Waterloo Region District School Board

REQUEST FOR TENDER

Smithson Public School – Office and HVAC Upgrades

Tender #7159-RW-22

ISSUE DATE: 18 February, 2022

ELECTRONIC SUBMISSIONS will be received by the Bidding System, no later than **2:00 p.m. local time, on 14 March, 2022**

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1.1 The following professional seals and signatures are provided as required by Paragraph 1.21.1 (4) Division C of the Ontario Building Code and apply to the areas of expertise for which each consultant was commissioned.

1.1.1 Architect

1.1.2 Structural

1.1.3 Mechanical and Electrical

END OF SECTION

SECTION 00 21 13 – INSTRUCTIONS TO BIDDERS

1.0 INTRODUCTION

1.1. Single Point of Contact

In relation to this procurement process, all communication shall be directed to:

Rebecca Witteman
Senior Procurement Specialist
Waterloo Region District School Board

All request for information, instructions or clarifications shall be directed to the Single Point of Contact only. Requests should be made through the Bidding System by clicking on the "Submit a Question" button found within the bid detail of the specified Tender.

Vendors shall not communicate with other Waterloo Region District School Board ("Board") employees or agents regarding this tender prior to award. Any attempt by a Vendor to bypass or influence the procurement process may result in disqualification of their Submission.

The Board will not be responsible for any verbal statement, instruction, or representations. In case of difference between any verbal information and written document, the written document shall govern. Information obtained from any source, other than the Single Point of Contact in writing, shall not be relied upon.

1.2. Consultant

The Board has hired the following consultant to assist in the preparation of this Tender: Workshop Architects

Addenda will be the Board's only form of communication. The Board will assemble addenda as required.

The consultant and any sub consultants are not to be contacted by any interested parties from the Tender issue date to the bid award notification. The consultant or any sub consultants will not respond to any direct communication.

The Board will be responsible for the contract administration of the project after the purchase order has been issued or the contract has been signed by the Board

1.3. About the Waterloo Region District School Board

The Waterloo Region District School Board is a provincially funded institution reporting to the Ministry of Education of Ontario and is one of the larger school boards in Ontario, operating 121 school locations and serving approximately 64,000 students in the Region of Waterloo.

1.4. Electronic Bid Submission and Bid Results

All Bids shall be submitted through the Bidding System only. Bidders must have a Bidding System Vendor Account and shall ensure the account is created with the Bidders full legal company name.

Hard copy Bid Submission will not be accepted by the Board.

Bids will not be accepted after the Closing Date and Time.

There will be no public opening for this Tender.

Once an award is made, the successful Bidder will be named on the Bidding System, and an award notification will be sent.

1.5. Bid Submission

.1 Bidders must include the appropriate submission requirements and mandatory forms specified in this section.

.2 Bidders shall have a “Vendor Account” in the Bidding System and be registered as a “plan taker” for this Bid Solicitation Document. Only the plan takers will have access to download this Bid Solicitation Document, receive addenda email notifications, download addenda and to submit their Bid electronically through the Bidding System.

.3 The onus is on the Bidder to ensure that the Bid is received and acknowledged in the Bidding System on or before the Closing Time. The Closing Time shall be determined by the Bidding System’s web clock. The timing of the Bid submission shall be based on when the Bid is RECEIVED by the Bidding System, not when a Bid is submitted by a Bidder.

.4 Bidders shall allow sufficient time to upload their Bid submission and attachment(s) (if applicable) and to resolve any issues that may arise as Bid transmission can be delayed in an “internet traffic jam” due to file transfer size, transmission speed, and other electronic considerations.

.5 Upon receiving a Bid, the Bidding System will send a confirmation email to the Bidder advising that the Bid was submitted successfully. If a Bidder does not receive a confirmation email despite submitting a Bid, the Bidder should contact technical support of the service provider hosting the Bidding System via email: support@bidsandtenders.ca

.6 The Bidding System will not accept Bids after the Closing Time as determined by the Bidding System’s web clock. Bids submitted by fax or paper copy or any other format will not be accepted.

.7 The Board hereby consent to the use of an Electronic Signature for the signing of all documents requested hereunder. Acceptable forms of signatures include, but are not limited to, the typing of the Bidder's authorized signing officer's name or the inclusion of an image of the Bidder's authorized signing officer's signature, so long as the electronic signature is sufficient to identify the Bidder's authorized signing officer. The Bidder's authorized signing officer agrees that whatever form of electronic signature is provided constitutes a signature for the purpose of executing all documents requested hereunder.

1.6. Withdrawal of Bid Submission / Irrevocable Period

Bidders may withdraw or edit and resubmit a Bid in the Bidding System at any time prior to the Closing Date and Time. The most recent submission or withdrawal received in the Bidding System on or before the Closing Time shall prevail and shall overwrite all previous submission(s) and withdrawal(s). The Closing Time shall be determined by the web clock within the Bidding System. After such time, requests to withdraw Bid Submissions will not be considered.

Bids will be irrevocable by the Bidder, and open for acceptance by the Board, for **60 (sixty)** days following the Closing Date

1.7. Bid Review

.1 All Bids received on or before the Closing Time will be reviewed for compliance based on this Bid Solicitation Document. Non-compliant Bids may be rejected. Bids not meeting any of the mandatory requirements included in this Bid Solicitation Document may be disqualified. Bidders may be contacted to clarify its submissions.

.2 It is the Bidder's responsibility to satisfy the Board that the Bidder can comply with the requirements contained within this Bid Solicitation Document and that the Bidder possesses the necessary inventory, equipment, facilities, resources and staff to perform the Work specified in this Bid Solicitation Document. Bidders may be required to submit evidence of above in a form acceptable to the Board. Substitution of materials, equipment, or methods different from that outlined in the terms of reference will not be accepted unless provided for within this Bid Solicitation Document or with the written approval from the Board.

.3 The Board also reserve the right to examine Bidder's facilities, equipment and visit the sub-contractors or sub-consultants proposed or Bidder's existing and past clients. The award decision may be revised based on the above.

.4 The Board will not be responsible for travel costs (including, but not limited to, time and mileage) if travel is required. No additional charges will be accepted by the Board for any cost incurred by the Bidder or any other party in participating in the Bid evaluations.

.5 The Board may, in their sole discretion, check references, conduct credit checks, review the litigation history and history of professional liability or other insurance claims, and obtain any other type of information that might aid the Board in its selection. The Board reserve the right to consider all or any information received from all available sources, whether internally or externally obtained. The Board may disqualify any Bid from further consideration based on results of reference or credit checks or review of litigation or claim history. The foregoing may include the Board's own experiences with the respective Bidder(s) or any of the subcontractors and sub-consultants proposed in its Bid.

1.8. Tie Bids

Where two (2) or more Bids have been received reflecting the same, compliant lowest Bid price, the time stamp for date and time submission in the Bidding System will dictate the award (earliest submission shall prevail).

1.9. Award Recommendation

.1 Subject to the reserved rights of the Board and availability of funds, the lowest compliant Bid will be recommended for award.

.2 The documents listed below will be incorporated as deemed necessary by the Board, into the Contract with the Successful Bidder. If there is a discrepancy between the wording of one document and the wording of any other document that appears on the list, the wording of the document that first appears on the list shall take precedence:

.3 Board approved change orders or Contract or Agreement amendment.

.4 Purchase Order, Contract or Agreement executed with the Bidder including exhibits.

.5 Bid Solicitation Document issued by the Board, including addenda, if applicable.

.6 Bid submitted by the Bidder.

.7 There shall be no obligation on the Board as a result of seeking Bids or conducting the procurement process and the Board reserve the right to cancel the Bid Solicitation, issue a revised request, or to pursue any other course of action which would aid in meeting their needs.

1.10. Documents Required for Award

Within ten (10) working days of receiving a request from the Board, the Bidder (the "Recommended Bidder") shall provide the following:

.1 Insurance certificate with coverage specified in the Bid Solicitation Document.

.2 WSIB clearance certificate valid on date of award or an exemption letter (if applicable and requested).

.3 Contract security, if applicable as specified in the Bid Solicitation Document.

.4 An executed Board issued Form of Agreement, duly signed by the authorized signatory.

.5 Any other submittal specified in the Bid Solicitation Document as a requirement of award.

In addition to all of the Board' other remedies, if a Recommended Bidder fails to execute the Form of Agreement or satisfy any other applicable conditions within ten (10) days of notice of selection, the Board may, in their sole and absolute discretion and without incurring any liability, rescind the selection of that Bidder.

1.11. Confirmation to Proceed

No work shall commence until each of the Board's Procurement Services has issued a purchase order, contract, or letter of intent to the Successful Bidder. Goods/Service or Work, as described shall not commence until all the required documents have been submitted to Procurement Services and the Form of Agreement executed by the Successful Bidder and the Board. For payment purposes, a Purchase Order shall be generated and issued to the Successful Bidder. The Purchase Order number must appear on all invoices in order to ensure prompt payment.

1.12. Site Visit

Due to Covid-19, Proponents are to supply and wear medical grade masks and eye protection. Due to the nature of this Tender, a NON mandatory site visit has been deemed necessary. Failure to attend and register at the time and location(s) specified would NOT result in disqualification. Representatives for the Proponents are requested to sign in at the NON-mandatory site meet. The Board at its sole discretion may schedule additional non-mandatory site visits. Proponents are to reference 1.8 Timetable for site meet date and time.

The site visit will take place at: Smithson Public School, located at 150 Belleview Ave., Kitchener, ON, N2B 1G7
The site meet is NON-mandatory for the following: Prime Contractors
Proponents are to meet at the Main Office.

Notify via the "submit a question" feature in this bidding system to the attention of: "Site Meet Request", the name of your company and staff that would like to attend a scheduled site meet.

Do not show up without submitting your request to attend the site meet.

The size of the groups at the site meet(s) will be limited as per current Public Health Recommendations.

An addenda prior to the site meet will be posted noting the companies and personnel and time for each scheduled site meet.

1.13. Supplemental Site Visits

Due to Covid-19, Proponents are to supply and wear medical grade masks and eye protection.

Supplemental site visits will be permitted for interested Proponents and subcontractors to gain access to the site in order to better prepare their bid submission and are not to be held prior to the mandatory or non-mandatory site visit.

When a supplemental site visit is required, the Proponent or subcontractors may only visit the school after 3:30 P.M., during a scheduled school day. The Proponent or subcontractors shall immediately report to the Main Office, sign in as per the school protocol and ask for the head custodian. The head custodian's role is to ensure that the Proponent or subcontractors are guided to the area of interest regarding this Tender document and to provide access where required.

Proponents or sub-trades may not direct any questions related to this Tender to the head custodian or any other Board staff present. Proponents asking the head custodian or Board staff questions related to the scope or Tender in general will be disqualified.

1.14. Communication

For the purpose of this Tender, the only contact for all Bidders, subcontractors if any, and any third-party suppliers of goods or services for all queries, questions and notifications, from the Tender issue date to the bid award notification date is to be directed to the submit a question feature in this bidding system:

1.15. From Issue Date to Deadline for Questions/Queries

Questions must be received by the Board's Single Point of Contact no later than the deadline for questions noted in the Anticipated Project Schedule.

If a Bidder finds any discrepancies, ambiguities or omissions within the Request for Tender (RFT) documents, or requires any clarifications regarding the RFT documents, questions and clarifications must be sent to the Board's Single Point of Contact through the Bidding System by clicking on the "Submit a Question" button found within the bid details page of that opportunity. Bidders are strongly

encouraged to ask clear and concise question(s) citing the relevant section of the Bid Solicitation Document.

The Board has endeavoured to provide complete, correct information and estimates to enable Bidders to properly assess and determine the scope and complexity of the Work prior to submitting a Bid. Bidders are solely responsible for determining if they require additional information or if anything appears incorrect or incomplete. The onus is on the Bidder to contact the Board's Single Point of Contact prior to the Deadline for Questions indicated in this document, if they have any questions or queries whatsoever or find omissions from or discrepancies in this Bid Solicitation document, unnecessary restrictions in the terms of reference, or should they be in doubt as to the meaning of any part of this document. Written answers or clarifications to issues of substance will be shared with all Bidders in the form of an Addendum.

1.16. After the release of the Bid Results Notification / Debriefing Requests

In accordance with the Broader Public Sector Procurement Directive, unsuccessful Bidders are entitled to a debriefing in order to receive feedback with respect to their Bid submission. In order to obtain a debriefing, Bidders shall contact the Board's Single Point of Contact listed in this Bid Solicitation Document in writing with their request within sixty (60) days of the award notification.

1.17. Consequences of not following the Proponent Contact Protocol

Communication initiated by the Proponent, subcontractors, or third-party suppliers of goods or services during the blackout period, to the Board or consultant may be grounds for disqualification from the Tender.

Communication by Proponents, subcontractors, or third-party suppliers of goods or services, to the consultant or the Board, other than the Board contact from the issue date to the Tender to receiving the award non award notification, may be grounds for disqualification from the Tender.

1.18. Anticipated Time Table

The following table represents the anticipated project timelines. This timeline is an estimate only, and may be subject to change by the Board at any time.

DESCRIPTION	DATE
Issue Date	February 18, 2022
Non-Mandatory Site Meeting	February 23nd, 2022 3:00 P.M.
Deadline for Questions	March 8th, 2022 2:00 P.M.

DESCRIPTION	DATE
Issue Date	February 18, 2022
Closing Date and Time	March 14, 2022, 2:00 pm local time
Anticipated Contract Start / Work begins	March 28, 2022
Substantial Completion Date	August 26, 2022
Deemed Complete Date	October 28, 2022

1.19. Blackout Period

A black out period shall exist between the deadline for questions and the date of award. During this period, there shall be no communication between the Bidders, the Board or any Board consultants, unless initiated by the Board' Single Point of Contact.

1.20. Deadline for Questions

Questions must be received by the Single Point of Contact no later than the deadline for questions noted in the Anticipated Project Schedule.

If a Bidder finds any discrepancies or omissions within the Request for Tender (RFT) documents, or requires any clarifications regarding the RFT documents, questions and clarifications must be sent to the Single Point of Contact through the Bidding System by clicking on the "Submit a Question" button found within the bid details page of that opportunity.

The Board shall not be bound by any verbal instruction or information provided by any Board employee or consultant of the Board. Only responses provided in an Addendum shall form part of this Bid Solicitation Document.

1.21. Addenda

All Addenda issued through the Bidding System shall form part of the Tender Document.

Any questions and clarifications regarding the terms of reference shall be requested through the Bidding System by the date noted above. Those that are deemed pertinent to the Tender document will be addressed in the form of an Addendum.

Bidders shall acknowledge the receipt of all Addenda in the Bidding System prior to the submission of their bid. Where Addenda has been issued, the system will not allow the Bidder to submit a bid prior to acknowledging all Addenda.

Where an Addendum is issued after a bid has been submitted, the Bidding System will automatically withdraw the submitted bid. The submission status will change to incomplete and will not be accepted by the Board as a submitted bid. It is the responsibility of the Bidder to acknowledge all Addenda and ensure the bid has been received by the Bidding System. Bidder should check the Bidding System for Addenda up until the closing date and time.

Addenda cannot be acknowledged after the Closing Date and Time.

1.22. Warranty and Maintenance

The Awarded Bidder, at the time of substantial completion shall furnish a written warranty covering material, maintenance, and work performed under the contract for a minimum period of two (2) years from the date of completion. Individual sections may extend warranties beyond the two year time frame. The Awarded Bidder is responsible for all required maintenance complete with materials and labour during the warranty period.

2.0 BOARD PURCHASE ORDER

Goods/Service or Work, as described shall not commence until all of the required documents have been submitted to Procurement Services and the CCDC 2 executed by the Awarded Bidder(s) and the Board. For Payment purposes, a Purchase Order shall be generated and issued to the Awarded Bidder(s). The Purchase Order number must appear on all invoices in order to ensure prompt payment.

3.0 THE BID CONTRACT

.1 The bidders and the Owner acknowledge that it is their intention to create a process contract (the “Bid Contract”) between the Owner and any bidder whose Bid meets the Mandatory Requirements. The bidders and the Owner further acknowledge that, if a Bid Contract is created between the Owner and one or more of the bidders, the terms of the Bid Contract are represented by the Bid Documents.

4.0 DEFINITIONS

4.1. Capitalized terms not otherwise defined in this Section or elsewhere in these Instructions to Bidders shall have the meanings ascribed to them in the Contract. All references in these Instructions to Bidders to “Section” or “paragraph” shall, unless specifically indicated otherwise, refer to a Section or paragraph of these Instructions to Bidders.

.1 **"Bid"** means the Base Bid Form and all other documents submitted by a bidder in accordance with these Instructions to Bidders.
.2 **"Single Point of Contact"** means the Procurement Specialist of the WRDSB, NOT the prime Consultant.
.3 **"Bid Documents"** has the meaning set out in item 7, Instructions to Bidders.
.4 **"Bid Form"** means the Base Bid Form or any of the Supplementary Bid Forms listed in paragraph 6.1.2, section 00 21 13.
.5 **"Black-Out Period"** is the period between the deadline for asking questions or making queries, to the Bid Award Notification.
.6 **"Board"** means the Waterloo Region District School Board.
.7 **"Consultant"** means Prime Consultant retained by the Board and identified in these documents.
.8 **"Contract"** means the written agreement to be signed between the Owner and the successful bidder in the form of CCDC 2 – 2008 stipulated price contract, as amended by supplementary conditions.
.9 **"Evaluation Score"** has the meaning set out in item 12.0 Bid Evaluation, Section 00 21 13.
.10 **"Evaluation Team"** means the committee / team appointed to guide, monitor and direct this bid process and evaluate Bids.
.11 **"Irrevocability Period"** has the meaning set out in Item 4.2, Section 00 72 13.
.12 **"Mandatory Requirements"** has the meaning set out in item 12, Section 00 21 13.
.13 **"Project Manager"** or Project Coordinator can be used interchangeably and is the Board's representative for the project.
.14 **"Submission Deadline"** is the date and time identified in Item 1.18, Section 00 21 13.

4.2. VENDORS OF RECORD

.1 Bidders must be approved as a Vendor of Record by the Owner. Bids received from contractors who have not been approved prior to the Tender period will be returned unopened.
.2 The Owner reserves the right to issue an addendum naming additional pre-qualified general contractors and additional pre-qualified Subcontractors and Suppliers.

5.0 BID DOCUMENTS

.1 The following documents form the basis of this bid process (collectively the "Bid Documents"):
    .1 Instructions to Bidders.

.2 Bid Forms comprising the Base Bid Form and, where required, the Supplementary Bid Form – List of Subcontractors, Supplementary Bid Form – Itemized, Separate and Alternative Prices, and Supplementary Bid Form – Unit Prices.
.3 CCDC 2 – 2008 stipulated price contract comprised of the Agreement Between Owner and Contractor, Definitions, and General Conditions of the Stipulated Price Contract.
.4 Supplementary Conditions.
.5 Specifications (as per table of contents).
.6 Drawings (as per list of Drawings).
.7 Any Reports or Studies, including, but not limited to, Asbestos, Hazardous Materials and Sub-Surface soil conditions included with the specifications or addenda.
.8 Addenda issued prior to the Submission Deadline.

5.2. Check Bid Documents for completeness upon receipt. Inform the Board's Single Point of Contact immediately, should any documents be missing or incomplete and/or upon finding any discrepancies or omissions.

5.3. The Bid Documents are made available only for the purpose of submitting Bids for the Project. Availability and/or use of the Bid Documents do not confer a license or grant for any other purpose.

6.0 PROHIBITION ON LOBBYING / COLLUSION

6.1. Bidders and/or any representatives employed or retained by them are strictly prohibited from engaging in conduct which is or could reasonably be considered as any form of political or other lobbying, or as an attempt to influence the outcome of this bid process.

6.2. A bidder shall not discuss or communicate directly or indirectly with any other bidder any information whatsoever regarding the preparation of a Bid. Bidders shall prepare and submit Bids independently and without any communication, knowledge, comparison of information, or arrangement, direct or indirect, with any other bidder.

6.3. Failure of any bidder to comply with this Section may result in the disqualification of the bidder and the rejection of its Bid.

7.0 CONFLICT OF INTEREST

7.1. Bidders shall disclose all perceived, potential and actual Conflicts of Interest. For the purposes of this bid process, "Conflict of Interest" includes:

.1 any situation or circumstance where, in relation to this bid process and/or the Contract, the bidder's other commitments, relationships or financial interests

could or could be perceived to exercise an improper influence over the objective, unbiased and impartial exercise of independent judgment by any member of the Evaluation Team, the Board, or the Owner;

.2 any situation or circumstance where any person(s) employed by the Owner in any capacity, or any member of the Board:

.1 has a direct or indirect financial interest in the award of the Contract to any bidder;

.2 is currently employed by, or is a subcontractor or a consultant to a bidder;

.3 is negotiating or has an arrangement concerning future employment or contracting with any bidder;

.4 has an ownership interest in, or is an officer or director of, any bidder.

7.2. If a bidder discovers, at any time, any perceived, potential or actual Conflict of Interest, the bidder shall promptly disclose the perceived, potential or actual Conflict of Interest by sending a written statement in the manner described in paragraph 8. Failure of any bidder to comply with this Section may result in the disqualification of the bidder and the rejection of its Bid.

7.3. Without limiting the generality of Section 22, the Owner may, in its sole discretion:

.1 exclude any bidder and its Bid on the grounds of Conflict of Interest;

.2 waive any and all perceived, potential or actual Conflicts of Interest upon such terms and conditions as the Owner, in its sole discretion, requires to satisfy itself that the Conflict of Interest has been appropriately managed, mitigated and minimized.

8.0 SITE INVESTIGATION

.1 Any soils investigation, environmental, geotechnical or other reports prepared or obtained with respect to the Place of the Work (collectively the “Reports”) are available from the Consultant. Where the Work involves existing buildings, structures, facilities, plant or equipment, any reports, data or as-built drawings concerning such buildings, structures, facilities, plant or equipment (collectively the “Data”) are available from the Consultant. The Reports should not be considered a representation of the site conditions of the entire Place of the Work, and the Reports and Data are provided for general information and guidance purposes only. Neither the Owner nor the Consultant guarantees the accuracy or completeness of the Reports or the Data, nor does either assume any responsibility for any interpretations or conclusions that bidders may make or draw from the Reports or the Data.

.2 Each bidder is solely responsible, at its own cost and expense, to carry out its own independent research and due diligence, or to perform any other investigations considered necessary by the bidder to satisfy itself as to all existing conditions, circumstances and limitations affecting the Work,

including the existence and/or locations of utilities and underground services. The bidders' obligations set out in this paragraph apply irrespective of any Reports, Data or any information contained in the Bid Documents.

.3 No allowances will be made for additional costs and no claims will be entertained in connection with conditions which could reasonably have been ascertained by investigation or other due diligence undertaken prior to the Submission Deadline, and/or in connection with Work which is required and which is reasonably inferable from the Bid Documents, the Reports and/or Data as being necessary.

