus caused.
- .2 The Contractor shall be responsible for his/her work and equipment until finally inspected, tested, and accepted. The Contractor shall protect any material that is not immediately installed. The Contractor shall close all open ends of Work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

3.3 Coordination

- .1 Site:
 - .1 Where the mechanical Work will be installed in close proximity to, or will interfere with, Work of other trades, the Contractor shall assist in working out space conditions to make a satisfactory adjustment. If the Contractor installs his/her Work before coordinating with other trades, so as to cause any interference with Work of other trades, the Contractor shall make the necessary changes in his/her Work to correct the condition without extra charge.
 - .2 Coordinate and schedule Work with all other Work in the same area, or with Work that is dependant upon other work, to facilitate mutual progress.
- .2 **Submittals:** Refer to the Submittals article in Part 1 of this Specification for requirements.

3.4 Wiring

- .1 All control and interlock wiring shall comply with national and local electrical codes and Division 16 of this specification. Where the requirements of this section differ from those in Division 16, the requirements of this section shall take precedence.
- .2 All NEC Class 1 (line voltage) wiring shall be UL Listed in approved raceway according to OESC and Division 16 requirements.

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- .3 All low-voltage wiring shall meet OESC Class 2 requirements. (Low-voltage power circuits shall be sub-fused when required to meet Class 2 current limit.)
- .4 Where OESC Class 2 (current-limited) wires are in concealed and accessible locations, including ceiling return air plenums, approved cables not in raceway may be used provided that cables are UL Listed for the intended application. For example, cables used in ceiling plenums shall be UL Listed specifically for that purpose.
- .5 All wiring in mechanical, electrical, or service rooms -or where subject to mechanical damage -shall be installed in raceway at levels below 3 m (10 ft.).

SEQUENCES OF OPERATION

3.5 Wall Fin Convectors - Designated WF-1/WF-2

- .1 Supply and install a remote mounted Braukmann thermostatic control valve and controller to control each wall fin. Provide guard at each thermostat.

3.6 Rooftop Unit RTU-1/RTU-2

- .1 Each rooftop unit comes complete with on-board controls, remote programmable thermostat and duct mounted discharge air stat.
- .2 Install and wire programmable thermostat to terminal strip at unit (typical of 2).
- .3 Install and wire discharge air stat to terminal strip at unit (typical of 2).

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PART 1 - GENERAL

1.1 References

- .1 Division 00 and Division 01 apply to and are a part of this Section.

1.2 Application

- .1 This Section specifies requirements that are common to Electrical Divisions work Sections and it is a supplement to each Section and is to be read accordingly. Where requirements of this Section contradict requirements of Divisions 00 or 01, conditions of Division 00 or 01 to take precedence.
- .2 Be responsible for advising product vendors of requirements of this Section.

1.3 Definitions

- .1 "concealed" - means hidden from normal sight in furred spaces, shafts, ceiling spaces, walls and partitions.
- .2 "exposed" - means work normally visible, including work in equipment rooms, service tunnels, and similar spaces.
- .3 "finished" - means when in description of any area or part of an area or a product which receives a finish such as paint, or in case of a product may be factory finished.
- .4 "provision" or "provide" (and tenses of "provide") - means supply and install complete.
- .5 "install" (and tenses of "install") - means secure in position, connect complete, test, adjust, verify and certify.
- .6 "supply" - means to procure, arrange for delivery to site, inspect, accept delivery and administer supply of products; distribute to areas; and include manufacturer's supply of any special cables, standard on site testing, initial start-up, programming, basic commissioning, warranties and manufacturers' assistance to Contractor.
- .7 "delete" or "remove" (and tenses of "delete" or "remove") - means to disconnect, make safe, and remove obsolete materials including back boxes and exposed piping and raceways; and patch and repair/finish surfaces to match adjoining similar construction; include for associated re-programming of systems and/or change of documentation identifications to suit deletions, and properly dispose of deleted products off site unless otherwise instructed by Consultant.
- .8 "BAS" - means building automation system; "BMS" - means building management system, "FMS" - means facility management system; and "DDC" means direct digital controls; references to "BAS", "BMS", "FMS" and "DDC" generally mean same.
- .9 "governing authority" and/or "authority having jurisdiction" and/or "regulatory authority" and/or "Municipal authority" - means government departments, agencies, standards, rules and regulations that apply to and govern work and to which work must adhere.
- .10 "Mechanical Divisions" - refers to Division 15 and other Divisions as specifically noted, and which work as defined in Specifications and/or on Drawings is responsibility of Mechanical Contractor, unless otherwise noted.

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- .11 "Electrical Divisions" - refers to Division 16 and other Divisions as specifically noted, and which work as defined in Specifications and/or on Drawings is responsibility of Electrical Contractor, unless otherwise noted.
- .12 "Mechanical Divisions" - refers to Divisions 21, 22, 23, 25 and other Divisions as specifically noted, and which work as defined in Specifications and/or on drawings is responsibility of Mechanical Contractor, unless otherwise noted.
- .13 "Electrical Divisions" - refers to Divisions 26, 27, 28 and other Divisions as specifically noted, and which work as defined in Specifications and/or on drawings is responsibility of Electrical Contractor, unless otherwise noted.
- .14 "Consultant" - means person, firm or corporation identified as such in Agreement or Documents, and is licensed to practice in Place of the Work, and has been appointed by Owner to act for Owner in a professional capacity in relation to the Work.
- .15 Wherever words "indicated", "shown", "noted", "listed", or similar words or phrases are used in Contract Documents they are understood, unless otherwise defined, to mean product referred to is "indicated", "shown", "listed", or "noted" in Contract Documents.
- .16 Wherever words "reviewed", "satisfactory", "as directed", "submit", or similar words or phrases are used in Contract Documents they are understood, unless otherwise defined, to mean that work or product referred to is "reviewed by", "to the satisfaction of", "submitted to", etc., Consultant.

1.4 Documents

- .1 Documents for bidding include but are not limited to issued Drawings, Specifications and Addenda.
- .2 Specification is arranged in accordance with CSI/CSC 16 Division Sections MasterFormat.
- .3 Drawings and Specifications are portions of Contract Documents and identify labour, products and services necessary for performance of work and form a basis for determining pricing. They are intended to be cooperative. Perform work that is shown, specified, or reasonably implied on the drawings but not mentioned in Specification, or vice-versa, as though fully covered by both.
- .4 Review Drawings and Specification in conjunction with documents of other Divisions and, where applicable, Code Consultant's report.
- .5 Unless otherwise specifically noted in Specifications and/or on Drawings, Sections of Electrical Divisions are not intended to delegate functions nor to delegate work and supply of materials to any specific trade, but rather to generally designate a basic unit of work, and Sections are to be read as a whole.
- .6 Drawings are performance drawings, diagrammatic, and show approximate locations of equipment and materials. Any information regarding accurate measurement of building is to be taken on site. Do not scale Drawings, and do not use Drawings for prefabrication work.
- .7 Drawings are intended to convey scope of work and do not show architectural and structural details. Provide fittings, offsets, transformations and similar items required as a result of obstructions and other architectural and/or structural details but not shown on Drawings.

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- .8 Locations of equipment and materials shown may be altered, when reviewed by Consultant, to meet requirements of equipment and/or materials, other equipment or systems being installed, and of building, all at no additional cost to Contract.
- .9 Specification does not generally indicate specific number of items or amounts of material required. Specification is intended to provide product data and installation requirements. Refer to schedules, Drawings (layouts, riser diagrams, schematics, details) and Specification to provide correct quantities. Singular may be read as plural and vice versa.
- .10 Starter/motor control centre (MCC)/variable frequency drive (VFD) schedule drawings are both mechanical and electrical, and apply to work of Mechanical Divisions and Electrical Divisions. Be responsible for reviewing starter, MCC, VFD, and motor specification requirements of Mechanical Divisions specifications and drawings, prior to Bid submission. Confirm and coordinate exact scope of work and responsibility of work between Mechanical Divisions and Electrical Divisions.
- .11 Drawings and Specifications are prepared solely for use by party with whom Consultant has entered into a contract and there are no representations of any kind made by Consultant to any other party.
- .12 When scale and date of Drawings are same, or when discrepancy exists within Specification, include most costly arrangement to take precedence.
- .13 In case of discrepancies or conflicts between Drawings and Specification, documents will govern in following order:
 - .1 Specification;
 - .2 Drawings of larger scale;
 - .3 Drawings of smaller scale;
 - .4 Drawings of later date when scale of Drawings is same.
- .14 In case of discrepancies or conflicts between Drawings and Specifications, Documents will govern in order specified in "General Conditions", however, when scale and date of Drawings are same, or when discrepancy exists within Documents, include most costly arrangement.

1.5 Metric & Imperial Measurements

- .1 Generally, both metric and imperial units of measurement are given in Sections of Specification governed by this section. Measurement conversions may be generally "soft" and rounded off. Exact measurements to be confirmed based on application. Where measurements are related to installation and on-site applications, confirm issued document measurements with applicable local code requirements, and/or as applicable, make accurate measurements on site. Where significant discrepancies are found, immediately notify Consultant for direction.

1.6 Examination of Bid Documents & Site

- .1 Carefully examine Documents and visit site to determine and review existing site conditions that will or may affect work, and include for such conditions in Bid Price.
- .2 Report to Consultant, prior to Bid Submittal, any existing site condition that will or may affect performance of work as per Documents. Failure to do so will not be grounds for additional costs.

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- .3 Upon finding discrepancies in, or omissions from Documents, or having doubt as to their meaning or intent, immediately notify Consultant, in writing.

1.7 Work Standards

- .1 Where any Code, Regulation, bylaw, standard, contract form, manual, printed instruction, and installation and application instruction is quoted it means, unless otherwise specifically noted, latest published edition at time of submission of Bids adopted by and enforced by local governing authorities having jurisdiction. Include for compliance with revisions, bulletins, supplementary standards or amendments issued by local governing authorities.
- .2 Where regulatory codes, standards and regulations are at variance with Drawings and Specification, more stringent requirement will apply unless otherwise directed by Consultant.
- .3 Supplementary mandatory Specifications and requirements to be used in conjunction with project include, but are not limited to, the following:
 - .1 American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc., (ASHRAE);
 - .2 American Standards Association (ASA or ANSI);
 - .3 ANSI/ASHRAE Standard 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings;
 - .4 Building Industry Consulting Services, International (BICSI);
 - .5 Canadian Standards Association (CSA);
 - .6 CSA C282, "Emergency Electrical Power Supply For Buildings";
 - .7 Electrical and Electronic Manufacturers Association of Canada (EEMAC);
 - .8 Electrical Safety Authority (ESA);
 - .9 Electronic Industries Association (EIA);
 - .10 Illuminating Engineering Society (IES);
 - .11 Institute of Electrical and Electronic Engineers (IEEE);
 - .12 Occupational Health and Safety Act - Ontario Regulation 632, "Confined Spaces";
 - .13 Occupational Health and Safety Act (OHSA);
 - .14 Ontario Building Code (OBC);
 - .15 Ontario Electrical Safety Code (OESC);
 - .16 Technical Standards and Safety Authority (TSSA);
 - .17 Telecommunications Industry Association (TIA);
 - .18 Underwriters Laboratories of Canada (ULC);
 - .19 Material Safety Data Sheets by product manufacturers;
 - .20 local utility inspection permits;
 - .21 Codes, Standards, and Regulations of local governing authorities having jurisdiction;
 - .22 additional codes and standards listed in Trade Sections;
 - .23 Owner's standards.

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- .4 Provide applicable requirements for barrier free access in accordance with latest edition of local governing building code.
- .5 Where any governing Code, Regulation, or Standard requires preparation and submission of special details or drawings for review they are to be prepared and submitted to appropriate authorities. Be responsible for costs associated with these submittals.
- .6 Unless otherwise specified install, equipment in accordance with equipment manufacturer recommendations and instructions, and requirements of governing Codes, Standards, and Regulations. Governing Codes, Standards, and Regulations take precedence over manufacturer instructions.
- .7 Work is to be performed by journeyperson tradesmen who perform only work that their certificates permit, or by apprentice tradesmen under direct on site supervision of experienced journeyperson tradesman. Journeyperson to apprentice ratio is not to exceed ratio determined by the Board as stated in Ontario College of Trades and Apprenticeship Act or local equivalent governing body in Place of the Work.
- .8 Journeyperson tradesmen are to have a copy of valid trade Certificates available at site for review by Consultant at any time.
- .9 Experienced and qualified superintendent is to be on-site at times when work is being performed.
- .10 Coordinate work inspection reviews and approvals with governing inspection department to ensure that construction schedule is not delayed. Be responsible for prompt notification of deficiencies to Consultant and submission of reports and certificates to Consultant.
- .11 Properly protect equipment and materials on site from damage due to elements and work of trades, to satisfaction of Consultant. Equipment and materials are to be in new condition upon Substantial Performance of the Work.

1.8 Permits, Certificates, Approvals & Fees

- .1 Contact and confirm with local authorities having jurisdiction including utility providers, requirements for approvals from such authorities.
- .2 Submit required applications, shop drawings, electrical distribution system protection device coordination studies, and short circuit calculations, and any other information requested by local authority.
- .3 Be responsible for ensuring that authorities having jurisdiction which require on-site inspection of work, have ample notification to perform inspection, with sufficient lead time to correct deficiencies in a manner that will not impede schedule of completion of Work.
- .4 Submit to Consultant, approval/inspection certificates issued by governing authorities to confirm that Work as installed is in accordance with rules and regulations of local governing authorities and are acceptable.
- .5 Include in each copy of operating and maintenance instruction manuals, copies of approvals and inspection certificates issued by regulatory authorities.
- .6 Where electromagnetic locks are provided whether by this Division or by others, be responsible for obtaining and paying for required certificates of work with regards to such electromagnetic lock work.

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1.9 Requirements For Contractor Retained Engineers

- .1 Professional engineers retained to perform consulting services with regard to Project work, i.e. seismic engineer, fire protection engineer, or structural engineer, are to be members in good standing with local Association of Professional Engineers, and are to carry and pay for errors and omissions professional liability insurance in compliance with requirements of governing authorities in Place of the Work.
- .2 Retained engineer's professional liability insurance is to protect Contractor's consultants and their respective servants, agents, and employees against any loss or damage resulting from professional services rendered by aforementioned consultants and their respective servants, agents, and employees in regards to the Work of this Contract.
- .3 Liability insurance requirements are as follows:
 - .1 coverage is to be a minimum of \$1,000,000.00 CDN inclusive of any one occurrence;
 - .2 insurance policy is not to be cancelled or changed in any way without insurer giving Owner minimum thirty days written notice;
 - .3 liability insurance is to be obtained from an insurer registered and licensed to underwrite such insurance in the Place of the Work;
 - .4 Retained consultants are to ascertain that sub-consultants employed by them carry insurance in the form and limits specified above;
 - .5 evidence of the required liability insurance in such form as may be required is to be issued to Owner, the Owner designated Consultant, and Municipal Authorities as required prior to commencement of aforementioned consultants services.

1.10 Workplace Safety

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials. Submit WHMIS MSDS (Material Safety Data Sheets) for products where required, and maintain one copy at site in a visible and accessible location available to personnel.
- .2 Comply with requirements of Occupational Health and Safety Act and other regulations pertaining to health and safety, including worker's compensation/ insurance board and fall protection regulations. When working in confined spaces, comply with requirements of Occupational Health and Safety Act - Ontario Regulation 632, "Confined Spaces" and any other applicable Ministry of Labour requirements.
- .3 If at any time during course of existing building work, hazardous materials other than those identified in Documents and pertaining to Project Scope of Work, are encountered or suspected that were not identified as being present and which specific instructions in handling of such materials were not given, cease work in area in question and immediately notify Consultant. Comply with local governing regulations with regards to working in areas suspected of containing hazardous materials. Do not resume work in affected area without approval from Consultant.

1.11 Planning & Layout of Work

- .1 Base installation layout, design, terminations, and supply of accessories, on Contract Documents with specific coordination with reviewed shop drawings.

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- .2 Plan, coordinate, and establish exact locations and routing of services with affected trades prior to installation such that services clear each other as well as other obstructions. Generally, order of right of way for services to be as follows:
 - .1 piping requiring uniform pitch;
 - .2 piping 100 mm (4") dia. and larger;
 - .3 large ducts (main runs);
 - .4 cable tray and bus duct;
 - .5 conduit 100 mm (4") dia. and larger;
 - .6 piping less than 100 mm (4") dia.;
 - .7 smaller branch ductwork;
 - .8 conduit less than 100 mm (4") dia..
- .3 As confirmed with Consultant, Mechanical Contractor is to determine final locations of major work within ceiling spaces.
- .4 Unless otherwise shown or specified, conceal work in finished areas, and conceal work in partially finished and/or unfinished areas to extent made possible by the area construction. Install services as high as possible to conserve headroom and/or ceiling space. Notify Consultant where headroom or ceiling space appears to be inadequate prior to installation of work.
- .5 Do not use Contract Drawing measurements for prefabrication and layout of raceways, conduits, ducts, bus ducts, luminaires, and other such work. Locations and routing are to be generally in accordance with Contract Drawings, however, prepare layout drawings for such work. Use established bench marks for both horizontal and vertical measurements. Confirm inverts, coordinate with and make allowances for work of other trades. Accurately layout work, and be entirely responsible for work installed in accordance with layout drawings. Where any invert, grade, or size is at variance with Contract Drawings, notify Consultant prior to proceeding with work.
- .6 Prepare plan and interference drawings (at a minimum drawing scale of 1:50 or 1/4"= 1'-0") of work for coordination with each trade Contractor. Arrange for preparation of detailed section drawings of ceiling spaces of corridors and any other congested areas. Sections are to be cross referenced with plan drawings so that trades may make use of section drawings. Section drawings to indicate lateral and elevation dimensions of major services within ceiling space. Lateral dimensions are to be from grid lines and elevations from top of floor slab. Obtain from Consultant, engineering drawings for this use. Contractors interference drawings are to be distributed among other Trade Contractors. Submit drawings to Consultant for review. Failure of General Contractor to prepare and coordinate overall interface drawings of trades does not relieve respective Division Contractor of responsibility to ensure that work is properly planned and coordinated.
- .7 Carry out alterations in arrangement of work that has been installed without proper coordination, study, and review, even if in accordance with Contract Documents, in order to conceal work behind finishes, or to allow installation of other work, without additional cost. In addition, make necessary alterations in other work required by such alterations, without additional cost.
- .8 Control products, products requiring maintenance, junction boxes, and similar products, particularly such products located above suspended ceilings must be located for easy access for servicing and/or removal. Products which do not meet this location requirement are to be relocated to an accessible location at no additional cost.

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- .9 Be responsible for making necessary changes, at no additional cost, to accommodate structural and building conditions that were missed due to lack of coordination.
- .10 Where drawings indicate that acoustic tile ceiling is being suspended below plaster ceiling, coordinate design of framework used to support suspended ceiling, lighting, diffusers, and other Divisions components that are mounted within or through ceiling. Do not mount devices to suspended ceiling. Secure and mount to ceiling slab above. Seal ceiling openings to maintain required fire rating.
- .11 Protect existing areas above, below and adjacent areas of Work from any debris, noise, or interruptions to existing services to satisfaction of Owner and Consultant. Maintain in operation existing services to these areas to allow Owner to continue use of these areas. If services that are required to be maintained run through areas of renovations, provide necessary protection to services or reroute, in coordination with Owner and Consultant. Include for required premium time work to meet these requirements.
- .12 Work being performed within occupied spaces and work affecting surfaces adjacent to occupied spaces may need to be performed after regular business hours. For areas where spaces are used by Owner on a 24 hours basis or over various hours, coordinate hours of work with Owner on a regular basis to suit Owner's schedule. Execute work at times confirmed with and agreed to by Consultant and Owner, so as not to inconvenience Owner's occupation or in any way hinder Owner use of building. Include for required premium timework to meet these requirements.
- .13 Project partial occupancy permits to be required throughout project. Provide for each partial permit, local governing authority certificate and any other testing/verification certificates for systems.

1.12 Coordination of Work

- .1 Review Contract Documents and coordinate work with work of each trade. Coordination requirements are to include, but not be limited to following:
 - .1 requirements for openings, sleeves, inserts and other hardware necessary for installation of work;
 - .2 concrete work such as housekeeping pads, sumps, bases, etc., required for work, and including required dimensions, operating weight of equipment, location, etc.;
 - .3 depth and routing of excavation required for work, and requirements for bedding and backfill;
 - .4 wiring work required for equipment and systems but not specified to be done as part of mechanical work, including termination points, wiring type and size, and any other requirements.
- .2 Ensure materials and equipment are delivered to site at proper time and in such assemblies and sizes so as to enter into building and be moved into spaces where they are to be located without difficulty.
- .3 Wherever possible, coordinate equipment deliveries with manufacturers and/or suppliers so equipment is delivered to site when it is required, or so it can be stored within building subject to available space as confirmed with Owner and protected from elements.

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- .4 Ensure proper access and service clearances are maintained around equipment, and, where applicable, access space for future equipment removal or replacement is not impeded. Comply with code requirements with regards to access space provision around equipment. Remove and replace any equipment which does not meet this requirement.
- .5 Where work is to be integrated, or is to be installed in close proximity with work of other trades, coordinate work prior to and during installation.

1.13 Component Final Locations

- .1 Owner and Consultant reserve right to relocate electrical components such as receptacles, switches, communication system, outlets, hard wired outlet boxes and luminaries at a later date, but prior to installation, without additional cost to Owner, if relocation per components do not exceed 3 m (10') from original location. No credits will be anticipated where relocation per components of up to and including 3 m (10') reduces materials, products and labour. Should relocations exceed 3 m (10') from original location, adjust contract price for that portion beyond 3 m (10') in accordance with provisions for changes in Contract Documents.

1.14 Systems Coordination

- .1 Be responsible for and perform specific coordination of various low voltage systems supplied by Electrical Divisions and also with systems supplied by other Divisions of Work. Include for but not be limited to provision of following, as applicable:
 - .1 coordinate with General Contractor and other Subcontractors, various systems of trades which in any way are interfaced with or monitored by or integrated to, or need to be coordinated with;
 - .2 prepare systems coordination drawings detailing related system coordination and integration points being monitored and/or controlled; submit coordination drawings as part of shop drawing submission;
 - .3 coordinate security system requirements with successful door hardware supplier and prepare detailed coordination drawings of component installations, wiring and conduit layouts, division of responsibility between various trades, etc.; review security system requirements with associated door hardware (electromagnetic locks, electric strikes, etc.), to ensure proper sequence of operation and door functionality is provided to suit each door configuration; prepare detailed door functionality of each door configuration and submit for review by Consultant;
 - .4 review systems requirements for component back boxes and conduits; ensure that system of conduits and boxes meet respective system wiring bending radii requirements;
 - .5 review specifications of each trade/Division (i.e. for BAS points, elevator requirements, electrical devices in millwork or prefabricated service consoles, outlet box and back box requirements), to ensure proper power supplies, interconnecting wiring requirements and back box/ outlet box requirements;
 - .6 review with manufacturers coordination and integration requirements of their systems;
 - .7 review each systems communication protocols to ensure they are compatible and can communicate with each other as required;

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- .8 review system shop drawings prior to submission to Consultant, to verify that each system has been coordinated with other systems and that required options and features are selected to meet coordination requirements;
- .9 be present at testing and commissioning functions of each system and provide technical assistance with regards to system operations;
- .10 be "on-site" coordinator of respective system trades with regards to respective system coordination of installation and testing;
- .11 coordinate with Consultant with regards to ensuring that systems coordinate and integrate properly to satisfaction of Owner;
- .12 document coordination and integration requirements and maintain records for submission as part of shop drawings;
- .13 respond to coordination and integration requirements and be responsible for such work;
- .14 where a system integrator has been included for, coordinate integration requirements with system integrator.

1.15 Products

- .1 Be responsible for ordering of products (equipment and materials) in a timely manner in order to meet project-scheduling timelines. Failure to order products to allow manufacturers sufficient production/delivery time to meet project-scheduling timelines is an unacceptable reason to request for other suppliers or substitutions.
- .2 Provide Canadian manufactured products wherever possible or required and when quality and performance is obtainable at a competitive price. Products are to be supplied from manufacturer's authorized Canadian representative, unless otherwise noted. Unless otherwise specified, products are to be new and are to comply with applicable respective Canadian standards. References to UL listings of products to include requirements that products are to be also Underwriters Laboratories of Canada (ULC) listed for use in Canada. Products are to meet or exceed latest ANSI/ASHRAE/IES 90.1 standards, as applicable. Do not supply any products containing asbestos materials or PCB materials.
- .3 Systems and equipment of this Project are to be "State of the Art" and be most recent and up to date series/version of product that is available at time of shop drawing review process. Products that have been stored or "on shelf" for an extended period of time will not be accepted. Software is to be of latest version available and be provided with updates available at time of shop drawing review process. Systems are to be designed such that its software is backwards compatible. Future upgrades are not to require any hardware replacements or additions to utilize latest software.
- .4 Products scheduled and/or specified have been selected to establish a performance and quality standard, and, in some instances, a dimensional standard. In most cases, base specified manufacturers are stated for any product specified by manufacturer's name and model number. Where acceptable manufacturers are listed, first name listed is base specified company. Bid Price may be based on products supplied by any of manufacturers' base specified or named as acceptable for particular product. If acceptable manufacturers are not stated for a particular product, base Bid Price on product supplied by base specified manufacturer.