9.0 DESIGNATED SUBSTANCES

1. Asbestos Audit, prepared by MTE Consultants Inc. for each facility is available in the tender package as well as at the school's main office. A duplicate set is also available in the Facility Services department located at the Education Centre. Unless otherwise specifically covered by Cash Allowance or Contingency Allowance for known asbestos materials, include in this contract for the removal under abatement, in compliance with O.Reg. 278/05, of all known asbestos containing materials, as identified in the audit, within 600mm of all new services, materials, and equipment, and/or as required to complete the work. No claims for extra cost will be accepted for areas known to contain asbestos containing materials.

2. Comply with applicable legislation regarding asbestos. Should the Contractor encounter asbestos, not noted in the above Asbestos Audit, that would be disturbed during the course of the Work they should stop the work in that immediate area and report the same to the Board Contact.

3. Preliminary paint samples were collected within the work area to determine if lead-based paints are present. The analytical results are available in the tender package along with a Designated Substance Report (DSR) (for lead paint), where lead-based paints were identified or were deemed highly suspected.

4. Disturbance or demolition of lead-based paints, surface coatings, sheetings, mortar, piping or solders shall be conducted by the Contractor in accordance with the procedures noted in the Environmental Abatement Council of Canada (EACC) "Lead Guideline" (October 2014) and/or the Ministry of Labour (MOL) "Lead on Construction Projects" guideline (April 2011). The extent of procedures required depends on the type of work to be conducted.

5. In addition to asbestos and/or lead, silica, and mercury are present in all WRDSB facilities. New construction, renovations or alterations require compliance by the Contractor with the applicable legislation. Other designated substances (i. e. acrylonitrile, arsenic, benzene, coke oven

emissions, isocyanates, ethyl oxide, and vinyl chloride) are not encountered in WRDSB facilities as significant constituents or in a form that would represent an exposure concern.

6. Examples of common building materials that are considered as containing the additional designated substances are listed below:

    1. Lead - paints and coatings, lead sheeting, pigment mortar, lead piping, lead solder and fittings. In addition to the procedures outlined for lead paint and coatings in the DSR, the Contractor shall inform all workers of the presence of paint finishes that are lead containing. Disturbance of lead-containing paints or surface coatings shall be conducted in accordance with the procedures outlined in the Environmental Abatement Council of Canada (EACC) “Lead Guideline” (October 2014) and/or the Ministry of Labour (MOL) “Lead on Construction Projects” guideline (April 2011). The extent of procedures required depends on the type of work to be conducted. Carefully demolish and recycle of any lead sheeting, piping, solder and fittings. Waste to be handled and disposed of in accordance with O.Reg. 347. Contractor to ensure workers use appropriate PPE and follow the appropriate methods for removal stipulated by the MOL Lead on Construction Guidelines.

    2. Silica - concrete, brick, stone, terrazzo, refractory brick as well as in plaster drywall, acoustic ceiling tiles, drywall joint compound, mortars, and adhesives in low concentrations. All work involving the demolition silica-containing materials shall follow the procedures outlined in the MOL “Silica on Construction Projects” guideline. Type 1 operations may be necessary based on the type of work conducted and the Contractor shall implement dust suppression methods and protect workers.

    3. Mercury - thermometers, barometers, thermostats, gauges, electrical switches, and lighting products including fluorescent light bulbs and a variety of High Intensity Discharge (HID) lamps as mercury vapour, metal halide and high pressure sodium lamps. Lamps and other devices that require demolition are be handled with care and kept intact to avoid potential exposure. Any mercury-containing lamps or other equipment that are demolished are to be recycled. Waste to be handled and disposed of in accordance with O.Reg. 347.

10.0 INSTRUCTIONS FOR COMPLETING THE BID

10.1. Listing of Subcontractors:

.1 Where required by the Bid Documents, bidders shall complete and submit a Supplementary Bid Form – List of Subcontractors, naming the Subcontractors and Suppliers which the bidder will employ to perform an item of the Work called for by the Contract. Failure of the bidder to list Subcontractors and

Suppliers, where required, may result in the Bid being declared non-compliant.

.2 Where the Owner has provided a Vendor of Record list, for any one or more Subcontractors and/or Suppliers to perform or supply an item of the Work called for by the Contract, bidders shall select a subcontractor or supplier from that Vendor of Record list to perform or supply that item of Work. Failure to do so shall result in the Bid being declared non-compliant.

.3 Where a bidder lists more than one Subcontractor or Supplier to perform or supply an item of the Work listed, the Subcontractor or Supplier that is listed last shall be deemed to be the Subcontractor or Supplier to be employed by the bidder to perform or supply such item of the Work.

.4 Where a bidder lists "own forces" in place of a Subcontractor, the bidder shall carry out such item of the Work with its own forces. Where "own forces" have been listed by a bidder, the Owner reserves the right to obtain information from the bidder and from third parties respecting the qualifications and experience of the bidder's "own forces" for such item of the Work.

10.2. Itemized, Separate and Alternative Prices:

.1 Where required by the Bid Documents, bidders shall complete and submit a Supplementary Bid Form – Itemized, Separate and Alternative Prices. The Owner reserves the right to accept or reject any or all itemized, separate and alternative prices submitted, and such prices shall remain in effect for the duration of the Contract. Failure to submit an itemized, separate or alternative price where required may result in the Bid being declared non-compliant.

10.3. Unit Prices:

.1 Where required by the Bid Documents, bidders shall complete and submit a Supplementary Bid Form – Unit Prices. Unit prices shall be in effect for the duration of the Contract and may be used to calculate the cost of additional work under the Contract. The Owner reserves the right to accept or reject any or all unit prices submitted, and such prices shall remain in effect for the duration of the Contract. Failure to submit a unit price where required may result in the Bid being declared non-compliant.

11.0 BID EVALUATION

11.1. Mandatory Requirements. Only bidders that submit Bids which the Evaluation Team determines meet all of the mandatory requirements set out below (collectively the "Mandatory Requirements") on a "pass/fail" basis will be eligible to be considered for an award of the Contract:

.1 The Bid includes the Base Bid Form.

.2 The bidder is a valid Vendor of Record.

.3 Where a mandatory site meeting was scheduled and held, the bidder attended the mandatory site meeting.
.4 The Bid includes the Security Documents.
.5 The Bid includes valid Vendor of Record Subcontractors and/or Suppliers.
.6 The Bid substantially complies with the other requirements of the Bid Documents.

11.2. Point Based Evaluation Criteria. Only Bids which meet all of the Mandatory Requirements will be evaluated by the Evaluation Team and awarded points based on criteria set out below.
.1 As few as zero (0) points will be awarded for each evaluation category; the maximum points available for each evaluation category are set out below.
.2 The total points awarded to a bidder will be that bidder's "Evaluation Score".

CRITERIA	Points Available
Mandatory bid documents	Pass/Fail
Bid price offered / bid price as adjusted by the amount of any itemized, separate and/or alternative price(s) which the Owner, in its discretion, decides to accept.	100%
MAXIMUM POINTS AVAILABLE	100

12.0 AWARD OF THE CONTRACT, DOCUMENTS TO BE DELIVERED, AND EXECUTION OF THE CONTRACT

12.1. Within ten (10) Working Days of receiving an award letter from the Owner, and prior to commencing the Work, the successful bidder shall deliver to the Owner:
.1 the performance bond and the labour and material payment bond described in the Bid Documents, the forms of such bonds to comply with the requirements of the Contract;
.2 certified true copies of the insurance policies required by the Contract or certificates of insurance, at the option of the Owner;
.3 a current WSIB clearance certificate;
.4 the bidder's health and safety policy for the Project; and
.5 a copy of the notice of project issued by the Ministry of Labour for the Project.

12.2. The successful bidder shall execute the Contract and shall deliver the executed original to the Owner within ten (10) Working Days of the bidder's receipt of the same.

13.0 PUBLIC STATEMENTS, CONFIDENTIALITY, AND MFIPPA

13.1. Bidders shall not publish, issue or make any statements or news release, electronic or otherwise, concerning their or any other Bid, this bid process, the evaluation of the Bids, the award of the contract, or cancellation of this bid process, without the express written consent of the Owner. The Owner's award of the Contract to a bidder does not constitute a general endorsement of that bidder's products or services.

13.2. All information provided by or obtained from the Owner in connection with this bid process is the sole property of the Owner and must be treated as confidential. Such information is not to be used for any purpose other than preparing a Bid.

13.3. By submitting a Bid, bidders acknowledge that the contents of their Bids will be disclosed, on a confidential basis, to the Evaluation Team and may be disclosed to members of the Board and the Owner's staff, agents and advisors for the purpose of evaluating or participating in the evaluation of the Bids. The Owner will use reasonable efforts to protect pricing, commercial terms, and other sensitive and confidential information provided by the bidders as part of a Bid (the "**Confidential Material**"), however, the Owner accepts no liability in the event that the Confidential Material, or any part of it, is disclosed even if the Evaluation Team, the Owner, its staff, agents, advisors or any other person associated with the Board or the Owner may have been negligent with respect to such disclosure.

13.4. Information provided in the Bids may be presented at public meetings of the Board and may be disclosed to the public. In addition, the Owner may be required to disclose information provided in the Bids pursuant to the provisions of the Municipal Freedom of Information and Protection of Privacy Act or other legislation. By submitting a Bid each bidder agrees to such disclosure and releases the Evaluation Team, the Owner, the Board, and the Consultant from any liability for the same.

14.0 RELEVANT POLICIES

.1 The Board has a number of relevant policies regarding tenders and bidders should familiarize themselves with the following policies:

- .1 Purchasing Policy- www.wrdsb.ca/about-the-wrdsb/procurement-services
- .2 Conflict of Interest - Employees or Trustees - https://www.wrdsb.ca/wp-content/uploads/4005-Procurement.pdf
- .3 Acceptance of Hospitality or Gifts - https://www.wrdsb.ca/wp-content/uploads/4005-Procurement.pdf
- .4 The Board also has emergency response procedures: - www.wrdsb.ca

END OF SECTION

SECTION 00 21 14 – VENDORS OF RECORD

1.0 INTRODUCTION

1.1. The **Waterloo Region District School Board**, in an effort to build an improved supplier database and to obtain exceptional long term value, has implemented a Vendors of Record list. This tender is open to those who are currently registered under the Board's Vendor Registration System.

1.2. Only those General Contractors and Subcontractors noted below may submit bids in their particular fields. Refer to specification sections for products, suppliers and installers that will be required in addition to the Vendors of Record noted below.

2.0 VENDOR REGISTRATION PROCESS

2.1. To become a Vendor of Record for future business opportunities, go to the Board's public website at **www.wrdsb.ca** and refer to *About Us - Purchasing Services - Vendor Registration,* and submit the completed application, as per instructions on the website.

3.0 PRIME / GENERAL CONTRACTORS

3.1. Any bid submission from bidders other than Vendors of Record contractors listed below or identified by Addendum will have their bid ruled informal.

3.2. The Owner reserves the right to issue an addendum naming additional general contractors as a Vendor of Record.

3.3. The following Prime / General Contractors are Vendors of Record with the Board and are invited to submit bids:

General Contractor	Phone	Email
Bestco Construction (2005) Ltd	(905) 304-4597	estimating@bestcoconstruction.com
Caird-Hall Construction Inc.	(905) 634-0903	caird-hall@bell.net
Collaborative Structures Limited	(519) 658-2750	jblackler@collaborativestructures.com
Complete Building Systems Inc.	(519) 576-5800	estimating@completebuildinsystems.ca
CRD Construction	(519) 822-1801	sbock@crdconstruction.on.ca
D. Grant Construction Limited	(519) 652-2949	swillis@dgrantconstruction.com
Dakon Construction	(519) 746-0920	james@dakon.ca
Eldale Structures Ltd	(519) 823-5500	bmcleod@eldale.com
Elgin Contracting and Restoration Ltd.	(519) 633-9969	info@elgincontracting.com

Gateman-Milloy Inc.	(519) 748-6500	info@gatemanmilloy.com
Golden Gate Contracting Inc	(905) 844-1122	estimation@ggcontracting.ca
K&L Construction (Ontario) Ltd	(519) 472-7164	todd.hodgins@kandlconstruction.com
Melloul Blamey Construction	(519) 886-8850	teresa.oreilly@melloul.com
Nith Valley Construction Ltd	(519) 662-1324	mail@nithvalley.com
PM Contracting Ltd	(519) 576-8327	sarahziegler@pm.on.ca
Pre-Eng Contracting Ltd.	(905) 738-6866	info@pre-eng.com
Reid & Deleye Contractors Ltd	(519) 688-2600	gregd@reid-deleye.com
RENOKREW	(416) 604-7042	info@renokrew.com
SG Cunningham Ltd	(519) 886-2730	allan@cunningham.on.ca
Sierra Construction	(519) 421-7413	info@sierraconstruction.ca
SPEC Construction Inc.	(519) 650-4030	info@spec-build.com
STM Construction Ltd	(519) 756-7030	robertbox@stmconstruction.com
Struct-Con Construction Ltd.	(905) 791-5445	harpreet@struct-con.ca
Tambro Construction	(519) 766-1234	btami@tambro.com
TRP Construction	(905) 336-1041	info@trpconstruction.ca
Van Horne Construction Ltd	(905) 677-5150	otekin@vanhorne.ca
Zehr Levesque Inc.	(519) 576-2233	estimating@zehrgroup.ca

4.0 SUBCONTRACTORS

4.1. Bidders shall select only a Subcontractor or Supplier listed below to perform or supply an item of Work indicated. Failure to do so shall result in a Bid being ruled informal.

4.2. The Owner reserves the right to issue an addendum naming additional Subcontractors and Suppliers as a Vendor of Record.

4.3. The following Subcontractors are Vendors of Record with the Board and are invited to submit bids to the General Contractors:

Mechanical Contractor	Phone	Email
AAA Air Conditioning Inc	(519) 747-9051	igrant.aaaac@gmail.com
AIM Industrial Inc.	(519) 747-2255	craigd@aimindustrial.ca
Black & McDonald Limited	(905) 560-3100	sfernandes@blackandmcdonald.com
Brenner Mechanical Inc	(519) 746-0439	clanglois@brenner.ca

Conestogo Mechanical Inc	(519) 579-6740	wquickfall@conestogomech.com
Dean Lane Contractors Inc	(519) 585-0903	dean@dean-lane.com
Dordan Mechanical Inc.	(519) 662-9900	danielg@dordanmech.com
Jay Stewart Mechanical	(519) 576-2663	admin@jaystewart.ca
Keith's Plumbing & Heating Inc.	(905) 544-8118	andrena@keithsph.com
LJ Barton Mechanical Inc.	(905) 304-1976	estimating@ljbarton.com
Nelco Mechanical Ltd	(519) 744-6511	mhobson@nelcomech.com
Reitzel Heating & Sheet Metal	(519) 884-3510	alan@reitzelheating.ca
Roberts Onsite Inc	(519) 578-2230	dmagnus@robertsonsite.ca
Sutherland-Schultz Ltd	(519) 653-4123	info@sutherland-schultz.com
Touchstone Building Technologies Inc.	(519) 997-2792	info@touchstonebti.ca
Trade Mark Industrial Inc	(519) 570-1511	tmoore@trade-markind.com
Velocity Mechanical Inc	(519) 896-1119	quotes@velocitymechanical.com
Wellington Plumbing & Heating Ltd.	(519) 821-4130	kyle@wellington-plumbing-hvac.com

Electrical Contractor	Phone	Email
AIM Industrial Inc.	(519) 747-2255	craigd@aimindustrial.ca
D&D Electric Ltd	(519) 603-2924	jquehl@ddelectric.ca
Fairway Electrical Services Incorporated	(905) 304-1133	cherd@fairwayelectrical.com
Harold Stecho Electric Ltd	(519) 746-0047	steves@stecho.ca
Juno Electric	(519) 821-4890	steno@junoelectric.ca
KW E Inc Electrical Contractors	(519) 653-6989	jim@kweinc.com
Live Electric	(519) 265-8566	estimates@live-electric.ca
Millers Electric Ltd	(519) 742-3465	scottg@meltd.on.ca
MJM Electric Limited	(519) 824-1989	mlang.mjm@gmail.com
Nadelec Contracting Inc	(905) 875-5239	john.nadelec@gmail.com
Nelco Mechanical Ltd	(519) 744-6511	mhobson@nelcomech.com
Roberts Onsite Inc	(519) 578-2230	dmagnus@robertsonsite.ca
Sentry Electric Inc	(705) 436-4530	info@sentryelectric.ca

Sutherland-Schultz Ltd	(519) 653-4123	info@sutherland-schultz.com
Trade-Mark Industrial Inc	(519) 570-1511	tmoore@trade-markind.com

Abatement Contractor	Phone	Email
A & O Contracting Inc	(905) 828-6868	anthony@aandocontracting.com
Azbest Environmental	(226) 751-5059	hank@azbest.ca
Biggs & Narciso Construction	(905) 470-8788	james@biggsandnarciso.com
Caliber Environmental Construction Services Inc.	(905) 884-5500	jimball@caliberenv.com
EAN Construction	(519) 603-0109	info@eanconstruction.com
Enviro-cor Enterprises	(519) 753-0993	kelly@enviro-cor.ca
FPR Environmental Inc	(519) 568-8222	frank@asbestosmouldexperts.com
GB Environmental Services	(905) 984-3455	gflett@gbenvironmental.net
I&I Construction Services Ltd	(905) 884-1290	tbarron@iandi.ca
Jobi Construction Ltd.	(519) 227-1181	bparsons@jobiconstruction.com
Power Environmental Power Vac	(905) 318-0622	info@powervachamilton.ca
Puroclean Property Restoration	(519) 653-8030	jreis@puroclean.com
Reitzel Bros. Environmental	(519) 648-2237	ddeleon@ags-environmental.com
Schouten Environmental Inc	(519) 577-8989	brant@schouten.ca
Zero Environmental Inc.	(519) 772-5500	info@zeroenvironmental.com

Millwork Contractor	Phone	Email
Baywood Interiors Ltd	(519) 748-9577	johnl@baywoodinteriors.com
Bendt Kitchens and Millwork Inc.	(519) 743-7418	jody@bendt.ca
BEZ Industries	(519) 579-3880	john@bezindustries.com
CCW Inc	(519) 886-2728	hermes.alvarez@ccwinc.com
DM Millwork Ltd	(519) 743-1556	dmmillwork@gto.net
GL Industries Ltd	(519) 787-4379	gary@glindustries.ca
Harris Corporate Interiors Inc.	(905) 563-6111	danny@hciinc.ca
HSCJ Millwork Inc.	(226) 606-3171	sam@hscjservices.com

Interior Store Display Installations	(519) 895-0532	garry@interiorstoredisplay.com
Leedwood Ltd.	(519) 805-3556	ryan@leedwood.ca
Second Generation Furnishings	(905) 738-1403	robert@2ndgen.ca
Top Millwork Interiors Inc.	(416) 736-9868	topmillwork@msn.com
Vdcm Architectural Woodwork Inc.	(519) 743-4409	estimating@vdcm.ca
Wood Design Ltd	(905) 595-1281	wooddesign.ltd@gmail.com

Roofing Contractor	Phone	Email
A.M. Roofing Systems Inc.	(905) 529-5111	mike@amroofingsystems.com
Atlas-Apex Roofing (Kitchener) Inc (fomerly Watertight)	(519) 894-4422	inquiries@atlas-apex.com
Dean-Thackeray Roofing Company Ltd	(519) 745-7386	patrick.dtr@bellnet.ca
Flynn Canada Ltd	(519) 624-8797	Joseph.Raposo@flynn.ca
LaFleche Roofing Services	(800) 387-1549	chris@laflecheroofing.com
Nedlaw Roofing Limited	(519) 648-2218	adam@nedlawroofing.com
Roque Roofing Inc.	(905) 525-9689	sarah@roqueroofing.com
Schreiber Brothers Ltd	(905) 561-7780	marinos@schreiberrroofing.com
Semple Gooder Roofing Limited	(519) 623-3300	jsottile@semplegooder.com
Spinton Roofing Limited	(905) 575-3686	mira@spintonroofing.com
Triumph Roofing & Sheet Metal Inc.	(416) 534-8877	info@triumphinc.ca
Wm. Green Roofing Ltd.	(519) 822-6414	sbrookes@wmgreenroofing.ca

Window Contractor	Phone	Email
Aerloc Industries Ltd.	(905) 628-6061	peterdendekkerjr@aerloc.com
Alwind Industries Ltd	(905) 738-4266	gm@alwind.com
Barton Glass	(905) 385-3599	pdhbartonglass@quickclic.net
Festival City Glass Ltd.	(519) 271-5182	festivalcityglass@gmail.com
Glass Canada Limited	(519) 642-4100	rdamstra@glass-canada.com

Huron Glass Inc	(519) 565-5007	huron.glass@tcc.on.ca
Kitchener Glass Ltd	(519) 744-5201	paul@kitchenerglass.com
KW Glass Systems Inc	(519) 725-9305	rick@kwglass.com
Peninsula Glass Inc.	(905) 735-2901	tim@peninsulaglass.ca
Ridley Windows and Doors	(905) 854-2228	lsutherland@ridleywindows.com
Shantz Windows	(519) 669-2629	bruce@shantzwindows.com
Sherwood Windows Group	(416) 675-3262	bhorton@sherwoodwindows.com
Windspec Inc	(905) 738-8311	wferri@windspec.com

Flooring Contractor	Phone	Email
Flooring Plus	(519) 747-5131	vartan@flooringplus.ca
M&M Carpet Inc.	(905) 279-7875	mmcarpet@bellnet.ca
Nufloors Simcoe	(519) 426-2619	garnatfloor@eastlink.ca
Rick's Carpet and Flooring	(519) 449-2362	gcouwenberg@rickscarpet.ca
S L Marcella Carpets Ltd	(519) 885-2357	nick@marcellacarpets.ca
The Belluz Group Ltd.	(905) 385-8999	abraham@belluzgroup.ca
Twin City Tile Co Ltd	(519) 743-4179	matt@twincitytile.com
Voll's Contract Flooring	(519) 669-1151	dkirch@vollscontract.ca
Zet Master Limited	(905) 789-6560	konrad@zetmaster.com

Painting Contractor	Phone	Email
Aves & Shaw Painting	(519) 742-3486	avesandshawltd@rogers.com
CertaPro Painters of Waterloo	(519) 616-1167	adyck@certapro.com
Expert Painting Inc	(519) 635-8106	expertpainting@hotmail.com
Gateway Painting Ltd.	(519) 500-0772	info@gwpainting.ca
Mike McMahon's Painting Ltd	(519) 744-0169	mikes.painting.ltd@sympatico.ca
Northern Painters (div Connco Group Ltd)	(800) 465-6985	northpaint@conncogroup.com
Platinum Painting & Decorating Inc.	(905) 790-2111	sandro@platinumpaintdecor.com

Westwood Painting Services Inc.	(905) 575-8458	westwoodpainting@cogeco.net

END OF SECTION

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SECTION 00 21 15 – SCOPE OF WORK

HVAC upgrades in classrooms, washrooms, corridors and vestibules in west wing & central lobby of school with minor interior renovations to suit.