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- .5 Documents have been prepared based on product available at time of Bidding. If, after award of Contract, and if successful manufacturer can no longer supply a product that meets base specifications, notify Consultant immediately. Be responsible for obtaining other manufacturers product that complies with base specified performance and criteria and meets project timelines. Proposed products are subject to review and consideration by Consultant and are considered as substitutions subject to a credit to Contract. In addition, if such products require modifications to room spaces, mechanical systems, electrical systems, etc., include required changes. Such changes are to be submitted in detail to Consultant for review and consideration for acceptance. There will be no increase in Contract Price for revisions. Above conditions supplement and are not to supersede any specification conditions in Division 01 with regards to substitutions or failure to supply product
- .6 Listing of a product as "acceptable" does not imply automatic acceptance by Consultant and/or Owner. It is responsibility of Contractor to ensure that any price quotations received and submittals made are for products that meet or exceed specifications included herein.
- .7 If products supplied by a manufacturer named as acceptable are used in lieu of base specified manufacturer, be responsible for ensuring that they are equivalent in performance and operating characteristics (including energy consumption if applicable) to base specified products. It is understood that any additional costs (i.e. for larger starters, larger feeders, additional spaces, etc.), and changes to associated or adjacent work resulting from provision of product supplied by a manufacturer other than base specified manufacturer, is included in Bid Price. In addition, in equipment spaces where equipment named as acceptable is used in lieu of base specified equipment and dimensions of such equipment differs from base specified equipment, prepare and submit for review accurately dimensioned layouts of rooms affected, identifying architectural and structural elements, systems and equipment to prove that equipment in room will fit properly meeting design intent. There will be no increase in Contract Price for revisions.
- .8 In addition to manufacturer products base specified or named as acceptable, other manufacturers of products may be proposed as substitutions to Consultant for review and consideration for acceptance, listing in each case a corresponding credit for each substitution proposed. However, base Bid Price on products base specified or named as acceptable. Certify in writing to Consultant that proposed substitution meets space, power, design, energy consumption, and other requirements of base specified or acceptable product. It is understood that there will be no increase in Contract Price by reason of any changes to associated equipment, mechanically, electrically, structurally or architecturally, required by acceptance of proposed substitution. Consultant has sole discretion in accepting any such proposed substitution of product. Indicate any proposed substitutions in areas provided on Bid Form. Do not order such products until they are accepted in writing by Consultant.
- .9 Indicate in Electrical Supplementary Bid Form, names of manufacturers for proposed products to be supplied, and which were based specified or scheduled with a manufacturer name. Names of proposed manufacturers on list must be one of names stated as acceptable for particular products, unless prior written permission from Consultant has been given for use of products by other manufacturers. Submit as directed.

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- .10 Where products are listed as "or approved equal", certify in writing that product to be used in lieu of base specified product, at least meets space, power, design, energy consumption, and other requirements of base specified product and is equivalent or better than base specified product. When requested by Consultant, provide full design detail drawings and specifications of proposed products. Acceptance of these "or approved equal" products is at sole discretion of Consultant. It is understood that there will be no increase in Contract Price by reason of any changes to associated equipment, mechanically, electrically, structurally or architecturally, required by acceptance of approved equal product. There must be no increase in Contract price due to Consultant's rejection of proposed equivalent product.
- .11 Whenever use of product other than base specified product is being supplied, ensure corresponding certifications and product information (detailed catalogue and engineering data, fabrication information and performance characteristics) are submitted to Consultant for review. Failure of submission of these documents to Consultant in a timely manner to allow for review will result in base specified product to be supplied at Consultant's discretion, at no additional cost to Contract.
- .12 Products supplied by a manufacturer/supplier other than a manufacturer listed as acceptable may be considered for acceptance by Consultant if requested in writing with full product documentation submitted, a minimum of 10 working days prior to Bid closing date.
- .13 Any proposed changes initiated by Contractor after award of Contract may be considered by Consultant at Consultant's discretion, with any additional costs for such changes if approved by Consultant, and costs for review, to be borne by Contractor.
- .14 Whenever use of product other than base specified products or named as acceptable is being supplied, allow sufficient time for processing of product submissions and time for Consultant's review, such that there will not be significant impact on contract time or work schedule.
- .15 Requirements for low voltage systems of this project that are of technology that changes rapidly and are forever evolving and changing, resulting in systems that may be out dated by time of installation, are to include provisions to allow Owner option to select most updated technology. Shop drawings for such systems and equipment are to include provisions for a minimum 6-week review time for Owner to review degree of technology of each system and determine acceptance. Owner will have right to substitute a more advanced technology subject to negotiated pricing.

1.16 Shop Drawings

- .1 At start-up meeting confirm with Consultant, products to be included in shop drawing submission. Prepare and submit list of products to Consultant for review.
- .2 Submit electronic copies of shop drawings unless otherwise directed by Consultant. Confirm exact requirements with Consultant.
- .3 Submit for review, drawings showing in detail design, construction, and performance of equipment and materials as requested in Specification. Include minimally for preparation and submission of following, as applicable:
 - .1 product literature cuts;
 - .2 equipment data sheets;
 - .3 equipment dimension drawings;

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- .4 system block diagrams;
- .5 sequence of operation;
- .6 connection wiring schematic diagrams;
- .7 functionality with integrated systems.
- .4 Each shop drawing or product data sheet is to be properly identified with project name and product drawing or specification reference. Shop drawing or product data sheet dimensions are to match dimension type on drawings.
- .5 Where any item of equipment is required by Code or Standard or By-Law to meet a specific energy efficiency level, or any other specific requirement, ensure this requirement is clearly indicated on submission.
- .6 Ensure proposed products meet each requirement of Project. Endorse each shop drawing copy "CERTIFIED TO BE IN ACCORDANCE WITH ALL REQUIREMENTS". Include company name, submittal date, and sign each copy. Shop drawings that are received and are not endorsed, dated and signed will be returned to be resubmitted.
- .7 Consultant to review shop drawings and indicate review status by stamping shop drawing copies as follows:
 - .1 "REVIEWED" or "REVIEWED AS NOTED" (appropriately marked) - If Consultant's review of shop drawing is final, Consultant to stamp shop drawing;
 - .2 "RETURNED FOR CORRECTION" - If Consultant's review of shop drawing is not final, Consultant to stamp shop drawing as stated above, mark submission with comments, and return submission. Revise shop drawing in accordance with Consultant's notations and resubmit.
- .8 Following is to be read in conjunction with wording on Consultant shop drawing review stamp applied to each and every shop drawing submitted:
- .9 "THIS REVIEW BY CONSULTANT IS FOR SOLE PURPOSE OF ASCERTAINING CONFORMANCE WITH GENERAL DESIGN CONCEPT. THIS REVIEW DOES NOT MEAN THAT CONSULTANT APPROVES DETAILED DESIGN INHERENT IN SHOP DRAWINGS, RESPONSIBILITY FOR WHICH REMAINS WITH CONTRACTOR. CONSULTANT'S REVIEW DOES NOT RELIEVE CONTRACTOR OF RESPONSIBILITY FOR ERRORS OR OMISSIONS IN SHOP DRAWINGS OR OF CONTRACTOR'S RESPONSIBILITY FOR MEETING REQUIREMENTS OF CONTRACT DOCUMENTS. BE RESPONSIBLE FOR DIMENSIONS TO BE CONFIRMED AND CORRELATED AT JOB SITE, FOR INFORMATION THAT PERTAINS SOLELY TO FABRICATION PROCESSES OR TO TECHNIQUES OF CONSTRUCTION AND INSTALLATION, AND FOR CO-ORDINATION OF WORK OF SUB-TRADES."
- .10 Submit each system and each major component as separate shop drawing submissions. Submit together, shop drawings for common devices such as devices of each system.
- .11 Obtain shop drawings for submission from product manufacturer's authorized representatives and supplemented with additional items specified herein.
- .12 Do not order product until respective shop drawing review process has been properly completed by Consultant.
- .13 Where extended warranties are specified for equipment items, submit specified extended warranty with shop drawing submittal.
- .14 Refer to specific requirements in other Sections.

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1.17 Equipment Loads

- .1 Supply equipment loads (self-weight, operating weight, housekeeping pad, inertia pads, etc.) to Consultant, via shop drawing submissions, prior to construction.
- .2 Where given choice of specific equipment, actual weight, location and method of support of equipment may differ from those assumed by Consultant for base design. Back-check equipment loads, location, and supports, and include necessary accommodations.
- .3 Where supporting structure consists of structural steel framing, it is imperative that equipment loads, location, and method of support be confirmed prior to fabrication of structural steel. Be responsible for confirming locations of equipment with Consultant prior to construction.

1.18 Openings

- .1 Supply opening sizes and locations to Consultant to allow verification of their effect on design, and for inclusion on structural drawings where appropriate.
- .2 No openings are permitted through completed structure without written approval of Consultant. Show required openings on a copy of structural drawings. Identify exact locations, elevations, and size of proposed openings and submit to Consultant for review, well in advance of doing work.
- .3 Prior to leaving site at end of each day, walk through areas of work and check for any openings, penetrations, holes, and/or voids created under scope of work of project, and ensure that any openings created under scope of work have been closed off, fire-stopped and smoke-sealed. Unless directed by Owner and coordinated with Consultant, do not leave any openings unprotected and unfinished overnight.

1.19 Scaffolding, Hoisting, & Rigging

- .1 Unless otherwise specified or directed, supply, erect and operate scaffolding, rigging, hoisting equipment and associated hardware required for work, and subject to approval of Consultant.
- .2 Immediately remove from site scaffolding, rigging and hoisting equipment when no longer required.
- .3 Do not place major scaffolding/hoisting equipment loads on any portion of structure without approval from Consultant.

1.20 Changes In The Work

- .1 Whenever Consultant proposes in writing to make a change or revision to design, arrangement, quantity, or type of any work from that required by Contract Documents, prepare and submit to Consultant for approval, a quotation being proposed cost for executing change or revision.
- .2 Quotation to be a detailed and itemized estimate of product, labour, and equipment costs associated with change or revision, plus overhead and profit percentages and applicable taxes and duties.
- .3 If overhead and profit percentages are not specified in Division 00 or 01, but allowable under Contract as confirmed with Consultant prior to contract signing, then allowable maximum percentages for overhead and profit are to be 7% and 5% respectively.

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- .4 Unless otherwise specified in Divisions 00 or 01, following additional requirements apply to quotations submitted:
 - .1 when change or revision involves deleted work as well as additional work, cost of deleted work (less overhead and profit percentages but including taxes and duties) is to be subtracted from cost of additional work before overhead and profit percentages are applied to additional work;
 - .2 material costs are not to exceed those published in local estimating price guides;
 - .3 electrical material labour unit costs are to be in accordance with National Electrical Contractors Association Manual of Labor Units at difficult level, less 25%;
 - .4 mechanical material labour unit costs are to be in accordance with Mechanical Contractors Association of America Labor Estimating Manual, less 25%;
 - .5 costs for journeyman and apprentice labour must not exceed prevailing rates at time of execution of Contract and must reflect actual personnel performing work;
 - .6 cost for site superintendent must not exceed 10% of total hours of labour estimated for change or revision, and change or revision must be such that site superintendent's involvement is necessary;
 - .7 costs for rental tools and/or equipment are not to exceed local rental costs;
 - .8 overhead percentage will be deemed to cover quotation costs other than actual site labour and materials, and rentals;
 - .9 quotations, including those for deleted work, to include a figure for any required change to Contract time.
- .5 Quotations submitted that are not in accordance with requirements specified above will be rejected and returned for re-submittal. Failure to submit a proper quotation to enable Consultant to expeditiously process quotation and issue a Change Order will not be grounds for any additional change to Contract time.
- .6 Make requests for changes or revisions to work to Consultant in writing and, if Consultant agrees, will issue Notice of Change.
- .7 Do not execute any change or revision until written authorization for change or revision has been obtained from Consultant.

1.21 Progress Payment Breakdown

- .1 Prior to submittal of first progress payment draw, submit a detailed breakdown of work cost to assist Consultant in reviewing and approving progress payment claims.
- .2 Payment breakdown is subject to Consultant's approval and progress payments will not be processed until an approved breakdown is in place. Breakdown is to include one-time claim items such as mobilization and demobilization, insurance, bonds (if applicable), shop drawings and product data sheets, commissioning including system testing and verification, and project closeout submittals.
- .3 Indicate equipment, material and labour costs for site services (if applicable) and indicate work of each trade in same manner as they will be indicated on progress draw.

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1.22 Notice For Required Field Reviews

- .1 Whenever there is a requirement for Consultant to perform a field review prior to concealment of any work, to inspect/re-inspect work for deficiencies prior to Substantial Performance of the Work, for commissioning demonstrations, and any other such field review, give minimum 5 working days notice in writing to Consultant.
- .2 If Consultant is unable to attend a field review when requested, arrange an alternative date and time.
- .3 Do not conceal work until Consultant advises that it may be concealed.
- .4 When Consultant is requested to perform a field review and work is not ready to be reviewed, reimburse Consultant for time and travel expenses.

1.23 Preliminary Testing

- .1 When directed by Consultant, promptly arrange, pay for, and perform site tests on any piece of equipment or any system for such reasonable lengths of time and at such times as may be required to prove compliance with Specification and governing Codes and Regulations, prior to Substantial Performance of the Work.
- .2 When, in Consultant's opinion, tests are required to be performed by a certified testing laboratory, arrange and pay for such tests.
- .3 These tests are not to be construed as evidence of acceptance of work, and it is agreed and understood that no claim for delays or damage will be made for injury or breakage to any part or parts of equipment or system due to test where such injuries or breakage were caused by faulty parts and/or workmanship of any kind.
- .4 When, in Consultant's opinion, tests indicate that equipment, products, etc., are defective or deficient, immediately remove such equipment and/or products from site and replace them with acceptable equipment and/or products, at no additional cost to the Contract.

1.24 Provisions For Systems/Equipment Used During Construction

- .1 Any system or piece of equipment that is specified to be provided under requirements of Documents and is required to be used during construction stages of work prior to issuing of Certificate of Substantial Performance of the Work, are to be provided with special interim maintenance and service to cover systems/equipment during time of use during construction period of project until project has been certified as substantially performed and such systems/equipment are turned over to Owner.
- .2 During this period of construction, such systems/equipment to not become property of Owner or be Owner's responsibility for maintenance or service. Systems/equipment are to remain property of respective manufacturers/suppliers or Contractor, who are responsible for full maintenance and servicing of systems/equipment in order to maintain validity of warranties after turn over to Owner.
- .3 Prior to application for a Certificate of Substantial Performance of the Work and turn over to Owner, such systems/equipment to be cleaned, restored to "new" condition, luminaries re-lamped with new lamps, genset serviced, paint finishes touched-up, filters cleaned or replaced, etc.

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1.25 Temporary Services

- .1 Coordinate with General Contractor, requirements for temporary services including but not limited to temporary electrical power, lighting and exit pathways. Locations of exit pathways to be as decided at discretion of General Contractor, and to be illuminated complete with emergency lighting, and provided with exit signage and fire alarm devices in accordance with requirements of local governing building code and local governing inspection authorities.

1.26 Cleaning

- .1 During construction, keep site reasonably clear of rubbish and waste material resulting from work on a daily basis to the satisfaction of Consultant. Before applying for a Certificate of Substantial Performance of the Work, remove rubbish and debris, and be responsible for repair of any damage caused as a result of work.
- .2 At time of final cleaning, clean luminaire reflectors, lenses, and other luminary surfaces that have been exposed to construction dust and dirt, including top surface, whether it is exposed or in ceiling space.
- .3 Clean switches, receptacles, communications outlets, coverplates, and exposed surfaces.
- .4 Clean other electrical equipment and devices installed as part of this project.
- .5 For work performed in electrical equipment rooms, electrical closets and communication closets, perform following:
 - .1 HEPA vacuum and clean interiors and buswork of switchboards, panels, cabinets and other electrical equipment of construction debris and dust prior to energization;
 - .2 HEPA vacuum top of switchboards, panels, cabinets, bus ducts, cable trays and conduits in room, followed by a thorough HEPA vacuuming of floors;
 - .3 do not lay permanent switchboard matting in electrical rooms until rooms are re-cleaned, and floors wet mopped and dried just prior to final turn over to Owner.

1.27 Record As-Built Drawings

- .1 Drawings for this project have been prepared on a CAD system using AutoCAD software of release version confirmed with Consultant. For purpose of producing record "as built" drawings, copies of Contract Drawings can be obtained from Consultant, at expense of \$25.00 CDN plus HST, per drawing, up to first 10 drawings, and \$5.00 CDN plus HST, per any additional drawings thereafter. Drawings may also to be used for preparation of layouts and interference drawings.
- .2 Drawings for this project have been prepared on a CAD system using AutoCAD software of release version confirmed with Consultant. For purpose of producing record "as built" drawings, copies of Contract Drawings can be obtained from Consultant.

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- .3 As work progresses at site, clearly mark in red in a neat and legible manner on a set of bound white prints of Contract Drawings, changes and deviations from routing of services and locations of equipment shown on Contract Drawings, on a daily basis. Changes and deviations include those made by addenda, change orders, and site instructions. Use notes marked in red as required. Maintain white print red line as-built set at site for exclusive use of recording as-built conditions, keep set up-to-date, and ensure set is available for periodic review. As-built set is also to include following:
 - .1 dimensioned location of inaccessible concealed work;
 - .2 locations of control devices with identification for each;
 - .3 location and identification of devices in concealed locations such as accessible ceiling spaces and raised floors;
 - .4 for underground piping and ducts, record dimensions, invert elevations, offsets, fittings, cathodic protection and accessories if applicable, and locate dimensions from benchmarks to be preserved after construction is complete;
 - .5 location of concealed services terminated for future extension and work concealed within building in inaccessible locations.
 - .6 location of fire alarm devices and include addresses of devices; identify fire alarm zones;
 - .7 identify routing and location of concealed conduits/ducts of diameter 50 mm (2") and greater;
- .4 Before applying for a Certificate of Substantial Performance of the Work, update a clean copy of Contract Drawing set in accordance with marked up set of "as-built" white prints including deviations from original Contract Drawings, thus forming an "as-built" drawing set. Submit "as-built" site drawing prints to Consultant for review. Make necessary revisions to drawings as per Consultant's comments, to satisfaction of Consultant.
- .5 Use final reviewed "as-built" drawing set to provide CAD files of drawings thus forming true "as-built" set of Contract Drawings. Identify set as "Project Record Copy". Load digital copies of final reviewed by Consultant as-built drawings onto USB type flash drive. Provide 2 complete sets of "as-built" drawings on separate USBs. Submit "as-built" sets of white prints and USBs to Consultant.
- .6 Submitted drawings are to be of same quality as original Contract Drawings. CAD drawing files are to be compatible with AutoCAD software release version confirmed with Consultant.
- .7 Unless otherwise noted in Divisions 00 or 01, failure to maintain accurate record drawings will incur additional 5% holdback on progress claims until drawings are brought up to date to satisfaction of Consultant.
- .8 For projects with phased turnover of project (refer to Division 01), review with Consultant completeness of as-built drawings prior to turn over of an area. Copies of hand drawn interim as-built drawings to be made available to Owner's maintenance personnel.

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- .9 Prepare and submit for review with record drawings, a neat, clear, properly identified, "as-built" electrical distribution riser diagram record drawing (in AutoCAD format release version confirmed with Consultant) of entire electrical distribution system up to and including line side connections to panelboards. Building and room outlines are to reflect "as-built" outlines. Include in diagrams for feeder types and sizes, conduit sizes, breaker, switchboard and distribution panel sizes, etc. Submit sample version to Consultant for review and comments prior to final manufacturer. Size diagrams same size as issued full Size Drawings. Mount riser diagrams on 10 mm (3/8") thick foam core complete with mylar finish cover, and hardware suitable for wall mounting in main electrical room.
- .10 Include on single lines, panelboard locations identified by room numbers below panel. When specific identified location is not available, nearest available room number to be used followed by a (Δ) triangle to flag approximate location. Encircle various loads by Building Wings (where applicable) for ease of identification. Group lighting loads on panelboards on top of panel. Identify motor control centres and splitters similar to panelboards. Identify fuse sizing including existing equipment where there is no difficulty in obtaining information. Use these requirements for pricing, and confirm exact requirements with Consultant prior to commencing work.
- .11 Replace existing posted single line electrical distribution drawings with revised to reflect renovations and revisions to electrical distribution equipment. Drawings to be of type to match existing as confirmed with Owner. Supply electronic files of format confirmed with Owner for following:
 - .1 fire alarm system test report devices and addresses;
 - .2 network cabling system test report devices and labelling of each device and cable.

1.28 Operating & Maintenance Manuals

- .1 Submit draft copy to Consultant for review. Incorporate any Consultant's comments in preparation final manuals.
- .2 For each item of equipment for which a shop drawing is required (except for simple equipment), supply minimum 3, project specific, indexed copies of equipment manufacturers' operating and maintenance (O&M) instruction data manuals. Confirm exact quantity of manuals with Consultant. Consolidate each copy of data in an identified hard cover three "D" ring binder. Each binder to include:
 - .1 front cover: project name label; wording - "Electrical Systems Operating and Maintenance Manual"; and date;
 - .2 introduction sheet listing Consultant, Contractor, and Subcontractor names, street addresses, telephone and fax numbers, and e-mail addresses;
 - .3 equipment manufacturer authorized contact person name, telephone number and company website;
 - .4 Table of Contents sheet, and corresponding index tab sheets;

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- .5 copy of each "REVIEWED" or clean, updated "REVIEWED AS NOTED" shop drawing or product data sheet, with manufacturer's/supplier's name, telephone and fax numbers, email address, company website address, and email address for local source of parts and service; when shop drawings are returned marked "REVIEWED AS NOTED" with revisions marked on shop drawing copies, they are to be revised by equipment supplier to incorporate comments marked on "reviewed" shop drawings and a clean updated copy is to be included in operating and maintenance manuals;
- .6 Maintenance data is to include:
 - .1 operation and trouble-shooting instructions for each item of equipment and each system;
 - .2 schedules of tasks, frequency, tools required, and estimated task time;
 - .3 recommended maintenance practices and precautions;
 - .4 complete parts lists with numbers.
- .7 Performance data is to include:
 - .1 equipment and system start-up data sheets;
 - .2 equipment test reports;
 - .3 final verification and commissioning reports.
- .8 explanation of operating principles and sequences;
- .9 inspection certificates issued by regulatory authorities;
- .10 wiring and connection diagrams;
- .11 copies of additional and revised panelboard directories;
- .12 warranties;
- .13 items requested specifically in Section Articles.
- .3 Generally, binders are not to exceed 75 mm (3") thick and not to be more than 2/3 full.
- .4 Operating and maintenance instructions are to relate to job specific equipment supplied under this project and related to Owner's building. Language used in manuals is to contain simple practical operating terms and language easy for in-house maintenance staff to understand how to operate and maintain each system.
- .5 Before applying for a Certificate of Substantial Performance of the Work, assemble one copy of O & M Manual and submit to Consultant for review prior to assembling remaining copies. Incorporate Consultant's comments into final submission.
- .6 Provide 2 (2) digital copies of contents of operating and maintenance manuals and load onto separate USB type flash drives and submit to Consultant. Prepare digital copies using version of Adobe Acrobat Portable Document Format or equal as confirmed with Consultant and enhanced with bookmarks and internal document links.

1.29 Warranty

- .1 Unless otherwise specified in Divisions 00 and 01, warrant work to be in accordance with Contract Documents and free from defects for a period of 1 year from date of issue of a Certificate of Substantial Performance of the Work.

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- .2 Where equipment includes extended warranty period, e.g., 5 years, first year of warranty period is to be governed by terms and conditions of warranty in Contract Documents, and remaining years of warranty are to be direct from equipment manufacturer and/or supplier to Owner. Submit signed and dated copies of extended warranties to Consultant.
- .3 Warranty to include parts, labour, travel costs and living expenses incurred by manufacturer's authorized technician to provide factory authorized on-site service.
- .4 Repair and/or replace any defects that appear in Work within warranty period without additional expense to Owner. Be responsible for costs incurred in making defective work good, including repair or replacement of building finishes, other materials, and damage to other equipment. Ordinary wear and tear and damage caused wilfully or due to carelessness of Owner's staff or agents is exempted.
- .5 Do not include Owner deductible amounts in warranties.
- .6 It is understood that warranties are to commence from time of Substantial Performance of the Work, regardless of what is noted within following Sections of Specification. Be responsible for providing whatever "bridging" or additional extended warranty period is required from time that material is purchased until this time.
- .7 Visit building during warranty period with Owner representatives. Owner to organize these visits. At these meetings, Owner representatives are to review performance of systems. If performance is satisfactory, then no further action needs to be taken. If unsatisfactory, then correct deficiencies, as directed by Owner representatives, to satisfaction of Owner representatives. These site visits to occur:
 - .1 once during first month of building operation;
 - .2 once during third month of building operation;
 - .3 once between fourth and tenth month in a season opposite to first and third month visits.

1.30 Project Close Out Submittals

- .1 Prior to application for Substantial Performance of the Work, submit required items and documentation specified, including following:
 - .1 Operating and Maintenance Manuals;
 - .2 as-built record drawings and associated data;
 - .3 extended warranties for equipment as specified;
 - .4 operating test certificates;
 - .5 final commissioning report;
 - .6 identified keys for equipment and/or panels for which keys are required, and other items required to be submitted;
 - .7 other data or products specified.

1.31 Instructions To Owner

- .1 Refer to equipment and system operational and maintenance training requirements specified in Division 01.

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- .2 Train Owner's designated personnel in aspects of operation and maintenance of equipment and systems as specified. Demonstrations and training are to be performed by qualified technicians employed by equipment/system manufacturer/supplier. Supply hard copies of training materials to each attendee.
- .3 Unless where specified otherwise in trade Sections, minimum requirements are for manufacturer/suppliers of each system and major equipment, to provide minimum two separate sessions each consisting of minimum 4 hours on site or in factory training (at Owner's choice), of Owner's designated personnel (for up to 6 people each session), on operation and maintenance procedures of system.
- .4 For each item of equipment and for each system for which training is specified, prepare training modules as specified below. Use Operating and Maintenance Manuals during training sessions. Training modules include but are not limited to:
 - .1 Operational Requirements and Criteria: equipment function, stopping and starting, safeties, operating standards, operating characteristics, performance curves, and limitations;
 - .2 Troubleshooting: diagnostic instructions, test and inspection procedures;
 - .3 Documentation: equipment/system warranties, and manufacturer's/supplier's parts and service facilities, telephone numbers, email addresses, and the like;
 - .4 Maintenance: inspection instructions, types of cleaning agents to be used as well as cleaning methods, preventive maintenance procedures, and use of any special tools;
 - .5 Repairs: diagnostic instructions, disassembly, component removal and repair instructions, instructions for identifying parts and components, and review of any spare parts inventory.
- .5 Before instructing Owner's designated personnel, submit to Consultant for review preliminary copy of training manual and proposed schedule of demonstration and training dates and times. Incorporate Consultant's comments in final copy.
- .6 Obtain in writing from Consultant, list of Owner representatives to receive instructions. Submit to Consultant prior to application for Certificate of Substantial Performance of the Work, complete list of systems for which instructions were given, stating for each system:
 - .1 date instructions were given to Owner's staff;
 - .2 duration of instruction;
 - .3 names of persons instructed;
 - .4 other parties present (manufacturer representative, consultants, etc.).
- .7 Obtain signatures of Owner's staff to verify they properly understood system installation, operation and maintenance requirements, and have received operating and maintenance instruction manuals and "as-built" record drawings.
- .8 Submit to Consultant copy of electronic version of training materials loaded on USB flash drive. Include in operating and maintenance manuals submission.
- .9 Provide digital video disc (DVD) recording of operating and instructions training for following systems:
 - .1 emergency power gensets and control system;
 - .2 fire alarm system;

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- .3 security systems;
- .4 nurse call system;
- .5 dimming system;
- .6 BAS.
- .10 Provide custom video in DVD format that details on site systems and equipment operations and includes following:
 - .1 professional videographer on site to capture training session; use wireless lavalier microphone to capture crystal clear audio of trainer in association with video footage; edit video to remove unnecessary footage;
 - .2 DVD to include custom site specific system/equipment screens that outline key information about system/equipment and devices used on site only;
 - .3 DVD to also include custom site specific video that details programming procedures in conjunction with a voiceover from on-site technician;
 - .4 DVD created with a main menu screen and authored with chapters to allow operator to access specific areas of training instantly.
- .11 Supply minimum quantity of 3 copies of DVDs for each system/equipment. Owner to have option of such information loaded and submitted on USB flash drives.

1.32 Final Inspection

- .1 Submit to Consultant, written request for final inspection of systems. Include written certification that:
 - .1 deficiencies noted during job inspections have been completed;
 - .2 field quality control procedures have been completed;
 - .3 maintenance and operating data have been completed and submitted to, reviewed and accepted by Consultant;
 - .4 tags and nameplates are in place and equipment identifications have been completed;
 - .5 clean-up is complete;
 - .6 spare parts and replacement parts specified have been provided and acknowledged by Consultant;
 - .7 as-built and record drawings have been completed and submitted to, reviewed and accepted by Consultant;
 - .8 Owner staff has been instructed in operation and maintenance of systems;
 - .9 commissioning procedures have been completed;
 - .10 fire alarm verification completed and certificate has been submitted.

PART 2 - PRODUCTS

2.1 Not Used

PART 3 - EXECUTION

3.1 Not Used

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PART 1 - GENERAL

1.1 Reference

- .1 Division 00 and Division 01 apply to and are a part of each Electrical Division Section.

1.2 Application

- .1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section of Electrical Divisions and is to be read accordingly.

1.3 Submittals

- .1 Submit shop drawings for products of this Section.
- .2 Additionally as part of shop drawing submission process, submit following to Consultant for review:
 - .1 sample of each proposed type of access door if supplied under work of this Division, as well as electronic copies of reflected ceiling plan drawings and wall elevation drawings showing proposed access door locations;
 - .2 dimensioned location drawings indicating required sleeves and formed openings in structural poured concrete or precast concrete construction or in roofing, and locations of cutting or drilling required for Electrical Divisions work;
 - .3 samples of materials and any other items as specified in succeeding Sections of Electrical Divisions;
 - .4 weight loads of selected equipment (upon request);
 - .5 equipment nameplate and warning sign proposed nomenclature, print type, symbols, sizing and colours;
 - .6 fire stopping installation drawings with ULC certifications;
 - .7 copies of prior to start of construction approvals from local governing authorities having jurisdiction.
- .3 Prior to application for Substantial Performance of the Work, submit following to Consultant for review (note: funds will be withheld until each of following items have been completed and documented to satisfaction of Consultant):
 - .1 fire alarm system testing and verification report of each component of work; devices to be certified working and in proper order;
 - .2 final distribution system testing and arc flash study performed and documented to satisfaction of Consultant;

1.4 Continuity of Supply For Standardization

- .1 Utilize materials of one manufacturer for aspects of work, where practical. Utilize one common manufacturer for wiring devices, such as switches and receptacles, whether installed loose or in a pre-manufactured component. Coordinate with each supplier and ensure conformance with this requirement. Identify deviations to Consultant and obtain approval of change prior to proceeding with work.

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PART 2 - PRODUCTS

2.1 Conduits

- .1 EMT (Thinwall), galvanized electrical metallic tubing to CSA C22.2 No. 83, complete with factory made bends where site bending is not possible and joints and terminations made with steel couplers and steel set screw type connectors with insulated throats, and concrete tight where required.
- .2 Rigid galvanized steel to CSA C22.2 No. 45, with exterior zinc and interior enamel coatings, galvanized threads where factory cut and red lead coated threads where site cut. Factory made bends where site bending is not possible, factory made and threaded fittings, and connectors, and terminations with rigid couplings, and concrete tight where required.
- .3 Galvanized steel flexible liquid tight metallic conduit to CSA C22.2 No. 56, complete with Ideal "Steel Tough" liquid-tight flexible conduit connectors at terminations.
- .4 Galvanized steel flexible metallic conduit to CSA C22.2 No. 56, complete with proper and suitable squeeze type connectors at terminations.
- .5 CSA approved and labelled, FT-4 rated, rigid plastic (PVC) conduit complete with site made heat gun bends on conduit to 50 mm (2") diameter, factory made elbows in conduit larger than 50 mm (2") diameter, solvent weld joints, factory made expansion joints where required, and terminations made with proper and suitable connectors and adaptors.
- .6 Medium density CSA certified polyethylene flexible plastic conduit in a continuous coil of proper length.
- .7 Factory or site threaded rigid aluminium conduit to CSA C22.3 No. 45, with bending, couplings, fittings, etc., requirements as for rigid galvanized steel conduit.
- .8 Factory threaded rigid bronze conduit with water-tight screwed joints, fittings, and connectors.
- .9 ENT - electrical non-metallic tubing to CSA C22.2 No. 227.1 and No 85, complete with matching ENT fittings and boxes; concrete tight and constructed of heavy duty impact resistant PVC; tubing of flexible corrugated construction; acceptable manufacturer is IPEX "Cor-Line" tubing with "Kwikon" fittings.
- .10 Tyco "True Color" red EMT fire alarm conduit.

2.2 Outlet Boxes

- .1 CSA approved stamped galvanized steel outlet boxes.
- .2 Crouse-Hinds Canada Ltd., CSA certified, "FS" or "FD" Series cast Feraloy and aluminium outlet boxes.
- .3 CSA certified rigid plastic (PVC) outlet boxes.

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- .4 Standard general purpose service floor boxes: CSA approved, UL scrub water compliant, fully adjustable angular and vertically, formed steel/cast iron, round single gang / rectangular or square multi-gang as required, flush in concrete floor installation, boxes complete with conduit knockout openings, adjustable collars, hinged flip open brass covers with provisions for mounting of duplex power receptacles, telephone jacks and data jacks. Provide barriered boxes when boxes contain both power and communication outlets and different voltage levels. Size boxes to suit thickness of floor slab as confirmed with Consultant and also to suit required bending radii of conductors. Refer to drawings for number of gang requirements. Acceptable manufacturers are Hubbell, Legrand and Thomas & Betts. Special floor boxes are specified elsewhere in another Section.
- .5 Crouse-Hinds Canada Ltd., CSA certified, "FS", or "FD" Series cast Feraloy and aluminium outlet boxes.
- .6 Columbex Green-Guard or equivalent Robroy, corrosion resistant, flame resistant, salt spray resistant, boxes uniformly coated inside and outside with epoxy acrylic of nominal thickness 0.05 mm (0.002"). Covers to be secured with stainless steel screws.
- .7 Each outlet box and back box to be suitable in respects for application and complete with suitable securing lugs, connectors suitable for connected conduit, knockouts and, where necessary, suitable plaster rings, concrete rings, covers, carpet flanges and any other required accessory.
- .8 Electrical boxes exposed exterior of building or in non-climate controlled locations to be weatherproof boxes complete with gasketted covers/faceplates.

2.3 Pull Boxes & Junction Boxes

- .1 Galvanized or prime coat plated steel, suitable in respects for application and complete with screw-on or hinged covers as required, and connectors suitable for connected conduit.
- .2 Cooper Crouse-Hinds, "Condulet", threaded cast Feraloy outlet boxes of an exact type to suit application, each complete with screw-on gasketted cover.
- .3 Rigid plastic (PVC), CSA certified, junction boxes and access fittings with solvent weld type joints and screw-on PVC covers.
- .4 Square D (Schneider Canada), Catalogue No. 970, cast bronze water-proof junction box for underwater lighting.
- .5 Physical size of pull boxes to be as required by local governing electrical code to suit number and size of conduits and conductors.
- .6 Each box to be suitable in respects for application and complete with suitable securing lugs, connectors suitable for connected conduit, knockouts and, where necessary, suitable plaster rings, concrete rings, covers and any other required accessory.
- .7 Boxes exposed exterior of building or in non-climate controlled locations to be weatherproof boxes complete with gasketted covers.

2.4 Sleeves

- .1 Galvanized steel sleeves as follows:
 - .1 No. 24 gauge with an integral flange at one (1) end to secure sleeve to formwork construction;

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- .2 Schedule 40 pipe;
- .2 Schedule 40 PVC sleeves.

2.5 Firestopping & Smoke Seal Materials

- .1 Asbestos-free, elastomeric materials and intumescent materials, tested, listed and labelled by ULC in accordance with CAN 4-S115-M85, and CAN/ULC-S101-M for installation in ULC designated firestopping, and smoke seal systems to provide a positive fire, water and smoke seal and a fire resistance rating (flame, hose stream and temperature) no less than fire rating for surrounding construction.
- .2 Fire stopping and smoke seal material system to be specifically ULC certified with designated reference number for its specific installation. As part of shop drawing submission, submit copies of firestopping drawings with ULC certificate and number for each specific installation. Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance ratings.
- .3 Systems to consist of both elastomeric and intumescent materials that are compatible with abutting dissimilar materials and finishes. Coordinate material requirements with trades supplying abutting areas of materials.
- .4 Typically, for openings of up to 250 mm (10") in diameter, provide putty pad type firestop materials equivalent to Specified Technologies Inc. "SpecSeal" intumescent, non-hardening, water resistant putties containing no solvents, inorganic fibres or silicone compounds.
- .5 Typically, for openings of greater than 250 mm (10") in diameter, and for rectangular openings, provide pillow type firestop materials equivalent to Specified Technologies Inc. "SpecSeal" re-enterable, non-curing, mineral fibre core encapsulated on six sides with intumescent coating contained in a flame retardant poly bag.
- .6 For applications where fire rated firestopping cable pathway system is to be special structurally reinforced, reusable and require no or minimal alterations to firestop component when cables are either added or removed, provide Specified Technologies Inc. "EZ-PATH" device modules comprised of steel raceway with intumescent foam pads allowing 0 to 100 percent cable fill. Structure to be sturdy enough to stand up to constant modification and use, but maintain its ULC firestopping rating.
- .7 Supply products of a single manufacturer for use on work of this Division.
- .8 Installer to be manufacturer trained and certified on specific product. Submit copy of certificate with shop drawings.
- .9 Include for manufacturer authorized representative to inspect and verify each installation and application. Submit test report signed and verified by system installer's authorized representative and manufacturer representative.
- .10 Acceptable certification to also include certification by Underwriters Laboratories of Northbrook IL, using tests conforming to ULC-S115 and given cUL listing published by UL in their "Products Certified for Canada (cUL) Directory".
- .11 Acceptable manufacturers are:
 - .1 Specified Technologies Inc.;
 - .2 3M Canada Inc.;

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- .3 Tremco;
- .4 A/D Fire Protection Systems;
- .5 Nelson;
- .6 Hilti Canada.

2.6 Fastening & Securing Hardware

- .1 Concrete inserts - Crane Canada Ltd., No. 4-M for concrete work for single or double conduit, cable tray, etc., runs and equipment. Unistrut Ltd. multiple type inserts for runs of three (3) or more conduits etc., or where a grid support system is required.
- .2 Concrete fasteners - "WEJ-IT" anchors, lead cinch anchors and/or "STAR" or "PHILLIPS" self-drilling anchors.
- .3 Masonry inserts - "WEJ-IT" expansion shields and machine bolts or, for light loads, fibre or lead plugs and screws.
- .4 Drywall or plaster wall and/or ceiling fasteners - 2-wing spring toggles.
- .5 Structural steel - Crane Canada Ltd., beam clamps.
- .6 Metal framing channels - 40 mm (1-5/8") width, galvanized steel channels complete with required fittings and ancillary hardware; acceptable manufacturers are:
 - .1 Unistrut;
 - .2 Thomas & Betts;
 - .3 Eaton B-Line.
- .7 Velcro tie wraps for bundling and securing cables.

2.7 Identification Nameplates

- .1 Laminated plastic (Lamacoid) black-white-black with bevelled edges, stainless steel screws, and proper identification engraving. Each nameplate to be sized to suit equipment for which it is provided, and required wording. Confirm nomenclature with Consultant. Various colour configurations to be used to differentiate systems. Confirm exact colour scheme with Consultant and/or Owner.
- .2 Brother "P-Touch", portable electronic labelling system complete with self-adhesive, permanent printed labels with required nomenclature.

2.8 Warning Signs

- .1 Thomas & Betts Ltd., semi-rigid vinyl panels with drilled holes in each corner, stainless steel screws, pressure sensitive mounting pads on back, and required printed wording. Generally, wording to be red on a white background with black trim confirmed with Consultant.

2.9 System Backboards

- .1 FSC (Forest Stewardship Council), G1S (good one side) construction grade fir plywood, containing no added urea formaldehyde, flame retardant prime coat painted on exposed surfaces, minimum 20 mm (3/4") thick, as sized on drawings and with flame spread rating in accordance with local governing building code requirements.

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2.10 Motor Starter Panels

- .1 Minimum No. 14 gauge sheet steel panels complete with steel angle reinforcing, framing and suitable splitter trough, fully primed and enamel painted, sized to accommodate starters required with spare space and capacity for at least two additional units.

2.11 Sprinkler Protection

- .1 Provide drip shields for protection of surface mounted equipment enclosures from water spray and dripping of liquids. Features of shields include:
 - .1 factory constructed by respective equipment manufacturers;
 - .2 constructed from non-combustible materials (sheet steel);
 - .3 enamel painted to match equipment;
 - .4 surfaces and edges filled/sanded smooth prior to painting;
 - .5 supported from equipment with structural steel rods/metal framing or other method approved by Consultant;
 - .6 structural support finish painted to match shield.
- .2 Include with equipment shop drawings, detailed dimensions of drip shields and methods of supporting.
- .3 Equipment with top cable/conduit entries to include additional sealing of entries with gasketting and/or waterproof sealant to prevent water from entering enclosure.
- .4 Design ventilation louvers such that live components are not exposed to water spray and dripping liquids.
- .5 Above requirements are additional minimum "sprinkler protection" standards for equipment specified as EEMAC/NEMA 1, 2 or 12.
- .6 Obtain CSA approval where required by local governing authorities.

2.12 Rooftop Conduit Support System

- .1 Cooper B-Line "Dura - Blok" series rooftop support systems with features as follows:
 - .1 CSA approved and/or ULC listed and labelled;
 - .2 non-penetrating of roof;
 - .3 vibration dampening;
 - .4 does not float;
 - .5 suitable for outdoor wet and freezing environments without damage caused by weather or freeze and thawing when exposed to de-icing chemicals;
 - .6 environmentally friendly;
 - .7 constructed of recycled rubber.
- .2 Materials:
 - .1 Dura-Blok Curb base made of 100% recycled rubber and polyurethane pre-polymer with a uniform load capacity to suit specific load application of support (minimum 744 kg/m [500 pounds/linear foot]); each base to have a reflective red stripe.

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- .2 DB Series base: Dimensions: 150 mm (6") wide by 125 mm (5") tall by required overall length (minimum 225 mm [9"]); this is to be minimum dimensions, but base requirements must be increased to suit specific applications as recommended by system manufacturer; includes low base steel frame C channel 1.9 mm (14 gauge) - 25 mm (1") high strut galvanized per ASTM A653; and pipe roller assembly.
- .3 DBE Series elevated: base with two 13 mm (1/2") diameter electro zinc all threaded rod risers and 14 ga. 25 mm (1") high galvanized steel slotted channel; adjustable height up to 400 mm (16"); refer to drawings or confirm with Consultant for exact height requirements.
- .4 Attaching hardware: Zinc-plated threaded rod, nuts and attaching hardware per ASTM B633.
- .5 Conduit clamps: single pipe supports constructed of galvanized steel and sized to accommodate sizing of installed conduits.
- .3 Confirm with system manufacturer that selected products provide proper support for application.
- .4 Acceptable manufacturers are as follows:
 - .1 Cooper B-Line;
 - .2 Clearline Technologies (C-Port);
 - .3 Erico (Caddy Pyramid).

PART 3 - EXECUTION

3.1 General Conduit Installation Requirements

- .1 Install conduit concealed in finished areas, and concealed to degree made possible by finishes in partially finished and unfinished areas. Conduit may be exposed in unfinished areas such as Electrical and Mechanical Rooms, unless otherwise noted on drawings or specified herein. Refer to and examine architectural drawings and room finish schedules to determine finished, partially finished or unfinished areas of building. Documents do not identify exact routing. Where shown, routing is diagrammatic, identifying general requirements of routing and locations. Include for necessary offsets, fittings, transformations and similar items required as a result of obstructions and other architectural or structural details not shown.
- .2 Where conduits are exposed, arrange them to avoid interference with other work, parallel to building lines and install as high as possible. Do not install conduits within 150 mm (6") of "hot" pipes or equipment unless conduits are associated with equipment. Independently run conduit to be supported from wall/ceiling structure, not from ceiling hangers, ductwork, piping, cable trays, formed steel decking, etc. Do not run conduits within 900 mm (3') of equipment access opening covers.

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- .3 Where conduit is proposed to be embedded within structural concrete, obtain Owner's approval and review with Consultant (Structural Engineer). Install such conduit in compliance with requirements of latest edition of CSA Standard CAN3-A23.1, "Concrete Materials, and Methods of Concrete Construction". Confirm and review with Structural Consultant, proper installation practices and methods. In areas where Consultant has directed conduit not to be embedded in concrete, run conduits through beams via sleeved openings pre-coordinated and reviewed with General Contractor and by Consultant (Structural Engineer). Do not embed conduit runs in concrete slab of parking garage areas, unless approved by Owner and reviewed with Consultant.
- .4 So as not to impair required strength of structure, following criteria to be generally followed but which is to be reviewed and coordinated with Consultant prior to start of Work:
 - .1 where conduits pass by a column, stay at least two times thickness of slab and drop away from column;
 - .2 where conduits terminate adjacent to a column or wall, bring conduit in toward column/wall as close to 90° to face of column as possible within two times thickness of slab and drop away from column;
 - .3 maximum size of conduit in structural slabs is 1/5 of solid portion of slab thickness;
 - .4 where more than two conduits are adjacent to each other, they are to be spaced greater of 3 diameters or 100 mm (4") apart;
 - .5 total of depth of conduits crossing over each other is to be less than one-third thickness of slab;
 - .6 place conduit in middle third of thickness of slab; do not lay conduit directly on reinforcing steel;
 - .7 do not run conduit adjacent to parallel reinforcing bars;
 - .8 do not run conduit longitudinally in beam without approval of Owner and review with Consultant; pass through beams at right angles to span of beam;
 - .9 where conduits pass through beams, maintain at least twice depth of beam separation away from supports;
 - .10 do not run conduits in slab beside a drop or beam within twice depth of slab from edge of drop or beam;
 - .11 do not run conduits through shear walls or columns without approval of Owner and review with Consultant;
 - .12 do not place conduit in structural elements in parking garage structures, water retaining structures or structures subjected to de-icing chemicals, without approval of Owner and review with Consultant.
- .5 For proposed use of conduit runs underground below slab include following provisions:
 - .1 concrete encased ductbank with conduits of non-ferrous materials and sloped to drain properly into pit;
 - .2 proper drain pit;
 - .3 system to be a pull-in system;
 - .4 20% spare conduits (with minimum of at least 1);
 - .5 system proposal to consider and address any effects of magnetic fields.

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- .6 Conduits are sized on drawings, but in absence of type and sizing, type and size to suit intended application in accordance with applicable local governing electrical code requirements. Sizes identified on drawings are minimum sizes and are not to be decreased unless approved by Owner and reviewed with Consultant.
- .7 Where receptacle type devices are located in existing floors and/or where feeds are required to furniture systems in open spaces, and where chasing of floor slab to run conduit is not acceptable to Owner after review with Consultant provide fire rated "poke-thru" assembly installed through floor and feed from conduit runs provided in ceiling space of floor below.