Interior renovations to reconfigure main office to include health room, barrier-free wc and expanded office area. Renovation to existing staff work room, staff wc and custodial area.

Conversion of existing classroom into Special Education Room.

Demolition of existing redundant vestibule and boiler room chimney.

Exterior scope includes new metal screen, roof access hatch and ladder, and HVAC related roof work

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Waterloo Region District School Board

Appendix B – Price Bid Form Sample

Instructions: Bid price shall be submitted through the Bidding System only

SCHOOL	BID PRICE	HST	TOTAL
	$	$	$
	$	$	$
	$	$	$

END OF SECTION

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Appendix C – WRDSB Project Asset and Warranty Card

WRDSB PROJECT ASSET & WARRANTY CARD

Instructions:

a. The WRDSB Project Asset & Warranty Card shall be filled out and completed for any project or work that calls for the replacement or new installation of any asset that has a warranty and requires ongoing preventative maintenance, as well any asset that is being removed.

b. The information for the WRDSB Project Asset & Warranty Card shall be collected and coordinated by the General Contractor responsible for the overall project. The WRDSB Project Asset & Warranty Card shall be filled out and submitted to the Board electronically to FAC_maintenance@wrdsb.ca and carbon copy the project coordinator at the point in time where the project is deemed "Substantially Complete" or at the start of the Warranty Period for said asset. For any project without a General Contractor, the Contractor or Trade responsible for the installation and/or removal of the asset shall complete the WRDSB Project Asset & Warranty Card and submit it to the Board in the same manner as mentioned above.

c. All items shall include the asset Identifier, asset description, location, manufacturer, model, serial number, and warranty end date (refer to example at bottom of page).

d. NO Warranty Period shall start without the written permission of the Board prior to the point of Substantial Completion of the project.

e. The Contractor that is responsible for the coordination and completion of the WRDSB Project Asset & Warranty Card shall ensure that the contractor or trade responsible for the installation of the item understands that the contractor or trade is responsible for the preventative and general maintenance of that item for the minimum 2 year warranty period as noted on the WRDSB Project Asset & Warranty Card.

f. **All** items installed under this contract that require ongoing preventative maintenance (PM) shall be included on the WRDSB Project Asset & Warranty Card. The following list contains examples to be included but not limited to;

Air Compressor
Air Handler- ERV, Heat Pump, RTU
AC Split -Indoor/Outdoor Unit
Automatic Doors
Backflow Preventer
Boiler
Chiller
Cooling Tower
Elevator/Lift
Eyewash Station-location only
Fire Panel
Grease Trap
Gym Equipment
Hoods- Kitchen/Fume
Operable Partitions
Sprinkler System -area covered
Tech Equipment

g. All maintenance during the warranty period shall be the responsibility of the contractor. This shall include, but not be limited to: air handling unit filter changes (3x min.per year), or as per manufacturers recommendations; servicing testable backflow preventors, including fees; and any and all required maintenance.

Sample:

To be filled out by Consultant				*To be filled out by Contractor*				
IDENTIFIER	ASSET	LOCATION (incl. Rm. No.)	REMOVED (R), OR NEW (N)	CONTRACTOR	MANUFACTURER	MODEL	SERIAL NUMBER	WARRANTY END DATE
Boiler 2	*Condensing Boiler*	*Boiler Rm. B005*	*R*	*Bob's Mechanical*	*Viessman*	*Vitocrossal 300 CA3B*	*1234x5678y90*	*Jan. 1, 2025*
HVAC 7	*New RTU*	*Roof D*	*N*	*Bob's Mechanical*	*Daiken*	*DPS020A*	*ABCD1EFGH2IJ*	*Jan. 1, 2025*
n/a	*Gym Partition*	*Gyms 122/123*	*R*	*Extreme Partitions*	*Hufcor*	*933EC*	*n/a*	*Jun. 30, 2028*

WRDSB Project Asset & Warranty Card

Project Name: ____________________

School / Location: ____________________

Date: ____________________

To be filled out by Consultant				*To be filled out by Contractor*				
IDENTIFIER	ASSET	LOCATION (include Room No.)	ASSET REMOVED (R) OR NEW (N)	CONTRACTOR	MANUFACTURER	MODEL	SERIAL NUMBER	WARRANTY END DATE

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Appendix D - VENDOR PERFORMANCE EVALUATION FORM AND GUIDELINES

The Board, in an effort to build an improved supplier base and to obtain exceptional long term value, has undertaken a project to register vendors. In conjunction, performance of vendors, either Prime and/or Sub that are involved with this project may be evaluated.

The evaluation may occur at or near substantial completion.

An evaluation may also occur at any stage of the project in order to request and implement a corrective action to facilitate the successful completion of the project.

The Board will evaluate prime contractors.

Prime contractors will evaluate sub-contractors that do not meet expectations and forward the results to the Board. The Board will initiate a request for corrective action to the subcontractor. This is separate from any corrective action that the prime contractor may have. Prime contractors may address the evaluation form and processes at the start up meeting, but it is the responsibility of the prime contractor and the subcontractors to communicate, understand and adhere to the evaluation form and guidelines.

The Board will forward Performance Evaluations to the evaluated prime contractor and/or Subcontractor, here after referred to as Vendor.

A Vendor Performance Evaluation that:

1) Meets or exceeds expectations:

   Is a very powerful tool that the evaluated vendor can forward as references to prospective clients giving a very accurate indication of their performance and abilities.

   As such, upon request, a vendor performance evaluation will be completed and forwarded to the same vendor, who can then forward it on to their prospective client.

2) Is below expectations:

   Will be forwarded to the vendor with a Request for Corrective Action.
   The Board will also lower the project size capability of the vendor at this time.

Upon the vendor’s successful completion and demonstration of the Request for Corrective Action, the Board may increase the project size capability of the vendor.

The Board or vendor upon the successful completion of the Request for Corrective Action may request a meeting in order to move forward in a positive manner.

Procurement Services will provide clarification and/or direction regarding the Request for Corrective Action, if requested, however the Vendor Performance Evaluation will remain as issued.

The Vendor Performance Evaluation, Requests for corrective action, and the vendor's corresponding corrective action will be filed at the Board.

The Vendor Performance Evaluation may be revised and or modified at any time without notice.

Business Services Division *Procurement Services*

VENDOR PERFORMANCE EVALUATION

Vendor Name: _____

Project Name: _____

Tender Number: _____

Classification: ☐ Prime Contractor ☐ Subcontractor

	CHECK ONE					
	Not Applicable	Far below expectations: inadequate, containing little detail insufficient knowledge	Does not fully meet expectations: limited knowledge and requirements	Meets expectations: demonstrates ability and knowledge to address basic requirements	Exceeds expectations: demonstrates clear, concise knowledge of requirements	Far exceeds expectations: highly comprehensive, excellent response
1. **Safety & Security:** (Understands & follows requirement guides)	☐	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐				
2. **Site Supervision:**	☐	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐				
3. **Billing Accuracy:**	☐	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐				
4. **Ability to Minimize Deficiencies:** (Timing, follow up, documentation of actions)	☐	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐				
5. **Ability to Maintain Schedule & React to Changes:** (Completeness of work, providing appropriate manpower)	☐	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐				
6. **Ability to stay focused on Scope:** (Does not seek additional work)	☐	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐				

Comments: _____

7. **Approximate dollar value evaluated:** 0-50,000 | 50,000. – 500,000. | 500, 000. +

8. **Additional Comments:** _____

Score:

General Contractor: _____ Date: _____
(If evaluating subcontractor) (company name) (Project Manager) (signature)

Project Evaluator: _____ Date: _____
(print name) (signature)

Manager: _____ Date: _____
(print name) (signature)

Procurement Services action taken: File Corrective Action (overall average score <3/individual score<3)

Procurement Manager: _____ Date: _____
(or designate) (print name) (signature)

Original –Vendor File Electronic copy- to Vendor
Corrective Action documentation to be filed with Vendor Performance Evaluation
I:/Purchasing/Buyers/BidsTemplates/Doc Templates –All/RFT Construction/APPENDIX F –Vendor Performance Evaluation Form

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SECTION 00 41 73 - SUPPLEMENTARY BID INFORMATION

If requested, the Supplementary Bid Information must be completed and submitted at time of the tender closing**. All pricing where requested in this form is plus HST.**

GENERAL CONTRACTOR

1.1 The following personnel will be assigned to manage and supervise the Work. Personnel will be subject to approval by the Board, and cannot be changed without prior written approval from the Board.

Site Supervisor: _____

Project Manager: _____

Part 2 ALTERNATIVE PRICES

2.1 The following are the prices for the alternative work listed hereunder. Such Alternative Work and amounts are NOT included in the Bid Price.

ITEM	AMOUNT
	$
	$
	$

Part 3 ITEMIZED PRICES

3.1 The following are the prices for the items of work listed hereunder. Such Work and amounts ARE included in the Bid Price.

3.2 The Board reserves the right to modify the Scope of Work and reduce the contract price accordingly, based upon the prices indicated

ITEM	AMOUNT
	$
	$
	$

Part 4 IDENTIFIED PRICES

4.1 The following are the values of work listed hereunder. Such work and amounts ARE included in the Bid Price.

4.2 The Board has requested these prices for information purposes only and does not intend to modify any Scope of Work based on the prices indicated.

ITEM	AMOUNT
	$
	$
	$

1.0 GENERAL

1.1. DEFINITIONS DECLARATION

.1 CCDC 2-2008 Edition, Stipulated Price Contract as may be amended, forms the basis of Definitions between the Owner and Contractor.

.2 These Definitions are bound to the CCDC 2 Definitions and CCDC 2 General Conditions.

1.2. SUPPLEMENTARY WORDS AND TERMS TO CCDC 2-2008

.1 The following words and terms are additional to the CCDC 2 Definitions.

.2 Addendum: A document that amends the Bid Documents during the Bidding Period and becomes part of the Contract Documents when a Contract is executed. (Plural: Addenda).

.3 Agreement: The signed and sealed legal instrument binding parties in a Contract, describing in strict terms their mutual arrangement, roles and responsibilities, commencement, and completion responsibilities.

.4 Alternative Price: The amount stipulated by a Bidder for an Alternative and stated as an addition, a deduction, or no change to the Bid Price.

.5 Authorities: Those having jurisdiction under law over Work or Parts thereof.

.6 Bid: To offer as a Bid stating for what price a Contractor will assume a Contract.

.7 Bid Documents: A set of documents consisting of the Instructions to Bidders, Bid Form, Contract Documents, and other information issued for the benefit of Bidders to prepare and submit a Bid.

.8 Bid Form: The specific and detailed form used to collect information about a Bid.

.9 Bidding: The process of preparing and submitting a Bid.

.10 Construction Documents: The Drawings and Project Manual. When combined with a Contract and Contract conditions, these documents form the Contract Documents.

.11 Contingency Allowance: An additional monetary amount added to a Project cost estimate and designated to cover unpredictable or unforeseen items of Work. The amount is usually based on some percentage of the estimated cost and expended and adjusted by Change Order. It is not intended to cover additions to the scope of Work.

.12 General Conditions: That part of the Contract Documents which sets forth many of the rights, responsibilities and relationships of the parties involved in a Contract.

.13 Exposed: Visible at completion of Work, in useable areas as well as interior of closets, cabinets, drawers, storage and service rooms, stairwells and exterior surfaces.

.14 Instructions To Bidders: Instructions contained in the Bid Documents to convey an Owner's expectations and criteria associated with submitting a Bid.

.15 Section: A portion of a Project Specification covering one or more segments of the total Work or requirements. Sections are included in a Project manual as required to meet Project requirements.

.16 Standard: A document describing a grade or a level of quality, which has been established by a recognized agency or organization, utilizing an internal voting process.

.17 Separate Price: A separate price for work to be added to the base price if selected by the Owner. This price type is not a part of the base bid price.

.18 Stipulated Price: An amount set forth in a Stipulated Price Contract as the total payment for the performance of the Work. Sometimes referred to as a stipulated sum or a lump sum stipulated price.

.19 Tender: Refer to definition of Bid.

.20 Unit Price: The amount payable for a single unit of Work as stated in a Schedule of Prices.

.21 Install: To remove from site storage, move or transport to intended location, install in position, connect to utilities, repair site caused damage, and make ready for use.

.22 Supply: To acquire or purchase, ship or transport to the site, unload, remove packaging to permit inspection for damage, re-package, replace damaged items, and safely store on-site.

.23 Provide: To Supply and Install

.24 Wherever words 'approved', 'selected', 'satisfactory', 'directed', 'permitted', 'inspected', 'instructed', 'required', 'submit', 'ordered', 'reviewed', 'reported to', or similar words or phrases are used in Contract Documents, it shall be understood, unless context provides otherwise, that words 'by Consultant' or 'to Consultants' follow.

.25 Words 'by others' when used in Specifications or on Drawings shall not mean by someone other than Contractor. Only means by which something shown or specified shall be indicated as not being in Contract is by initials 'NIC' or words 'not in Contract', 'by Owner', or 'by Other Contractor'.

END OF SECTION

SECTION 00 72 13 – TERMS AND CONDITIONS

1.0 PROVISIONS

1.1. Proceedings Against the Board

.1 The Proponent represents and warrants that the Proponent is not a party to any suits, actions, litigation proceedings, arbitration's, alternative dispute resolutions, investigations or claims by or against or otherwise involving the Board and the Proponent. The Board will reject the bid in the view of the current, pending or threatened litigation, arbitration, alternative dispute resolution or disputes involving the Board and Proponent. The Awarded Bidder may also be required, at the discretion of the Board, to sign a Certificate in a form satisfactory to the Board confirming that the Awarded Bidder is not associated with any company involved in litigation with the Board.

1.2. Standard of Behaviour

.1 The Board will not knowingly purchase goods and/or services from Awarded Bidders who operate in contravention of local and international laws. Proponents submitting bids are in fact agreeing that they do not purchase or use products that are in contravention of local and international laws. If a product and/or service supplied to the Board is discovered to be in contravention, the Board reserves the right to rectify the issue with the Awarded Bidder that may include the cancellation of the contract.

1.3. Federal, Provincial, Regional and Municipal Laws

.1 The Awarded Bidder must stay current and comply with, for the durations of the agreement, all current laws and bylaws.

.2 No Smoking and Scent –Free

.1 The Province has legislated under the Smoke Free Ontario Act that smoking is not permitted on any Board owned properties. Furthermore, most Board properties are “scent free”. Smoking will not be permitted on-site. Offenders will be asked to leave the site, and infractions could result in corrective action and or fine.

1.4. Professional Conduct

.1 All contractors must conduct themselves in a professional manner at all times when dealing with Board staff, with the public, and while working on site. Unprofessional conduct could result in immediate termination of the contract.

1.5. Sustainable Purchasing

The procurement needs of the Board represent a significant level of responsibility to demonstrate leadership and support for greener business practices. Integrating environmental performance and impact into supply chain decisions is a commitment to improvement of the environment and the quality of life.

Green procurement shall be viewed in the context of achieving value for money for the total life-cycle costs. It requires the inclusion of environmental impact considerations into the procurement process, including planning, acquisition, use and disposal. Value for money shall include the consideration of many environmental tangible and intangible factors when determining the total life-cycle costs and environmental impact.

1.6. Paramountcy Clause

.1 Proponents who have additional and/or supplementary agreements that require the Board's signature prior to providing the required products and/or services to the Board must submit that said draft agreement with their bid. No additional agreements will be accepted by the Board after the closing date Tender time of the Tender. In the event of any conflict between the provisions of the terms of the Awarded Bidder's additional and/or supplementary agreement(s) and the provisions of this Tender document, the terms of the Tender contract shall govern.

1.7. Freedom of Information

.1 To comply with the Freedom of Information and Protection of Privacy Act, all bids submitted to the Board become the property of the Board, and as such, are subject to the Freedom of Information and Protection of Privacy Act. Clearly identify any portion of the bid submission that could cause injury if disclosed.

1.8. Criminal Background Checks and Collection of Personal Information

.1 The Board must comply with Regulation 521 (Collection of Personal Information) to the Education Act with respect to criminal background checks and offence declarations.

.2 If required by the Board, the Awarded Bidder will provide the Board, or designate with a Criminal Background Check covering offences under the Criminal Code, the Controlled Drugs and Substances Act, and any other offences which would be revealed by a search of the automated Criminal Records Retrieval System.

.3 An Offence Declaration in a Board-approved form for every individual or employee of the Awarded Bidder who may come into direct contact with Board staff and/or students on a regular basis at any Board site prior to the occurrence, and on or before September 1 each year thereafter is required. The Board will determine in its sole discretion whether an individual or employee of the Awarded Bidder come into direct contact with pupils on a regular basis.

.4 Termination of contracts and indemnification by the Awarded Bidder will result from noncompliance.

1.9. Accessibility

.1 Proponents 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. Proponents acknowledge 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.

2.0 COMMUNICATION

2.1. Verbal Communication

.1 Neither the Board nor Board consultant will provide verbal direction or clarification during the tender process. As a result, verbal recollections will not be considered valid.

2.2. Request for Clarification

.1 The Board reserves the right to seek clarification and supplementary information from Proponents after the Bid Submission Deadline. The response received by the Board from a Proponent shall, if accepted by the Board, form an integral part of that Proponent’s proposal.

3.0 SPECIFICATIONS

3.1. Materials

.1 Bid only on new materials in perfect condition. Demonstrators, seconds or defective materials are unacceptable. Any materials found not to be in a new

condition or as specified will be returned to the Awarded Bidder at the Awarded Bidder's expense.

.2 Proponents, if requested by the Board, must furnish with their bid a materials safety data sheet (M.S.D.S.), for all products they are bidding on, where applicable. This is a requirement of the Occupational Health and Safety Act. Subsequently, should any business result from this Tender, the Board will not accept any additional charges or surcharges related to the supplying of M.S.D.S. for any item(s) on this Tender.

.3 All electrical equipment and components must bear a C.S.A. or Electrical Safety Association (E.S.A.) label.

.4 Bid prices must be for goods and/or services exactly as specified.

4.0 BID PREPARATION

The Board will not be liable for any costs incurred by the Proponent for the preparation of their bid.

4.1. Online Submission Forms

.1 All forms are submitted online through the bidding system.

.2 The bidder's signature has the authority to bind the Proponent.

4.2. Bid Price

.1 Bid prices are to be shown as all applicable taxes extra.

.2 Bid prices must be held firm until the project is completed to the satisfaction of the Board.

.3 The bid price herein constitutes the total costs to the Board for all work involved in the respective items and that this cost also includes all insurance, transportation charges, use of all tools and equipment, supervision, bonds, overhead expense, warranty, all profits and all other work, services, conditions furnished in accordance with the requirements of the contract documents.

.4 Bid prices must be in Canadian Funds.

.5 Period for which bids are irrevocable after the tender submission deadline is: 60 days.

4.3. Bonding Requirements

.1 Bid Amount

Bonding requirements are based on the total bid amount INCLUSIVE of ALL applicable taxes.

Bonding is not requested if the Board estimates that the project is less than $200,000.00. The Board determines the Bonding requirements and specifies them on the Bid Sheet.

.2 Bid Bond and Agreement to Bond

Bid submissions that request Bonding are inclusive of all taxes and must be accompanied by a bid deposit in the form of a digital Bid Bond in an electronically verifiable and enforceable (e-Bond) format in the amount(s) not less than 10% of the total Contract Value made payable to the Waterloo Region District School Board (the 'Board") as surety that, if the Bid is accepted, a Contract will be entered into for the proper performance of the work. For more information, contact your surety company or visit the Surety Association of Canada website.

Bidders shall upload their Bid Bond to the Bidding System, in the bid submission file labeled "Bid Bond". All instruction and details for accessing authentication shall be included with the digital Bond uploaded in the Bidding System.

Bids that do not contain the bid deposit(s) in the required amount as specified in this paragraph will be declared non-compliant and will be rejected. A scanned PDF copy of bonds or original certified cheque, bank draft, money order, etc. are not acceptable as Bid deposit and will result in your Bid being rejected.

The bid deposit of the Bidder whose submission is accepted shall be forfeited by the Bidder should the Bidder fail to execute a Contract or provide the necessary documents as required within this Bid Solicitation document (including signed agreement, satisfactory security, insurance certificate, Workplace Safety and Insurance Board letter of clearance) within the time stipulated as a written notice from the Board.

For bid amounts where Bonding is not requested, the Awarded Bidder agrees to pay to the Board the difference in costs between the bid submitted and the final contract should the Awarded Bidder fail to either execute or deliver the contract documents in accordance with the Bid Solicitation within ten (10) working days of written notification of the award of the contract.

.3 **Performance Securities**

For bid amounts where bonding is required, inclusive of all taxes, upon award the successful Bidder shall provide a digital Bid Performance and Labour and Materials Bond in an electronically verifiable and enforceable (e-Bond) format in the amount(s) of not less than 50% Performance Bond and a 50% Labour and Materials Bond of the total Contract Value made payable to the Waterloo Region

District School Board (the 'Board") as surety that, if the Bid is accepted, a Contract will be entered into for the proper performance of the work. For more information, contact your surety company or visit the Surety Association of Canada website.

If the successful Bidder fails to provide a performance bond when requested, the Board may declare the bid deposit forfeited and the Bidder will be held responsible for any increased costs or damages incurred by the Board. Any Bidder who fails to provide all required documents within the timelines provided, or otherwise fails to enter into an agreement with the Board upon notice of being the successful Bidder may be subject to future bidding constraints by the Board.

Performance surety shall guarantee all conditions as set out in the contract, including proper execution of the work and for all matters for which the successful Bidder is responsible for throughout the two (2) year period of maintenance and warranty.

Any costs associated with performance surety are the responsibility and cost of the Bidder.

Bonds must be submitted through the Bidding System within ten (10) days of receiving the Intent to Award.

4.4. INSURANCE

.1 Proof of WSIB Coverage (Onsite work only)

If the Proponent does not provide a policy endorsement for Employer's Liability and Voluntary Compensation, the Proponent shall submit a valid certificate of WSIB coverage to the Board, with the tender submission and any subsequent policy renewal, referencing this Agreement. The Proponent shall ensure that each Subcontractor complies with the WSIB requirements set out in this Article by obtaining similar types of coverage if the Subcontractor does not provide a policy endorsement for Employer's Liability and Voluntary Compensation.

.2 Insurance (Onsite Construction work only)

The proponent is to reference CCDC2-2008 GC 11.1 Insurance and ensure that this section is adhered to.

.3 General & Vehicle

General and vehicle liability insurance covering incidents of property damage or bodily injury (including death) for owned and non-owned vehicle accidents

occurring during the work in this Tender, or actions of the employees of the Awarded Bidder while acting within the scope of their duties as required in this Tender shall be maintained. Verification of current "Good Standing" may be requested.

The inclusive per incident minimum amount of coverage is: Two Million Dollars ($2,000,000).

5.0 BID EVALUATION

Preference will be given to the lowest compliant bid.

The “lowest bid price” shall be used to determine the lowest compliant bid. Alternate prices, separate prices and any substitutions that may affect the contract price shall not be considered in determining the “lowest bid price”.

The Proponent will not be awarded the tender if the Site Supervisor and/or Project Manager identified by the Proponent are not deemed suitable by the Board.

If the Board has a sense that the Proponent with “lowest bid price” has capacity issues, then the Board will meet with the Proponent after the tender closing date and prior to the Board awarding the Tender.

At the meeting the Proponent will present the following in written form:

1. The Proponent’s capacity resource plan documents which illustrates how the Proponent determines capacity.

2. The level of capacity the Proponent and its resources would be with the award of the Tender.

3. An evaluation of recent projects that the Proponent has completed, where the Proponent was at equal or greater capacity as it relates to the capacity resources available.

In order for the Proponent’s bid to be considered the lowest compliant bid the Proponent will to the Board’s satisfaction have presented in written from the information requested.

6.0 BID RESULTS NOTIFICATION

The Board will forward the results notification to https://wrdsb.bidsandtenders.ca listing the Awarded Bidder and Bid Price.

7.0 AWARD NOTIFICATION

No shipment is to be made or work to commence until a purchase order, contract, or letter of intent is issued by Procurement Services to the Awarded Bidder.

Construction Projects

For construction projects above $200,000 the Awarded Bidder may be required to execute a “Canadian Standard Form of Construction Contract to a Stipulated Sum” (revised 2008) CCDC 2, 2008 including amendments thereto as set out in this Tender.

The Awarded Bidder shall execute the said formal contract as called for, within seven (7) working days after notification of acceptance of their Tender or forfeit the amount of Bid Bond enclosed in the Tender.

8.0 POST AWARD

8.1. Bonding (Construction)

Upon receiving the Intent to Award letter, the Bidder is solely responsible for submitting Bonding documents through the Bidding System. Payments to the Awarded Bidder will not be processed without bonding being submitted. Failure to submit bonding within seven (7) working days may result in the cancellation of the contract.

8.2. Purchase Order

For Payment purposes, a Purchase Order shall be generated and issued to the Awarded Bidder(s). The Purchase Order number must appear on all invoices in order to ensure prompt payment.

8.3. Changes

The Board may order changes in the material or work, in writing, with the contract sum being adjusted accordingly. All changes for additional material or work must be agreed upon and submitted in writing to the Board.

9.0 SUBCONTRACTING

9.1. Subcontracting

Subcontracting, beyond the original list of subcontractors submitted with bid submission, of any portion of the work outlined in these specifications will not be permitted without prior written consent of the Board.

If approval is granted, any work undertaken by subcontractors shall be as set forth in this Tender document and the use of subcontractors shall in no way relieve the Awarded Bidder of their responsibilities.

The Board reserves the right to reject a proposed subcontractor for any reasonable cause.

9.2. Assignment

Any business resulting from this Tender call shall not be assigned to any other company (or individual) without prior written approval of the Board.

10.0 FORCE MAJEURE

If Delays in a failure of performance by either party under the Contract shall not constitute default hereunder or give rise to any claim for damages if and to the extent caused by occurrences beyond the control of the party affected, including but not limited to decrees of Government, acts of God, fires, floods, explosions, pandemics, riots, war, rebellion, sabotage and atomic or nuclear incidents, lawful acts of public authorities, or delays caused by common carriers, which cannot reasonably be foreseen or provided against. However, lack of finances, strikes, or other concerted acts by workers, delay or failure arising out to the nature of the work to be done, or from the normal actions of the elements or from any normal difficulties which may be encountered in the performance of the Work, having regard to the nature thereof, shall in no event be deemed to be a cause beyond a party's control. If in the reasonable opinion of either party to this Contract that performance of the Contract is made impossible by force majeure, then either party shall notify the other in writing and the Board shall either terminate the Contract forthwith without any future payments being made or authorize the Vendor to continue performance of the Contract with such adjustments as may be required by the existence of the force majeure and agreed upon by both parties.

11.0 TERMINATION

11.1. Sufficient Cause

The Board reserves the right to terminate any contract Tender purchase order resulting from this Tender call for sufficient cause, such as: non-performance, late

deliveries, inferior quality, pricing problems, customer service, etc. Should such action be necessary, the Board would provide written notice to the Awarded Bidder.

11.2. Funding Out

Should the Board fail to appropriate funds to enable payments including multi-year agreements, the Board may cancel the contract without termination charges, provided the Awarded Bidder receive thirty (30) days written notice of such termination from the Board.

12.0 RESULT DISPUTE PROCESS

Subsequent to a debriefing a Proponent may dispute the decision of the Board. The process outlined below is to be followed:

The Proponent is to file in writing their protest with the Manager of Procurement by certified mail, within force15 business days of the Debriefing. The Protest Notice shall include:

(i) The name and address of the Proponent.

(ii) Identification of the RFX.

(iii) Detailed and factual statement of the grounds for protest.

(iv) Supporting documentation.

(v) Desired relief, action ruling.

The Manager of Procurement will respond to the Proponent, by certified mail, within 20 business days of receiving the written notice.

If a resolution cannot be met, the Proponent must contact the Superintendent of Business and Financial Services by certified mail, within 10 business days of receiving the first response from the Manager of Procurement. The decision by the Superintendent of Business and Financial Services will be deemed final and the Proponent will receive written notice within 20 business days.

13.0 RIGHTS OF THE BOARD

In addition to any other express rights or any other rights which may be implied in the circumstances, the Board reserves the right to:

(i) Reject any bid received from a Proponent which is party to any past or existing suits, actions, and litigation proceedings, arbitration's, alternative dispute resolutions, investigations, vendor performance evaluations that are below expectations or claims by or against or otherwise involving the Board and the Proponent. Note: the Awarded Bidder(s) may also be required, at the discretion of the Board, to sign a Certificate in a form satisfactory to the Board confirming that the Awarded Bidder(s) is not associated with any company involved in litigation with the Board.

(ii) make public the names of any or all Proponents;

(iii) request written clarification or the submission of supplementary written information from any Proponent;

(iv) waive formalities and accept Bids which substantially comply with the requirements of this tender;

(v) verify with any Proponent or with a third party any information set out in a Bid;

(vi) disqualify any Proponent whose Bid contains misrepresentations or any other inaccurate or misleading information;

(vii) disqualify any Proponent or the Bid of any Proponent who has engaged in conduct prohibited by this tender;

(viii) make changes, including substantial changes, to this tender provided that those changes are issued by way of addenda in the manner set out in this tender;

(ix) accept or reject a Bid if only one Bid is submitted;

(x) accept or reject the lowest or any bid not necessarily accepted by the Board;

(xi) select any Proponent other than the Proponent whose Bid reflects the highest compliant score to the Board;

(xii) cancel this TENDER process at any stage;

(xiii) cancel this TENDER process at any stage and issue a new TENDER for the same or similar services with a minimum substantial change in scope of 10%;

(xiv) accept any Bid in whole or in part;

(xv) discuss with any Proponent different or additional terms to those contemplated in this tender or in any Proponent’s Bid;

(xvi) reject any or all Bids in its absolute discretion;

(xvii) negotiate with the leading Proponent prior to award;

(xviii) evaluate and accept Proponent's alternatives whereby possible efficiencies may prove to be advantageous to the Board;

(xix) to all Bids, responses, inquiries, or other related correspondence in reference to this tender , and all reports, charts, and other documentation submitted by Proponents shall become the property of the Waterloo Region District School the Board when received; and the Board shall not be liable for any expenses, costs associated with the preparation and submittal of any proposal(s), or for any travel and or per diem costs that are incurred including any or all product samples that may be requested during the evaluation stage of the proposal, losses or any direct or indirect damages incurred or suffered by any Proponent or any third party resulting from the Board exercising any of its rights under this TENDER or exercising any rights, which may be implied in the circumstances.

By submitting its Bid, the Proponent authorizes the collection by the Board of the information set out under (v), (vi) and (vii) in the manner contemplated in those subparagraphs.

13.1. Volume and Exclusivity

The Board makes no guarantee of the value or volume of work to be assigned to the Awarded Bidder. Any agreement executed with the Awarded Bidder may not be an exclusive contract for the provision of the described goods/services.

END OF SECTION

SUPPLEMENTARY CONDITIONS & AMENDMENTS TO STANDARD CONSTRUCTION DOCUMENT CCDC2 -2008 STIPULATED PRICE SUBCONTRACT

(the "Supplementary Conditions")

AGREEMENT, DEFINITIONS, AND

GENERAL CONDITIONS

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

AGREEMENT BETWEEN OWNER AND CONTRACTOR

SC1 *ARTICLE A-3 – CONTRACT DOCUMENTS*

SC1.1	3.1	Add the following documents to the list of *Contract Documents* in Article A-3.1: • Waterloo Region District School Board's Supplementary Conditions & Amendments to Standard Construction Document CCDC2 -2008 Stipulated Price Subcontract, November 2020 Version, including any Special Supplementary Conditions listed in Appendix 2 thereto • *Drawings* • *Specifications* • Performance Bond (Form 32 -Performance Bond under Section 85.1 of the *Act*) • Labour and Material Payment Bond (Form 31 – Labour and Material Payment Bond under Section 85.1 of the *Act*) **[NTD: Remove documents and references if not applicable.]**

SC2 ARTICLE A-5 – PAYMENT

SC2.1	5.1	In Article A-5.1 after the word "Subject to" insert the words "GC 13.2 and" -and- delete the words "and, where such legislation or regulations do not exist or apply, subject to a holdback of ten + two percent (10+2%)" and replace them with "and the *Owner*'s right to issue *Notices of Non-Payment*."
SC2.2	5.1.1	Delete the words "amount certified by the *Consultant* together" in subparagraph 5.1.1 and replace them with "allowable amount set out in a *Proper Invoice*".

SC2.3	5.1.2	Delete subparagraph 5.1.2 in its entirety and replace it with the following: ".2 upon *Substantial Performance of the Work*, as certified by the *Consultant*, and on the 61st day after the publication of the certificate of *Substantial Performance of the Work* in accordance with the *Act*, there being no claims for lien registered against the title to the *Place of the Work*, pay the *Contractor* the unpaid balance of the holdback together with such *Value Added Taxes* as may be applicable to such payment, less any amount stated in the *Owner*'s *Notice of Non-Payment*,"
SC2.4	5.1.3	Delete subparagraph 5.1.3 in its entirety and replace it with the following: ".3 upon receipt of the final certificate for payment from the *Consultant*, and on the 61st day after the date on which the *Contractor* completes the *Work*, there being no claims for lien registered against the title to the *Place of the Work*, pay the *Contractor* the unpaid balance of the *Contract Price* together with such *Value Added Taxes* as may be applicable to such payment *,* and"
SC2.5	5.3.1	Delete paragraph 5.3.1 in its entirety and replace it with the following: ".1 Should either party fail to make payments as they become due under the terms of the *Contract* or in an award by arbitration or court, interest shall also become due and payable on such unpaid amounts at the prejudgment interest rate prescribed by the *Courts of Justice Act* (Ontario)*,* as it may change from time to time."

SC3 *NEW* ARTICLE A-9 – CONFLICT OF INTEREST

SC3.1	Article A-9	Add new ARTICLE A-9 CONFLICT OF INTEREST as follows: "**ARTICLE A-9 CONFLICT OF INTEREST** 9.1 The *Contractor*, *Subcontractors* and *Suppliers* and any of their respective advisors, partners, directors, officers, employees, agents, and volunteers shall not engage in any activity or provide any services where such activity or the provision of such services creates a conflict of interest (actually or potentially, in the sole opinion of the *Owner*) with the provision of the *Work* pursuant to the *Contract*. The *Contractor* acknowledges and agrees that a conflict of interest, as

		described in this Article A-9, includes, but is not limited to, the use of *Confidential Information* where the *Owner* has not specifically authorized such use. 9.2 The *Contractor* shall disclose to the *Owner*, in writing, without delay, any actual or potential situation that may be reasonably interpreted as either a conflict of interest or a potential conflict of interest, including the retention of any *Subcontractor* or *Supplier* that is directly or indirectly affiliated with or related to the *Contractor*. 9.3 The *Contractor* covenants and agrees that it will not hire or retain the services of any employee or previous employee of the *Owner* where to do so constitutes a breach by such employee or previous employee of the *Owner's* conflict of interest policy, as it may be amended from time to time, until after completion of the *Work* under the *Contract*. 9.4 It is of the essence of the *Contract* that the *Owner* shall not have direct or indirect liability to any *Subcontractor or Supplier*, and that the *Owner* relies on the maintenance of an arm's-length relationship between the *Contractor* and its *Subcontractors and Suppliers*. Consistent with this fundamental term of the *Contract*, the *Contractor* will not enter into any agreement or understanding with any *Subcontractor or Supplier*, whether as part of any contract or any written or oral collateral agreement, pursuant to which the parties thereto agree to cooperate in the presentation of a claim for payment against the *Owner*, directly or through the *Contractor*, where such claim is, in whole or in part, in respect of a disputed claim by the *Subcontractor or Supplier* against the *Contractor*, where the payment to the *Subcontractor or Supplier* by the *Contractor* is agreed to be conditional or contingent on the ability to recover those amounts or a portion thereof from the *Owner*, failing which the *Contractor* shall be saved harmless from all or a portion of those claims. The *Contractor* acknowledges that any such agreement would undermine the required arm's-length relationship and constitute a conflict of interest. For greater certainty, the *Contractor* shall only be entitled to advance claims against the *Owner* for amounts pertaining to *Subcontractor or Supplier* claims where the *Contractor* has actually paid or unconditionally acknowledged liability for those claims or where those claims are the subject of litigation or binding arbitration between the *Subcontractor or Supplier* and the *Contractor* has been found liable for those claims.

		9.5 Notwithstanding paragraph 7.1.2 of GC 7.1 - OWNER'S RIGHT TO PERFORM THE WORK, TERMINATE THE CONTRACTOR'S RIGHT TO CONTINUE WITH THE WORK, OR TERMINATE THE CONTRACT, a breach of this Article A-9 by the *Contractor*, any of the *Subcontractors*, or any of their respective advisors, partners, directors, officers, employees, agents, and volunteers shall entitle the *Owner* to terminate the *Contract*, in addition to any other rights and remedies that the *Owner* has in the *Contract*, in law, or in equity."

SC4 *NEW* ARTICLE A-10 TIME OF THE ESSENCE

SC4.1	Article A-10	Add the following new Article A-10 as follows: **"ARTICLE A-10 TIME OF THE ESSENCE** 10.1 It is agreed that one of the reasons the *Contractor* was selected by the *Owner* for this *Contract* is the *Contractor's* representation and covenant that it will attain *Substantial Performance of the Work* within the *Contract Time* stated in Article A-1 of this *Contract*. 10.2 The *Contractor* acknowledges and agrees that it is responsible to marshal its resources and those of its *Subcontractors and Suppliers* in a manner which will permit timely attainment of the *Substantial Performance of the Work*. The *Contractor* agrees that time is of the essence of this *Contract*."

SC5 DEFINITIONS

SC5.1	Consultant	Amend the definition of "Consultant" by adding the following to the end of the definition: "For the purposes of the *Contract*, the terms "*Consultant"*, "*Architect*" and "*Engineer*" shall be considered synonymous."
SC5.2	Act	Add the following definition: **"27. Act** *Act* means the *Construction Act*, R.S.O. 1990, c. C.30, as amended, including all regulations passed under it that are

		enforceable as of the date of execution of this *Contract*. For certainty, the first procurement process for the *Project* (i.e. the "improvement" as that term is defined in the *Act*) was commenced on or after October 1, 2019)."
SC5.3	Adjudication	Add the following definition: "**28. Adjudication** *Adjudication* means construction dispute interim adjudication as defined under the *Act*."
SC5.4	Confidential Information	Add the following definition: "**29. Confidential Information** *Confidential Information* means all the information or material of the *Owner* that is of a proprietary or confidential nature, whether it is identified as proprietary or confidential or not, including but not limited to information and material of every kind and description (such as drawings and move-lists) which is communicated to or comes into the possession or control of the *Contractor* at any time, but *Confidential Information* shall not include information that: .1 is or becomes generally available to the public without fault or breach on the part of the *Contractor*, including without limitation breach of any duty of confidentiality owed by the *Contractor* to the *Owner* or to any third party, but only after that information becomes generally available to the public; .2 the *Contractor* can demonstrate to have been rightfully obtained by the *Contractor* from a third party who had the right to transfer or disclose it to the *Contractor* free of any obligation of confidence; .3 the *Contractor* can demonstrate to have been rightfully known to or in the possession of the *Contractor* at the time of disclosure, free of any obligation of confidence; or .4 is independently developed by the *Contractor* without use of any *Confidential Information*."
SC5.5	Construction Schedule	Add the following definition: "**30. Construction Schedule or construction schedule** *Construction Schedule* means the schedule for the performance of the *Work* provided by the *Contractor* pursuant to GC 3.5,

		including any amendments to the *Construction Schedule* made pursuant to the *Contract Documents*."
SC5.6	Construction Schedule Update	Add the following definition: "**31. Construction Schedule Update** *Construction Schedule Update* means an update to the *Construction Schedule* by the *Contractor* using Microsoft Project (or other approved scheduling software) that accurately depicts the progress of the *Work* relative to the critical path established in the *Construction Schedule* approved in GC 3.5.1 (or any approved successor *Construction Schedule*), aligns with the currently approved date for *Substantial Performance of the Work*, shows up-to-date projected major activity sequences and durations, and shows any changes or delays in anticipated completion dates of major activities in the *Work* relative to the last *Construction Schedule Update,* and includes the following minimum deliverables: (a) a record version of the updated *Construction Schedule* in .pdf format; (b) an editable copy of the updated *Construction Schedule* in native format (e.g. .mpp format for Microsoft Project)."
SC5.7	Direct Costs	Add the following definition: "**32. Direct Costs** *Direct Costs* are the reasonable costs of performing the contract or subcontract including costs related to the additional supply of services or materials (including equipment rentals), insurance and surety bond premiums, and costs resulting from seasonal conditions, that would not have been incurred, but do not include indirect damages suffered, such as loss of profit, productivity or opportunity, or any head office overhead costs."
SC5.8	EFT	Add the following definition: "**33. EFT** *EFT* has the definition given to it under GC 5.3.2."
SC5.9	Force Majeure	Add the following definition: "**34. Force Majeure**

		Force Majeure means any cause, beyond either parties' control, other than bankruptcy or insolvency, which prevents the performance by a party, or both, of any of their respective obligations under the *Contract* and the event of *Force Majeure* did not arise from a party's default and could not be avoided or mitigated by the exercise of reasonable effort or foresight. *Force Majeure* includes: *Labour Disputes*; fire; unusual delay by common carriers or unavoidable casualties; delays in obtaining permits or licenses; civil disturbance; emergency acts, orders, legislation, regulations or directives of any government or other public authority; acts of a public enemy; war; riot; sabotage; blockage embargo; lightning; earthquake; adverse weather conditions but only if substantially beyond the weather norms of the *Place of the Work*; acts of God; or declared epidemic or pandemic outbreak or other public health emergency (e.g. SARS, COVID-19)."
SC5.10	Install	Add the following definition: "**35. Install** *Install* means install and connect. *Install* has this meaning whether or not the first letter is capitalized."
SC5.11	Labour Dispute	Add the following definition: "**36. Labour Dispute** *Labour Dispute* means any lawful or unlawful labour problems, work stoppage, labour disruption, strike, job action, slow down, lock-outs, picketing, refusal to work or continue to work, refusal to supply materials, cessation or work or other labour controversy which does, or might, affect the *Work*."
SC5.12	Notice of Non-Payment	Add the following definition: "**37. Notice of Non-Payment** *Notice of Non-Payment* means a notice of non-payment of holdback (Form 6) or a notice of non-payment (Form 1.1) under the *Act*, as applicable to the circumstances."
SC5.13	OHSA	Add the following definition: "**38. OHSA** *OHSA* means the *Occupational Health and Safety Act*, R.S.O. 1990, c. O.1, as amended, including all regulations thereto."

SC5.14	Overhead	Add the following definition: "**39. Overhead** *Overhead* means all site and head office operations and facilities, all site and head office administration and supervision; all duties and taxes for permits and licenses required by the authorities having jurisdiction at the *Place of the Work*; all requirements of Division 1, including but not limited to submittals, warranty, quality control, calculations, testing and inspections; meals and accommodations; and, tools, expendables and clean-up costs."
SC5.15	Payment Period	Add the following definition: "**40. Payment Period** *Payment Period* has the definition given to it under GC 5.2.1."
SC5.16	Pre-Invoice Submission Meeting	Add the following definition: "**41. Pre-Invoice Submission Meeting** *Pre-Invoice Submission Meeting* has the definition given to it under GC 5.2.1."
SC5.17	Proper Invoice	Add the following definition: "**42. Proper Invoice** *Proper Invoice* means a "proper invoice" as that term is defined in Section 6.1 of the *Act*, including the minimum requirements set out in Appendix "1" of the Supplementary Conditions."
SC5.18	Proper Invoice Submission Date	Add the following definition: "**43. Proper Invoice Submission Date** *Proper Invoice Submission Date* has the definition given to it under GC 5.2.2.1."
SC5.19	Request for Information (RFI)	Add the following definition: "**44. Request for Information (RFI)** *Request for Information* or *RFI* means written documentation sent by the *Contractor* to the *Owner* or to the *Owner's* representative or the *Consultant* requesting written clarification(s) and/or interpretation(s) of the *Drawings* and/or *Specifications*, *Contract* requirements and/or other pertinent

		information required to complete the *Work* of the *Contract* without applying for a change or changes to the *Work*."