3.2 Installation of Conduit

- .1 Provide conduit for conductors except armoured cable and copper sheathed mineral insulated conductors, and except where duct or similar raceway materials are provided.
- .2 Provide conduit as follows:
 - .1 for interior building surface mounted services greater than 600 V - rigid galvanized steel;
 - .2 for feeders exceeding 600 V for main distribution wiring in Electrical rooms, and for concealed conduit in exterior walls-rigid galvanized steel;
 - .3 for exposed conduit outside building, for semi-exterior areas such as loading areas and within parking garage floor areas - rigid galvanized steel (rigid PVC where permitted by local codes and Owner and reviewed with Consultant);
 - .4 for exposed conduit in non-climate controlled areas, in areas of corrosive elements - epoxy coated ridged galvanized steel;
 - .5 for branch circuit conductors underground inside building, and underground outside building beneath concrete, asphalt, and similar paving material-rigid PVC;
 - .6 for branch circuit conductors underground outside building clear of concrete, asphalt and similar paving material-flexible polyethylene plastic conduit;
 - .7 for conductors in surface mounted conduit of parking garage - rigid galvanized steel; conduit not to be embedded in concrete within parking garage areas, unless approved in writing by Consultant; if approval obtained from Consultant, rigid PVC may be used embedded in concrete slabs;
 - .8 for conductors associated with pool area outlets and equipment - surface mounted epoxy coated rigid galvanized steel or rigid PVC in concrete slab;
 - .9 for exposed conduit mounted at a height of less than 1200 mm (4') in electrical, mechanical or other service areas - rigid galvanized steel;
 - .10 for short branch circuit connectors to motorized equipment and distribution transformers (minimum length 450 mm (18"), maximum length 600 mm (24") with 180° loop where possible) - galvanized steel flexible liquid-tight conduit;
 - .11 for branch circuit conductors associated with isolated power systems and located in a concealed space in a wall or in a concrete floor slab-rigid PVC with separate insulated ground conductor;
 - .12 at points, where conductors cross building expansion joints - galvanized steel flexible conduit with no less than 600 mm (24") of extra curve;
 - .13 for branch circuit conductors in poured concrete slab - rigid PVC;

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- .14 for interior conduit above 50 mm (2") diameter containing distribution conductors or communication systems conductors (fire alarm, telephone etc.) (except as noted above) - EMT with separate insulated ground conductor;
- .15 for corrosive environments - epoxy coated rigid steel;
- .16 for conductors except as noted above or elsewhere in this Specification - EMT.
- .3 Run rigid conductors in rigid type conduits suitable for application. Do not use flexible conduit.
- .4 Secure conduit located in poured concrete work in place in a manner such that conduit will not float or move when concrete is poured. Adequately protect such conduit from damage prior to and during concrete pour, and from concrete and water penetration.
- .5 Review with Consultant prior to Start of Work, maximum allowable size of conduit for installation in poured concrete. Placement of reinforcing steel in structural concrete work will take precedence over placement of conduit. Spaced adequately multiple runs of conduit in poured concrete work, as reviewed with Consultant.
- .6 Install flexible polyethylene conduit in continuous lengths wherever possible and "snake" conduit in trench. Where joints are necessary, make same with nylon inserts and stainless steel gear type clamps. Terminate with rigid conduit threadless connectors. Grade bed to provide proper drainage of conduits.
- .7 Support underground conduit on a well-tamped flat bed of earth, free from rocks or protrusions of any kind. Grade and slope bed to provide conduits and ducts with proper drainage. Coordinate with General Trades Contractor for provision of means to carry away drainage water. Obtain required approvals of work from local governing electrical utility and review with Consultant prior to back filling and covering. Provide pull cord in each duct run.
- .8 Provide manufactured expansion joints in rigid PVC plastic conduit at spacing as recommended by conduit manufacturer.
- .9 Provide a separate ground conductor in plastic conduits.
- .10 Support and secure surface mounted and suspended single or double runs of metal conduit at support spacing in accordance with local governing electrical code requirements by means of galvanized pipe straps, conduit clips, ringbolt type hangers, or by other proper manufactured devices.
- .11 Support multiple mixed size metal conduit runs with Unistrut Ltd., Electrovert Ltd. "CANTRUSS" or Burndy Ltd. "FLEXIBLE" conduit racks spaced to suit spacing requirements of smallest conduit in group.
- .12 Unless otherwise noted, provide conduit fittings constructed of same materials as conduit and which are suitable in respects for application.
- .13 Provide proper adaptors for joining conduits of different materials.
- .14 Cut square and properly ream site cut conduit ends.
- .15 Handle, install and thread epoxy coated conduit in accordance with manufacturer instructions as not to damage epoxy coating. Seal joints with manufacturer's sealing compound.

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- .16 Use of ENT is subject to written consent of Owner and review by Consultant. Where use is approved by Owner and reviewed with Consultant, run ENT embedded in concrete floor slabs and install in accordance with local governing electrical code requirements and manufacturer instructions. Secure runs to maintain them straight and parallel/perpendicular to building lines. Allow for Consultant to inspect installation before concrete pour.
- .17 Provide conduit as sized on drawings. Size conduit not sized on drawings in accordance with latest edition of local governing electrical code with consideration that sizes of branch circuit conductors indicated are minimum sizes and must be increased as required to suit length of run and voltage drop in accordance with voltage drop schedule found on drawings or at end of this section. Where conductor sizes are increased to suit voltage drop requirements, increase scheduled or specified conduit size to suit. Unless otherwise noted on drawings or required by local governing electrical code or specified elsewhere, conduit to be of minimum size 13 mm (1/2") diameter. Structured network cabling system conduit to be of minimum 19 mm (3/4") diameter, unless otherwise noted.
- .18 Site made bends for conduit to maintain full conduit diameter with no kinking, and conduit finishes are not flake or crack when conduit is bent.
- .19 Plug ends of roughed-in conduits which are exposed during construction with approved plugs.
- .20 Ensure that conduit systems which are left empty for future wiring are clean, clear, capped and properly identified at each termination point. Provide end bushing and suitable fish wires in such conduits.
- .21 Provide empty conduits to ceiling spaces from flush mounted panelboards located below and/or near hung ceiling. Refer to drawing detail.

3.3 Expansion Facilities for Conduit Crossing Building Expansion Joints

- .1 Wherever concealed or surface mounted conduits cross building expansion joints, provide expansion facilities to permit free movement without imposing additional stress or loading upon support system, and to prevent excessive movement at joints and connections, in accordance with drawing details.

3.4 Installation of Outlet Boxes & Back Boxes

- .1 Provide an outlet box or back box for each luminaire, wiring device, telephone outlet, fire alarm system component, communications systems components, and each other such outlet.
- .2 Size boxes to accommodate exact supplied components and for bending radii of installed cables. Confirm requirements with respective system vendors.
- .3 Outlet boxes flush mounted in interior construction, surface mounted in concealed interior locations, and surface mounted in exposed interior locations where connecting conduit is EMT, to be stamped and galvanized steel outlet boxes unless otherwise noted.

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- .4 Outlet boxes for surface mounted exterior lighting, receptacles, and other device outlets, boxes flush mounted in exterior building surfaces, and boxes mounted in interior device locations where connecting conduit is rigid and boxes in perimeter wall where insulation and vapour barrier is present, and boxes in non-climate controlled areas to be "FS" or "FD" Series cast boxes unless otherwise noted.
- .5 Provide sealing around boxes in walls where insulation and vapour barrier is present or for walls of rooms that are sealed. Maintain sealing system of wall.
- .6 Outlet boxes in underground plastic conduit systems to be rigid PVC plastic outlet boxes, unless otherwise noted.
- .7 Outlet boxes for flush floor mounted devices to be concrete tight formed galvanized steel fully adjustable flush floor boxes. Locate in to position and install in accordance with manufacturer instructions. Coordinate installation with trades pouring concrete floor slab or trade responsible for floor construction.
- .8 Provide a barriered outlet box for switches connected to normal and emergency power and share a common faceplate.
- .9 Provide epoxy coated boxes for epoxy coated conduit. Handle and install epoxy coated boxes in accordance with manufacturer instructions as not to damage epoxy coating. Seal joints with manufacturer sealing compound.
- .10 Provide outlet boxes for special wiring devices, for special equipment and special applications. Refer to requirements specified in other Sections and/or on drawings.
- .11 Size and arrangement of outlet boxes to suit device which they serve.
- .12 Mounting heights and locations for outlet boxes are typically indicated on drawings, however confirm exact location and arrangement of outlets prior to roughing-in. Architectural drawings and Consultant's instructions have precedence over electrical drawing diagrammatic layouts and specified mounting heights and locations.
- .13 Do not install outlet or back boxes "back-to-back" in walls and partitions. Stagger such outlets and seal against noise transmission in accordance with drawing details. "Thru-wall" type boxes will not be permitted for any application.
- .14 Provide blank coverplates on existing obsolete boxes which are to remain in position.
- .15 Provide blank coverplates over boxes left empty for future installation of devices. Clearly identify each box as to its intended use, to Owner's approval and reviewed with Consultant. Generally, provide stainless steel type blank coverplates.

3.5 Mounting Heights

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .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.
 - .2 Wall receptacles:
 - .1 General: 400 mm. In block, 400 mm to underside
 - .2 Above top of continuous baseboard heater: 200 mm.

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- .3 Above top of counters or counter splash backs: 200 mm.
- .4 In mechanical rooms: 1200 mm. In block. 1200 mm to top side
- .3 Panelboards: 1800 mm or as indicated.
- .4 Telephone and Interphone outlets: at height of adjacent outlet of 400 mm. In Block, 200 mm to underside.
- .5 Wall mounted telephone and interphone outlets: 1500 mm.
- .6 Fire alarm stations: 1200 mm.
- .7 Fire alarm bells: 2250 mm
- .8 Television outlets: 400 mm. In block 400 mm to underside
- .9 Wall mounted speakers: 2250 mm.
- .10 Emergency call switches and/or pushbuttons: 900 mm

3.6 Installation of Pull Boxes & Junction Boxes

- .1 Provide pull boxes in conduit systems wherever shown on drawings, and/or wherever necessary to facilitate conductor installations. Generally, conduit runs exceeding 30 m (100") in length, or with more than two - 90° bends, are to be equipped with a pull box installed at a convenient and suitable intermediate accessible location.
- .2 Size boxes to accommodate exact supplied system and for bending radii of installed cables. Confirm requirements with respective system vendors.
- .3 Provide junction boxes wherever required and/or indicated on drawings and as required by local governing electrical code.
- .4 Provide sealing around boxes in walls where insulation and vapour barrier is present or for walls of rooms that are sealed. Maintain sealing system of wall.
- .5 Boxes in rigid conduit and EMT inside building to be stamped galvanized or prime coated steel.
- .6 Boxes in exterior rigid conduit and boxes in perimeter wall where insulation and vapour barrier is present, to be "Condulet" cast gasketed boxes, unless otherwise noted.
- .7 Boxes in plastic conduit to be rigid PVC plastic boxes complete with required couplings.
- .8 Provide epoxy coated boxes for epoxy coated conduit. Handle and install epoxy coated boxes in accordance with manufacturer instructions as not to damage epoxy coating. Seal joints with manufacturer sealing compound.
- .9 Pull boxes and junction boxes to be accessible after work is completed.
- .10 Accurately locate and identify concealed pull boxes and junction boxes on "As-built" record drawings.
- .11 Clearly identify main pull or junction boxes (excluding obvious outlet boxes) by painting outside of covers. Spray painting is not permitted unless approved by Owner and reviewed with Consultant. Paint colours to be in accordance with following schedule:
 - .1 lighting-yellow;
 - .2 normal power-blue;
 - .3 essential power-orange;
 - .4 fire alarm-red;
 - .5 telephone-green;

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- .6 miscellaneous signals-brown.
- .12 In addition to painting miscellaneous signal boxes, clearly identify specific system in which box is installed.
- .13 Cover boxes in fire walls with aluminium tape and seal with caulking.

3.7 Installation of Sleeves

- .1 Where conduits, round ducts and conductors pass through structural poured concrete, provide sleeves of type suitable for application, and approved by local governing codes.
- .2 Sleeves in concrete slabs, except as noted below, are to be No. 24 gauge or equivalent, with an integral flange to secure sleeves for formwork construction.
- .3 Sleeves in waterproof concrete slabs and in other slabs where waterproof sleeves are required are to be lengths of Schedule 40 pipe sized to extend 100 mm (4") above floor.
- .4 Sleeves in poured concrete walls and foundation are to be Schedule 40 pipe.
- .5 Size sleeves, unless otherwise noted, to leave 13 mm (1/2") clearance around conduit, duct, conductor, etc. Void between sleeves and conduit, duct, conductors, etc., to be packed and sealed for length of sleeves as in accordance with article titled "Firestopping and Smoke Seal Materials" specified here in this Section. Ensure that sleeves set in exterior walls are packed and sealed with governing authority approved materials suitable for application and that both ends of sleeves are packed watertight with approved permanently flexible and water tight materials. Exact responsibility of work to be coordinated with General Trades Contractor.
- .6 Submit to concrete reinforcement detailer at proper time, drawings indicating required sleeves, recesses and formed openings in poured concrete work. Completely and accurately dimension such drawings and relate sleeves, recesses and formed openings to suitable grid lines and elevation datum.
- .7 Supply sleeves of a water protecting type in accordance with detail found on drawings for installation in following locations:
 - .1 in Mechanical and Fan Room floor slabs, except where on grade;
 - .2 in slabs over Mechanical, Fan, Electrical and Telephone Equipment Rooms or closets;
 - .3 in floors equipped with waterproof membranes.
- .8 "Gang" type sleeving to be permitted only with approval of Owner and reviewed with Consultant.
- .9 Terminate sleeves for work which is exposed, so that sleeve is flush at both ends with wall, partition, or slab surface such that sleeve may be covered completely by escutcheon plates.

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3.8 Installation of Firestopping & Smoke Seal Materials

- .1 Where electrical work penetrates or punctures fire rated construction, provide ULC certified, listed and labelled firestopping and smoke sealing packing material systems to seal openings and voids around and within raceway and to ensure that continuity and integrity of fire separation is maintained. Submit to Consultant, copies of certificates of compliance from an independent testing agency, attesting that fire stopping and smoke seal materials meet ULC requirements. Openings not in immediate vicinity of working areas are to be firestopped and sealed same day as being opened.
- .2 Examine condition of voids to be filled to ensure suitability for systems. Verify installation of service penetrations and adjacent construction has been completed. Prepare substrates and surfaces to a clean, dry, frost-free condition, and primed to firestop system manufacturer recommendations to receive firestopping system.
- .3 Install fire stopping and smoke seal materials for each installation in strict accordance with specific ULC certification number and manufacturer instructions. Comply with local governing building code requirements and obtain approvals from local building inspection department. Ensure that openings through fire separations do not exceed maximum size wall opening, and maximum and minimum dimensions indicated in ULC Guide No. 40 U19 for Service Penetration Assemblies and fire stopping materials.
- .4 Ensure that continuity and integrity of fire separation is maintained and conform to requirements of latest edition of ULC publication "List of Equipment and Materials, Volume II, Building Construction".
- .5 Where work requires removal of existing firestopping materials and replacement of firestopping materials after cabling changes have been made, ensure that replacement material is same material and manufacturer of existing if any remains in place, or ensure that all existing material is removed before installation of replacement material.
- .6 After installation work is complete, arrange for manufacturer authorized representative to inspect and verify each installation and provide a test report signed by installing trade and manufacturer representative. Test report to list each installation and respective ULC certification and number.

3.9 Installation of Fastening & Securing Hardware

- .1 Provide fasteners and similar hardware required for conduit, duct, raceway, conductors, etc. and for equipment hanger and/or support material unless otherwise noted.
- .2 Accurately and properly set concrete inserts in concrete framework. Where multiple type inserts are used, space same to suit requirements of smallest conduit, etc., in group.
- .3 Fasten hanger and support provisions to masonry with expansion shields and machine bolts, or, for light loads, use plugs, and screws.
- .4 In drywall or plaster walls and/or ceilings use two wing toggles and for heavy loads, provide steel anchor plates with two or more toggles to spread load.
- .5 Provide beam clamps for attaching hanging and/or support provisions to structural steel, or where approved by Owner and reviewed with Consultant, weld hanging and support provisions to structural steel.
- .6 Explosive powder actuated fasteners are not permitted unless specific written approval for their use and type has been obtained from Consultant.

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- .7 Under no circumstances use ceiling suspension hangers or grids for suspension of conduit and conductors. Install supports to permanent structure of building, limited to areas that will not damage structural stability.
- .8 Provide "J" hooks in accessible ceiling spaces where conduit is not provided for structured cabling runs or other telecommunication cabling, as approved by Consultant.
- .9 Comply with J-hook manufacturer loading limitations and spacing criteria. Do not exceed 1.2 m (4') spacing interval. Add additional J-hooks if cabling sags, at discretion of Consultant. Drill anchors for J-hooks into slab not into post tensioned beams. Do not install more than one system on each J-hook.
- .10 Install Velcro tie wraps on bundled telecommunication cables and do not over tighten. Provide FT6/CMP rated wraps in plenum type spaces as per local building code requirements.
- .11 Comply with Structural Engineer's limitations for maximum penetrations of securing hardware into concrete slabs.

3.10 Installation of Identification Nameplates

- .1 For each piece of electrical distribution equipment from electrical source of supply up to and including panelboards, for special control panels and cabinets, and for each other piece of electrical equipment, provide engraved Lamacoid identification nameplates secured to apparatus with stainless steel screws. Nameplates to indicate source of electrical supply and include Consultant's equipment identification number. Identify whether equipment is on "NORMAL POWER SYSTEM" or "ESSENTIAL POWER SYSTEM". Comply with CSA Z32 requirements.
- .2 Equip large multiple cell or component apparatus such as switchboards and distribution panels with main nameplates identifying equipment, voltage characteristics, capacity and source of supply, and with sub-nameplates clearly identifying each cell or component and its service.
- .3 Panelboard nameplates to identify panelboard number as designated on drawings, unless otherwise instructed. Nameplates for disconnect switches, control panels, and cabinets to outline their service and source of supply.
- .4 In areas where equipment having removable doors that can be commonly installed on different equipment, ensure that each door is identified to which piece of equipment it is associated with, such that nameplates are with correct equipment.
- .5 Provide nameplates engraved "Dedicated Circuit" on faceplates for receptacles on dedicated circuits in Critical and Intermediate Patient Care Areas. Provide nameplates engraved "Housekeeping" for Housekeeping receptacles generally located in Corridors with exact extent to be determined on site. In these areas where lamacoid nameplates are employed, engrave source of supply (circuit designation) on these nameplates as well.
- .6 Faceplates for devices not in patient care areas or not in corridors in vicinity of patient care areas are to be labelled with plastic self-adhesive printed labels with similar information as specified for nameplates. Provide labels on inside and outside face of faceplates. Apply a layer of a clear coat finish over each label.
- .7 Panelboard identification is to be arranged as follows: "WING-C-LP-A-1" where:
 - .1 "WING" denotes building wing;

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- .2 "C" denotes floor of wing;
- .3 "LP" denotes panelboard type;
- .4 "A" denotes panelboard number;
- .5 "1" denotes a sub-fed panelboard of same number.
- .8 Building wings for panelboard identifications to be confirmed with Consultant prior to start of work.
- .9 Building floors for panelboard identifications to be indicated as follows:
 - .1 "B" or "C" - denotes Basement or Concourse where applicable to match installation;
 - .2 "G" - denotes Ground Floor;
 - .3 1 to 10 - denotes Floors 1 through 10.
- .10 Panelboard types are to indicate service as follows:
 - .1 "DP" denotes "Distribution Panel" that feeds various branch circuit panels and larger loads;
 - .2 "LP" denotes "Lighting Panel" for lighting and general receptacle loads;
 - .3 "PP" denotes "Power Panel" for multiple loads within a specific area such as a shop;
 - .4 "KP" denotes "Kitchen Panel" for equipment loads within kitchen.
- .11 Where panelboards are supplied from Emergency Power, panelboard type to be preceded by letter "E", i.e. "EDP", "ELP", "EPP", "EKP", etc.
- .12 Nameplates to be mechanically secured lamacoid and be colour coded as follows:
 - .1 Normal Power - Black with white letters;
 - .2 Emergency Power - Red with white letters;
 - .3 Isolated Power - Red with white letters;
- .13 Above identification nameplate and nomenclature requirements are for typical requirements for pricing only.
- .14 In pull boxes, junction boxes and at terminations, identify feeders by use of plastic plates indicating system voltage and circuit designations. Plates to be 25 mm (1") in diameter and have letter stamped 9 mm (5/8") high. Colour coding to be:
 - .1 Phase A - red;
 - .2 Phase B - black;
 - .3 Phase C - blue;
 - .4 Neutral - white;
 - .5 Ground - green.
- .15 Confirm print size type and size, colours, sizing and nomenclature of nameplates with Consultant prior to ordering. Submit sample board.

3.11 Installation of Warning Signs

- .1 Provide warning signs as applicable for applications as noted.

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- .2 Secure signs to equipment with stainless steel screws. Number of signs required and sign wording, symbols, and colours to be approved by Owner and reviewed with Consultant, and local electrical utility, where applicable.

3.12 Installation of Rooftop Support System

- .1 Install rooftop support system for conduits/raceways in accordance with manufacturer instructions and recommendations to suit type of raceway and roofing materials.
- .2 If gravel top roof, remove gravel from around and under pipe support. Coordinate work with building roofing vendor confirmed with Owner and reviewed with Consultant.
- .3 Consult existing roofing vendor for roof membrane compression capacities and roof loading limitations. Comply with restrictions.
- .4 Use properly sized clamps to suit conduit sizes. Ensure that installation and use of system does not invalidate existing roof warranties.
- .5 Engage existing roofing vendor to inspect installation and verify that installation has not damaged roof.

3.13 Branch Circuit Balancing

- .1 Connect branch lighting and power circuits to panelboards so as to balance actual loads (wattage) within 5%. If required, transpose branch circuits when work is complete to meet this requirement.
- .2 At request of Consultant, perform necessary tests to show compliance with above requirement. Make such tests after building is occupied.

3.14 Disconnection, Removal & Relocation Work

- .1 Where indicated on drawings or where required to perform Work of this Project, disconnect and remove items of existing obsolete electrical work. Relocate required devices as required to accommodate work of other Divisions. Where luminaires, switches, receptacles, and other devices and/or equipment is removed, disconnect at point of electrical supply, remove obsolete wiring and conduit up to source, unless otherwise noted, and make system safe to Owner satisfaction and as reviewed with Consultant. Remove obsolete conduit/raceways in accessible ceiling spaces, exposed locations, etc. Where existing obsolete conduit and similar raceway material cannot be removed, such as embedded in concrete, cut back and cap obsolete conduit and raceways. Refer to specific notes on drawings.
- .2 When respective work is deleted, such deletions are to in no way affect operation of any existing interconnected mechanical or electrical components that remain. When existing circuits are being disconnected, maintain supervision of area to ensure that such circuits do not affect essential existing circuits being retained.
- .3 Refer to architectural drawings which define extent of areas being demolished in existing building. Review drawings and site and include for demolition and/or renovation of services as required to accommodate alterations detailed.
- .4 Unless otherwise noted, obsolete materials which are removed and are not to be relocated or reused are to become your property. Remove from site and properly dispose. Obtain from Owner and coordinate with Consultant, a list of existing electrical items which are to be removed and turned over to Owner. Said items are to remain property of Owner.

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- .5 Where existing services pass through or are in an area to serve items which are to remain, or pass through areas that are to be deleted, maintain services, but re-route as required. Include for rerouting existing services concealed behind existing finishes and which become exposed during renovation work, so as to be concealed behind new or existing finishes. Confirm with Owner services which are to be kept in service and operational.
- .6 Revise panelboard directories accordingly, if affected by any renovation, disconnection, or removal of work. Use Owner's actual room names/numbers.
- .7 Protect existing devices being relocated or deleted to ensure that they are not damaged. Test such devices prior to disconnection and de-energization, to ensure that each device is in proper working condition. Ensure that motors are in proper rotation direction. Examine each device for damage. Report devices not working or with damage to Consultant prior to initiating any work. It will be assumed that devices are in proper working order and good condition if not reported.
- .8 Provide junction boxes, outlet boxes, wiring, plates, etc., as necessary for complete relocation of devices. Clean relocated or temporary removed devices and equipment, and ensure that they are in good operating condition before being reinstalled. Where existing luminaires are relocated, clean luminaires and inspect for damage. Re-lamp relocated luminaires. Report defects or damages to Consultant. Do not splice conductors unless approved by Owner and reviewed with Consultant. Utilize junction boxes and terminal devices for proper extension of circuits where approved. Otherwise replace circuits with home run continuous run of suitable lengths.
- .9 Provide blank coverplates on existing obsolete boxes which are to remain in position.
- .10 After installation is complete, test parts of re-used or relocated electrical equipment and correct faults and grounds. Include for fire alarm verification company to verify any relocated devices and downstream affected devices, and verify system as required by local fire authority to suit actual relocation work. For other existing systems, engage manufacturers authorized representative or Owner's system maintenance contractor, to inspect and verify relocated devices. Coordinate and confirm exact requirements with Owner and/or Consultant. Document testing in test reports, signed by testing technician. Submit copies to Consultant.
- .11 Interior, exterior or underground electrical services (including auxiliary services, telephone, fire alarm, P.A. System, etc.) to operating parts of building are not to be hampered under any conditions and to that effect, necessary work may have to be carried out on an overtime basis, at no additional cost to this project. Existing risers are to be maintained in service as required to feed other areas of building(s). Do not interrupt any services without prior written approval by Owner and reviewed with Consultant. Submit formal requests to Consultant outlining in detail requirements of proposal and wait for instructions from Consultant.
- .12 Be present when new doors or openings are being cut into existing walls and ceilings. Should any damage occur to electrical system, restore system to a safe and sound condition.
- .13 Where references are made on drawings that existing receptacles, etc., be extended and/or relocated to suit new construction, receptacles, etc., are to be tested and if found defective, be replaced with new devices. Cracked or broken cover plates are to be replaced and match Architectural finishes. Contractor may optionally replace existing basic receptacles, switches, and faceplates with devices matching existing devices.