GENERAL CONDITIONS OF THE STIPULATED PRICE CONTRACT

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

PART 1 GENERAL PROVISIONS

SC6 GC 1.1 CONTRACT DOCUMENTS

SC6.1	1.1.6	Add the following to the end of paragraph 1.1.6: "The *Specifications* are divided into divisions and sections for convenience but shall be read as a whole and neither such division nor anything else contained in the *Contract Documents* will be construed to place responsibility on the *Owner* or the *Consultant* to settle disputes among the *Subcontractors* and *Suppliers* with respect to such divisions. The *Drawings* are, in part, diagrammatic and are intended to convey the scope of the *Work* and indicate general and appropriate locations, arrangements and sizes of fixtures, equipment and outlets. The *Contractor* shall obtain more accurate information about the locations, arrangements and sizes from study and coordination of the *Drawings*, including *Shop Drawings* and shall become familiar with conditions and spaces affecting those matters before proceedings with the *Work*. Where site conditions require reasonable minor changes where the change requires only the additional labour of one half hour or less, the *Contractor* shall make such changes at no additional cost to the *Owner*. Similarly, where known conditions or existing conditions interfere with new installation and require relocation, the *Contractor* shall include such relocation in the *Work*. The *Contractor* shall arrange and install fixtures and equipment in such a way as to conserve as much headroom and space as possible. The schedules are those portions of the *Contact Documents*, wherever located and whenever issued, which compile information of similar content and may consist of drawings, tables and/or lists."
SC6.2	1.1.7.1	Delete paragraph 1.1.7.1 in its entirety and replace it with the following:

		".1 the order of priority of documents, from highest to lowest, shall be: - the Supplementary Conditions; - the Agreement between the *Owner* and the *Contractor*, - the Definitions - the General Conditions, - Division 1 of the *Specifications*, - technical *Specifications*, - material and finishing schedules - the *Drawings*."
SC6.3	1.1.7.5 to 1.1.7.8	Add new subparagraphs 1.1.7.5, 1.1.7.6, 1.1.7.7 and 1.1.7.8 as follows: "1.1.7.5 Noted materials and annotations on the *Drawings* shall govern over the graphic representation of the *Drawings.* 1.1.7.6 Finishes in the room finish schedules shall govern over those shown on the *Drawings.* 1.1.7.7 Architectural drawings shall have precedence over structural, plumbing, mechanical, electrical and landscape drawings insofar as outlining, determining and interpreting conflicts over the required design intent of all architectural layouts and architectural elements of construction, it being understood that the integrity and installation of the systems designed by the *Consultant* or its sub-*Consultants* are to remain with each of the applicable drawing disciplines. 1.1.7.8 Should reference standards contained in the *Specifications* conflict with the *Specifications,* the *Specifications* shall govern. Should reference standards and *Specifications* conflict with each other or if certain requirements of the *Specifications* conflict with other requirements of the *Specifications*, the more stringent requirements shall govern."
SC6.4	1.1.8	Delete paragraph 1.1.8 in its entirety and replace it with the following: "1.1.8 The *Consultant*, on behalf of the *Owner* shall provide the *Contractor* without charge, PDF copies of the *Contract Documents*.

SC7 GC 1.3 RIGHTS AND REMEDIES

SC7.1	1.3.2	In paragraph 1.3.2 delete the word "No" from the beginning of the paragraph and replace it with the words: "Except with respect to the requirements set out in paragraphs 2.2.13, 6.4.1, 6.5.4, 6.6.1 and 8.2.2, no…"

SC8 *NEW* GC 1.5 EXAMINATION OF DOCUMENTS AND SITE

SC8.1	1.5	Add new GC 1.5 – EXAMINATION OF DOCUMENTS AND SITE as follows: "**GC 1.5 EXAMINTION OF DOCUMENTS AND SITE** 1.5.1 The *Contractor* declares and represents that in tendering for the *Work*, and in entering into a *Contract* with the *Owner* for the performance of the *Work*, it has investigated for itself the character of the *Work* to be done, based on information generally available from a visit to the *Place of the Work* and to the standard set out under GC 3.14.1 The *Contractor* has assumed and does hereby assume all risk of known conditions now existing or arising in the course of the *Work* which might or could make the *Work*, or any items thereof more expensive in character, or more onerous to fulfil, than was contemplated or known when the tender was made or the *Contract* signed. 1.5.2 The *Contractor* also declares that in tendering for the *Work* and in entering into this *Contract,* the *Contractor* did not and does not rely upon information furnished by the *Owner* or any of its agents or servants respecting the nature or confirmation of the ground at the site of the *Work*, or the location, character, quality or quantity of the materials to be removed or to be employed in the construction of *Work*, or the character of the construction machinery and equipment or facilities needed to perform the *Work*, or the general and local performance of the work under the *Contract* and expressly waives and releases the *Owner* from all claims with respect to the said information with respect to the *Work*. 1.5.3 *Contractor* further represents, warrants and acknowledges that it considered and took into account in the *Contract Price* all reasonably known impacts and restrictions arising from the COVID-19 pandemic, including without limitation corresponding legislative changes that may impact performance of the *Project*, various weather conditions that

		may affect the *Work*, the availability of supplies and labour or other conditions or risks that the *Contractor* knew about or reasonably ought to have known about prior to the date of the *Contract*."

PART 2 ADMINISTRATION OF THE CONTRACT

SC9 GC 2.2 ROLE OF THE CONSULTANT

SC9.1	2.2.4	Delete paragraph 2.2.4 in its entirety.
SC9.2	2.2.5	Delete paragraph 2.2.5 and replace it with the following: "2.2.5 Upon receipt of an application for payment that satisfies the requirement of a *Proper Invoice*, based on the *Consultant's* observations and evaluation of the *Contractor's* application for payment, the *Consultant* will determine the amounts owing to the *Contractor* under the *Contract* and will issue certificates for payment as provided in Article A-5 - PAYMENT, GC 5.3 PROGRESS PAYMENT, GC 5.5 PAYMENT OF HOLDBACK UPON SUBSTANTIAL PERFORMANCE OF THE WORK, and GC 5.7 - FINAL PAYMENT. If the *Consultant* determines that the amount payable to the *Contractor* differs from the amount stated in a *Proper Invoice*, the *Consultant* shall notify the *Owner* as provided in GC 5.3.1.2 and prepare a draft of the applicable *Notice of Non-Payment* for the amount in dispute."
SC9.3	2.2.7	Delete the words "Except with respect to GC 5.1 – FINANCING INFORMATION REQUIRED OF THE OWNER".
SC9.4	2.2.13	At paragraph 2.2.13, insert the following at end of that paragraph: "If, in the opinion of the *Contractor*, the *Supplemental Instruction* involves an adjustment in the *Contract Price* or in the *Contract Time*, it shall, within ten (10) *Working Days* of receipt of a *Supplemental Instruction*, provide the *Consultant* with a notice in writing to that effect. Failure to provide written notification within the time stipulated in this paragraph 2.2.13 shall be deemed an acceptance of the *Supplemental Instruction* by the *Contractor*, without any adjustment in the *Contract Price* or *Contract Time*."

SC10 GC 2.3 REVIEW AND INSPECTION OF THE WORK

SC10.1	2.3.2	Amend paragraph 2.3.2 by adding the words "and *Owner*" after the words "*Consultant*" in the second and third lines.
SC10.2	2.3.3	Delete paragraph 2.3.3 in its entirety and replace it with the following: "2.3.3 The *Contractor* shall furnish promptly two copies to the *Consultant* and one copy to the *Owner* of all certificates and inspection reports relating to the *Work*."
SC10.3	2.3.4	In paragraph 2.3.4 add the word "review" after the word "inspections" in the first and second lines of paragraph 2.3.4.
SC10.4	2.3.5	In paragraph 2.3.5 in the first line after the word "*Consultant*", add "or the *Owner*".
SC10.5	2.3.8	Add a new paragraph 2.3.8 as follows: "2.3.8 The *Consultant* will conduct periodic reviews of the *Work* in progress, to determine general conformance with the requirements of the *Contract Documents*. Such reviews, or lack thereof, shall not give rise to any claims by the *Contractor* in connection with construction means, methods, techniques, sequences and procedures, nor in connection with construction safety at the *Place of Work*, responsibility for which belongs exclusively to the *Contractor*."

SC11 GC 2.4 DEFECTIVE WORK

SC11.1	2.4.1	Amend GC 2.4.1 by inserting ", the *Owner* and/or its agent" in the first sentence following "rejected by the *Consultant*".
SC11.2	2.4.1.1 to 2.4.1.2	Add new paragraphs 2.4.1.1 and 2.4.1.2 as follows: "2.4.1.1 The *Contractor* shall rectify, in a manner acceptable to the *Consultant* and to the *Owner through the Consultant* all defective work and deficiencies throughout the *Work*, whether or not they are specifically identified by the *Consultant*. 2.4.1.2 The *Contractor* shall prioritize the correction of any defective work, which, in the sole discretion of the *Owner through the Consultant*, adversely affects the day to day operations of the *Owner* or which, in the sole discretion of the *Consultant*, adversely affects the progress of the *Work*."

SC11.3	2.4.2	Delete paragraph 2.4.2 in its entirety and replace it with the following: "2.4.2 The *Contractor* shall promptly pay the *Owner* for costs incurred by the *Owner*, the *Owner's* own forces or the *Owner's* other contractors, for work destroyed or damaged or any alterations necessitated by the *Contractor's* removal, replacement or re-execution of defective work."
SC11.4	2.4.4	Add new paragraph 2.4.4 as follows: "2.4.4 Neither acceptance of the *Work* by the *Consultant* or the *Owner*, nor any failure by the *Consultant* or the *Owner* to identify, observe or warn of defective *Work* or any deficiency in the *Work* shall relieve the *Contractor* from the sole responsibility for rectifying such defect or deficiency at the *Contractor's* sole cost, even where such failure to identify, observe or warn is negligent."

PART 3 EXECUTION OF THE WORK

SC12 GC 3.1 CONTROL OF THE WORK

SC12.1	3.1.2	Amend paragraph 3.1.2 by inserting the words "Construction Schedule" after the word "sequences".
SC12.2	3.1.3 & 3.1.4	Add new paragraphs 3.1.3 and 3.1.4 as follows: "3.1.3 Prior to commencing individual procurement, fabrication and construction activities, the *Contractor* shall verify at the *Place of the Work*, all relevant measurements and levels necessary for proper and complete fabrication, assembly and installation of the *Work* and shall further carefully compare such field measurements and conditions with the requirements of the *Contract Documents*. Where dimensions are not included or exact locations are not apparent, the *Contractor* shall immediately notify the *Consultant* in writing and obtain written instructions from the *Consultant* before proceedings with any part of the affected *Work*. 3.1.4 Notwithstanding the provisions of paragraphs 3.1.1 and 3.1.2, the *Owner* shall have access to the site at all times to monitor all aspects of construction. Such access shall in no circumstances affect the obligations of the *Contractor* to fulfill its contractual obligations."

SC13 GC 3.2 CONSTRUCTION BY OWNER OR OTHER CONTRACTORS

SC13.1	3.2.2.1	Delete paragraph 3.2.2.1 in its entirety.
SC13.2	3.2.2.2	Delete paragraph 3.2.2.2 in its entirety.
SC13.3	3.2.2.3	Delete paragraph 3.2.2.3 in its entirety.
SC13.4	3.2.2.4	Delete paragraph 3.2.2.4 in its entirety.
SC13.5	3.2.3.2	Delete paragraph 3.2.3.2 and replace it with the following: ".2 co-ordinate and schedule the activities and work of other contractors and the *Owner's* own forces with the *Work* of the *Contractor* and connect as specified or shown in the *Contract Documents*."
SC13.6	3.2.3.4	Add new paragraph 3.2.3.4 as follows: ".4 Subject to GC 9.4 CONSTRUCTION SAFETY, for the *Owner's* own forces and for other contractors, assume overall responsibility for compliance with all aspects of the applicable health and safety legislation in force at the *Place of the Work*, including all of the responsibilities of the "constructor", pursuant to the *OHSA*."

SC14 GC 3.3 TEMPORARY WORK

SC14.1	3.3.2	In paragraph 3.3.2, in the second line after the words "where required by law", insert "or by the *Consultant*".

SC15 GC 3.4 DOCUMENT REVIEW

SC15.1	3.4.1	Delete paragraph 3.4.1 in its entirety and replace it with the following: "3.4.1 The *Contractor* shall review the *Contract Documents* and shall report promptly to the *Consultant* any error, inconsistency, or omission the *Contractor* may discover. Such review by the *Contractor* shall be undertaken with the standard of care described in paragraph 3.14.1 of the *Contract*. Except for its obligation to make such review and report the result, the *Contractor* does not assume any responsibility to the *Owner* or to the *Consultant* for the accuracy of the *Contract Documents*. Provided it has exercised the degree of care and skill described in this paragraph 3.4.1, the *Contractor* shall not be liable for damage or costs resulting from such errors, inconsistencies, or

		omissions in the *Contract Documents*, which the *Contractor* could not reasonably have discovered through the exercise of the required standard of care."
SC15.2	3.4.2 & 3.4.3	Add new paragraphs 3.4.2 and 3.4.3 as follows: "3.4.2 If, at any time, the *Contractor* finds errors, inconsistencies, or omissions in the *Contract Documents* or has any doubt as to the meaning or intent of any part thereof, including laying out of the Work, the *Contractor* shall immediately notify the *Consultant*, and request instructions, a *Supplemental Instruction, Change Order,* or *Change Directive,* as the case may require, and the *Contractor* shall not proceed with the work affected until the *Contractor* has received such instructions, a *Supplemental Instruction*, *Change Order* or *Change Directive*. Neither the *Owner* nor the *Consultant* will be responsible for the consequences of any action of the *Contractor* based on oral instructions. 3.4.3 Errors, inconsistencies and/or omissions in the *Drawings* and/or *Specifications* which do not allow completion of the *Work* of the *Contract* shall be brought to the *Consultant's* attention prior to the execution of the *Contract* by means of an *RFI*."

SC16 GC 3.5 CONSTRUCTION SCHEDULE

SC16.1	3.5.1	Delete paragraph 3.5.1 in its entirety and replace with the following: "3.5.1 The *Contractor* shall: .1 within five (5) calendar days of receiving written confirmation of the award of the *Contract*, prepare and submit to the *Owner* and the *Consultant* for their review and approval, a construction schedule in the format indicated below that indicates the timing of the activities of the *Work* and provides sufficient detail of the critical events and their inter-relationship to demonstrate the *Work* will be performed in conformity with the *Contract Time* and in accordance with the *Contract Documents.* Such schedule is to include a delivery schedule for *Products* whose delivery is critical to the schedule for the *Work* or are required by the *Contract* to be included in a *Products* delivery schedule. The *Contractor* shall employ construction scheduling software, being the latest version of "Microsoft Project", that permits the progress of the *Work*

		to be monitored in relation to the critical path established in the schedule. The *Contractor* shall provide such schedule and any successor or revised schedules in both electronic format and hard copy. Once accepted by the *Owner* and the *Consultant*, the construction schedule submitted by the *Contractor* shall become the baseline "**Construction Schedule**"; .2 provide the expertise and resources, such resources including manpower and equipment, as are necessary on a best efforts basis to maintain progress under the accepted baseline *Construction Schedule* or revised construction schedule accepted by the *Owner* pursuant to GC 3.5 CONSTRUCTION SCHEDULE, which includes without limitation, the *Contractor*'s use of all possible and, if necessary, extraordinary measures, to bring the progress of the *Work* into compliance with the *Construction Schedule*, such as (i) increasing the presence of its own forces at the *Place of the Work*; (ii) directing any *Subcontractors* or *Suppliers* to increase their labour forces and equipment; (iii) working overtime and extra shifts; and (iv) providing any additional supervision and coordination of the *Project*, all at the *Contractor's* own cost and expense save and except where GC 6.5.1, 6.5.2, or 6.5.3 apply; and, .3 monitor the progress of the *Work* on a weekly basis relative to the baseline *Construction Schedule*, or any revised *Construction Schedule* accepted by the *Owner* pursuant to GC 3.5 CONSTRUCTION SCHEDULE, deliver a *Construction Schedule Update* to the *Consultant* and *Owner* with each application for payment, at a minimum, or as may be reasonably required by the *Consultant* and advise the *Consultant* and the *Owner* weekly in writing of any variation from the baseline or slippage in the schedule; and, .4 if after applying the expertise and resources required under paragraph 3.5.1.2, the *Contractor* forms the opinion that the slippage in schedule reported in paragraph 3.5.1.3 cannot be recovered by the *Contractor*, it shall, in the same notice provided under paragraph 3.5.1.3, indicate to the *Consultant* if the *Contractor* intends to apply for an extension of *Contract Time* as provided in PART 6 — CHANGES IN THE WORK; and,

		.5 ensure that the *Contract Price* shall include all costs required to phase or stage the *Work*."
SC16.2	3.5.2 & 3.5.3	Add new paragraphs 3.5.2 and 3.5.3 as follows: "3.5.2 If, at any time, it should appear to the *Owner* or the *Consultant* that the actual progress of the *Work* is behind schedule or is likely to become behind schedule, or if the *Contractor* has given notice of such to the *Owner* or the *Consultant* pursuant to subparagraph 3.5.1.3, the *Contractor* shall, either at the request of the *Owner* or the *Consultant*, or following giving notice pursuant to subparagraph 3.5.1.3, take appropriate steps to cause the actual progress of the *Work* to conform to the schedule or minimize the resulting delay. Within five (5) calendar days of the request by the *Owner* or the *Consultant* or the notice being given pursuant to subparagraph 3.5.1.3, the *Contractor* shall produce and present to the *Owner* and the *Consultant* a plan demonstrating how the *Contractor* will achieve the recovery of the last accepted schedule. 3.5.3 The *Contractor* is responsible for performing the *Work* within the *Contract Time*. Any schedule submissions revised from the accepted baseline construction schedule or revised schedule accepted by the *Owner* pursuant to GC 3.5 CONSTRUCTION SCHEDULE, during construction are not deemed to be approved extensions to the *Contract Time.* All extensions to the *Contract Time* must be made in accordance with PART 6 – CHANGES IN THE WORK. "

SC17 GC 3.6 SUPERVISION

SC17.1	3.6.1	Delete paragraph 3.6.1 in its entirety and replace with the following: "3.6.1 The *Contractor* shall employ a competent full-time superintendent, acceptable to the *Owner* and *Consultant*, who shall be in full time attendance at the *Place of Work* while the *Work* is being performed. The superintendent shall not be changed by the *Contractor* without valid reason which shall be provided in writing and shall not be changed without prior consultation with and agreement by the *Owner* and the *Consultant*. The *Contractor* shall replace the superintendent within 7 *Working Days* of the *Owner's* written notification, if the superintendent's performance is not acceptable to the *Owner*. The *Contractor* shall provide the *Owner* and the *Consultant* with the names, addresses and telephone numbers of the

		superintendent referred to in this paragraph 3.6.1 and other responsible persons who may be contacted for emergency and other reasons during non-working hours."
SC17.2	3.6.2	Delete paragraph 3.6.2 in its entirely and replace with the following: "3.6.2 The superintendent, and any project manager appointed by the *Contractor*, shall represent the *Contractor* at the *Place of Work* and shall have full authority to act on written instructions given by the *Consultant* and/or the *Owner*. Instructions given to the superintendent or the project manager shall be deemed to have been given to the *Contractor* and both the superintendent and any project manager shall have full authority to act on behalf of the *Contractor* and bind the *Contractor* in matters related to the *Contract*."
SC17.3	3.6.3 to 3.6.6	Add new paragraph 3.6.3, 3.6.4, 3.6.5 and 3.6.6 as follows: "3.6.3 The *Owner* may, at any time during the course of the *Work*, request the replacement of the appointed representative(s). Immediately upon receipt of the request, the *Contractor* shall make arrangements to appoint an acceptable replacement, which is approved by the *Owner*. **SC40** 3.6.4 The supervisory staff assigned to the *Project* shall also be fully competent to implement efficiently all requirements for scheduling, coordination, field engineering, reviews, inspections and submittals defined in the *Specifications,* and have a minimum 5 years documented "Superintendent/Project Management" experience. **SC41** 3.6.5 The *Consultant and Owner* shall reserve the right to review the record of experience and credentials of supervisory staff assigned to the *Project* prior to commencement of the *Work*. **SC42** 3.6.6 A superintendent assigned to the *Work* shall be "Gold Seal Certified" as per the Canadian Construction Association; or a superintendent that can demonstrate the requisite experience and success related to the *Project* to the sole satisfaction of the *Owner*."

SC18 *GC 3.7 SUBCONTRACTORS AND SUPPLIERS*

SC18.1	3.7.1.1	In paragraph 3.7.1.1 add to the end of the second line the words "including any warranties and service agreements which extend beyond the term of the *Contract*."
SC18.2	3.7.1.2	In subparagraph 3.7.1.2 after the words "the *Contract Documents*" add the words "including any required surety bonding".
SC18.3	3.7.2	Delete paragraph 3.7.2. in its entirety and replace it with the following: "3.7.2 The substitution of any *Subcontractor* and/or *Suppliers* after submission of the *Contractor's* bid will not be accepted unless a valid reason is given in writing to and approved by the *Owner*, whose approval may be arbitrarily withheld. The reason for substitution must be provided to the *Owner* and to the original *Subcontractor* and/or *Supplier* and the *Subcontractor* and/or *Supplier* shall be given the opportunity to reply to the *Contractor* and *Owner.* The *Contractor* shall be fully aware of the capability of each *Subcontractor* and/or *Supplier* included in its bid, including but not limited to technical ability, financial stability and ability to maintain the proposed construction schedule."
SC18.4	3.7.7, 3.7.8 & 3.7.9	Add new paragraphs 3.7.7, 3.7.8, and 3.7.9 as follows: "3.7.7 The *Consultant* or the *Owner*, acting reasonably, may from time to time require the *Contractor* to remove from the *Project* any personnel of the *Contractor*, including project managers, superintendents or *Subcontractors*. Such persons shall be replaced by the *Contractor* in a timely fashion to the satisfaction of the *Consultant* or the *Owner*, as the case may be, at no cost to the *Owner*. 3.7.8 Where provided in the *Contract*, the *Owner* may assign to the *Contractor*, and the *Contractor* agrees to accept, any contract procured by the *Owner* for *Work* or services required on the *Project* that has been pre-tendered or pre-negotiated by the *Owner*, and upon such assignment, the *Owner* shall have no further liability to any party for such contract. 3.7.9 The *Contractor* covenants that each subcontract or supply contract which the *Contractor* enters into for the purpose of performing the *Work* shall expressly provide for the assignment thereof to the *Owner* (at the option of the *Owner*) and the assumption by the *Owner* of the obligations of the *Contractor*

		thereunder, upon the termination of the *Contract* and upon written notice by the *Owner* to the other parties to such subcontracts or supply contracts, without the imposition of further terms or conditions; provided, however, that until the *Owner* has given such notice, nothing herein contained shall be deemed to create any contractual or other liability upon the *Owner* for the performance of obligations under such subcontracts or supply contracts and the *Contractor* shall be fully responsible for all of its obligations and liabilities (if any) under such subcontracts and supply contracts."