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- .14 Be responsible for disconnecting power supply to branch circuits controlling lighting, receptacles, panels, mechanical equipment, etc., for safe removal of equipment, conduit, wiring, boxes, etc., affected by demolition.
- .15 Close openings in boxes, panels, etc., that result from removal of equipment, conduit, wiring, fixtures, etc. Close openings in a proper manner and properly terminate and insulate cables to restore system to a safe operating condition, to Consultant's satisfaction.
- .16 Be present and supervise removal of electrical equipment, P.A. speakers, etc., during demolition of ceilings, walls, floors, etc. Existing equipment which is not to be relocated but interferes with demolition, are to be temporarily relocated until demolition work is completed. Services to temporarily relocated equipment are to be maintained at all times.
- .17 Arrange with General Contractor for removal and re-installation of existing ceiling tiles as required to perform work. Prior to removal, inspect tiles for damage and report any to Owner and Consultant. Any loose cabling is to be secured, and luminaires additionally supported with cables secured to ceiling slab. After work has been completed and successfully inspected, arrange with General Contractor for reinstallation of ceiling tiles to existing standards and re-install devices. Be responsible for replacement of tiles and grid members damaged during work of Electrical Division. Comply with applicable governing authority requirements with regards to ceiling work in special areas.
- .18 Where existing surfaces are damaged by Electrical Divisions work and/or where existing devices are removed from wall, ceilings, floors and other surfaces, and such deleted devices are not being replaced in same locations, patch locations of these removed devices and re-finish. Patching and finishing is to be provided by tradesmen skilled in particular trade or application worked on, to Consultant's approval. Where openings are left in existing ceiling tiles, replace ceiling tiles with new matching tiles approved by Consultant. Unless otherwise included for in other Divisions, include for:
 - .1 preparing existing surfaces to be filled and repainted to be cleaned as required to remove dirt, dust, oil, grease, loose paint, rust and any other foreign matter which would prevent proper bonding of new finish; sand glossy surfaces to uniform dull texture;
 - .2 filling in and patching surfaces with same material as existing surfaces; finished surfaces to match and line with existing adjoining surfaces;
 - .3 providing fire stopping materials to maintain fire rating of the existing surfaces; refer to specification article titled - Firestopping and Smoke Seal Materials.
 - .4 using paint rollers and/or brushes to apply and extend paint finish over full height and/or width of area affected, to a straight line in location determined by Consultant;
 - .5 applying sufficient number of coats such that patched area is indistinguishable to surrounding area;
 - .6 materials used to be of equivalent quality to existing finishes standards and be compatible with finishes to which they are applied;
 - .7 finishes to be approved by Owner and reviewed with Consultant.
- .19 If at any time during course of building work, asbestos containing materials are encountered or suspected, cease work in area in question and immediately notify Consultant. Comply with local governing authority regulations. Do not resume work in affected area without approval from Consultant.

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3.15 Interruptions to & Shut-Downs of Services & Systems

- .1 Shutdowns and interruptions to existing systems and services are to be coordinated fully with and performed at times acceptable to Owner and reviewed with Consultant. Generally, shutdown may be performed only between hours of 12:00 midnight Sunday until 6:00 a.m. Monday morning. Include for costs of premium time to perform work during nights, weekends or other times outside of normal working hours, which may be necessary to comply with stipulations specified herein this Article. Services for operation of existing non-renovated areas of building are to be maintained.
- .2 Upon award of contract, submit to Consultant for review and approval, a list of anticipated shut-down times and their maximum duration.
- .3 Prior to each shut-down or interruption, inform Consultant and Owner in writing 5 working days in advance of proposed shut-down or interruption and obtain written consent to proceed. Do not shut down or interrupt any system or service without written consent. Note that shutdowns of some essential services may require additional advance notification time.
- .4 Work associated with shut-downs and interruptions are to be carried out as continuous operations to minimize shut-down time and to reinstate systems as soon as possible. Prior to any shut-down, ensure that materials and labour required to complete work for which shut-down is required are available at site.
- .5 Confirm with Consultant if any feeder is designated for special considerations and if designated as such and is to be interrupted, ensure that at least following preparations are met:
 - .1 provide a schedule of proposed feeders to be interrupted; propose one feeder at a time to be worked on per scheduled shutdown;
 - .2 provide a method of procedure for work;
 - .3 prepare above documentation and submit for review by Consultant at least fifteen working days prior to date of each proposed work;
 - .4 on day/night of proposed feeder work, advise Consultant of which feeder is to be worked on; confirm with Consultant requirements for witnessing work;
 - .5 de-energize feeders and perform work as per Consultant and Owner reviewed schedule;
 - .6 after feeders are re-routed, megger test each feeder.
- .6 Where working in close proximity to "live parts" or inside energized panels or energized cubicles of switchboards/substations, provide protection "boots" over bussing and insulating mats to cover areas of exposed live parts.

3.16 Cutting, Patching & Core Drilling

- .1 Unless otherwise noted, General Trades Contractors are responsible for cutting, patching, and core drilling of existing building required for installation of Work.
- .2 Where added conduits and/or conductors penetrate existing construction, identify, and mark out locations for openings. Size openings to leave 13 mm (1/2") clearance around conduit and/or conductors. Coordinate work with General Trades Contractor.
- .3 Ensure that openings in fire rated construction are sealed as per requirements of article titled "Firestopping And Smoke Seal Materials" specified herein this Section and as per Division 07, as applicable.

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- .4 Fire stop and seal openings as specified, and patch as required before end of workday. No openings are to be left open overnight unless approved by Owner and coordinated with Consultant.

3.17 Finish Painting of Electrical Work

- .1 Unless otherwise noted, finish painting of exposed Electrical Divisions work is to be performed as part of work of Division 09.
- .2 Provide identification painting for electrical distribution equipment in accordance with application requirements of Division 09. Confirm exact finish colours with Consultant. Equipment requiring special colour identification painting to include but not be limited to following:
 - .1 pull boxes and junction boxes;
 - .2 communication system conduit;
 - .3 genset exhaust piping.
- .3 Spray painting is not permitted unless approved in writing by Owner and reviewed by Consultant.

3.18 Conduit Provisions for Miscellaneous Systems

- .1 Provide following components to accommodate future installation of various miscellaneous systems by system installers who are to provide equipment and wiring:
 - .1 conduit - diameters as sized on drawings with non-metallic fish wires or pull cords and suitable bushings for conduit terminations, and as specified in Part 2; provide labelling at each end to clearly identify each conduit run with respect to system and path;
 - .2 outlet boxes - standard galvanized steel, each complete with a blank type faceplate, and as specified in Part 2;
 - .3 pull boxes, junction boxes, back boxes and sleeves - and as specified in Part 2.
- .2 Miscellaneous systems are typically as shown on drawings. Unless otherwise noted on drawings, provide dedicated conduit runs for each system. Coordinate sizes of boxes with respective system vendors to ensure proper sizing to accommodate components and that allows for wiring bending radii. Confirm conduit and box requirements also with system vendors.
- .3 Provide pull boxes in conduit runs longer than 30 m (100') or having more than two - 90 degree bends. Size pull boxes to be at least 8 times entering conduit in length. Pull box sizes to comply with respective system standards.
- .4 Leave conduits free and clear of all obstructions and terminate as required. Equip terminations with bushing, and clearly identify each run. Provide fish wires in all empty conduits. Run telecommunications conduits to comply with separation from sources of electromagnetic radiation as per standard ANSI/TIA/EIA-569. Site bend telecommunications conduit elbows to comply with system conduit bending radii requirements.
- .5 Confirm exact requirements and locations of equipment with Consultant and respective system installers prior to roughing-in.
- .6 Refer to system riser diagrams on drawings.

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- .7 Quantities for outlets to be as per floor plan drawings and not riser diagrams.

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Grounding & Bonding

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PART 1 - GENERAL

1.1 Submittals

- .1 Not applicable.

PART 2 - PRODUCTS

2.1 Basic Materials

- .1 Provide required components to complete grounding and bonding work to requirements of local governing electrical authority and codes.

PART 3 - EXECUTION

3.1 General Grounding & Bonding Requirements

- .1 Provide required grounding and bonding work in accordance with drawings, local governing electrical authority, governing authorities having jurisdiction and local governing electrical inspection authority. Provide local governing electrical utility grounding requirements for stations, vaults and electrical rooms, as applicable. Confirm requirements with local governing electrical utility.
- .2 Connect grounding conductors to motors 10 hp and above or circuits 20A or above, with a solderless terminal and a bolt tapped to motor frame or equipment housing. Connect to smaller motors or equipment by fastening terminal to a connection box. Connect junction boxes to equipment grounding system with grounding clips mounted directly on box or with machine screws. Completely remove paint, dirt, or other surface coverings at grounding conductor connection points so good metal-to-metal contact is made.
- .3 Ground and bond various telecommunications, audio visual systems, security, life safety and control systems in accordance with respective system manufacturers recommendations and in accordance with local governing electrical code requirements.
- .4 Ground conductors not sized on drawings are to be sized in accordance with local governing electrical authority requirements. Ground conductor size is to be no smaller than requirements specified herein this article or on drawings.

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Vibration Isolation & Seismic Restraints

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PART 1 - GENERAL

1.1 Submittals

- .1 Submit shop drawings of products specified in this Section.
- .2 Submit copies of documents requested herein, testing reports, certificate of approvals, and commissioning sheets.

PART 2 - PRODUCTS

2.1 Vibration Control & Seismic Restraint

- .1 Electrical equipment installation is to meet local governing authority having jurisdiction and code seismic requirements and additional requirements for vibration isolation.
- .2 Provide labour, materials, and equipment required and necessary to seismically restrain electrical equipment and equipment bases including concrete pads, and guarantee function of materials and equipment supplied.
- .3 Make electrical connections to vibration-isolated equipment with flexible conduit or other flexible means acceptable to Consultant and local governing authority having jurisdiction so as not to restrict maximum anticipated movement of equipment under seismic excitation movement.
- .4 In event that inadequate isolation is provided by isolation product Manufacturer isolation package, be responsible for improving isolation to an acceptable standard at no additional cost to contract. Isolation product Manufacturer seismic restraint engineer to verify that seismic restraints and combination isolator/restraints intended for use on project are fit for intended purpose. Be responsible for ensuring that Manufacturer seismic restraints are in compliance with applicable local building code requirements for Place of Work.
- .5 Provide additional seismic requirements for suspended electrical raceways, luminaires, and other equipment as per governing local authority requirements and requirements of current codes and by-laws.
- .6 Acceptable manufacturers of seismic restraints include:
 - .1 Vibro-Acoustics;
 - .2 Mason Industries;
 - .3 Kinetic Noise Control;
 - .4 Eaton B-Line.

PART 3 - EXECUTION

3.1 Installation

- .1 Comply with seismic restraint Engineer and manufacturer installation recommendations.

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- .2 Obtain required training from Manufacturer representative on any special installation procedures. Install components in accordance with Manufacturer instructions to suit specific installation requirements.
- .3 Test, adjust, and certify installation. Submit copies of test report to Consultant.
- .4 Refer to Part 2 for specific installation requirements.

3.2 Inspection

- .1 Inspect for removal of break away hardware to ensure proper torques of installed systems.
- .2 For non-visually verifiable product, manufacturers to verify proper torque for a minimum 10% of application. Document torques for applications per Manufacturer instructions.

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Low Voltage Cables

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PART 1 - GENERAL

1.1 Submittals

- .1 Submit shop drawings for products and accessories.
- .2 Submit samples of conductors, when requested by Consultant.

PART 2 - PRODUCTS

2.1 General Power Cables

- .1 CSA approved, ULC labelled and certified. Unless otherwise noted, conductors to be copper and be suitable for applications as noted in governing local electrical code.
- .2 RW90 CSA certified, single copper conductor to CSA C22.2 No. 38, 600/1000 volts, maximum 90°C (194°F) conductor temperature, -40°C (-40°F) minimum installation temperature, X-link polyethylene (XLPE) insulation, colour coded.
- .3 T90 Nylon, CSA certified, single copper conductor to CSA C22.2 No. 75, 600 volts, maximum 90°C (194°F) dry conductor temperature, -10°C (-14°F) minimum installation temperature, PVC insulated, nylon covered.
- .4 TWU single copper conductor to CSA C22.2 No. 75, 600 volts, maximum 60°C (140°F) conductor temperature, -40°C (-40°F) minimum installation temperature, PVC insulated suitable for wet and buried installations, colour coded.
- .5 RWU90 CSA certified, single copper conductor to CSA C22.2 No. 38, 1000 volts, maximum 90°C (194°F) conductor temperature, -40°C (-40°F) minimum installation temperature, extra thickness X-link polyethylene (XLPE) insulation suitable for wet and buried installations, colour coded.
- .6 AC90 flexible armoured cable with "RW90" conductors and bare copper ground conductor and overall interlocked aluminium tape armour, to CSA C22.2 No. 51 (R2004).
- .7 AC90 ISO-BX flexible armoured cable with "RW90" conductors with low temperature Exelene insulation and two additional solid copper bonding conductors (one bare, one insulated) and overall interlocked aluminium tape armour, to CSA C22.2 No. 51 (R2004).
- .8 DLO stranded tinned copper conductor, to CSA type RW90, with 90°C rated ethylene propylene rubber insulation and black chlorinated polyethylene overall jacket; flame retardant and suitable for wet locations; rated for up to 2000 volts.
- .9 Solid conductors to and including No. 10 AWG; stranded conductors in sizes larger than No. 10 AWG; branch circuit conductors constructed of 98% conductive copper; and approved for minimum 600 volts, with minimum 1000 volts where noted.

2.2 Connectors

- .1 Armoured cable connectors must be proper squeeze type connectors and plastic anti-short bushings at terminations.
- .2 Connectors for conductors connecting to devices as per local governing electrical requirements to be equal to IDI Electric (Canada) Ltd., "Ideal" No. 451, No. 452 and No. 453, "Wing-Nut", CSA certified, 600 volts, rated pressure type connectors.

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- .3 Splice connectors to line voltage branch circuit conductors and feeders to be CSA approved compression type connectors as follows:
 - .1 of voltage rating to suit application;
 - .2 typically for conductors No 8 AWG and greater;
 - .3 long barrel, double crimp compression;
 - .4 tin plated seamless copper tubing;
 - .5 chamfered barrel;
 - .6 colour coded for die identification;
 - .7 used with manufacturer matching dies and compression tool;
 - .8 covered with suitable 3M or Raychem flexible polyolefin, fire resistant, heat shrink tubing.
- .4 For conductors sized 3/0 and greater, provide long barrel double crimp, 2 hole compression type lug connectors, unless otherwise noted.

2.3 Conductor Pulling Lubricant

- .1 IDI Electric (Canada) Ltd., "Ideal Yellow 77" or "Wire Lube" as required.
- .2 "French Chalk" or "Talcum Powder" conductor pulling lubricant.

2.4 Teck Cables

- .1 Nexans, "TECK90" cables as follows:
 - .1 certified to CAN/CSA C22.2 No.131, Type TECK 90 Cable;
 - .2 rated for outdoor, weather resistant and wet locations applications;
 - .3 600/1000 V rated;
 - .4 Conductor: Bare, Soft drawn, Class B Compact or Compressed Stranded Copper conductors per ASTM;
 - .5 insulation: chemically cross linked thermosetting polyethylene (XLPE);
 - .6 bonding conductor (1/C Cable): Soft drawn bare copper;
 - .7 inner jacket: sunlight resistant PVC jacket tightly applied over assembly, to prevent slipping of core in a vertical position;
 - .8 armour: flexible interlocked aluminum armour, over inner jacket for mechanical protection;
 - .9 overall PVC jacket rated -40°C (-40°F).
 - .10 barrier tape over shield.
- .2 Acceptable manufacturers are:
 - .1 Nexans;
 - .2 Prysmian Cables (Pirelli);
 - .3 General Cable;
 - .4 Aetna Cables;
 - .5 Kerite Company.

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2.5 Cable Splice Kits

- .1 3M Company, cold shrink in line splice kits as follows:
 - .1 CSA approved;
 - .2 meets requirements of ANSI C119-1 Standard with voltage ratings up to 1 kV;
 - .3 cold shrink design which requires no application of heat source for installation;
 - .4 open-ended, tubular, rubber sleeves which are factory expanded and assembled onto removable core;
 - .5 core is removed after the tube has been positioned for installation over an inline connection, terminal lug, etc., allowing tube to shrink and form a water-resistant seal;
 - .6 cold shrink tubing constructed of EPDM rubber;
 - .7 suitable for indoor ,outdoor and direct burial applications;
 - .8 additionally include required compression lugs of type compatible with cable type and electrical vinyl or silicone tape.
- .2 Provide exact splice type as per termination manufacturer recommendations to match (or exceed where applicable) cable properties including following:
 - .1 voltage class rating and insulation BIL level;
 - .2 conductor material, conductor size and cable/shielding type;
 - .3 indoor or outdoor application.
- .3 Install splice kits in accordance with manufacturer detailed instructions. Prepare cable for accommodating splice jacketing tubes and body in accordance with splice kit manufacturer instructions. Install proper lugs using matching size die and crimping tool. Apply overall taping. After installation has been completed and inspected, test splice as per manufacturer recommendations.
- .4 Acceptable manufacturers are:
 - .1 3M Company;
 - .2 Tyco Raychem;
 - .3 Prysmian Cables.

PART 3 - EXECUTION

3.1 Project Conditions

- .1 If identified in documents, verify that field measurements and conditions are as identified.
- .2 Cable routing on drawings is schematic and approximate. Route cable as required to meet project conditions. Determine exact routing and lengths on site.
- .3 Confirm fire protection ratings of construction to ensure that rooms and paths of conductors are fire rated in accordance with local governing codes requirements. Include fire rated conductors as required to meet local governing codes requirements.

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3.2 Co-Ordination

- .1 Co-ordinate work with work provided under other electrical work and work of other trades.
- .2 Determine required separation between cable and other work.
- .3 Determine cable routing to avoid interference with other work.
- .4 Submit any alternative cable routing to Consultant for review prior to proceeding with work.

3.3 Installation of Conductors

- .1 Provide required conductors. Ensure fire rated conductors are provided for applications as required by local governing codes, standards and local governing authorities.
- .2 In applications where multiple conductors in conduit are being run, provide a trapeze configuration of metal C-channels and threaded rod hangers to support cable/conduit from ceiling slab. Wall mounted cable/conduit brackets and ring type conduit hangers may also be permitted in applications approved by Consultant. Provide required cable support system accessories which are not specified herein or shown on drawings but are required for proper installation.
- .3 Conductors, unless otherwise noted, to be as follows:
 - .1 underground inside or outside building and for non-climate controlled areas - "TWU" or "RWU90";
 - .2 for connections to electric heating coils in supply air ductwork systems, and for connections to other electric heating equipment where use of 90 degrees C. rated conductors are recommended by heating equipment manufacturer - "RW90";
 - .3 for conductors requiring fire rating by current regulations and local codes including feeders for emergency systems, fire fighter's elevators, fire alarm systems, other life safety systems and for applicable signal and control circuits of these systems - type "MI" CSA approved, ULC listed and labelled, 2 hour fire rated, copper sheathed mineral insulated copper conductors;
 - .4 climate controlled areas branch circuit wiring in accessible ceiling spaces and within stud wall construction consisting of drops down to luminaires and drops down stud walls to devices and in furniture systems - "AC90" flexible armoured cable ("BX") (maximum 6m (20') run permitted);
 - .5 branch circuit wiring for patient care areas accessible suspended ceiling spaces consisting of drops down to luminaires - "AC90" flexible armoured cable ("BX"); (maximum 3 m (10') run permitted); flexible armoured cable (i.e. "AC90") is not permitted within walls of patient care areas";
 - .6 branch circuit wiring for non-patient care areas in accessible ceiling spaces and within stud wall construction consisting of drops down to luminaires and drops down stud walls to devices and in furniture systems - "AC90" flexible armoured cable ("BX") (maximum 6m (20') run permitted);
 - .7 for installation interior of pre-fabricated service consoles - "T90 Nylon" or "RW90" in flexible metallic conduit; or "AC90 ISO-BX" to code requirements; refer also to drawing notes;
 - .8 for isolated power system load side wiring - "RW90";

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- .9 for climate controlled areas wiring except as noted above or specified elsewhere in Specification or as noted on drawings - "T90 Nylon" or "RW90".
- .4 Support flexible armoured cable in ceiling spaces and in stud wall construction with steel 2 hole cable straps to "Code" requirements. Flexible armoured cables must run in a neat manner parallel to building lines. Utilize centralized conduit runs to maintain maximum permitted runs of flexible armoured cables as specified. Provide insulating grommet at cut ends of flexible armoured cable to protect conductor insulation.
- .5 Splicing of conductors is permitted for replacement of existing conductors and extension as noted on drawings and where approved by Consultant. Splicing of conductors is subject to following conditions:
 - .1 splicing to extend existing conductors;
 - .2 for low voltage control and signal conductors, splicing made within an electrical box with terminal strips;
 - .3 for interior line voltage conductors, splicing made within an electrical box with cold shrink splice kits and mechanical compression connectors; full assembly to suit type and size of conductors and as approved by Consultant;
 - .4 for exterior line voltage conductors, splicing made with outdoor weatherproof cold shrink splice kits and mechanical compression connectors; full assembly to suit type and size of conductors and as approved by Consultant;
 - .5 splice/splice box properly identified with suitable painting or labelling;
 - .6 splice/splice box clearly identified on "as-built" drawings;
 - .7 use of pressure type twist connectors only with written consent of Consultant, but generally not permitted;
 - .8 use of "split bolts" is not permitted.
- .6 Install compression connectors with proper dies and compression tool as per connector manufacturer instructions. Install cold shrink tubing and associated materials as per manufacturer instructions.
- .7 Low voltage conductors to typically be No. 18 AWG "TEW" except for use in fire alarm system applications, unless otherwise noted. Provide specified fire alarm cables for fire alarm system applications or security system applications as approved by Code and local governing authorities. Conductors not installed in conduit or raceways to be fire insulated rated in accordance with latest governing Code Flame Spread requirements.
- .8 When installing type NMD90 conductors through metal studs, provide insulating grommets on stud openings to protect conductor insulation.
- .9 Generally, conductor sizes are indicated on drawings. Such sizes are minimum requirements and must be increased, where required, to suit length of run and voltage drop in accordance with applicable conductor voltage drop schedule appended to end of this Section.
- .10 Do not use conductors smaller than No. 12 AWG in systems over 30 volts, unless otherwise noted. Do not use conductors smaller than No. 6 AWG for exterior luminaire wiring unless otherwise noted.
- .11 Colour code conductors throughout to identify phases, neutrals and ground by means of self-laminating coloured tape, coloured conductor insulation, or properly secured coloured plastic discs. Colours, unless otherwise noted, to be as follows:
 - .1 Phase A - red;

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- .2 Phase B - black;
- .3 Phase C - blue;
- .4 Ground - green;
- .5 Neutral - white;
- .6 Control - orange.
- .12 Colours for isolated power system "load" side power wiring to be as follows:
 - .1 Live No. 1 - brown;
 - .2 Live No. 2 - orange;
 - .3 Ground - green.
- .13 Use "French Chalk" or talcum powder for pulling in isolated power centre "load" side wiring.
- .14 When pulling wires into conduit use lubricant and ensure that wires are kept straight and are not twisted or abraded.
- .15 Control conductors, in addition, to be numbered with Brady Ltd. or Electrovert Ltd. Z type markers.
- .16 Colour code conductors for communications systems in accordance with system component manufacturer recommendations.
- .17 Neatly secure exposed wire in apparatus enclosures with approved supports or ties.
- .18 Install low voltage conductors in conduits, unless otherwise noted within Documents.
- .19 Comply with local electrical code requirements and conductor manufacturer recommendations when terminating and connecting aluminium conductors.

3.4 Installation of Teck Cables

- .1 Provide cables as required for specific applications. Handle, install, and terminate in accordance with manufacturer recommendations and instructions and as herein specified.
- .2 When pulling cable, apply pulling tension to conductor not in sheath of cable. Limit cable pulling tension to as recommended by cable manufacturer.
- .3 Terminate cable in equipment with lugs and termination kits as per cable manufacturer instructions.
- .4 Installation of cable splices and terminations to be made by personnel skilled in this type of work.
- .5 Ground shielding as per cable manufacturer instructions.
- .6 Take necessary precautions when handling cable on reel to ensure that no damage will result in uncoiling process.
- .7 No splices are allowed unless justified by cable pulling tension calculations and approved in writing by Consultant. Obtain approval of splice location from Consultant.

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PART 1 - GENERAL

1.1 Submittals

- .1 Submit shop drawings for products specified in this Section.

PART 2 - PRODUCTS

2.1 Switches

- .1 Switches to be CSA approved, ULC listed and labelled devices.
- .2 Hubbell Canada Inc., HBL 1221 Series, CSA approved, heavy duty, industrial grade, back, and side wired, AC quiet action toggle type, 20 ampere, 120-277 V switches. Switches to include steel-nickel plated bridge, nylon toggle, one piece rivet-less copper alloy spring contact arm and terminal plate, silver cadmium oxide contacts, brass binding head screws, one piece integral grounding terminal and stainless steel automatic grounding clips. Provide single way, 2-way, 3-way, and key type to suit specific application requirements.
- .3 Hubbell Canada Inc., HBL 181221CN Series, CSA approved, extra heavy duty, industrial grade, back and side wired, AC quiet action toggle type, 20 ampere, 347 V switches. Switches to include steel-nickel plated bridge, nylon toggle, one piece rivet-less copper alloy spring contact arm and terminal plate, silver cadmium oxide contacts, brass binding head screws, one piece integral grounding terminal and stainless steel automatic grounding clips.
- .4 Hubbell Canada Inc. No. 1221-IL, CSA approved, heavy duty, specification grade, AC quiet action, illuminated polycarbonate handle toggle type, 20 ampere, 120-277 V switches.
- .5 Legrand - Pass & Seymour, No. 1200 series, pressure sensitive door switches complete with metal box, plates, and wire leads, and suitable for flush installation. Light is "ON" when door is open.
- .6 Hubbell Canada Inc., DS120 "Style Line" decorator series, CSA approved, specification grade, back and side wired, A.C. rocker type, 20 ampere, 120-277 V switches. Switches to include steel-nickel plated bridge, nylon rocker, one piece rivet-less copper alloy spring contact arm and terminal plate, silver cadmium oxide contacts, brass binding head screws, one piece integral grounding terminal and stainless steel automatic grounding clips. Provide single way, 2-way, 3-way, and pilot type to suit specific application requirements.
- .7 Hubbell Canada Inc., No. DS120 series "Style Line", decorator specification grade, 20 ampere, 120-277 V decorative rocker type switches, LED lighted with load off, back and side wired and complete with matching faceplates and screws.
- .8 Hubbell Canada Inc., No. DS120 series "Style Line", decorator specification grade, 20 ampere, 120-277 V decorative rocker type switches, LED pilot light on with load on, back and side wired and complete with matching faceplates and screws.

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- .9 Hubbell Canada Inc., SNAP1221 series, CSA approved, specification grade, back, and side wired, AC quiet action toggle type, 20 ampere, 120-277 V switches. Switches to include steel-nickel plated bridge, nylon toggle, one piece rivet-less copper alloy spring contact arm and terminal plate, silver cadmium oxide contacts, brass binding head screws, one piece integral grounding terminal and stainless steel automatic grounding clips. Provide single way, 3-way, and pilot type to suit specific application requirements.
- .10 Hubbell Canada Inc., SNAP2121 decorator series, CSA approved, specification grade, back and side wired, A.C. rocker type, 20 ampere, 120-277 V switches. Switches to include steel-nickel plated bridge, nylon rocker, one piece rivet-less copper alloy spring contact arm and terminal plate, silver cadmium oxide contacts, brass binding head screws, one piece integral grounding terminal and stainless steel automatic grounding clips. Provide single way, 3-way, and pilot type to suit specific application requirements.
- .11 Acceptable manufacturers are:
 - .1 Hubbell Canada Inc.;
 - .2 Cooper Wiring Devices (Arrow Hart);
 - .3 Legrand - Pass & Seymour;
 - .4 Leviton.

2.2 Receptacles

- .1 Receptacles to be CSA approved, ULC listed, certified and labelled devices.
- .2 Hubbell Canada Inc., No. HBL 5361 series, extra heavy duty, specification grade, flush, nylon face, single, 20 ampere, 125 V, 3-wire grounding receptacles.
- .3 Hubbell Canada Inc., No. HBL 5461 series, extra heavy duty, specification grade, flush, nylon face, single, 20 ampere, 250 V, 2-pole 3-wire grounding receptacle.
- .4 Hubbell Canada Inc., No. BR15TR series, commercial specification grade, 15 ampere, 125 V, 2-pole, 3-wire grounding, tamper-resistant (safety shutter) duplex receptacles.
- .5 Hubbell Canada, No. GFR 5262SG / GFR 5362SG "AUTOGUARD" Series, extra heavy duty grade, 15/20 ampere, 125 V, duplex, ULC Class "A", Group One, tamper resistant, weather resistant ground fault circuit interrupting receptacles complete with automatic self-test diagnostics, green power ON LED, red ground fault LED and 10 kA short circuit current rating.
- .6 Hubbell Canada, No. GFR 5262TR / GFR 5362TR "CIRCUIT GUARD" Series, extra heavy duty grade, 15/20 ampere, 125 V, duplex, ULC Class "A", Group One, tamper resistant, weather resistant ground fault circuit interrupting receptacles complete with red ground fault LED and 10 kA short circuit current rating.
- .7 Hubbell Canada, No. GFR15SNAP / GFR20SNAP Series, commercial grade, 15/20 ampere, 125 V, duplex, ULC Class "A", Group One, tamper resistant, weather resistant ground fault circuit interrupting receptacles with auto grounding, complete with right angled pigtailed terminal with 150 mm (6") leads, power on/ground fault LED and 10 kA short circuit current rating.
- .8 Hubbell Canada Inc., No. HBL2152 / HBL2162 "Extra Heavy Duty Style Line" decorator series, CSA approved, ULC listed, back and side wired, nylon face/body construction, 15/20 ampere, 125 V, 2 pole, 3 wire grounding, duplex receptacles complete with wrap around galvanized steel mounting strip and oversize terminal screws.

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- .9 Hubbell Canada Inc., No. DR15 / DR20 "Commercial Style Line" decorator series, specification grade, CSA approved, ULC listed, back and side wired, nylon face/body construction, 15 ampere, 125 V, 2 pole, 3 wire grounding, duplex receptacles complete with wrap around galvanized steel mounting strip and oversize terminal screws.
- .10 Hubbell Canada Inc., No. DR15TR / DR20TR "Commercial Style Line" tamper resistant, specification grade, decorator series, CSA approved, ULC listed, back and side wired, nylon face/body construction, 15/20 ampere, 125 V, 2 pole, 3 wire grounding, duplex receptacles complete with wrap around galvanized steel mounting strip and oversize terminal screws.
- .11 Hubbell Canada Inc., No. USB 15X2 "Style Line" series, CSA approved, ULC listed, tamper resistant, back and side wired, 15 ampere, 125 V
- .12 Legrand - Pass & Seymour, No. 2122, 15 ampere, 125 V, recessed, ivory clock hanger receptacles and wall plates.
- .13 Hubbell Canada Inc., No. 9430, EEMAC type 14-30R, 30 ampere, 125/250 V, 3-pole, 4-wire single electric clothes dryer receptacles with steel faceplates.
- .14 Hubbell Canada Inc., No. 9450, EEMAC type 14-50R, 50 ampere, 125/250 V, 3-pole, 4-wire single electric range receptacles with steel faceplates.
- .15 Hubbell Canada, No. IG 5262, heavy duty, specification grade, 15 ampere, 125 V, duplex, orange colour, nylon construction, back, and side wired isolated receptacles.
- .16 Hubbell Canada, No. 4710, specification grade, 15 ampere, 125 V, single, 2-pole, 3-wire grounding twist lock receptacle.
- .17 Hubbell Canada, No. 15 ampere and 50 ampere receptacles complete with neutral and ground conductors required for indicated number of phases as shown.
- .18 Where noted that 20 A receptacles are required, include for "T" slot type of respective series of receptacles.
- .19 Colour of special switches and receptacles (unless specified above), to be as specified in PART 3 of this Section of Specification.
- .20 Special switches and receptacles not specified above are to be specified on drawings. Low voltage lighting controls are specified in Section titled Lighting Control.
- .21 Acceptable manufacturers are:
 - .1 Hubbell Canada Inc.;
 - .2 Cooper Wiring Devices (Arrow Hart);
 - .3 Legrand - Pass & Seymour;
 - .4 Leviton.

2.3 Faceplates

- .1 Grade 18 8, type 302/304, 1 mm (0.032") thick stainless steel, satin, brushed or natural finish, complete with a peel off protective plastic film, and stainless steel screws.
- .2 Grade 18 8, type 430, 1 mm (0.032") thick stainless steel, satin, brushed or natural finish, complete with a peel off protective plastic film, and stainless steel screws.
- .3 Phenolic (urea thermosetting plastic) faceplates, brown or ivory, complete with matching screws.

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- .4 Hubbell Canada, high impact strength, and flame resistant hospital wall plates of nylon or thermoplastic construction. Standard and mid sizes are to be provided in various colour finishes, to suit specific applications.
- .5 Legrand - Pass & Seymour, "Jumbo" 302 stainless steel wall plates.
- .6 Hubbell Canada Inc., No. WP8E / WP8EH, NEMA 3R rated, CSA approved, ULC listed and labelled, single gang, vertical/horizontal mounting, weather-proof in-use, gasketed, cast aluminium faceplates for standard duplex receptacles in wet locations.
- .7 Hubbell Canada Inc., No. WP26E/WP26EH, NEMA 3R rated, CSA approved, ULC listed and labelled, single gang, vertical/horizontal mounting, weather-proof in-use, gasketed, cast aluminium faceplates for GFI receptacles in wet locations.
- .8 Hubbell Canada Inc., No. HBL1795, ULC listed and labelled, single gang, vertical mounting, weather proof in-use, gasketed, clear bubble plate, silicone rubber faceplates for standard AC toggle switches in wet locations.
- .9 Galvanized steel stamped faceplates.
- .10 Legrand - Pass & Seymour, "Sierra Thermoset" series, moulded of non-combustible mar proof material and complete with colour matching screws.
- .11 Hubbell Canada Inc., forged brass "S" Series faceplates with flip open doors for receptacles.
- .12 Colours and finishes of faceplates are specified in Part 3 of this Section.
- .13 Acceptable manufacturers are as per switches and receptacles.

PART 3 - EXECUTION

3.1 Installation of Switches

- .1 Provide switches and install in electrical outlet boxes. Refer to drawings to determine flush or surface mounting requirements. Generally, flush mount devices in finished areas. Size electrical boxes to suit device requirements as per device manufacturer recommendations. Properly ground device to box and ground system as per code requirements and manufacturer instructions.
- .2 Illuminated operation of lighted switches to suit specific applications as confirmed with Consultant.
- .3 Ensure that switches located adjacent to doors are located at strike side of door. Confirm door swing requirements on architectural drawings, not on electrical drawings.
- .4 Coordinate installation of door switches with trades responsible for provision of doors and frames. Confirm exact locations of switches with Consultant to ensure optimum operation of switch to door position.

3.2 Installation of Receptacles

- .1 Provide receptacles and install in electrical outlet boxes. Refer to drawings to determine flush or surface mounting requirements. Generally, flush mount devices in finished areas. Size electrical boxes to suit device requirements as per device manufacturer recommendations. Properly ground device to box and ground system as per code requirements and manufacturer instructions.

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- .2 For pricing only, receptacles to be ivory for devices connected to normal power circuits, red for devices connected to essential power circuits including isolate power centres. Isolated ground receptacles connected to circuits fed from uninterruptible power supply units to be orange colour. Generally, install receptacles in Patient Care Areas vertically with ground pins up.
- .3 Provide a separate insulated ground wire for each isolated ground receptacle. Do not install isolated ground receptacles in patient care areas.
- .4 Install USB charger receptacles in extra deep boxes in accordance with manufacturer recommendations.
- .5 Install exterior receptacles located in landscaped grounds in accordance with drawing detail.
- .6 Confirm receptacle finishes via submission of sample board to Consultant. Do not order any devices unless final finishes have been approved by Consultant.
- .7 Where receptacles are indicated in counters and benches, box cut-out to be provided in counter and bench. Provide a box, receptacle, plate and branch circuit wiring. Branch circuit wiring within counters and benches to be flexible armoured cable, under requirements of local governing electrical code and standards. Install and connect complete.
- .8 Confirm final receptacle finishes with Consultant. Do not order any devices unless final finishes have been approved by Consultant.

3.3 Installation of Faceplates

- .1 Provide each switch and receptacle with a faceplate with an opening or openings suitable for device it conceals and covers openings around boxes. Secure faceplates to device frames with screws to match faceplates. Provide larger than standard type faceplates for devices that require engraved nomenclature to define special purpose for that device.
- .2 Provide nylon type standard size faceplates for flush mounted switches and receptacles circuited to normal power.
- .3 Provide galvanized stamped steel faceplates in service areas and equipment rooms where devices are surface mounted.
- .4 Isolated ground receptacles connected to circuits fed from uninterruptible power supply units to be equipped with faceplates in orange colour.
- .5 Provide faceplates for computer equipment isolated ground receptacles with label printed with "Computer Equipment Only" lettering.
- .6 Provide weatherproof insulated faceplates with hinged and gasketed receptacle access flaps for weatherproof receptacles denoted "WP" on drawings.
- .7 Generally, oversized faceplates to be provided where engraved lettering is required.
- .8 Faceplates for flush floor mounted receptacles to be forged brass rectangular faceplates.
- .9 Confirm exact material, finish, and colour of faceplates for devices in any particular area with Consultant prior to ordering. Submit sample board as per requirements of Part 1.

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- .10 Provide faceplates with printed self-adhesive label on inside face identifying circuit number and panel feeding device. Turn over label maker to Consultant prior to application for Certificate of Substantial Performance of the Work.

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PART 1 - GENERAL

1.1 Submittals

- .1 Submit shop drawings for products specified in this Section.

PART 2 - PRODUCTS

2.1 Disconnect Switches

- .1 Eaton (Cutler-Hammer), heavy duty, CSA approved, disconnect (safety) switches.
Features include:
 - .1 front operated with a handle suitable for padlocking in "OFF" position and arranged so that enclosure cover cannot be opened while handle is in "ON" position
 - .2 operating mechanisms: quick-break, positive acting with visible blades and a line terminal shield;
 - .3 fusible units with fuse clips suitable for HRC fuses, unless otherwise noted;
 - .4 ampere rating, number of poles and fuse requirements as indicated on drawings;
 - .5 factory primed and painted switch enclosures.
- .2 Disconnects for variable speed drives to be suitable for use with such drives and include auxiliary switch/contact to de-energize control power circuit, as required and as applicable.
- .3 Enclosures for disconnects mounted in interior climate controlled areas and standard non-climate controlled areas to be NEMA 3R. For corrosive environmental applications, enclosures to be minimum NEMA 4X.
- .4 Acceptable manufacturers are:
 - .1 Eaton (Cutler-Hammer);
 - .2 Siemens Electric Ltd.;
 - .3 Schneider Electric (Square D).

2.2 Fuses

- .1 Unless otherwise indicated, fuses to be Form I, Class "J" HRC fuses for constantly running equipment, and Form II, Class "C" HRC fuses for motorized equipment that cycle "ON" and "OFF".
- .2 Fuses to be of type suitable for applications as required by local governing electrical codes and in coordination with respective equipment Manufacturer recommendations in which fuses are required. Coordinate also with Mechanical Division Contractor for requirements for Mechanical Division equipment.
- .3 Fuses to be of product of one manufacturer.
- .4 Acceptable manufacturers are:
 - .1 Mersen (Ferraz Shawmut);
 - .2 English Electric Ltd.;

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- .3 Noram;
- .4 Cooper Bussmann.

PART 3 - EXECUTION

3.1 Installation of Disconnect Switches

- .1 Provide disconnects switches and install into locations and connect complete. Ensure adequate clearance is provided as per local code requirements and as required for access for operation and maintenance. Install as follows:
 - .1 wherever shown on drawings and/or specified herein;
 - .2 wherever required by MCC/VFD/starter schedule drawings;
 - .3 for motorized equipment which cannot be seen from motor starter location or is more than 9 m (30') from starter location (in accordance with local governing electrical code requirements);
 - .4 for "packaged" equipment fed from a motor starter panel.
- .2 Ensure enclosure ratings are suitable for intended applications.
- .3 Provide engraved Lamacoid nameplate with nomenclature reviewed with Consultant.

3.2 Installation of Fuses

- .1 Install fuses in mounting devices immediately before energizing circuit.
- .2 Ensure correct fuses fitted to physically matched mounting devices.
- .3 Ensure correct fuses fitted to assigned electrical circuit.
- .4 Provide a complete set of fuses for each fusible disconnect, motor starter, and similar fusible equipment provided or supplied.
- .5 Supply 3 spare fuses of each size and type used on project, mount fuses in cabinet. Secure cabinet in wall location as reviewed with Consultant.

3.3 Electrical Connections For Mechanical, Owner, Etc., Equipment

- .1 Provide required electrical connections to apparatus provided and/or supplied by Electrical Divisions. Review shop drawings and coordinate with each equipment vendor, requirements for power feeds and control/communication interconnections and provide these requirements to complete installations work.
- .2 In addition to providing electrical feeders and connections to equipment provided by Electrical Divisions, provide required electrical connections to apparatus provided and/or supplied by Mechanical Divisions, Owner and as part of other Divisions.
- .3 Unless otherwise noted, provide electrical connections including power and control wiring for equipment supplied by Owner or by other Divisions, and except where specified for control wiring of Mechanical Divisions automatic control systems specification Section. Provide complete wired and empty conduit systems with fish cord, junction boxes, pull boxes, outlet boxes, faceplates, sleeves, etc. Provide disconnect switches, receptacles and other required wiring and connection accessories. Coordinate work with respective Consultants and suppliers of equipment to be provided with electrical connections.

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- .4 Refer to Division 11, and include for coordination and interconnections of Division 11 requirements and equipment schedule.
- .5 Coordinate with trades of other Divisions to ensure provision of proper electrical requirements. Unless otherwise noted or reviewed with Consultant, be responsible for provision of interconnect wiring between remote operator devices, controllers, and equipment being controlled by operator devices, whether or not such devices/controllers are supplied by Electrical Divisions. Where equipment is of split unit design and line voltage is required to both units, be responsible for feeders to each unit as coordinated with equipment manufacturer and Division responsible for equipment. Provide disconnect switches, receptacles and other required wiring and connection accessories. Provide system/equipment power feeds with hard wired or receptacle type connections, as required. Coordinate exact requirements prior to start of work, at time of shop drawing submissions and prior to roughing-in of work. Coordinate work with suppliers of equipment to be provided with electrical connections which may include but not be limited to following:
 - .1 laboratory equipment;
 - .2 audio visual systems;
 - .3 telecommunication systems;
 - .4 mechanical systems and equipment.
- .6 Provide coordination of alarm connections of equipment with Mechanical Divisions BAS Contractor. Refer to drawings of both Electrical Divisions and Mechanical Divisions for BAS points to be connected. Include for wiring in conduit, contacts, termination/junction boxes, etc., as required for inter connection.
- .7 Mechanical Divisions are responsible for supply of motor starters and variable frequency drives (VFDs) (also known as variable speed drives -VSDs) and harmonic filters for motorized apparatus supplied by them and is to provide Lamacoid identification throughout. Motor starters, VFDs and/or MCCs are generally to be as scheduled. Generally starters are supplied in following manner:
 - .1 loose starters for mounting adjacent to apparatus or on motor starter panels;
 - .2 mounted starters in factory assembled and pre-wired motor control centres;
 - .3 mounted starters on factory assembled and pre-wired packaged equipment.
- .8 VFDs (with harmonic filters where required) are to be supplied and set in position by Mechanical Divisions. Coordinate installation and connection requirements with Mechanical Divisions and respective equipment manufacturers. Obtain required wiring diagrams.
- .9 Be responsible for following work:
 - .1 mounting loose starters and providing "line" and "load" power connections;
 - .2 making "line" side power connections to panelboards and "load" side connections to motors;
 - .3 making "line" side power connections to starters on "packaged" equipment;
 - .4 coordinating feeder entries to starters and starter assemblies with Mechanical Divisions;
 - .5 providing additional disconnect switches (complete with identification) detailed on drawings, or required by Code, or for apparatus which cannot be seen from its starter or is in excess of 9 m (30') from its starter;

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- .6 connections to thermistors and provision of additional relays as required for connections to starters; generally, Mechanical Divisions are to supply required thermistors and relays necessary for starters; review Mechanical Divisions specifications and/or drawings defining these requirements and include necessary work, wiring, conduit and components not being supplied by Mechanical Divisions;
- .7 performing required motor starter interlocking in accordance with requirements specified and as outlined on starter schedules; coordinate interlocking requirements with Mechanical Divisions;
- .8 ensure that an identification nameplate is provided on each motor starter or disconnect;
- .9 ensure that an identification nameplate is provided on each disconnect switch nameplate is to identify name and voltage;
- .10 ensure that an identification nameplate is provided and attached with stainless steel screws to each separately mounted 3-phase motor starter or group of 3-phase motor starters a suitably sized black-white-black Lamacoid nameplate engraved to read:
- .11 "MOTOR(S) IS CAPABLE OF MAKING TWO (2) STARTS IN SUCCESSION, COASTING TO REST WITH APPROXIMATELY 15 MINUTES ELAPSED TIME BETWEEN STARTS, WITH MOTOR INITIALLY AT AMBIENT TEMPERATURE, OR OF MAKING ONE (1) START WITH MOTOR INITIALLY AT A TEMPERATURE NOT EXCEEDING ITS RATED LOAD OPERATING TEMPERATURE, IF ΩK^2 OF LOAD, LOAD TORQUE DURING ACCELERATION, APPLIED VOLTAGE AND METHOD OF STARTING ARE THOSE FOR WHICH MOTOR WAS DESIGNED."
- .12 Where supplied by Mechanical Divisions and connected by Electrical Divisions, connect VFDs and harmonic filters in strict accordance with manufacturer instructions. Provide manufacturer recommended conductors and connectors to suit respective connected equipment. Provide required upstream fused disconnects or breakers and overload protection. Maintain separation of power and control conductors as per Manufacturer requirements to minimize effects of electromagnetic interference. Properly ground and bond equipment. Coordinate exact installation requirements with Mechanical Division and equipment vendors.

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PART 1 - GENERAL

1.1 Submittals

- .1 Submit shop drawings for products of this Section and as identified in Appendix A - Schedule of Luminaires found at end of this Section.
- .2 Submit shop drawings for products of this Section, and on Schedule of Luminaires on drawings.
- .3 Include photometric data, lamp, and ballast information for each luminaire. Include ballast data identifying maximum circuit loading limitations.
- .4 Photometric data to include: total input watts, candlepower summary, candela distribution zonal lumen summary, luminaire efficiency, CIE type, coefficient of utilization, lamp type and lumen rating in accordance with IESNA testing procedures.
- .5 Include copy of certification that lenses and louvers comply with local governing building code requirements for flame spread ratings.

1.2 Warranty

- .1 Warranty requirements are as follows:
 - .1 unless otherwise noted, high intensity discharge (HID) lamps for a period of twelve (12) months from date of acceptance of Work by Owner for its intended use;
 - .2 unless otherwise noted, LED and LED drivers for a period of five (5) years from date of acceptance of Work by Owner for its intended use;
 - .3 unless otherwise noted, solid state ballasts for a period of five (5) years from date of acceptance of Work by Owner for its intended use;
 - .4 unless otherwise noted, non-solid state ballasts for a period of three (3) years from date of acceptance of Work by Owner for its intended use;
 - .5 include costs for personnel, equipment and labour for replacing lamps and ballasts covered under warranty;
 - .6 re-lamp luminaires (except LED types) used during construction period before such date of acceptance of Work by Owner.

1.3 Spare Lamps

- .1 In addition to including lamps except for LED types for each luminaire, provide spare lamps and turn over to Owner based on following criteria:
 - .1 one (1) spare lamp for each type of luminaire used for site lighting;
 - .2 a quantity of ten percent (10%) of each type of lamp used for luminaires on this project rounded up to Manufacturer standard whole case if quantity is less than a case;
 - .3 each type to be provided in separate identified containers.

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1.4 Substitutions

- .1 Provide luminaires as specified in Schedule of Luminaires and as per documented List of Manufacturers, where applicable. During construction period, no substitutions are permitted unless compelling reasons are given and accepted by Owner and Consultant. A delay caused by Contractor's failure to order luminaires to meet construction schedule is not a valid reason.
- .2 Make requests for proposed substitutions as per requirements of Section titled Electrical Work General Instructions and Division 01.
- .3 Consideration of any proposed substitutions after Bid Period to be at Consultant's sole discretion.

PART 2 - PRODUCTS

2.1 Luminaires

- .1 Provide luminaires in accordance with Schedule of Luminaires found on drawings. Luminaires are to be CSA approved or have special local electrical authority approval.
- .2 Provide luminaires in accordance with Schedule of Luminaires.
- .3 Some luminaires as noted or directed by Consultant or identified in other Division documents may be supplied by Owner or under another Division of Work. Include in Bid, Work and materials to accommodate such fixtures, including:
 - .1 receiving and inspecting fixtures;
 - .2 complete installation;
 - .3 providing basic installation hardware not supplied by luminaire manufacturer;
 - .4 aiming and connecting;
 - .5 providing power feeders and conduit/boxes;
 - .6 cleaning, adjusting and testing;
 - .7 providing lamps where documented or as scheduled, unless otherwise noted or directed by Consultant or supplied with fixture by fixture manufacturer;
 - .8 provide required power connections and where luminaires are controlled via remote low voltage controller;
 - .9 include for installation of controller and providing required low voltage wiring in conduit and necessary connections;
 - .10 coordination of exact requirements with supplier of fixtures and Consultant prior to installation.
- .4 Provide thickness of metal as indicated in Schedule of Luminaires and details, or as required so that luminaires are rigid, stable and resists deflection, twisting, warping or bending under normal installation procedures, re-lamping etc., or no less than requirements specified herein the specifications.
- .5 Unless otherwise noted, construct luminaire bodies from minimum 20 gauge cold rolled prime steel and of rigid construction to permit any suspension method without sag. Unless otherwise noted, provide body finishes of corrosion resistant, chemically treated and electrostatically spray painted baked white enamel. Reflecting surfaces to be white with an average reflectance of not less than 85%. Provide adjustable mounting brackets for troffers mounted in ceilings.