SC19 GC 3.8 LABOUR AND PRODUCTS

SC19.1	3.8.2	Delete paragraph 3.8.2 and substitute with the following: "3.8.2 *Products* provided shall be new and shall conform to all current applicable specifications of the Canadian Standards Association, Canadian Standards Board or General Standards Board, ASTM, National Building Code, provincial and municipal building codes, fire safety standards, and all governmental authorities and regulatory agencies having jurisdiction at the *Place of the Work*, unless otherwise specified. *Products* which are not specified shall be of a quality consistent with those specified and their use acceptable to the *Consultant*. *Products* brought on to the *Place of the Work* by the *Contractor* shall be deemed to be the property of the *Owner*, but the *Owner* shall be under no liability for loss thereof or damage thereto arising from any cause whatsoever. The said *Products* shall be at the sole risk of the *Contractor*. Workmanship shall be, in every respect, first class and the *Work* shall be performed in accordance with the best modern industry practice."
SC19.2	3.8.3	Amend paragraph 3.8.3 by adding the words, "…, agents, *Subcontractors* and *Suppliers*…" after the word "employees" in the first line.
SC19.3	3.8.4 to 3.8.8	Add new paragraphs 3.8.4, 3.8.5, 3.8.6, 3.8.7, and 3.8.8 as follows: "3.8.4 Upon receipt of a *Notice in Writing* from the *Owner,* the *Contractor* shall immediately remove from the *Place of the Work*, tradesmen and labourers or anyone whose conduct jeopardizes the safety of the *Owner's* operations or who are considered by the *Owner* or the *Consultant* to be unskilled or otherwise objectionable. Immediately upon receipt of the

request, the *Contractor* shall make arrangements to appoint an acceptable replacement.

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

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

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

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

		Should the *Contractor* be unable to obtain a substitute *Product* equal to or superior to the specified *Product* and the *Owner* accepts a different Product, the *Contract Price* shall be adjusted accordingly, as approved by the *Consultant*."

SC20 GC 3.9 DOCUMENTS AT THE SITE

SC20.1	3.9.1	Delete paragraph 3.9.1 in its entirety and substitute the following: "3.9.1 The *Contractor* shall keep one copy of the current *Contract Documents*, *Supplemental Instructions*, contemplated *Change Orders*, *Change Orders*, *Change Directives*, cash allowance disbursement authorizations, reviewed *Shop Drawings*, submittals, reports and records of meeting at the *Place of the Work*, in good order and available to the *Owner* and *Consultant*."

SC21 GC 3.10 SHOP DRAWINGS

SC21.1	3.10.1	Delete paragraph 3.10.1 in its entirety and replace with the following: "3.10.1 The *Contractor* shall provide shop drawings as described in the *Contract Documents* and as the *Consultant* may reasonably request."
SC21.2	3.10.3	Delete paragraph 3.10.3 and replace it with the following: "3.10.3 The *Contractor* shall prepare a *Shop Drawings* schedule acceptable to the *Owner* and the *Consultant* prior to the first application for payment. A draft of the proposed *Shop Drawings* schedule shall be submitted by the *Contractor* to the *Consultant* and the *Owner* for approval. The draft *Shop Drawings* schedule shall clearly indicate the phasing of *Shop Drawings* submissions. The *Contractor* shall periodically re-submit the *Shop Drawings* schedule to correspond to changes in the *Construction Schedule*."
SC21.3	3.10.9	Delete paragraph 3.10.9 in its entirety and substitute the following: "3.10.9 At the time of providing *Shop Drawings*, the *Contractor* shall advise the *Consultant* in writing of any deviations in *Shop Drawings* from the requirements of the *Contract Documents*. The *Consultant* shall indicate the acceptance of such deviation expressly in writing. Where manufacturers' literature is submitted in lieu of scaled drawings, it shall be clearly marked

		in ink, to indicate the specific items for which review is requested."
SC21.4	3.10.13 to 3.10.17	Add new paragraphs 3.10.13, 3.10.14, 3.10.15, 3.10.16, and 3.10.17 as follows: "3.10.13 Reviewed *Shop Drawings* shall not authorize a change in the *Contract Price* and/or the *Contract Time*. 3.10.14 Except where the parties have agreed to a different *Shop Drawings* schedule pursuant to paragraph 3.10.3, the *Contractor* shall comply with the requirements for *Shop Drawings* submissions stated in the *Specifications*. 3.10.15 The *Contractor* shall not use the term "by others" on *Shop Drawings* or other submittals. The related trade, *Subcontractor* or *Supplier* shall be stated. 3.10.16 Certain *Specifications* sections require the *Shop Drawings* to bear the seal and signature of a professional engineer. Such professional engineer must be registered in the jurisdiction of the *Place of the Work* and shall have expertise in the area of practice reflected in the *Shop Drawings*. 3.10.17 The *Consultant* will review and return *Shop Drawings* and submittals in accordance with the schedule agreed upon in paragraph 3.10.3, The *Contractor* shall allow the *Consultant* a minimum of 10 *Working Days* to review *Shop Drawings* from the date of receipt. If resubmission of *Shop Drawings* is required, a further 10 *Working Day* period is required for the *Consultant's* review."

SC22 GC 3.11 USE OF THE WORK

SC22.1	3.11.1	In the second line between the words "permits, or" add, "by direction of the *Owner* or *Consultant*".
SC22.2	3.11.3	Add new paragraph 3.11.3 as follows: "3.11.3 The *Owner* shall have the right to enter or occupy the *Work* in whole or in part for the purpose of placing fittings and equipment, or for other use before *Substantial Performance of the Work*, if, in the opinion of the *Consultant*, such entry and occupation does not prevent or substantially interfere with the

		Contractor in the performance of the *Contract* within the *Contract Time.* Such entry or occupation shall neither be considered as acceptance of the *Work*, nor in any way relieve the *Contractor* from its responsibility to complete the *Contract*."

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SC23 GC 3.12 CUTTING AND REMEDIAL WORK

SC23.1	3.12.5 & 3.12.6	Add new paragraphs 3.12.5 and 3.12.6 as follows: "3.12.5 Unless specifically stated otherwise in the *Specifications*, the *Contractor* shall do all cutting and making good necessary for the proper installation and performance of the *Work.* 3.12.6 To avoid unnecessary cutting, the *Contractor* shall lay out its work and advise the *Subcontractors,* when necessary, where to leave holes for installation of pipes and other work."

SC24 GC 3.13 CLEAN UP

SC24.1	3.13.1	At the end of the paragraph 3.13.1, add the following: "The *Contractor* shall remove accumulated waste and debris at least once a week as a minimum or as required by the nature of the *Work.*
SC24.2	3.13.2	In paragraph 3.13.2, in the fourth line Add the word "materials" between the word "tools" and the words "*Construction Equipment*".
SC24.3	3.13.3	In paragraph 3.13.3, in the first and second lines Add the word "materials" between the word "tools" and the words "*Construction Equipment*" -and- In paragraph 3.13.3 delete the words "Prior to application for the final payment," and replace them with "As a condition precedent to submitting its application for final payment,".
SC24.4	3.13.4 & 3.13.5	Add new paragraphs 3.13.4 and 3.13.5 as follows: "3.13.4 The *Contractor* shall clean up garbage during and after construction and maintain the *Place of the Work* in a neat and orderly condition on a daily basis. Prior to leaving the *Place of the Work* and following completion of the *Work*, the *Contractor* shall make good all damage to the building and its components

		caused by the performance of the *Work* or by any *Subcontractor* or *Supplier*. The *Contractor* shall leave the *Place of the Work* in a clean and finished state; remove all *Construction Equipment* and materials; remove all paint, stains, labels, dirt, etc. from the *Place of the Work*; and touch up all damaged painted areas (if applicable). The *Contractor* shall be responsible for restoring those areas of the *Place of the Work*, impacted by the *Work*, to their original condition." 3.13.5 Without limitation to or waiver of the *Owner's* other rights and remedies, the *Owner* shall have the right to back charge to the *Contractor* the cost of damage to the site caused by transportation in and out of the *Place of the Work* by the *Contractor*, *Subcontractors* or *Suppliers,* if not repaired before final payment. 3.13.6 The *Contractor* shall dispose of debris at a location and in a manner acceptable to the *Owner* (and to the authorities having jurisdiction at the *Place of the Work* and at the disposal area) and the *Contractor* shall cover containers with tarpaulins."

SC25 *NEW* GC 3.14 CONTRACTOR STANDARD OF CARE

SC25.1	3.14	Add a new GC 3.14 – CONTRACTOR STANDARD OF CARE as follows: "**GC 3.14 CONTRACTOR STANDARD OF CARE** "3.14.1 In performing its services and obligations under the *Contract*, the *Contractor* shall exercise the standard of care, skill and diligence that would normally be provided by an experienced and prudent contractor supplying similar services for similar projects. The *Contractor* acknowledges and agrees that throughout the *Contract,* the performance of the *Contractor's* obligations, duties and responsibilities shall be interpreted in accordance with this standard. The *Contractor* shall exercise the same standard of care, skill and diligence in respect of any *Products*, personnel or procedures which it may recommend to the *Owner* or employ on the *Project*. 3.14.2 The *Contractor* further represents, covenants and warrants to the *Owner* that:

		.1 the personnel it assigns to the *Project* are appropriately experienced; .2 it has a sufficient staff of qualified and competent personnel to replace any of its appointed representatives, subject to the *Owner's* approval, in the event of death, incapacity, removal or resignation; and .3 there are no pending, threatened or anticipated claims, liabilities or contingent liabilities that would have a material effect on the financial ability of the *Contractor* to perform its work under the *Contract*."

SC26 *NEW* GC 3.15 OCCUPANCY OF THE WORK

SC26.1	3.15.1	Add a new GC 3.15 – OCCUPANCY OF THE WORK as follows: "**GC 3.15 OCCUPANCY OF THE WORK** 3.15.1 The *Owner* reserves the right to take possession of and use for any intended purpose any portion or all of the undelivered portion of the *Project* even though the *Work* may not be substantially performed, progress of the work shall continue in such a way that it will not interfere with use of the occupied space or operation of the facility. The taking of possession or use of any such portion of the *Project* shall not be deemed to be the *Owner's* acknowledgement or acceptance of the *Work* or the *Project*, nor shall it relieve the *Contractor* of any of its obligations under the *Contract*. 3.15.2 Whether the *Project* contemplates *Work* by way of renovations in buildings which will be in use or be occupied during the course of the *Work* or where the *Project* involves *Work* that is adjacent to a structure which is in use or is occupied, the *Contractor,* without in any way limiting its responsibilities under the *Contract*, shall take all reasonable steps to avoid interference with fire exits, building access and egress, continuity of electric power and all other utilities, the operation of HVAC systems, to suppress dust and noise and to avoid conditions likely to propagate mould or fungus of any kind and all other steps reasonably necessary to promote and maintain the safety and comfort of the users and occupants of such structures or adjacent structures."

PART 4 ALLOWANCES

SC27 GC 4.1 CASH ALLOWANCES

SC27.1	4.1.1	Delete the second sentence in paragraph 4.1.1.
SC27.2	4.1.4	Delete paragraph 4.1.4 in its entirety and replace it with the following: "4.1.4 Where the actual cost of the *Work* under any cash allowance exceeds the amount of the allowance, any unexpended amounts from other cash allowances shall be reallocated, at the *Consultant's* direction, to cover the shortfall, and, in that case, there shall be no additional amount added to the *Contract Price* for overhead and profit. Only where the actual cost of the *Work* under all cash allowances exceeds the total amount of all cash allowances shall the *Contractor* be compensated for the excess incurred and substantiated, plus an amount for overhead and profit on the excess only, as set out in the *Contract Documents*."
SC27.3	4.1.5	Delete paragraph 4.1.5 in its entirety and substitute the following: "4.1.5 The net amount of any unexpended cash allowances, after providing for any reallocations as contemplated in paragraph 4.1.4, shall be deducted from the *Contract Price* by *Change Order* without any adjustment for the *Contractor's* overhead and profit on such amount."
SC27.4	4.1.8 & 4.1.9	Add new paragraphs 4.1.8 and 4.1.9 as follows: "4.1.8 The *Owner* reserves the right to call, or to have the *Contractor* call, for competitive bids for portions of the *Work*, which are to be paid for from cash allowances. 4.1.9 Cash allowances cover the net cost to the *Contractor* of services, *Products*, *Construction Equipment*, freight, unloading, handling, storage, installation, provincial sales tax, and other authorized expenses incurred in performing any *Work* stipulated under the cash allowances but does not include any *Value Added Taxes* payable by the *Owner* and the *Contractor.*"

PART 5 PAYMENT

SC28 GC 5.1 FINANCING INFORMATION REQUIRED OF THE OWNER

SC28.1	5.1	Delete GC 5.1 – FINANCING INFORMATION REQUIRED OF THE OWNER and all paragraphs thereunder, including any reference to GC 5.1 throughout the *Contract*.

SC29 GC 5.2 APPLICATIONS FOR PROGRESS PAYMENT

SC29.1	5.2.1	Delete paragraph 5.2.1 and replace it with the following: "5.2.1 Upon execution of the *Contract*, and in any event prior to the *Contractor* submitting its first application for payment, the *Owner* shall issue a purchase order to the *Contractor* for the performance of the *Contract*. The number indicated on such purchase order must be clearly identifiable on all applications for payment. Applications for payment shall be dated the last day of each month or an alternative day of each month agreed to in writing by the parties, with each month representing one payment period under the *Contract* (each a "**Payment Period**"). Within 3 calendar days of the end of each *Payment Period*, the *Contractor* will submit a draft application for payment to the *Owner* and the *Consultant*. Upon receipt of the draft application for payment, and within 7 calendar days, a representative of each of the *Contractor*, *Owner*, and the *Consultant* shall attend a meeting to discuss and review the work completed during the *Payment Period*, including quantities, if applicable (the "**Pre-Invoice Submission Meeting**"). In the event that the scheduled date for the *Pre-Invoice Submission Meeting* is not a *Working Day*, the *Pre-Invoice Submission Meeting* shall occur on the next *Working Day*. The *Contractor* shall bring with it to the *Pre-Invoice Submission Meeting* the following: .1 a copy of the draft application for payment; .2 any documents the *Contractor* is required to bring to the *Pre-Invoice Submission Meeting* as stipulated in the *Contract Documents* or as reasonably requested by the *Owner*; and .3 any other documents reasonably requested, in advance, by the *Owner* or the *Consultant*."
SC29.2	5.2.2	Delete paragraph 5.2.2 in its entirety and replace it with the following:

		"5.2.2 Applications for payment shall be given in accordance with the following requirements: .1 within 5 calendar days following the *Pre-Invoice Submission Meeting*, the *Contractor* shall deliver its application for payment to the *Owner* and to the *Consultant* for *Work* performed during the *Payment Period* ("**Proper Invoice Submission Date**") subject to the following: .1 if the fifth calendar day following the *Pre-Invoice Submission Meeting*, to which an invoice relates falls on a day that is not a *Working Day*, the *Proper Invoice Submission Date* shall be deemed to fall on the next *Working Day*. .2 the application for payment must be delivered to the *Owner* and to the *Consultant* in the same manner as a *Notice in Writing* during the hours of 9:00 am to 4:00pm (EST) on the *Proper Invoice Submission Date*. Delivery to the *Owner* shall be to the following address: finance-ap@wrdsb.ca .3 If an application for payment is received after 4:00 p.m. (EST) on the applicable *Proper Invoice Submission Date*, the application for payment will not be considered or reviewed by the *Owner* and *Consultant* until the next *Proper Invoice Submission Date.* Notwithstanding the foregoing, the *Owner* in its sole and absolute discretion may elect to accept an application for payment submitted after 4:00 p.m. on the applicable *Proper Invoice Submission Date*; however, such acceptance shall not be construed as a waiver of any of its rights or waive or release the *Contracto*r's obligations to strictly comply with the requirements prescribed in this subparagraph 5.2.2.3. .4 No applications for payment shall be accepted by the *Owner* prior to the *Proper Invoice Submission Date*."
SC29.3	5.2.3	Delete paragraph 5.2.3 and replace it with the following: "5.2.3 The amount claimed shall be for the value, proportionate to the amount of the *Contract*, of *Work* performed and *Products* delivered and incorporated into the *Work* as of the last date of

		the applicable *Payment Period*. Materials may also be deemed to be supplied to an improvement, for payment purposes, when, in the *Owner's* opinion, they are placed and properly secured on the land on which the improvement is made, or placed upon land designated by the *Owner* or agent of the *Owner*, but placing the materials on the land so designated does not, of itself, make that land subject to a lien. No amount claimed shall include products delivered and incorporated into the work, unless the products are free and clear of all security interests, liens and other claims of third parties. No amount claimed shall include *Products* delivered to the *Place of the Work* unless the *Products* are free and clear of all security interests, liens, and other claims of third parties."
SC29.4	5.2.4	After the word "*Consultant*" in paragraph 5.2.4 add the words "and the *Owner*"
SC29.5	5.2.5	After the word "*Consultant*" in the first line of paragraph 5.2.5 add the words "or the *Owner*" -and- In the second line, delete the word "*Consultant*" and replace it with "*Owner*".
SC29.6	5.2.7	Delete paragraph 5.2.7 and replace it with the following: "5.2.7 The *Contractor* shall prepare and maintain current as-built drawings which shall consist of the *Drawings* and *Specifications* revised by the *Contractor* during the *Work*, showing changes to the *Drawings* and *Specifications*, which current as-built drawings shall be maintained by the *Contractor* and made available to the *Consultant* for review with each application for progress payment. The *Consultant* shall recommend to the *Owner* that the *Owner* retain a reasonable amount for the value of the as-built drawings not presented for review."

SC30 GC 5.3 PROGRESS PAYMENT

SC30.1	5.3.1.1	Add the following words to the end of subparagraph 5.3.1.1: "and confirm whether all of the criteria for a *Proper Invoice* are satisfied. If not, the application for payment will be returned to the

		Contractor with reasons from the *Owner* or the *Consultant* setting out why the application for payment is not a valid *Proper Invoice*."
SC30.2	5.3.1.2	Delete paragraph 5.3.1.2 and replace it with the following: "5.3.1.2 Following receipt of a *Proper Invoice*, the *Consultant*: .1 will issue to the *Owner* with a copy to the *Contractor*, a certificate for payment in the amount applied for, or .2 if the *Consultant* finds that such other amount is properly due under the application for payment or otherwise finds that the application for payment must be amended, it shall notify the *Owner* and prepare an applicable *Notice of Non-Payment* (Form 1.1) with reasons for the amendment."
SC30.3	5.3.1.3	Delete subparagraph 5.3.1.3 in its entirety and substitute as follows: ".3 the *Owner* shall make payment to the *Contractor* on account no later than 28 calendar days after the receipt by the *Owner* of a *Proper Invoice*, subject to the delivery by the *Owner* of a *Notice of Non-Payment* (Form 1.1)."
SC30.4	5.3.2 to 5.3.7	Add new paragraphs 5.3.2, 5.3.3, 5.3.4, 5.3.5, 5.3.6, and 5.3.7 as follows: "5.3.2 All payments to the *Contractor* shall be processed using electronic funds transfer ("**EFT**") and deposited directly to the *Contractor*'s bank account unless agreed to otherwise by the *Contractor* and the *Owner* in writing. Prior to the *Contractor* submitting its *Proper Invoice*, the *Owner* shall provide the *Contractor* with the necessary documents to facilitate EFT payments. 5.3.3 Payment shall be deemed to have been made to the *Contractor* on the date in which funds are transferred via EFT to the *Contractor*'s bank account. 5.3.4 In the event that the *Owner* disputes the amount claimed as payable in the *Proper Invoice*, within 14 calendar days of receipt of the *Proper Invoice*, the *Owner* shall provide to the *Contractor*, a *Notice of Non-Payment* (Form 1.1). 5.3.5 Where the *Owner* has delivered a *Notice of Non-Payment*, as specified under paragraph 5.3.1.3 or 5.3.4, the *Owner* and the

		Contractor shall first engage in good faith negotiations to resolve the dispute. If within 10 calendar days following the issuance of a *Notice of Non-Payment*, the *Owner* and the *Contractor* cannot resolve the dispute, either party may issue a notice of adjudication in a form prescribed under the *Act*. The *Owner* and *Contractor* will then submit the dispute to *Adjudication* as set out under PART 8 – DISPUTE RESOLUTION. 5.3.6 The amounts disputed and described under the *Notice of Non-Payment* shall be held by the *Owner* until all disputed amounts of the *Proper Invoice* have been resolved pursuant to PART 8 – DISPUTE RESOLUTION. Any portion of the *Proper Invoice* which is not the subject of the *Notice of Non-Payment* shall be payable within the time period set out in paragraph 5.3.1.3. 5.3.7 The *Contractor* represents, warrants, and covenants to the *Owner* that it is familiar with its prompt payment and trust obligations under the *Act* and will take all required steps and measures to ensure that it complies with the applicable prompt payment and trust provisions under the *Act* including, without limitation, section 8.1 of the *Act*. Evidence of the *Contractor*'s compliance under this GC 5.3.7, including evidence demonstrating that all EFTs by the *Owner* to the *Contractor* are kept in a bank account in the *Contractor*'s name, will be made available to the *Owner* within 5 *Working Days* following receipt by the *Contractor* of a *Notice in Writing* making such request."

SC31 GC 5.4 SUBSTANTIAL PERFORMANCE OF THE WORK

SC31.1	5.4.2	Delete paragraph 5.4.2 in its entirety and substitute the following: "5.4.2 The *Consultant* will review the *Work* to verify the validity of the application and shall promptly, and in any event, no later than 30 calendar days after receipt of the *Contractor's* complete deficiency list and application: .1 prepare a final deficiency list incorporating all items to be completed or corrected. Each item is to have an indicated value for correction or completion. Determination of the value for *Substantial Performance* of the *Work* is defined in GC 5.10 – DEFICIENCY HOLDBACK. The final deficiency list complete with values is to be included with

		the *Consultant's* draft verification and shall be reviewed with the *Owner* prior to 5.4.2.2. .2 having completed 5.4.2.1: .1 the *Consultant* shall advise the *Contractor* in writing that the *Work* or the designated portion of the *Work* is not substantially performed and give reasons why, or .2 the *Consultant* shall state the date of *Substantial Performance of the Work* in a certificate and issue a copy of that certificate to each the *Owner* and the *Contractor.*"
SC31.2	5.4.3	Delete paragraph 5.4.3 in its entirety and substitute the following: "5.4.3 Following the issuance of the certificate of *Substantial Performance of the Work* referenced in subparagraph 5.4.2.2.2: .1 the *Contractor* shall complete the *Work* within sixty (60) calendar days; .2 no payments will be processed nor will any *Proper Invoices* be received by the *Owner* between *Substantial Performance of the Work* and the completion of the *Work*; .3 The *Owner* reserves the right to contract out any or all unfinished *Work* if it has not been completed within sixty (60) days of *Substantial Performance of the Work* without prejudice to any other right or remedy and without affecting the warranty period. The cost of completing the *Work* including *Owner* and *Consultant* wages and materials shall be deducted from the *Contract Price.*"
SC31.3	5.4.4 to 5.4.6	Add new paragraphs 5.4.4, 5.4.5 and 5.4.6: "5.4.4 The *Contractor* shall publish, in a construction trade newspaper in the area of the location of the *Work*, a copy of the certificate of *Substantial Performance of the Work* referred to in GC 5.4.2.2.2 within seven (7) days of receiving a copy of the certificate signed by the *Consultant*, and the *Contractor* shall provide suitable evidence of the publication to the *Consultant* and the *Owner*. If the *Contractor* fails to publish such notice, the *Owner* shall be at liberty to publish said certificate and back-charge the *Contractor* its reasonable costs for doing so.