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- .6 Unless otherwise noted, linear and continuous linear architectural LED luminaires bodies to be constructed of extruded aluminum and of rigid construction. Unless otherwise noted, provide body finishes of corrosion resistant, chemically treated and electrostatically applied post powder coat finish. Efficiency not to be less than 69%.
- .7 Unless otherwise noted, vandal resistant luminaires to be constructed of heavy duty extruded aluminum rails and die cast end caps, complete with stainless steel Torx with centre reject pin and Allen head set screws. Screw heads to be mounted and concealed under lens. Lens to be extruded UV stabilized polycarbonate lens with internal linear ribbed design.
- .8 Provide neoprene or silicone gasketting, barriers and stops where required to prevent light leaks or water/water vapour penetration.
- .9 Fabricate housings to allow for easy accessibility and replacement of parts.
- .10 Fabricate fixtures with a minimum number of joints. Make unexposed joints by acceptable method such as welding, brazing, screwing or bolting. Soldered joints are unacceptable. Do not use blind metal tapping methods or rivets for fastening parts which must be removed during service, or for fastening electrical components and supports. Cast parts, including die-cast members, to be of uniform quality, close grained, rigid, true to pattern, free from blow holes, pores, discoloration, hard spots, shrinkage defects, and cracks or other imperfections that affect strength and appearance or are indicative of inferior metals or alloys.
- .11 Reflectors and reflecting cones or baffles to be free of any tooling marks, spinning lines or marks by other assembly techniques. Finishes to be equal to first quality polished, baffled, and anodized "Alzak".
- .12 Lamp sockets to be suitable for indicated lamps and be set so that lamps are positioned in optically correct relation to all luminaire components. Pre-set adjustable sockets at factory for lamp specified.
- .13 Lenses and louvers to comply with local governing building code and other local governing code flame spread rating requirements.
- .14 Unless otherwise noted, construct acrylic lens from 100% virgin acrylic and not less than 3.22 mm (0.125") thick. Glass lenses to be minimum 9.5 mm (0.375") thick.
- .15 Recessed luminaires with replaceable/serviceable parts such as ballasts, lamps, sockets, etc., must be accessible from lens side (i.e.. room side) of fixtures to allow for proper accessibility.
- .16 Luminaires to be factory assembled and tested prior to delivery on site.
- .17 Exposed parts and hardware of luminaires located in non-climate controlled areas to be corrosion resistant and weather resistant. Hardware to be tamper-proof. Manufacturer exterior luminaire poles with corrosion resistant finish and construction. Pole suppliers to ensure that poles supplied are suitable for steady wind velocity and gust velocity of area of installation, and suitable for total effective projected area of lighting equipment. Submit verification of this with shop drawings.
- .18 When requested, submit luminaire samples.
- .19 Dimensions for linear and continuous linear LED as shown on drawings are for bidding purposes only. Job measure for exact dimensions requirements to suit installation location.

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- .20 Confirm exact colours and finishes of luminaires with Consultant after award of contract but prior to ordering. Obtain information in time to meet installation schedule.
- .21 Coordinate with ballast manufacturers and dimmer/occupancy control manufacturers to ensure that components are compatible with each other and that interconnections do not affect performance, life or any warranties.
- .22 Products of same specified type to be of same manufacturer.

2.2 Lamps

- .1 Confirm exact colour temperature of lamps with Owner, prior to ordering.
- .2 Supply lamp kit consisting of various lamps with different beam spreads, for accent type luminaires. Utilize lamp kit during adjusting and aiming to determine final selection of lamps.
- .3 Acceptable lamp manufacturers are:
 - .1 Philips Lighting;
 - .2 OSRAM Sylvania;
 - .3 Current Lighting, HLI & GLI.

2.3 LEDs & Drivers

- .1 General features include:
 - .1 CSA approved, ULC listed and labelled;
 - .2 Operating temperature:
 - .1 Luminaires for applications in non-climate controlled area: operating temperature range through -40°C (-40°F) to 60°C (140°F);
 - .2 Luminaires for applications in climate controlled area: operating temperature range through -20°C (-4°F) to 50°C (122°F);
 - .3 With rapid and changing development of LED technology, provide most technically proven and most advanced and successfully tested LED technology at time of installation;
 - .4 Specification standards to meet requirements of IES LM 79 and LM-80.
 - .5 Be 100% compatible with connected dimmer controls to provide dimming down to 5%.
- .2 Light emitting diodes (LEDs) features to include:
 - .1 LEDs to be selected from same colour bin size for consistency in chromaticity and meet ANSI C78 377A as a minimum;
 - .2 generally, colour temperature range to be from 2700 K to 6500 K; specific temperature requirements to be identified on Schedule of Luminaires;
 - .3 minimum CRI of 80 ;
 - .4 rated life (based on 70% lumen depreciation level) from 50,000 to 70,000 hours.
- .3 Driver (ballast) features to include:
 - .1 Operate from 60 Hz input source of 120 VAC with sustained variations of $\pm 10\%$ (voltage and frequency) with no damage to driver;
 - .2 Output regulated to $\pm 5\%$ across load range;

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- .3 Power factor greater than 0.90;
- .4 Total harmonic distortion less than 20%;
- .5 Class A sound rating;
- .6 Comply with ANSI C62.41 Category A for transient protection.
- .4 Acceptable manufacturers to be as recommended by luminaire manufacturers.

PART 3 - EXECUTION

3.1 Installation

- .1 Provide luminaires as required. Obtain required training from manufacturer representative on any special installation procedures. Install products in accordance with manufacturer instructions to suit specific installation requirements.
- .2 Before placing luminaire orders:
 - .1 verify quantity requirements;
 - .2 thoroughly review ceiling types, finishes and construction details; verify ceiling types with latest Architectural Drawings; order luminaires to suit correct ceiling type;
 - .3 ensure that required mounting assemblies, frames, rings and similar features are included;
 - .4 confirm colours and finishes with Consultant.
- .3 Include for assembly and mounting of luminaires and lamps, complete with:
 - .1 wiring and connections;
 - .2 fittings and hangers;
 - .3 aligners;
 - .4 box covers;
 - .5 other accessories required for a complete, safe and fully operational assembly.
- .4 Where outlet boxes locations are shown on drawings, they are diagrammatic only. Position outlet boxes to coincide with suspension hangers and knockouts.
- .5 Install ceiling fixtures in centre of tiles unless dimensioned otherwise on Reflected Ceiling Plans. Locate hangers on tile centres or intersections. Mount recessed downlights, troffers, and surface mounted luminaires in or on full tiles. Install fixtures in and on acoustical tile ceilings in alignment with tile joints.
- .6 Cut holes for recessed luminaires to exact size so that gaps are not visible or luminaire trims cover gaps.
- .7 Mount surface ceiling luminaires perfectly level or plumb, tightly to ceiling without showing a space or light leak between frame and ceiling.
- .8 Carefully align linear luminaires shown in continuous lines or rows, so that rows appear as straight lines. Variation in alignment not to exceed 6 mm (1/4") for any 5 m (16') run.
- .9 Provide spacers for fixtures mounted on low density ceiling material.
- .10 Provide plaster frames for recessed fixtures in plaster or gypsum board ceilings.
- .11 Prepare fixtures, trim and poles and standards required to be painted.

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- .12 Protect wiring with tape or tubing at all points where abrasion may occur. Conceal wiring within fixture construction except where design or mounting dictates otherwise.
- .13 Splices:
 - .1 Minimize number of splices.
 - .2 Make with approved mechanical insulated steel spring type connectors, suitable for temperature and voltage conditions to which splices are to be subjected.
 - .3 Splices are not to be made unless properly terminated in accessible identified junction boxes.
- .14 Support luminaires directly by ceiling slab structure and not to formed steel decking, ceiling hangers, ductwork, piping, cable trays, etc.
- .15 Do not tighten wing nuts, bolts, or screws that allow fixture adjustment for recessed adjustable fixtures.
- .16 Install spread lenses only where called out on Schedule of Luminaires and Specifications.
- .17 Use cloth gloves when handling reflector cones, louvers, halogen lamps, glass, sconces and all exposed surfaces of fixtures.
- .18 Co-ordinate luminaire installation with work of other trades to ensure that necessary recessing depths and mounting spaces are provided.
- .19 Install luminaires in accordance with applicable architectural drawing reflected ceiling plans and/or wall elevations and/or field instructions issued by Consultant. Confirm luminaire locations prior to roughing-in. In equipment rooms, shafts and similar secondary areas, install luminaires after mechanical and other major work is roughed in and adjust luminaire locations as required.
- .20 Align and position all adjustable luminaires, and ensure that luminaires with adjustable lamp holders are properly positioned to correspond to lamps specified.
- .21 Comply with requirements of local governing electrical code regarding support of luminaires in suspended ceilings.
- .22 Independently suspend luminaires in suspended ceilings from ceiling slab. For each luminaire, provide minimum two (2) cable supports secured to ceiling slab and to luminaire. Confirm with local governing authorities and review with Consultant if a variance to this requirement can be made for specific luminaires of low weight.
- .23 Connect luminaires to power circuits and controls as required. Refer to drawings notes and schedules. Include for both normal and emergency power circuits as required.
- .24 Locate exit signs in final locations confirmed with Consultant and approved by local building code authority. Connect to power circuits as required. Where applicable for emergency power requirements, connect to emergency battery units. Relocate exit sign and re-direct direction arrows to suit local building code authority requirements and Consultant's directions.
- .25 Notify Consultant immediately and relocate if necessary as directed by Consultant, if:
 - .1 fixture placement is in conflict with a structural beam, mechanical duct, plumbing pipe, etc.;
 - .2 space above ceiling is not sufficient;

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- .3 any reason that a fixture cannot be located where it is dimensioned or shown on construction documents.
- .26 Existing luminaires designated to be relocated and reused, to be:
 - .1 disconnected, removed and stored in a safe area as designated by Owner until ready for re-installation;
 - .2 inspected, cleaned, repaired and re-lamped;
 - .3 identified to Consultant of requirement for replacement parts for broken lenses, faulty ballasts, broken mounting hardware, etc., as necessary to return luminaires to good working condition; identify cost to Consultant for repair/replacement parts.
- .27 Provide remote ballasts for luminaires as scheduled. Secure in place where shown, and connect complete.
- .28 Provide seismic restraints to suspended luminaires, in accordance with latest local governing building code requirements.
- .29 Provide dimming drivers in luminaries to be dimmed. Coordinate between dimming system vendor and luminaire vendors to ensure 100% compatibility.
- .30 Ground and bond luminaires as per local governing electrical code requirements.
- .31 If requested, demonstrate operation of luminaires intended for special applications such as building floodlights and other decorative purposes. Adjust their locations within a reasonable distance to obtain effects desired.
- .32 Prior to turn over of Work to Owner, clean luminaires in manner recommended by manufacturer and to satisfaction of Consultant.
- .33 Lamps to be new and intact when project is complete and ready for acceptance.
- .34 Include a full lamp listing in Operating and Maintenance Instruction Manuals.

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PART 1 - GENERAL

1.1 Submittals

- .1 Submit shop drawings for products specified in this Section.

1.2 Product Compatibility

- .1 Lighting controls and luminaires when integrated together for control purposes must be 100% compatible with each other. Coordinate with ballast/driver and lamp manufacturers, LV relay panel manufacturers and dimmer/occupancy control manufacturers to ensure that components are compatible with each other and that interconnections do not affect performance, life or any warranties.

PART 2 - PRODUCTS

2.1 Occupancy Sensors (Standard)

- .1 Legrand - Watt Stopper, CSA approved devices to provide automatic control of lighting with following components:
 - .1 power and slave packs;
 - .2 dual technology occupancy sensors;
 - .3 controls and daylight sensors;
 - .4 wiring in conduit and mounting hardware.
- .2 Where required, power packs to be self-contained, 347/120 VAC/24 VDC (or of voltage shown on drawings) transformer relay system. Slave packs to contain isolated relay. System to allow one sensor to control luminaires circuited to both essential power circuits and normal power circuits.
- .3 For applications in general areas: ceiling mounted, CI-305, PIR technology type occupancy sensors as follows:
 - .1 low voltage operation;
 - .2 360° lens area coverage, extending out up to 13 m (44') and area of 111 m² (1200 ft²);
 - .3 low profile ceiling mounting design;
 - .4 passive infrared technologies;
 - .5 integral light sensor;
 - .6 adjustable sensitivity and digital time delay;
 - .7 walk-through mode;
 - .8 LED indication of occupancy detection;
 - .9 isolated relay for interconnection to auxiliary control systems where required.
- .4 For applications in general areas: ceiling mounted, DT-300, dual technology type sensors as follows:
 - .1 combination passive infrared and ultrasonic technologies;

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- .2 when both PIR and ultrasonic technologies detect occupancy, lights turn ON automatically; once lights are ON, detection by either technology holds lights ON until occupancy is no longer detected and time delay elapses;
- .3 low voltage operation;
- .4 360° lens area coverage, extending out up to 6 m (20') and area of 92.9 m² (1000 ft²);
- .5 low profile ceiling mounting design;
- .6 integral light sensor;
- .7 adjustable sensitivity and digital time delay;
- .8 walk-through mode;
- .9 LED indication of occupancy detection;
- .10 isolated relay for interconnection to auxiliary control systems where required.
- .5 For applications in general areas: ceiling mounted, DT-355, dual technology type sensors as follows:
 - .1 combination passive infrared and ultrasonic technologies;
 - .2 when both PIR and ultrasonic technologies detect occupancy, lights turn ON automatically; once lights are ON, detection by either technology holds lights ON until occupancy is no longer detected and time delay elapses;
 - .3 can be set so that only one technology is needed to trigger;
 - .4 low voltage operation;
 - .5 360° lens area coverage, extending out up to 6 m (20') and area of 92.9 m² (1000 ft²);
 - .6 low profile ceiling mounting design;
 - .7 integral light sensor;
 - .8 adjustable sensitivity and digital time delay;
 - .9 walk-through mode;
 - .10 LED indication of occupancy detection;
 - .11 isolated relay for interconnection to auxiliary control systems where required.
- .6 For sensors mounted in ceiling/wall corners: series DT-200 with features as follows:
 - .1 combination passive infrared and ultrasonic technologies;
 - .2 when either or both (user set option) PIR and ultrasonic technologies detect occupancy, lights turn ON automatically; once lights are ON, detection by either technology holds lights ON until occupancy is no longer detected and time delay elapses;
 - .3 complete with adjustable swivel mounting bracket;
 - .4 wide dispersion lens area coverage, extending out up to 16 m (55') and area of 185 m² (2000 ft²);
 - .5 low voltage operation;
 - .6 low profile design;
 - .7 integral light sensor;
 - .8 adjustable sensitivity and digital time delay;
 - .9 walk-through mode;

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- .10 LED indication of occupancy detection;
- .11 isolated relay for interconnection to auxiliary control systems where required.
- .7 For applications in washrooms and small storage rooms: wall mounted "DW-100" Series dual technology sensors as follows:
 - .1 wall switch sensor turns lights OFF and ON based on occupancy;
 - .2 factory default operation is for Manual-ON mode, so that users turn light on only when needed;
 - .3 variety of control options including Auto-ON operation, walk-through and test mode; additional settings allow choice of which sensing technologies hold ON or retrigger lighting;
 - .4 colour matched lens and low profile design;
 - .5 wide dispersion lens area coverage, extending out up to 10 m (35') and area of 37 m² (400 ft²);
 - .6 infrared and ultrasonic technologies;
 - .7 adjustable time delays and sensitivity;
 - .8 manual pushbutton operation (override);
 - .9 low voltage or line voltage operation to suit specific applications;
 - .10 complete with required mounting accessories.
- .8 DW-200 Series dual technology occupancy sensors as follows:
 - .1 dual relay, infrared and ultrasonic technologies wall switch sensor for controlling 2 independent light loads/circuits;
 - .2 when both PIR and ultrasonic technologies detect occupancy, lights turn ON automatically; once lights are ON, detection by either technology holds lights ON until occupancy is no longer detected and time delay elapses;
 - .3 colour matched lens and low profile design;
 - .4 wide dispersion lens area coverage, extending out up to 10 m (35') and area of 37 m² (400 ft²);
 - .5 adjustable time delays and sensitivity;
 - .6 manual pushbutton operation (override);
 - .7 selectable walk-through, test and presentation modes;
 - .8 low voltage or line voltage operation to suit specific applications;
 - .9 complete with required mounting accessories.
- .9 For corridors or wide space coverage: Ceiling mounted, WT series, ultrasonic technology type sensors as follows:
 - .1 ultrasonic technologies;
 - .2 when ultrasonic technology detects occupancy, lights turn ON automatically; once lights are ON, detection holds lights ON until occupancy is no longer detected and time delay elapses;
 - .3 low voltage operation;
 - .4 corridor applications to include linear lens area coverage, extending out up to 13.5 m (45') in 2 directions;
 - .5 wider spaces applications to include wide dispersion coverage to suit space, up to 200 m² (2200 ft²);

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- .6 low profile ceiling mounting design;
- .7 integral light sensor;
- .8 adjustable digital time delay;
- .9 LED indication of occupancy detection;
- .10 isolated relay for interconnection to auxiliary control systems where required.
- .10 Relays to be provided as required to integrate sensors to BAS. Coordinate exact requirements with central lighting control system vendor and BAS vendor.
- .11 Wiring in conduit, mounting hardware and ancillary devices to be provided as per Manufacturer requirements.
- .12 System to be complete with initial 1 year parts and labour warranty, with additional extended 5 years parts warranty.
- .13 Include for and arrange for Manufacturer authorized representative to perform on site testing, verification and certification of installed system. Refer to Part 3 installation article for additional requirements.
- .14 Generally, acceptable manufacturers are:
 - .1 Legrand-Watt Stopper;
 - .2 Hubbell (supplied by Omnilumen);
 - .3 Sensor Switch;
 - .4 Leviton;
 - .5 NX Lighting Controls

PART 3 - EXECUTION

3.1 Installation of Occupancy Sensors

- .1 Provide occupancy sensors and daylight sensors and associated devices to control lighting in areas as required. Provide power packs as required with suitable voltage and power ratings.
- .2 Exact type of occupancy sensors and type of lenses to be verified by manufacturer/supplier to ensure proper coverage in sensed areas only, and compatibility to interconnected systems. Confirm with respective manufacturers.
- .3 Be responsible for providing, locating, and aiming appropriate sensors in correct location required for complete and proper volumetric coverage within range of coverage(s) of controlled areas per Manufacturer recommendations. Rooms to have 90-100% coverage to completely cover controlled area to accommodate occupancy habits of single or multiple occupants at any location within room(s). Locations and quantities of sensors shown and/or noted are illustrations only and should only be used as guidelines. Provide additional sensors if required to properly and completely cover respective room.
- .4 Verify with Manufacturer factory authorized representative, exact type of sensor to be used in each area, placement of sensors and installation criteria, to best meet requirements of end user. Manufacturer representative should be consulted for more non-typical installation types. Ensure that sensors connected to dimming system are 100% compatible with dimming system.

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- .5 Where luminaires in rooms/areas are fed from normal and emergency power circuits, provide suitable relays and provisions to ensure that operation of luminaires on emergency power are maintained during loss of normal power.
- .6 Proper judgement must be exercised in executing installation so as to ensure that best possible installation in available space and to overcome local difficulties due to space limitations or interference of structural components. Also provide, at Owner's facility, training necessary to familiarize Owner personnel with operation, use, adjustment, and problem solving diagnosis of occupancy sensing devices and systems.
- .7 Install devices in accordance with Manufacturer instructions. Provide wiring in conduit. Provide required power connections and interconnection to luminaires and power panels. Provide manual switches to override control system in each area/room as shown.
- .8 Confirm finishes of sensors with Consultant prior to ordering.
- .9 Confirm mounting heights with Architect and manufacturer prior to roughing-in and installation.
- .10 Adjust sensitivity and time delays to best suit Owner furniture layout drawings. Allow for minor adjustments of locations (1 m [3.3']) of sensors.
- .11 After installation is complete, provide for Manufacturer authorized representative to inspect, test and verify system performance and installation.
- .12 After completion of project and within 30 days after Owner has taken occupancy and furnishings are in place, provide for Manufacturer authorized representative to revisit site to test and make final adjustments.

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PART 1 - GENERAL

1.1 Submittals

- .1 Submit shop drawings for products specified in this Section.

PART 2 - PRODUCTS

2.1 Emergency Lighting Units

- .1 Emergi-lite "ESL" Series, CSA approved, 120 VAC/12 VDC emergency lighting battery units. Units are complete with batteries, charger, dual lamp heads per unit (where shown); cabinet and 1.2 m (4') AC cord and plug set. Units to also be complete with automatic testing and self-diagnostic circuitry, and remote monitoring provisions. System to be designed to provide emergency lighting levels in accordance with local governing building requirements.
- .2 Battery unit for connection to retractable heads to be with time delay for auto reclose of door and not include automatic testing and self-diagnostic circuitry.
- .3 Chargers are fully automatic, solid-state type that automatically and instantaneously energizes lamp load upon failure of AC supply. Battery protection circuit automatically shuts down lamp load when battery reaches full discharge. Chargers to fully recharge battery in 12-24 hours and be current limited and short circuit proof.
- .4 Batteries to be long life sealed lead, maintenance free and have a capacity to supply sufficient output power to lamp loads and to exit sign emergency loads for a period of time in accordance with latest requirements of local governing building code but be a minimum of 30 minutes. Batteries to be designed for and guaranteed for at least 10 years of life expectancy.
- .5 Cabinets are constructed of No. 18 gauge steel, finished in white enamel. Front cover is removable to provide easy and full access to battery and charger connections. Knockouts are provided on top for lamp heads. Cabinet includes protective wire-guard, where required and/or where identified with "WG" designation on drawings.
- .6 Units include "PUSH-TO-TEST" switch, AC and high charge pilot lights and AC cord set.
- .7 Integral lamp heads are 12V, 6 W MR16 LED lamps, decorative design, high impact plastic, adjustable heads.
- .8 Unless otherwise scheduled in Schedule of Luminaires, provide remote lamp heads as follows:
 - .1 remote surface mounted heads in climate controlled areas to be type EF40 series, vandal resistant heavy duty, clear, UV resistant polycarbonate lens type, die cast aluminum back plate, single and double adjustable head, 181 mm L x 117 mm W x 95 mm D (7-1/8" x 4-5/8" x 3-3/4"); complete with 12V, 6 W MR16 LED lamps;
 - .2 remote surface mounted heads in climate controlled areas to be type EF26 series, vandal resistant, frosted polycarbonate cube type, single or double adjustable heads, complete with 12V, 6 W MR16 LED lamps; single unit approximately 121 mm L x 124 mm W x 121 mm D (4-3/4" x 4-7/8" x 4-3/4");

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- .3 remote surface mounted heads in climate controlled equipment rooms and building maintenance/service areas to be No. EF9 series, single, double or triple adjustable swivel fire retardant thermoplastic heads with 12V, 6 W MR16 LED lamps; single unit approximately 114 mm L x 184 mm H x 89 mm D (4.5" x 7.25" x 3.5"); fixtures identified with "WG" to be complete with wire guard;
 - .4 remote surface mounted heads in climate controlled equipment rooms and building maintenance/service areas to be No. EF18 series, single, double or triple, large adjustable swivel fire retardant thermoplastic heads with 12V, 6 W MR16 LED lamps; single unit approximately 114 mm L x 184 mm H x 89 mm D (4.5" x 7.25" x 3.5"); fixtures identified with "WG" to be complete with wire guard;
 - .5 remote recessed mounted heads in climate controlled areas to be type EF15 series gimbal ring adjustable "eyeball"; overall ring diameter of 200 mm (8") and in-ceiling depth of 86 mm (3-3/8"), with 12V, 6 W MR16 LED lamps;
 - .6 remote surface mounted heads in non-climate controlled areas to be type EF39 series, NEMA 4X certified, weather-proof, vandal resistant fully gasketed cast aluminium back plate with polycarbonate lens, single and double adjustable head complete with 12V, 6 W MR16 LED lamps;
 - .7 retractable units to be "Retract-a Lite" series head complete with motorized lamp assembly and be completely concealed in wall or ceiling during normal power conditions; upon a power failure, door to automatically rotate 180 degrees to expose emergency lighting heads and power on heads; upon restoration of normal power or at end of battery discharge, lamps turn off and assembly rotates back to normal concealed position with heads retracted; lamp-door assembly of modular construction with quick connect plugs for easy installation; does not require presence of AC power in order to open or close door; lamps to be 12V, 6 W MR16 LED;
 - .8 remote surface mounted heads in hazardous areas to be type EFXPR series as follows:
 - .1 CSA certified for Class I, Divisions 1 and 2, Groups A, B, C, D; Class II, Divisions 1 and 2, Groups E, F, G; Class III, Divisions 1 and 2;
 - .2 die cast aluminum body with grey epoxy powder coat finish;
 - .3 weather-proof, vandal resistant fully gasketed;
 - .4 clear, impact and heat resistant prismatic glass globe;
 - .5 bi-pin halogen lamps;
 - .6 6, 12, 24 and 120 V operation;
 - .7 ceiling/wall/pendant mounting;
 - .8 tungsten/halogen lamps of wattage from 12W to 70W.
 - .9 remote in suspended ceiling type battery units to be provided as per Schedule of Luminaires; remote heads connected to these battery units to be provided as per drawing Schedule of Luminaires;
 - .10 remote heads to be of tamper proof construction;
 - .11 wire-guards where identified with "WG" designation on drawings.
- .9 Include for Manufacturer authorized representative to perform on-site after installation inspection, testing, adjusting, and verification of equipment. Such work to be performed during premium after-hours time. Refer to Part 3 for additional requirements.

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- .10 Acceptable manufacturers are:
 - .1 ABB Emergi-lite;
 - .2 Lumacell;
 - .3 Beghelli (supplied by Omnilumen);
 - .4 Redi-lite
 - .5 Aimlite.

2.2 T-Bar Ceiling Emergency Lighting Units

- .1 Emergi-lite "TS" Series, CSA approved, 120 VAC/12 VDC emergency lighting battery units suitable for flush mounting in T-bar type suspended ceilings. Units to be complete with integral lamp heads, batteries, charger, recessed housing and T-bar ceiling mounting hanger assembly. Units to also be complete with automatic testing and self-diagnostic circuitry.
- .2 Chargers to be fully automatic, solid-state type that automatically and instantaneously energizes lamp load upon failure of AC supply. Battery protection circuit automatically shuts down lamp load when battery reaches full discharge. Chargers to fully recharge battery in twelve (12) to twenty-four (24) hours and be current limited and short circuit proof. Units to include test switch and status indicator light.
- .3 Batteries to be long life sealed lead, maintenance free and have a capacity to supply sufficient output power to lamp loads and to exit sign emergency loads for a period of time in accordance with latest requirements of local governing building code but which is to be a minimum of sixty (60) minutes. Batteries to be designed for and guaranteed for at least ten (10) years of life expectancy.
- .4 Housing backboxes are constructed of No. 20 gauge steel, finished in white enamel. Back cover is removable to provide easy and full access to battery and charger connections. Front cover to include diagnostic indicator lights, test switch and provisions to mount light heads. Housing with batteries and charger are installed concealed above ceiling level.
- .5 Integral and remote surface mounted lamp heads in climate controlled areas to be decorative design, high impact plastic, adjustable units with 12V, 6 W MR16 LED lamps.
- .6 Remote recessed mounted lamp heads in climate controlled areas to be type EFR designer series white powder coated head with overall ring diameter of approximately 100 mm (4") and with housing having in-ceiling depth of approximately 150 mm (6"), with 12V, 6 W MR16 LED lamps.
- .7 Include for Manufacturer authorized representative to perform on-site after installation inspection, testing, adjusting, and verification of equipment. Such work to be performed during premium after hours' time. Refer to Part 3 for additional requirements.
- .8 Acceptable manufacturers are:
 - .1 ABB Emergi-lite;
 - .2 Lumacell;
 - .3 Redi-lite
 - .4 Beghelli (supplied by Omnilumen).

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2.3 Combination Emergency Lighting Battery Units & Exit Signs

- .1 Emergi-lite "Premier" Series, CSA C22.2 No. 141 certified, CSA-C860 approved, combination emergency lighting battery units and exit signs. System to be designed to provide emergency lighting levels in accordance with local governing building requirements.
- .2 Units are complete with batteries, charger, dual lamp heads per unit and features as follows:
 - .1 dual 120/347V AC input and 12V DC output;
 - .2 one-piece unit frame and face plates made of injection-moulded white durable high-impact thermoplastic;
 - .3 snap in/out chevrons; no screws are necessary to hold the faceplate or backplate to housing;
 - .4 faceplates feature uniformly illuminated legend using LEDs to provide illumination in normal and emergency operation and mounted inside housing; LED-sensitive diffuser is mounted behind legend to provide the 150 mm (6") high by 20 mm (3/4") stroke letters with even illumination;
 - .5 equipped with self-testing / self-diagnostic features that automatically self-tests for one minute every 30 days, 10 minutes in 6th month and 30 minutes annually; when a fault is detected, bi-colour pilot light turns from green to red and flash, identifying source of failure (battery, charger circuitry, lamp load, LED strip);
 - .6 vandal-resistant shield with tamper-proof screws;
 - .7 unit suitable for wall or ceiling mount.
- .3 Chargers are fully automatic, solid-state type that automatically and instantaneously energizes lamp load upon failure of AC supply. Battery protection circuit automatically shuts down lamp load when battery reaches full discharge. Chargers to fully recharge battery in 12-24 hours and be current limited and short circuit proof.
- .4 Batteries to be long life sealed lead, maintenance free and have a capacity to supply sufficient output power to lamp loads and to exit sign emergency loads for a period of time in accordance with latest requirements of local governing building code but be a minimum of 60 minutes. Batteries to be designed for and guaranteed for at least 10 years of life expectancy.
- .5 Units include test switch and a green pilot light, located on face plate above legend.
- .6 Integral lamp heads are 12 V, 6 W, LED, decorative design, high impact plastic, tool-less adjustable swivels, dual heads.
- .7 Include for Manufacturer authorized representative to perform on-site after installation inspection, testing, adjusting, and verification of equipment. Such work to be performed during premium after hours' time. Refer to Part 3 for additional requirements.
- .8 Acceptable manufacturers are:
 - .1 ABB Emergi-lite;
 - .2 Lumacell;
 - .3 Aimlite;
 - .4 Beghelli (supplied by Omnilumen);
 - .5 Read-lite.

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PART 3 - EXECUTION

3.1 Installation of Emergency Lighting Units

- .1 Provide emergency lighting battery units and lighting heads as specified herein and on Schedule of Luminaires, and mount where required. Connect battery units complete to dedicated emergency circuit of local power panels designated for this purpose or where identified on drawings, plug into designated adjacent receptacle. Provide wiring in conduit and connections to remote lamp heads and extend to central battery unit serving area.
- .2 Install units such that units to be automatically actuated upon failure of power supply to normal lighting in area covered by that unit equipment.
- .3 Connect exit signs to battery units circuits in applications where exit signs require backup DC supply.
- .4 Install combination units in locations and connect complete.
- .5 Obtain required training from Manufacturer representative on any special installation procedures. Install units in accordance with Manufacturer instructions to suit specific installation requirements.
- .6 Note that drawings identify location for battery units and generally identify circuiting of remote heads. In absence of direction of circuiting, provide wiring in conduit to feed remote heads and exit lights from nearest battery unit with sufficient capacity in area, in accordance with application requirements, Manufacturer requirements, and applicable codes. Multiple battery units may be required to accommodate connection of remote heads in some areas. Provide sufficient battery units to accommodate connected lamp loads and system design time of operation. Where more than one battery unit is installed in same immediate location, only one unit is required to be provided with integral lamp heads.
- .7 Where battery model number is noted, it is for general reference and exact capacity may be required to be increased to suit connected loads and required battery output time duration to suit local governing codes. Ensure that emergency lighting operates at lighting levels and for duration to meet local governing codes.
- .8 Provide remote mounting lamp heads as specified and refer to Schedule of Luminaires where additional requirements may be identified. Provide remote mounting lamp heads in locations to provide system performance in compliance with requirements of Documents and where applicable, local governing building code. Connect complete to battery units. Be responsible for revisions to system, including relocations, aiming and additional remote heads as determined by testing results. Generally, provide wiring in accordance with Manufacturer requirements but be minimum No. 10 AWG, and increased to suit voltage drop requirements recommended by system manufacturer to comply with local electrical code requirements. Confirm finish requirements with Consultant prior to ordering.
- .9 Provide wiring in conduit and install devices in accordance to Manufacturer instructions. Comply with local governing codes and authority requirements with regards to providing fire rated conductors (MI) for life safety applications.
- .10 Installing Contractor shall confirm in writing at the end of the project and prior to occupancy that all emergency lighting fixtures have been testing in working order to minimum OBC requirements: 30 minutes.

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3.2 Installation of T-Bar Emergency Lighting Units

- .1 Provide emergency lighting battery units for recessed mounting to T-bar ceiling system, and mount where required. Connect battery units complete to dedicated emergency circuit of local power panels designated for this purpose or to designated power circuits where identified on drawings.
- .2 Obtain required training from Manufacturer representative on any special installation procedures. Install units in accordance with Manufacturer instructions to suit specific installation requirements.
- .3 Install housing backbox recessed in ceiling construction as per Manufacturer instructions. Install with suitable T-bar hangers.
- .4 Provide remote mounting lamp heads as specified and refer to Schedule of Luminaires where additional requirements may be identified. Provide remote mounting lamp heads in locations to provide system performance in compliance with requirements of Documents and where applicable, local governing building code. Connect complete to battery units. Be responsible for revisions to system, including relocations, aiming and additional remote heads as determined by testing results. Generally, provide wiring in accordance with Manufacturer requirements but be minimum No. 10 AWG, and increased to suit voltage drop requirements recommended by system manufacturer to comply with local electrical code requirements. Confirm finish requirements with Consultant prior to ordering.
- .5 Provide wiring in conduit and install devices in accordance to Manufacturer instructions. Provide wiring in conduit to feed remote heads and exit lights, where applicable. Comply with local governing codes and authority requirements with regards to providing fire rated conductors (MI) for life safety applications.
- .6 When installation of emergency lighting equipment is complete, and in conjunction with Manufacturer authorized representative, inspect and test entire system, adjust as required, and certify in writing to Consultant that system is complete, have been tested, adjusted, and are in proper operating condition. Also, be responsible for engaging emergency lighting manufacturer to perform an illumination level test in presence of Consultant, throughout all areas of building. Manufacturer technician to be responsible for properly aiming remote light heads, recording light level readings on a record set of floor plans and calculating light level readings. Co-ordinate and arrange for local authority building inspector approvals. Prepare and submit to Consultant a letter on manufacturer's letterhead and signed by Manufacturer authorized technician, stating that emergency lighting levels meet requirements of local building code requirements and applicable CSA Standards. Notify Owner and Consultant at least 10 days prior to propose testing date. Testing dates and times to be reviewed with Consultant.
- .7 Provide minimum one hard bound copy and electronic copy of signed test report.

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PART 1 - GENERAL

1.1 Submittals

- .1 Submit shop drawings for products specified in this Section.

PART 2 - PRODUCTS

2.1 Existing Fire Alarm System

- .1 Existing fire alarm system serving complex is to be verified on site. Provide additional devices and work to extend system to serve renovated areas. Additional devices to be 100% compatible with and of same manufacture as per existing system. Include provision of necessary control panel and annunciator work of existing system to accommodate integration of additional devices.
- .2 Include for and engage Owner existing system manufacturer authorized technicians to provide and perform required system products and work.
- .3 Verify with existing fire alarm system manufacturer during Bid period, exact requirements needed to provide renovation work. If necessary, visit site with manufacturer to review existing conditions. Confirm and coordinate exact work responsibilities with system vendor. Items of clarification or proposed revisions to Bid Documents must be reviewed with Consultant during Bid Period.

2.2 Additional Fire Alarm System Work

- .1 System work to include but not be limited to provision of following:
 - .1 modifications to existing head end equipment including provision of additional device connection modules, zone modules, amplifiers and system re-programming;
 - .2 additional transponders/data gathering panels (DGP);
 - .3 additional initiating devices (pull stations, heat/smoke/flame detectors);
 - .4 additional alarm indicating devices (bells/horns, strobes);
 - .5 additional interfaces and interconnections to auxiliary building systems;
 - .6 review of existing battery backup capacity and amplifiers (as applicable) and increasing capacities to accommodate additional device loading and to meet applicable governing local code requirements;
 - .7 additional wiring in conduit.
- .2 Additional system components to be listed as products of a single manufacturer under appropriate category, by Underwriters Laboratories of Canada and bear ULC label. System components and work in conjunction with system installation to meet specific application requirements of local governing authorities, codes, standards, regulations and requirements of following:
 - .1 CAN/ULC-S524, Standard For Installation Of Fire Alarm Systems;
 - .2 CAN/ULC-S527, Control Units For Fire Alarm Systems;
 - .3 CAN/ULC-S537, Standard For Verification Of Fire Alarm Systems ;

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- .4 local governing building code;
- .5 local governing electrical code;
- .6 local governing building permit applications for approvals;
- .7 other requirements of local governing authorities.

2.3 Modifications & Devices

- .1 Modify control panels and annunciators to supervise and annunciate additional and relocated devices. Additional initiating devices shall be devices that are 100% compatible with existing controls and be ULC listed and labelled for connecting to respective control units. Include costs for manufacturer authorized representative to perform control panel/transponder work and to reprogram system software to accommodate renovation work. Provide additional zone modules as required and additional batteries as required to supply back-up battery capacity to the additional components.
- .2 Additional devices to be ULC listed and labelled devices suitable for fire alarm applications. Power supplies and other components to be CSA approved where required by local governing authorities and codes.
- .3 Exact type of device to be used in each area of installation to be as recommended by system manufacturer to suit specific applications and to be approved for such use as per ULC standards. Devices in non-climatic controlled areas to be weatherproof, corrosion resistant and ULC listed for use in below freezing temperatures. System manufacturer to be responsible for ensuring compliance with these requirements.
- .4 Devices:
 - .1 Additional smoke detectors and heat detectors: to be of type and rating to suit specific application as per existing system Manufacturer recommendations.
 - .2 Audible devices: of type to match existing system standards.
 - .3 Strobes and combinations strobes/audible devices: of type to match existing system standards; include additional strobes to meet latest governing building code requirements.
 - .4 Addressable modules as required for connection of additional devices.
 - .5 Ancillary devices as required to complete system.
 - .6 Refer to drawings for additional device requirements.
- .5 End-Of-Line Resistors and Isolators:
 - .1 End-of-line resistors for standard alarm and signalling circuits to be sized to ensure correct supervisory current flows in each circuit.
 - .2 End-of-line resistors to be mounted on a stainless steel plate for mounting on a standard single gang box and bear ULC label.
 - .3 Isolators to be provided in accordance with code requirements and installed as per system Manufacturer requirements to isolate/monitor zones, loops, group of devices within building and between buildings.
- .6 Wiring:
 - .1 CSA approved and ULC listed wire and cable, approved for fire alarm circuits; with colour coded, insulated solid copper conductors; of type as per local governing electrical code and local governing fire authority requirements.

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- .2 Sized and installed in accordance with system Manufacturer instructions and local governing electrical code.
- .3 To be mechanically protected to satisfaction of local fire authority.

2.4 Testing & Verification Work

- .1 Refer to Part 3 for system testing, verification and certification Work.

PART 3 - EXECUTION

3.1 Installation - General

- .1 Prior to start of Work as part of shop drawing submission process, review with system manufacturer following:
 - .1 device types to ensure that selected type is suitable for intended application on project;
 - .2 locations of devices to ensure proper operation and coverage are in compliance with requirements of local fire authorities;
 - .3 device mounting heights to ensure proper operation and coverage are in compliance with requirements of local fire authorities;
 - .4 device back box requirements to ensure size and depth suit system Manufacturer recommendations for specific devices;
 - .5 proposed revisions required to existing system sequence of operation.
- .2 Immediately advise Consultant of any requirements of above that may necessitate revisions to design documents.
- .3 Install fire alarm system components and connect complete.
- .4 Perform Work in conjunction with this installation to meet requirements of latest editions of local governing building code, local governing electrical code, ULC Standards including Installation Standard CAN/ULC-S524, and any applicable local governing codes. If any requirements of these specifications are different, omitted or contrary to ULC-S524 Standard, then ULC Standard governs and overrides these specifications, but in no instance will standards established by drawings and specifications be reduced by any of Codes referred to previously. Control units and annunciators to be in accordance to latest requirements of ULC Standard CAN/ULC-S527 "Control Units for Fire Alarm Systems.
- .5 During work to existing fire alarm system, proposed time and duration of interruption to be approved by Consultant. At any time due to emergency situations, Owner may request by-passed zone(s) to be re-instated immediately. In all areas where renovation work requires shutdown of any part of fire alarm protection system, provide manual fire alarm protection (Fire Warden) by means of supervising area as approved by local governing authorities. At no time allow fire alarm system or any one (1) zone to be left inoperative overnight. Provide required bypass wiring and temporary wiring to maintain all parts of fire alarm system operative during construction and alterations.
- .6 Perform Work in phases as specified in Divisions 00 and/or 01 and as noted on drawings.
- .7 Fire alarm system Manufacturer authorized technician to supervise control panel, transponder, and annunciator work.

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3.2 Installation of Devices

- .1 Install required devices. Do not install devices in locations that may hamper proper operation of devices including adjacent devices.
- .2 Obtain required training from manufacturer representative on any special installation procedures. Install devices and perform work in accordance with Manufacturer instructions and requirements and in accordance to applicable codes of local governing authorities having jurisdiction.
- .3 Confirm device finishes with Consultant prior to ordering.
- .4 Install manual pull stations in boxes as required, recessed outlet boxes with plaster rings, except in unfinished areas where pull stations are surface mounted, in which case, install stations in surface mounted boxes. Comply with mounting height requirements for local governing building code barrier free access.
- .5 Install mounting plate of thermal detectors to ceiling mounted boxes as required. Secure detectors to plates. Refer to floor plans and drawing symbol list to determine rating of detectors in any given area. Generally, do not install rate-of-rise type detectors in areas subject to sudden changes in temperatures, such as entrance vestibules. Confirm application requirements with system manufacturer and ensure that devices are ULC listed for such applications and are approved by local fire authority for such use.
- .6 Generally, audible device locations are indicated on drawings, however, exact audible device quantities and locations to be in accordance with results of audibility device coverage site tests. Provide suitable sound detection metering and personnel to make necessary tests. Relocate audible devices and/or provide additional audible devices as required.
- .7 Provide double voltage relays, with multiple contacts as required, to shut down fans as noted on drawings. Arrange relays to be energized at all times from fire alarm system to ensure that they are fail safe.
- .8 Install visual notification appliances 2400 mm (8') above floor or 300 mm (12") below finished ceiling line. Provide visual notification devices in areas subject to high ambient noise levels, such as mechanical equipment rooms, computer equipment rooms, parking garage, etc., and areas designated for hearing impaired as per local building code requirements. Provide minimum 2 circuits per floor and connect devices in alternating scheme.
- .9 Devices in non-climate controlled areas to be weatherproof, corrosion resistant, ULC listed for operation in below freezing temperatures, and as recommended by system manufacturer for use for each specific application. Where electronics are not recommended for cold temperature applications, include for Manufacturer recommendations and directions in remotely locating addressable modules in closest heated areas and connecting to respective device in non-climate controlled areas.
- .10 In areas of high abuse, devices to include vandal resistant, tamperproof and vermin proof features such as guards, fasteners requiring use of special tools and fasteners not exposed.

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3.3 Additional Requirements

- .1 Install wiring in conduit unless otherwise directed by Consultant. Perform wiring connections associated with fire alarm system on terminal strips in junction boxes and colour coded. Provide wiring colour coding consistent for entire length of each run. When pulling wires into conduit, use lubricant and run wires straight and not twisted or abraded. Neatly secure exposed wires in apparatus enclosures with approved supports or ties. Clearly identify wiring at each termination point. In addition, number wiring with Brady Ltd. or Electrovert Ltd. Z-type markers. Colour conductors for each part of system in accordance with system equipment Manufacturer recommendations. Paint conduit couplings red of paint type suitable for application to standards of Division 09.
- .2 Install wiring in accordance to requirements of applicable governing electrical code and to requirements of local governing authorities.
- .3 Run alarm indicating circuits (speakers) and alarm receiving circuits (pull stations, detectors) in separate conduits from each other.
- .4 resistors at ceiling lines above a pull station location. Provide isolators and install in accordance with ULC standards. Properly label and identify. Do not locate end-of-line resistors and isolators in concealed locations. Generally install in equipment rooms.
- .5 Refer to drawing riser diagram and connection schedules. Quantities of components to be as per floor plans and not riser diagram.
- .6 Confirm exact location of components prior to roughing-in.
- .7 Ground and bond system as required by local governing electrical code and authority and system manufacturer.

3.4 System Testing, Verification & Certification

- .1 Submit to Consultant for approval, proposed schedule for testing and verification of system. Obtain such approvals prior to start of testing. Consultant and/or other Owner representatives to have option to witness all or part of testing and verification work. Notify Consultant and Owner minimum 7 working days in advance of testing.
- .2 Include for fire alarm system manufacturer to inspect, test, verify and certify system components and wiring, individually and as a complete system, in accordance with requirements of CAN/ULC S537. Work to include but not be limited to provision of following:
 - .1 to ensure that type of equipment installed is that designated by Contract Documents;
 - .2 to ensure that wiring connections to equipment components show that installer observed ULC and CSA requirements;
 - .3 to ensure that equipment was installed in accordance manufacturer recommendations, and that signalling devices of whatever manufacture were operated or tested to verify their operation;
 - .4 to ensure that supervisory wiring of those items of equipment connected to a supervised circuit is operating and that governmental regulations, if any, concerning such supervisory wiring, have been met to satisfaction of inspecting officials;

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- .5 to ensure that sequence of operation is in accordance with existing sequence of operation and any modifications identified on documents and are approved by local fire authority;
- .6 to ensure that devices are commissioned and operable.
- .3 System manufacturer to also be responsible for, but not be limited to, provision of following additional work to existing systems:
 - .1 coordinate with local fire authority inspector and Electrical Division Contractor, required testing and verification work in order to obtain certification and meet local fire code and local fire authority requirements;
 - .2 test system battery power supplies and demonstrate compliance with local governing building code and local fire authority requirements that battery supplies are capable of providing required 24 hours of supervisory power followed by local governing building code required time (or time directed by local fire authority) of full load power; exact method of testing to be approved by local fire authority, Consultant and Owner; confirm exact procedures with previously named parties prior to testing; include for sufficient sound measurement devices and personnel in order to successfully comply with this requirement;
 - .3 full review, testing, and verification of operation of building ventilation and smoke exhaust system and its integrated operation with fire alarm system and various pieces of air handling equipment;
 - .4 full review, testing and verification of operation of integrated systems such as elevators and their emergency sequence of operation, supervisory annunciation of sprinkler/standpipe monitor switches, pressure switches and flow switches, diesel genset alarms, security alarms, BAS alarms, release of door holders and electromagnetic locks, and any other integrated components; coordinate requirements with trades responsible for integrated components and systems who will be present at time of testing and verification work;
 - .5 test that system audible devices provide alarm sound levels in areas as per local governing building code and local fire authority requirements; site adjust tap settings of audible devices as required to achieve required audibility levels; also test that emergency voice communication system meets or exceed intelligibility requirements of local governing building code and is approved by local fire authority;
 - .6 assist in testing and verification of electromagnetic door locks to meet requirements of authorities having jurisdiction and to obtain overall approval of installation;
 - .7 coordination with Electrical Divisions and local fire authority to provide requirements to obtain certificates of approvals from local fire authority;
 - .8 provide full detailed test sheets of tested components and provide certification that system work has been fully tested, that devices have passed testing and that system is in proper work order in compliance to local governing code requirements and project documents; testing report documents to be additionally provided in electronic format as confirmed with Owner and Consultant.

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- .4 Where project work is phased and Owner requires occupancy at various stages, include for providing system testing, verification and certification after completion of each phase of work, to approval of local governing authorities. Upon Substantial Performance of the Work, include for providing system testing, verification and certification of entire system work.
- .5 Contact local fire authority inspector and coordinate and arrange for Fire Inspector to perform required inspections. Integrate local fire authority inspection requirements with testing and verification work to extent as per Fire Inspector's directions. Obtain full approval and certification by local fire authority.
- .6 Local fire authority inspector, Consultant and Commissioning Agent to at their discretion test system or parts of system in their review of test reports. Correct/repair any failures or deficiencies found in system, whether or not identified in test reports of manufacturer. Re-test and re-verify until successfully passed, at no extra cost to Owner.
- .7 Obtain from local fire authority required certificate of approval of system and forward to Consultant.
- .8 Arrange for manufacturers to supply reasonable amounts of technical assistance with respect to any changes required to conform to paragraphs above. During period of inspection, testing and verification, make Electricians available to do any required correction work and to assist during this Work. Include for trades responsible for integrated components (i.e. exhaust fans, sprinklers, elevators, gensets, etc.) and systems to be present at time of testing and verification work.
- .9 On completion of verification, inspection and testing of system, obtain from manufacturer and forward to Consultant, a verification certificate together with detailed inspection reports listing each and every system component, its location in building and its acceptability. Verification certificate and inspection reports to be prepared and signed by certified testing technicians of manufacturer. Signed test reports to confirm that systems are installed and perform in accordance with requirements specified above.
- .10 Obtain from system manufacturer and testing agency and forward to Consultant a certificate of liability insurance of minimum amount of Two Million Dollars (\$2,000,000.00) that is to be registered for this project to show satisfactory proof of manufacturer liability coverage for both their product and personnel.
- .11 Unless approved in writing by Consultant and Owner, do not use open flame and/or smoke for testing.
- .12 Testing technician to be certified and approved for fire alarm system testing by Canadian Fire Alarm Association (CFAA) and local Fire Marshall, as applicable.
- .13 Additionally, refer to testing, coordination and verification requirements in Section titled Electrical Work Analysis and Testing and include applicable requirements.

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3.5 Monitoring of Systems

- .1 In areas that remain occupied and used by Owner during Work, daily monitor and supervise existing fire alarm system serving renovation/working areas. Ensure that system is left in proper operating condition at end of each working day. Include for but not be limited to performing following:
 - .1 under presence of Owner representative, check each morning and evening (start and end of work) of each day, system to ensure that it is in proper working condition;
 - .2 if portions of system are not in proper working order, provide temporary bypass wiring (if fire alarm system, must be subject to approval of local fire authority), and/or provide supervisory personnel to monitor systems for area affected;
 - .3 document and sign off with Owner representative signing off also, each respective daily check condition;
 - .4 ensure that work to system does not affect portion of system serving areas outside of renovation/working areas.