		5.4.5 Prior to submitting its written application for *Substantial Performance of the Work*, the *Contractor* shall submit to the *Consultant*: .1 statutory declaration in the form of CCDC 9; .2 WSIB clearance certificate showing good standing; .3 updated insurance certificate; .4 guarantees; .5 warranties; .6 certificates; .7 final testing and balancing reports; .8 distribution system diagrams; .9 spare parts; .10 maintenance manuals; .11 samples; .12 reports and correspondence from authorities having jurisdiction in the *Place of the Work*; .13 shop drawings; .14 inspection certificates; .15 red-lined record drawings from the construction trailer in two copies. sand other materials or documentation required to be submitted under the *Contract*, together with written proof acceptable to the *Owner* and the *Consultant* that the *Work* has been substantially performed in conformance with the requirements of municipal, governmental, and utility authorities having jurisdiction in the *Place of the Work*. The *Consultant* shall refuse to certify *Substantial Performance of the Work* if the submittals referred to in this paragraph 5.4.5 are not provided by the *Contractor*. 5.4.6 The *Owner* shall withhold, from amounts otherwise payable to the *Contractor,* an amount not to exceed one (1) percent of the *Contract Price* as security for the obligation of the *Contractor* to deliver two copies of the red-lined record drawings.”

SC32 GC 5.5 PAYMENT OF HOLDBACK UPON SUBSTANTIAL PERFORMANCE OF THE WORK

SC32.1	5.5.1.3	Add new subparagraph 5.5.1.3 as follows: ".3 submit a statement that no written notices of lien have been received by the *Contractor*."
SC32.2	5.5.2	Amend paragraph 5.5.2 by adding the following sentence to the end of that paragraph: "Where after thirty (30) days following the publication of the certificate of *Substantial Performance of the Work*, pursuant to GC 5.4.4, the value of the *Work* remaining to be complete under the *Contract*, plus the estimated cost to repair any remaining deficiencies, exceeds the amount of the unpaid balance of the *Contract Price* (as determined by the *Payment Certifier*, acting reasonably), the *Owner* may publish a *Notice of Non-Payment* of holdback in accordance with the *Act* (Form 6) and retain an amount from the holdback to supplement the unpaid value of the *Contract Price* to secure the correction of deficiencies and completion of the *Work*. Such amounts may include all *Consultant* and *Owner* costs including any and all staff and material costs, design, tendering and contractor and supplier costs related to the correction of deficiencies and/or warranty claims."
SC32.3	5.5.3	Delete paragraph 5.5.3 in its entirety.
SC32.4	5.5.4	Delete the first and second sentences in paragraph 5.5.4 and replace them with the following: "There being no claims for lien registered against title to the *Place of the Work*, as confirmed by a title search of the *Place of the Work* and there being no claims for lien or written notices of lien delivered to the *Owner*, the holdback amount authorized by the certificate for payment of the holdback amount issued by the *Consultant*, pursuant to GC 5.5.2, is due and payable on the 61st calendar day following the publication of the certificate of *Substantial Performance of the Work* referred to in GC 5.4.4. "
SC32.5	5.5.5	Delete paragraph 5.5.5 in its entirety and replace it with the following: "5.5.5 Notwithstanding the *Owner's* obligation to make payment of the holdback amount in accordance with GC 5.5.4, the processing of such payment remains subject to the *Owner's* internal EFT timing limitations. The *Owner* covenants, and the *Contractor* agrees, that payment of the holdback shall be made by EFT at the first opportunity during the *Owner's* normal processing of

		EFTs upon the holdback becoming due in accordance with GC 5.5.4."

SC33 GC 5.6 PROGRESSIVE RELEASE OF HOLDBACK

SC33.1	5.6	Delete GC 5.6 in its entirety.

SC34 GC 5.7 FINAL PAYMENT

SC34.1	5.7.1	In paragraph 5.7.1, delete the words "an application for final payment" and replace them with the following: "an application for final payment that complies with the requirements for a *Proper Invoice*, accompanied by any documents or materials not yet delivered pursuant to paragraph 5.4.5, together with complete and final as-built drawings. The *Contractor* shall also provided written certification that there are no outstanding claims, pending claims or future claims from the *Contractor* or their *Subcontractors* or *Suppliers.* The *Consultant* shall promptly inform the *Owner* of the receipt the application for final payment and confirm whether all of the criteria for a *Proper Invoice* are satisfied. If not, the application for payment will be returned to the *Contractor* with reasons from the *Owner* or the *Consultant* setting out why it is not a valid *Proper Invoice."*
SC34.2	5.7.2	Delete the words "10 calendar days" and replace them with "5 calendar days" from paragraph 5.7.2. -and- delete the words "advise the *Contractor* in writing that the application is valid or give reasons why it is not valid." and replace them with the following: ".1 no later than 5 calendar days after the receipt of the *Proper Invoice* for final payment, the *Consultant* will issue to the *Owner* and copy to the *Contractor*, a certificate for final payment in the amount applied for, or .2 if the *Consultant* finds that such other amount is properly due under the *Proper Invoice* for final payment or otherwise finds that the *Proper Invoice* for final payment must be amended, it

		shall notify the *Owner* and prepare a draft *Notice of Non-Payment* (Form 1.1) with reasons for the amendment."
SC34.3	5.7.3	Delete paragraph 5.7.3 in its entirety and replace it with the following: "5.7.3 Where the *Owner* has delivered a *Notice of Non-Payment*, as specified under paragraph 5.7.2, the *Owner* and the *Contractor* shall first engage in good faith negotiations to resolve the dispute. If within 10 calendar days following the issuance of a *Notice of Non-Payment*, the *Owner* and *Contractor* cannot resolve the dispute, either party may issue a notice of adjudication in a form prescribed under the *Act*. The *Owner* and *Contractor* will then submit the dispute to *Adjudication* as set out under PART 8 – DISPUTE RESOLUTION."
SC34.4	5.7.4	Delete from the second line of paragraph 5.7.4 the words, "5 calendar days after the issuance of" and substitute the words "28 calendar days after receipt of a *Proper Invoice* for final payment, subject to the delivery by the *Owner* of a *Notice of Non-Payment* (Form 1.1)".
SC34.5	5.7.5	Add new paragraph 5.7.5 as follows: "5.7.5 The amounts disputed and described under the *Notice of Non-Payment* shall be held by the *Owner* until all disputed portions of the *Proper Invoice* for final payment have been resolved pursuant to PART 8 – DISPUTE RESOLUTION. Any portion of the *Proper Invoice* which is not the subject of the *Notice of Non-Payment* shall be payable within the time period set out in paragraph 5.7.4."

SC35 GC 5.8 WITHHOLDING OF PAYMENT

SC35.1	5.8.1	Delete paragraph 5.8.1 and replace with the following: "5.8.1 If because of conditions reasonably beyond the control of the *Contractor*, there are items of work that cannot be performed, payment in full for that portion of the *Work* which has been performed as certified by the *Consultant* shall not be withheld or delayed by the *Owner* on account thereof, but the *Owner* may withhold, subject to its requirement to issue a *Notice of Non-Payment* under the *Act*, until the remaining portion of the *Work* is finished, only such an amount that the *Consultant* determines is sufficient and reasonable to cover the cost of performing such remaining work. The remaining work shall be valued as deficient work as defined in GC 5.10.1."

SC36 *NEW* GC 5.10 DEFICIENCY HOLDBACK

SC36.1	5.10.1	Add new GC 5.10 – DEFICIENCY HOLDBACK as follows: "**GC 5.10 DEFICIENCY HOLDBACK** 5.10.1 Notwithstanding any provisions contained in the *Contract Documents* concerning certification and release of monies to the *Contractor*, the *Owner* reserves the right to establish a deficiency holdback, at the time of the review for *Substantial Performance of the Work,* based on a 200% dollar value of the deficiencies listed by the *Consultant*. The value of work outstanding for the calculation of *Substantial Performance of the Work* under the *Act* shall utilize the 100% dollar value. No individual deficiency will be valued at less than two hundred dollars ($200.00). The deficiency holdback shall be due and payable to the *Contractor* on the 61st day =following completion of all of the deficiencies listed by the *Consultant*, there being no claims for lien registered against the title to the *Place of the Work* issued in accordance with the *Act*, and less any amounts disputed under an *Owner*'s *Notice of Non-Payment* (Form 1.1)."

PART 6 CHANGES IN THE WORK

SC37 GC 6.1 OWNER'S RIGHT TO MAKE CHANGES

SC37.1	6.1.2	Add the following to the end of paragraph 6.1.2: "This requirement is of the essence and it is the express intention of the parties that any claims by the *Contractor* for a change in the *Contract Price* and/or *Contract Time* shall be barred unless there has been strict compliance with PART 6 - CHANGES IN THE WORK. No verbal dealings between the parties and no implied acceptance of alterations or additions to the *Work* and no claims that the *Owner* has been unjustly enriched by any alteration or addition to the *Work*, whether in fact there is any such unjust enrichment or not, shall be the basis of a claim for additional payment under this *Contract* or a claim for any extension of the *Contract Time*."
SC37.2	6.1.3 to 6.1.8	Add new paragraphs 6.1.3, 6.1.4, 6.1.5, 6.1.6, 6.1.7 and 6.1.8 as follows: "6.1.3 The *Contractor* agrees that changes resulting from construction coordination, including but not limited to, site surface

		conditions, site coordination, and *Subcontractor and Supplier* coordination are included in the *Contract Price* and the *Contractor* shall be precluded from making any claim for a change in the *Contract Price* as a result of such changes. 6.1.4 Labour costs shall be actual, prevailing rates at the *Place of the Work* paid to workers, plus statutory charges on labour including WSIB, unemployment insurance, Canada pension, vacation pay, hospitalization and medical insurance. The *Contractor* shall provide these rates, when requested by the *Consultant*, for review and/or agreement. 6.1.5 Quotations for changes to the *Work* shall only include *Direct Costs* and be accompanied by itemized breakdowns together with detailed, substantiating quotations or cost vouchers from *Subcontractors* and *Suppliers,* submitted in a format acceptable to the *Consultant* and shall include any *Direct Costs* associated with extensions in *Contract Time.* 6.1.6 When both additions and deletions covering related *Work* or substitutions are involved in a change to the *Work*, payment, including *Overhead* and profit, shall be calculated on the basis of the net difference, if any, with respect to that change in the *Work*. 6.1.7 No extension to the *Contract Time* shall be granted for changes in the *Work* unless the *Contractor* can clearly demonstrate that such changes significantly alter the overall construction schedule submitted at the commencement of the *Work.* Extensions of *Contract Time* and all associated costs, if approved, shall be included in the relevant *Change Order.* 6.1.8 When a change in the *Work* is proposed or required, the *Contractor* shall within 10 calendar days submit to the *Consultant* for review a claim for a change in *Contract Price* and/or *Contract Time.* Should 10 calendar days be insufficient to prepare the submission, the *Contractor* shall within 5 calendar days, advise the *Consultant* in writing of the proposed date of submission of the claim. Claims submitted after the dates prescribed herein will not be considered.”

SC38 GC 6.2 CHANGE ORDER

SC38.1	6.2.1	In paragraph 6.2.1 after the last sentence in the paragraph add the following: "The adjustment in the *Contract Time* and the *Contract Price* shall include an adjustment, if any, for delay or for the impact that the change in the *Work* has on the *Work* of the *Contractor*, and once such adjustment is made, the *Contractor* shall be precluded from making any further claims for delay or impact with respect to the change in the *Work.*"
SC38.2	6.2.3 to 6.2.5	Add new paragraphs 6.2.3, 6.2.4, and 6.2.5 as follows: "6.2.3 The value of a change shall be determined in one or more of the following methods as directed by the *Consultant*: .1 by estimate and acceptance of a lump sum; .2 by negotiated unit prices which include the *Contractor's* overhead and profit, or; .3 by the actual *Direct Cost* to the *Owner,* such costs to be the actual cost after all credits included in the change have been deducted, plus the following ranges of mark-up on such costs: .1 Contractor on Work of their own forces, 5% overhead, 5 % profit .2 Sub-Contractor on Work of their own forces, 5% overhead, 5% profit .3 Contractor on Work of Sub-Contractor, 5% overhead only, the above includes for all site and office related overhead costs. 6.2.4 All quotations shall include *Direct Costs* and be submitted in a complete manner listing: .1 quantity of each material, .2 unit cost of each material, .3 man hours involved,

		.4 cost per hour, .5 *Subcontractor* quotations submitted listing items 1 to 4 above and item 6 below. .6 mark-up. 6.2.5 The *Owner* and the *Consultant* will not be responsible for delays to the *Work* resulting from late, incomplete or inadequately broken-down valuations submitted by the *Contractor.*"
SC38.3		

SC39 GC 6.3 CHANGE DIRECTIVE

SC39.1	6.3.6.1	Amend paragraph 6.3.6.1 by deleting the final period and adding the following: ".1 Five percent (5%) for profit plus five percent (5%) for overhead on work by the *Contractor's* own forces up to the value of $15,000 and five percent (5%) for profit plus three percent (3%) for *Overhead* on work by the *Contractor's* own forces in excess of $15,000 and, .2 5 percent (5%) fee on amounts paid to *Subcontractors* or *Suppliers* under subparagraph 6.3.7.9 for changes up to the value of $15,000 and five percent (5%) on changes over $15,000. Unless a *Subcontractor's* or *Supplier's* price has been approved by the *Owner,* the *Subcontractor* or *Supplier* shall be entitled to its actual net cost as determined in accordance with paragraph 6.3.7, plus ten percent (5%) for profit and five percent (5%) for *Overhead* on such actual net cost for changes in the *Work*, up to the value of $15,000 and five percent (5%) for profit and three percent (3%) for overhead on such actual net cost changes in the *Work* in excess of $15,000."
SC39.2	6.3.6.2	Delete paragraph 6.3.6.2 and replace it with the following: ".2 If a change in the *Work* results in a net decrease in the *Contract Price* in excess of $15,000 the amount of the credit shall be the net cost, with deduction for *Overhead* and profit. If a change in the *Work* results in a net decrease in the *Contract Price* of $15,000 or less, the amount of the credit shall be the net cost, without deduction for *Overhead* or profit.

SC39.3	6.3.7.1	In subparagraph 6.3.7.1 after the words “in the direct employ of the *Contractor*” add the words “while directly engaged in the work attributable to the change”.
SC39.4	6.3.7	At the end of paragraph 6.3.7 add the following: “All other costs attributable to the change in the *Work* including the costs of all administrative or supervisory personnel are included in *Overhead* and profit calculated in accordance with the provisions of paragraph 6.1.5.”

SC40 GC 6.4 CONCEALED OR UNKNOWN CONDITIONS

SC40.1	6.4.1	Delete paragraph 6.4.1 in its entirety and replace with the following: “6.4.1.1 Prior to the submission of the bid on which the *Contract* was awarded, the *Contractor* confirms that it carefully investigated the *Place of the Work* and carried out such tests as it deemed appropriate and, in doing so, applied to that investigation the degree of care and skill required by paragraph 3.14.1. If the *Contractor* has not conducted such careful investigation, it is deemed to assume all risk of conditions or circumstances now existing or arising in the course of the *Work* which could make the *Work* more expensive or more difficult to perform than was contemplated at the time the *Contract* was executed. No allowances will be made for additional costs and no claims by the *Contractor* will be entertained in connection with conditions which could reasonably have been ascertained by such investigation or other due diligence undertaken prior to the execution of the *Contract*. 6.4.1.2 No claim by the *Contractor* will be considered by the *Owner* or the *Consultant* in connection with conditions which could reasonably have been ascertained by such investigation or other due diligence undertaken prior to the execution of the *Contract*. 6.4.1.3 The *Contractor* expressly acknowledges that, prior to the submission of the bid on which the *Contract* was awarded, the *Contractor* may have been prevented from carefully investigating the *Place of the Work* as a result of *Force Majeure*. Understanding such limitations, the *Contractor* proceeded with its bid. The *Contractor* shall not, therefore, make any claim arising from *Force Majeure* conditions which

		may have prevented the *Contractor* from fulfilling its obligations under this GC 6.4."
SC40.2	6.4.2	Amend paragraph 6.4.2 by adding a new first sentence as follows: "Having regard to paragraph 6.4.1, if the *Contractor* believes that the conditions of the *Place of the Work* differ materially from those reasonably anticipated, differ materially from those indicated in the *Contract Documents* or were concealed from discovery notwithstanding the conduct of the investigation described in paragraph 6.4.1, it shall provide the *Owner* and the *Consultant* with *Notice in Writing* no later than five (5) *Working Days* after the first observation of such conditions." -and- amend the existing second sentence of paragraph 6.4.2 in the second line, following the word "materially" by adding the words "or were concealed from discovery notwithstanding the conduct of the investigation described in paragraph 6.4.1,".
SC40.3	6.4.3	Delete paragraph 6.4.3 in its entirety and substitute the following: "6.4.3 If the *Consultant* makes a finding pursuant to paragraph 6.4.2 that no change in the *Contract Price* or the *Contract Time* is justified, the *Consultant* shall report in writing the reasons for this finding to the *Owner* and the *Contractor*."
SC40.4	6.4.5	Add new paragraph 6.4.5 as follows: "6.4.5 No claims for additional compensation or for an extension of *Contract Time* shall be allowed if the *Contractor* fails to give *Notice in Writing* to the *Owner* or *Consultant,* as required by paragraph 6.4.2."

SC41 GC 6.5 DELAYS

SC41.1	6.5.1	In paragraph 6.5.1 delete the words after the word "for" in the fourth line and replace them with the words "…reasonable *Direct Costs* directly flowing from the delay, but excluding any consequential, indirect or special damages (including, without limitation, loss of profits, loss of opportunity or loss of productivity)."
SC41.2	6.5.2	In paragraph 6.5.2,

		delete the words "not issued as the result of an act or fault of the *Contractor* or any person employed or engaged by the *Contractor* directly or indirectly," and replace them with "issued on account of a direct breach, violation, contravention, or a failure to abide by any laws, ordinances, rules, regulations, or codes by the *Owner*, the *Owner's* other contractor(s), or the *Consultant*, and relating to the *Work* or the *Place of the Work*," -and- delete the words after the word "for" in the fourth line of paragraph 6.5.2, and replace them with the words "…reasonable *Direct Costs* directly flowing from the delay, but excluding any consequential, indirect or special damages (including, without limitation, loss of profits, loss of opportunity or loss of productivity)."
SC41.3	6.5.3	Delete paragraph 6.5.3 in its entirety and replace with the following: "6.5.3 If either party is delayed in the performance of their obligations under this *Contract* by *Force Majeure*, then the *Contract Time* shall be extended for such reasonable time as the *Owner* and the *Contractor* shall agree. The extension of time shall not be less than the time lost as a result of the event causing the delay, unless the parties agree to a shorter extension. Neither party shall be entitled to payment for costs incurred by such delays. Upon reaching agreement on the extension of the *Contract Time* attributable to the *Force Majeure* event, the *Owner* and the *Contractor* shall execute a *Change Order* indicating the length of the extension to the *Contract Time* and confirming that there are no costs payable by the either party for the extension of *Contract Time*. However, if at the time an event of *Force Majeure* arises a party is in default of its obligations under the *Contract* and has received a notice of default pursuant to PART 7 – DEFAULT NOTICE, this paragraph 6.5.3 shall not excuse a party from its obligation to cure the default(s). For greater certainty, the defaulting party, to the extent possible, must continue to address and cure the default notwithstanding an event of *Force Majeure*."
SC41.4	6.5.4	Delete paragraph 6.5.4 in its entirety and replace it with the following: "6.5.4 No extension or compensation shall be made for delay or impact on the *Work* unless notice in writing of a claim is given to the *Consultant* not later than ten (10) *Working Days* after the commencement of the delays or impact on the *Work*, provided

		however, that, in the case of a continuing cause of delay or impact on the *Work*, only one notice of claim shall be necessary."
SC41.5	6.5.6 to 6.5.8	Add new paragraphs 6.5.6, 6.5.7 and 6.5.8 as follows: "6.5.6 If the *Contractor* is delayed in the performance of the *Work* by an act or omission of the *Contractor* or anyone directly or indirectly employed or engaged by the *Contractor,* or by any cause within the *Contractor's* control, then (i) firstly, at its expense, and to the extent possible, the *Contractor* shall accelerate the work and/or provide overtime work to recover time lost by a delay arising under this paragraph 6.5.6, and (ii) secondly, where it is not possible for the *Contractor* to recover the time lost by implementing acceleration measures and/or overtime work, the *Contract Time* may be extended for such reasonable time as the *Owner* may decide in consultation with the *Consultant* and the *Contractor*. The *Owner* shall be reimbursed by the *Contractor* for all reasonable costs incurred by the *Owner* as the result of such delay, including, but not limited to, Owner's staff costs, the cost of all additional services required by the *Owner* from the *Consultant* or any sub-consultants, project managers, or others employed or engaged by the *Owner*, and in particular, the costs of the *Consultant's* services during the period between the date of *Substantial Performance of the Work* stated in Article A-1 herein, as the same may be extended through the provision of these General Conditions, and any later or actual date of *Substantial Performance of the Work* achieved by the *Contractor*. 6.5.7 Without limiting the obligations of the *Contractor* described in GC 3.2 – CONSTRUCTION BY OWNER OR OTHER CONTRACTORS or GC 9.4 – CONSTRUCTION SAFETY, the *Owner* or *Consultant* may, by *Notice in Writing*, direct the *Contractor* to stop the *Work* where the *Owner* or *Consultant* determines that there is an imminent risk to the safety of persons or property at the *Place of the Work*. In the event that the *Contractor* receives such notice, it shall immediately stop the *Work* and secure the site. The *Contractor* shall not be entitled to an extension of the *Contract Time* or to an increase in the *Contract Price* unless the resulting delay, if any, would entitle the *Contractor* to an extension of the *Contact Time* or the reimbursement of the *Contractor's* costs as provided in paragraphs 6.5.1, 6.5.2 or 6.5.3.

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

PART 7 DEFAULT NOTICE

SC42 GC 7.1 OWNER'S RIGHT TO PERFORM THE WORK, TERMINATE THE CONTRACTOR'S RIGHT TO CONTINUE WITH THE WORK OR TERMINATE THE CONTRACT

SC42.1	7.1.3.4	Add a new subparagraph 7.1.3.4 as follows: ".4 an "acceptable schedule" as referred to in subparagraph 7.1.3.2. means a schedule approved by the *Consultant* and the *Owner* wherein the default can be corrected within the balance of the *Contract Time* and shall not cause delay to any other aspect of the *Work* or the work of other contractors, and in no event shall it be deemed to give a right to extend the *Contract Time*."
SC42.2	7.1.4.1	Delete subparagraph 7.1.4.1 and replace it with the following: ".1 correct such default and deduct the cost, including *Owner's* expenses, thereof from any payment then or thereafter due the *Contractor*."
SC42.3	7.1.4.2	Delete subparagraph 7.1.4.2 and replace it with the following: ".2 by providing *Notice in Writing* to the *Contractor*, terminate the *Contractor's* right to continue with the *Work* in whole or in part or terminate the *Contract*, and publish a notice of termination (Form 8) in accordance with the *Act*."
SC42.4	7.1.5.3	In subparagraph 7.1.5.3 delete the words: "however, if such cost of finishing the *Work* is less than the unpaid balance of the *Contract Price*, the *Owner* shall pay the *Contractor* the difference"
SC42.5	7.1.6	Delete paragraph 7.1.6 in its entirety.
SC42.6	7.1.6 to 7.1.10	Add new paragraphs 7.1.6, 7.1.7, 7.1.8, 7.1.9 and 7.1.10 as follows: "7.1.6 In addition to its right to terminate the *Contract* set out herein, the *Owner* may terminate this *Contract* at any time for any other reason and without cause upon giving the *Contractor* fifteen (15) *Working Days Notice in Writing* to that effect. In such event, the *Contractor* shall be entitled to be paid for all *Work* performed including reasonable profit, for loss sustained

upon *Products* and *Construction Equipment*, and such other damages as the *Contractor* may have sustained as a result of the termination of the *Contract*, but in no event shall the *Contractor* be entitled to be compensated for any loss of profit on unperformed portions of the *Work*, or indirect, special, or consequential damages incurred.

7.1.7 The *Owner* may suspend *Work* under this *Contract* at any time for any reason and without cause upon giving the *Contractor Notice in Writing* to that effect. In such event, the *Contractor* shall be entitled to be paid for all *Work* performed to the date of suspension and be compensated for all actual costs incurred arising from the suspension, including reasonable profit, for loss sustained upon *Products* and *Construction Equipment*, and such other damages as the *Contractor* may have sustained as a result of the suspension of the *Work*, but in no event shall the *Contractor* be entitled to be compensated for any indirect, special, or consequential damages incurred. In the event that the suspension continues for more than thirty (30) calendar days, the *Contract* shall be deemed to be terminated and the provisions of paragraph 7.1.6 shall apply.

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

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

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

		continue after such termination of the *Contract* or suspension of the *Work*."

SC43 GC 7.2 CONTRACTOR'S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT

SC43.1	7.2.2	Delete paragraph 7.2.2 and replace it with the following: "7.2.2 If the *Work* is suspended or otherwise delayed for a period of 40 consecutive *Working Days* or more under a stop work order issued by a court or other public authority on account of a breach, violation, contravention, or a failure to abide by any laws, ordinances, rules, regulations, or codes directly by the *Owner*, the *Owner's* other contractor(s), or the *Consultant*, and relating to the *Work* or the *Place of the Work*, the *Contractor* may, without prejudice to any other right or remedy the *Contractor* may have, terminate the *Contract* by giving the *Owner* Notice in *Writing* to that effect."
SC43.2	7.2.3 .1	Delete subparagraph 7.2.3.1 in its entirety.
SC43.3	7.2.3 .2	Delete subparagraph 7.2.3.2 in its entirety.
SC43.4	7.2.3 .4	In subparagraph 7.2.3.4, delete the words "except for GC 5.1 - FINANCING INFORMATION REQUIRED OF THE OWNER".
SC43.5	7.2.5	Renumber paragraph 7.2.5 as paragraph 7.2.6. and add a new paragraph 7.2.5 as follows: "7.2.5 If the default cannot be corrected within the 5 *Working Days* specified in paragraph 7.2.4, the *Owner* shall be deemed to have cured the default if it: .1 commences correction of the default within the specified time; .2 provides the *Contractor* with an acceptable schedule for such correction; and, .3 completes the correction in accordance with such schedule."

SC43.6	7.2.6	Delete paragraph 7.2.6 entirely and replace with the following: "7.2.6 If the *Contractor* terminates the *Contract* under the conditions described in GC 7.2 – CONTRACTOR'S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT, the *Contractor* shall be entitled to be paid for all *Work* performed to the date of termination, as determined by the *Consultant*. The *Contractor* shall also be entitled to recover the direct costs associated with termination, including the costs of demobilization and losses sustained on *Products* and *Construction Equipment*. The *Contractor* shall not be entitled to any recovery for any special, indirect or consequential losses, including loss of profit."
SC43.7	7.2.7 to 7.2.9	Add new paragraphs 7.2.7, 7.2.8 and 7.2.9 as follows: "7.2.7 The *Contractor* shall not be entitled to give notice of the *Owner's* default or terminate the *Contract* in the event the *Owner* withholds certificates or payment or both in accordance with the *Contract* because of: .1 the *Contractor's* failure to pay all legitimate claims promptly, or .2 the failure of the *Contractor* to discharge construction liens which are registered against the title to the *Place of the Work.* 7.2.8 The *Contractor's* obligations under the *Contract* as to quality, correction and warranty of the *Work* performed by the *Contractor* up to the effective date of termination shall continue in force and shall survive termination of this *Contract* by the *Contractor*. 7.2.9 If the *Contractor* suspends the *Work* or terminates the *Contract* as provided for in GC 7.2 – CONTRACTOR'S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT, the *Contractor* shall ensure the site and the *Work* are left in a safe, secure condition as required by authorities having jurisdiction at the *Place of the Work* and the *Contract Documents*."

SC44 GC 8.1 AUTHORITY OF THE CONSULTANT

SC44.1	8.1.3	Delete paragraph 8.1.3 in its entirety and substitute as follows:

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

SC45 GC 8.2 NEGOTIATION, MEDIATION AND ARBITRATION

SC45.1	8.2.1	Amend paragraph 8.2.1 by changing part of the second line from "shall appoint a *Project Mediator*" to "may appoint a *Project Mediator,* except that such an appointment shall only be made if both the *Owner* and the *Contractor* agree."
SC45.2	8.2.4	Amend paragraph 8.2.4 by changing part of the second line from "the parties shall request the *Project Mediator"* to "and subject to paragraph 8.2.1 the parties may request the *Project Mediator".*
SC45.3	8.2.6 to 8.2.8	Delete paragraphs 8.2.6, 8.2.7 and 8.2.8 in their entirety.
SC45.4	8.2.6	Add new paragraph 8.2.6 as follows: "8.2.6 The dispute may be finally resolved by arbitration under the Rules for Arbitration of Construction Disputes as provided in CCDC 40 in effect at the time of bid closing, provided that both the *Contractor* and the *Owner* agree. If the *Contractor* and the *Owner* agree to resolve the dispute by arbitration, the arbitration shall be conducted in the jurisdiction of the *Place of the Work*."
SC45.5	8.2.9, 8.2.10 & 8.2.11	Add a new paragraphs 8.2.9, 8.2.10, and 8.2.11 as follows: "8.2.9 Prior to delivering a notice of *Adjudication* in a form prescribed by the *Act*, the parties agree to first address all disputes by attending at least one meeting with the *Owner*'s representative, the *Consultant*'s representative, and the *Contractor*'s representative, prior to commencing an *Adjudication*. The parties agree that such steps will be taken to resolve any disputes in a timely and cost effective manner. If a resolution to the dispute(s) is not made at such a meeting, any party who plans to commence an *Adjudication* shall provide the other party with 5 *Working Days' Notice in Writing* of its intention to issue a notice of *Adjudication*.

		8.2.10 Other than where the *Contractor* is obliged to commence an *Adjudication* pursuant to an undertaking under the *Act*, neither the *Owner* nor the *Contractor* shall commence an *Adjudication* during the *Restricted Period*. 8.2.11 Where either party has delivered a notice of *Adjudication* in a form prescribed by the *Act*, the procedures and rules set out under the *Act* and the regulations thereto shall govern the *Adjudication*."

SC46 GC 9.1 PROTECTION OF WORK AND PROPERTY

SC46.1	9.1.1.1	Delete subparagraph 9.1.1.1 in its entirety and substitute the following: ".1 errors in the *Contract Documents* which the *Contractor* could not have discovered applying the standard of care described in paragraph 3.14.1;"
SC46.2	9.1.2	Delete paragraph 9.1.2 in its entirety and substitute as follows: "9.1.2 Before commencing any *Work*, the *Contractor* shall determine the locations of all underground or hidden utilities and structures indicated in or inferable from the *Contract Documents*, or that are inferable from an inspection of the *Place of the Work* exercising the degree of care and skill described in paragraph 3.14.1."
SC46.3	9.1.5	Add new paragraph 9.1.5 as follows: "9.1.5 With respect to any damage to which paragraphs 9.1.3 or 9.1.4 apply, the *Contractor* shall neither undertake to repair or replace any damage whatsoever to the work of other contractors, or to adjoining property, nor acknowledge that the same was caused or occasioned by the *Contractor*, without first consulting the *Owner* and receiving written instructions as to the course of action to be followed from either the *Owner* or the *Consultant*. Where, however, there is danger to life, the environment, or public safety, the *Contractor* shall take such emergency action as it deems necessary to remove the danger."

SC47 GC 9.2 TOXIC AND HAZARDOUS SUBSTANCES

SC47.1	9.2.5.5	Add a new subparagraph 9.2.5.5 as follows: ".5 in addition to the steps described in subparagraph 9.2.5.3, take any further steps it deems necessary to mitigate or stabilize any conditions resulting from encountering toxic or hazardous substances or materials."
SC47.2	9.2.6	Add the following to paragraph 9.2.6, after the word "responsible" in the second line: "or whether any toxic or hazardous substances or materials already at the *Place of the Work* (and which were then harmless or stored, contained or otherwise dealt with in accordance with legal and regulatory requirements) were dealt with by the *Contractor* or anyone for whom the *Contractor* is responsible in a manner which does not comply with legal and regulatory requirements, or which threatens human health and safety or the environment, or material damages to the property of the *Owner* or others,".
SC47.3	9.2.8	Add the following to paragraph 9.2.8, after the word "responsible" in the second line: "or whether any toxic or hazardous substances or materials already at the *Place of the Work* (and which were then harmless or stored, contained or otherwise dealt with in accordance with legal and regulatory requirements) were dealt with by the *Contractor* or anyone for whom the *Contractor* is responsible in a manner which does not comply with legal and regulatory requirements, or which threatens human health and safety or the environment, or material damages to the property of the *Owner* or others,".
SC47.4	9.2.10	Add new paragraph 9.2.10 as follows: "9.2.10 The *Contractor*, *Subcontractors* and *Suppliers* shall not bring on to the *Place of the Work* any toxic or hazardous substances and materials except as required in order to perform the *Work*. If such toxic or hazardous substances or materials are required, storage in quantities sufficient to allow work to proceed to the end of any current work week only shall be permitted. All such toxic and hazardous materials and substances shall be handled and disposed of only in accordance with all laws and regulations that are applicable at the *Place of the Work*."

SC48 GC 9.4 CONSTRUCTION SAFETY

SC48.1	9.4.1	Delete paragraph 9.4.1 in its entirety and substitute as follows: "9.4.1 The *Contractor* shall be solely responsible for construction safety at the *Place of the Work* and for compliance with the rules, regulations, and practices required by the *OHSA*, including, but not limited to those of the "constructor", and shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the *Work*. Without limiting the foregoing, the *Contractor* shall be solely responsible for construction safety in respect of its *Consultants*, other *Consultants, Subcontractors* and *Suppliers*, the *Owner's* own forces, and other contractors, subcontractors, and suppliers during the course of the *Project*."
SC48.2	9.4.2 to 9.4.10	Add new paragraphs 9.4.2 to 9.4.10 as follows: 9.4.2 Prior to the commencement of the *Work*, the *Contractor* shall submit to the *Owner*: .1 the evidence of workers' compensation compliance required by GC 10.4.1; .2 copies of the *Contractor's* insurance policies having application to the *Project* or certificates of insurance, at the option of the *Owner*; .3 documentation setting out the *Contractor's* in-house safety programs; .4 a copy of the "Notice of Project" filed with the Ministry of Labour; .5 copies of any documentation or notices to be filed or delivered to the authorities having jurisdiction for the regulation of occupational health and safety at the *Place of the Work*. 9.4.3 The *Contractor* shall indemnify and save harmless the *Owner*, its agents, trustees, officers, directors, employees, consultants, successors, appointees, and assigns from and against the consequences of any and all safety infractions committed by the *Contractor* under the occupational health and safety legislation in force at the *Place of the Work* including the

payment of legal fees and disbursements on a substantial indemnity basis.

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

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

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

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

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

		9.4.9 The *Contractor* shall arrange regular safety meetings, and shall supply and maintain, at its own expense, at its office or other well-known place at the job site, safety equipment necessary to protect the workers and general public against accident or injury as prescribed by the authorities having jurisdiction at the *Place of the Work*, including, without limitation, articles necessary for administering first-aid to any person and an emergency procedure for the immediate removal of any inured person to a hospital or a doctor's care. 9.4.10 The *Contractor* shall promptly report in writing to the *Owner* and the *Consultant* all accidents of any sort arising out of or in connection with the performance of the *Work*, whether on or adjacent to the job site, giving full details and statement of witnesses. If death or serious injuries or damages are caused, the accident shall be promptly reported by the *Contractor* to the *Owner* and the *Consultant* by telephone or messenger in addition to any reporting required under the applicable safety regulations."

SC49 GC 10.1 TAXES AND DUTIES

SC49.1	10.1.2	Amend paragraph 10.1.2 by adding the following sentence to the end of the paragraph: "For greater certainty, the *Contractor* shall not be entitled to any mark-up for overhead or profit on any increase in such taxes and duties and the *Owner* shall not be entitled to any credit relating to mark-up for overhead or profit on any decrease in such taxes. The *Contractor* shall provide a detailed breakdown of Additional taxes if requested by the *Owner* in a form satisfactory to the *Owner*."
SC49.2	10.1.3	Add new paragraph 10.1.3 as follows: "10.1.3 Where the *Owner* is entitled to an exemption or a recovery of sales taxes, customs duties, excise taxes or *Value Added Taxes* applicable to the *Contract*, the *Contractor* shall, at the request of the *Owner*, assist with the application for any exemption, recovery or refund of all such taxes and duties and all amounts recovered or exemptions obtained shall be for the sole benefit of the *Owner*. The *Contractor* agrees to endorse over to the *Owner* any cheques received from the federal or provincial governments, or any other taxing authority, as may be required to give effect to this paragraph."

SC50 GC 10.2 LAWS, NOTICES, PERMITS, AND FEES

SC50.1	10.2.5	Amend paragraph 10.2.5 by adding the words "Subject to paragraph 3.4" at the beginning of the paragraph. -and- Add the following to the end of the second sentence: "…and no further *Work* on the affected components of the *Contract* shall proceed until these directives have been obtained by the *Contractor* from the *Consultant*."
SC50.2	10.2.6	Amend paragraph 10.2.6 by adding the following sentence to the end of the paragraph: "In the event the *Owner* suffers loss or damage as a result of the *Contractor's* failure to comply with paragraph 10.2.5 and notwithstanding any limitations described in paragraph 12.1.1, the *Contractor* agrees to indemnify and to hold harmless the *Owner* and the *Consultant* from and against any claims, demands, losses, costs, damages, actions suits or proceedings resulting from such failure by the *Contractor*."
SC50.3	10.2.7	Amend paragraph 10.2.7 by inserting the words "which changes were not, or could not have reasonably been known to the *Owner* or to the *Contractor*, as applicable, at the time of bid closing and which changes did not arise as a result of a public emergency or other *Force Majeure* event" to the second line, after the words "authorities having jurisdiction".
SC50.4	10.2.8	Add new paragraph 10.2.8 as follows: "10.2.8 The *Contractor* shall furnish all certificates that are required or given by the appropriate governmental authorities as evidence that the *Work* as installed conforms with the laws and regulations of authorities having jurisdiction, including certificates of compliance for the *Owner's* occupancy or partial occupancy. The certificates are to be final certificates giving complete clearance of the *Work*, in the event that such governmental authorities furnish such certificates."

SC51 GC 10.4 WORKERS' COMPENSATION

SC51.1	10.4.1	Delete paragraph 10.4.1 and replace with the following:

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

SC52 GC 11.1 INSURANCE

SC52.1	11.1	Delete entirety of GC 11.1 and replace with the following: "**GC 11.1 INSURANCE** 11.1.1 Without restricting the generality of GC 12 – INDEMNIFICATION, the *Contractor* shall provide, maintain, and pay for the insurance coverages specified in GC 11.1 – INSURANCE. Unless otherwise stipulated, the duration of each insurance policy shall be from the date of commencement of the *Work* until the expiration of the warranty periods set out in the *Contract Documents*. Prior to commencement of the *Work* and upon the placement, renewal, amendment, or extension of all or any part of the insurance, the *Contractor* shall promptly provide the *Owner* with confirmation of coverage and, if required, a certified true copy of the policies certified by an authorized representative of the insurer together with copies of any amending endorsements. .1 **General Liability Insurance** General liability insurance shall be in the name of the *Contractor,* with the *Owner* and the *Consultant* named as Additional insureds, with limits of not less than $2,000,000.00 inclusive per occurrence for bodily injury, death, and damage to property, including loss of use thereof, for itself and each of its employees, *Subcontractors* and/or agents. The insurance coverage shall not be less than the insurance required by IBC Form 2100, or its equivalent replacement, provided that IBC Form 2100 shall contain the latest edition of the relevant CCDC endorsement form. To achieve the desired limit,

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

.2 **Automobile Liability Insurance**

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

.3 **Aircraft and Watercraft Liability Insurance**

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

.4 Property and Boiler and Machinery Insurance

		(1) Builder's Risk property insurance shall be in the name of the *Contractor* with the *Owner* and the *Consultant* named as Additional insureds. The policy shall insure against all risks of direct physical loss or damage to the property insured which shall include all property included in the *Work*, whether owned by the *Contractor* or the owner or owned by others, so long as the property forms part of the *Work*. The property insured also includes all materials and supplies necessary to complete the work, whether installed in the work temporarily or permanently, in storage on the project site, or in transit to the project site, as well as temporary buildings, scaffolding, falsework forms, hoardings, excavation, site preparation and similar work. The insurance shall be for not less than the sum of the amount of the contract price and the full value of products that are specified to be provided by the owner for incorporation into the work, if applicable, with the deductible of $10,000.00 payable by the contractor. The insurance shall include the foregoing and, otherwise, shall not be less than the insurance required by IBC Form 4042 or its equivalent replacement provided that the IBC Form 4042 shall include the latest Addition of the relevant CCDC endorsement form. The coverage shall be based on a completed value form and shall be maintained continuously until ten (10) days after the date of the final certificate of payment. (2) Boiler and machinery insurance shall be in the name of the *Contractor*, with the *Owner* and the *Consultant* named as Additional insureds, for not less than the replacement value of the boilers, pressure vessels and other insurable objects forming part of the *Work*. The insurance provided shall not be less than the insurance provided by the "Comprehensive Boiler and Machinery Form" and shall be maintained continuously from commencement of use or operation of the property insured and until 10 days after the date of the final certificate for payment. (3) The policies shall allow for partial or total use or occupancy of the *Work.* (4) The policies shall provide that, in the case of a loss or damage, payment shall be made to the *Owner* and the *Contractor* as their respective interests may appear. The *Contractor* shall act on behalf of the *Owner* for the purpose of adjusting the amount of such loss or damage payment with the

		insurers. When the extent of the loss or damage is determined, the *Contractor* shall proceed to restore the *Work*. Loss or damage shall not affect the rights and obligations of either party under the *Contract* except that the *Contractor* shall be entitled to such reasonable extension of the *Contract Time,* relative to the extent of the loss or damage, as determined by the *Owner*, in its sole discretion. (5) The *Contractor* shall be entitled to receive from the *Owner*, in Addition to the amount due under the *Contract*, the amount at which the *Owner's* interest in restoration of the *Work* has been appraised, such amount to be paid as the restoration of the *Work* proceeds and as provided in GC 5.2 – APPLICATIONS FOR PROGRESS PAYMENT and GC 5.3 – PROGRESS PAYMENT. In Addition, the *Contractor* shall be entitled to receive from the payments made by the insurer the amount of the *Contractor's* interest in the restoration of the *Work*. (6) In the case of loss or damage to the *Work* arising from the work of other contractors, or the *Owner's* own forces, the *Owner*, in accordance with the *Owner's* obligations under paragraph 3.2.2.4 of GC 3.2 – CONSTRUCTION BY OWNER OR OTHER CONTRACTORS, shall pay the *Contractor* the cost of restoring the *Work* as the restoration of the *Work* proceeds and as provided in GC 5.2 – APPLICATIONS FOR PROGRESS PAYMENT and GC 5.3 – PROGRESS PAYMENT. **.5 Contractors' Equipment Insurance** "All risks" contractors' equipment insurance covering construction machinery and equipment used by the *Contractor* for the performance of the *Work*, excluding boiler insurance, shall be in a form acceptable to the *Owner* and shall not allow subrogation claims by the insurer against the *Owner.* The policies shall be endorsed to provide the *Owner* with not less than 30 days' notice, in writing, in advance of cancellation, change or amendment restricting coverage. Subject to satisfactory proof of financial capability by the *Contractor* for self-insurance of his equipment, the *Owner* agrees to waive the equipment insurance requirement. 11.1.2 The *Contractor* shall be responsible for deductible amounts under the policies except where such amounts may

		be excluded from the *Contractor's* responsibility by the terms of GC 9.1 - PROTECTION OF WORK AND PROPERTY and GC 9.2 - DAMAGES AND MUTUAL RESPONSIBILITY. 11.1.3 Where the full insurable value of the *Work* is substantially less than the *Contract Price*, the *Owner* may reduce the amount of insurance required to waive the course of construction insurance requirement. 11.1.4 If the *Contractor* fails to provide or maintain insurance as required by the *Contract Documents*, then the *Owner* shall have the right to provide and maintain such insurance and provide evidence of same to the *Contractor*. The *Contractor* shall pay the costs thereof to the *Owner* on demand, or the *Owner* may deduct the amount that is due or may become due to the *Contractor*. 11.1.5 All required insurance policies shall be with insurers licensed to underwrite insurance in the jurisdiction of the *Place of the Work*."

SC53 GC 11.2 CONTRACT SECURITY

SC53.1	11.2.1	Delete paragraph 11.2.1 and replace it with the following: "11.2.1 If required by the *Contract Documents*, the *Contractor* shall, prior to the execution of the *Contract* and within 7 calendar days of receiving *Notice in Writing* to do so, furnish a performance bond and labour and material payment bond which meets the requirements under paragraph 11.2.2."
SC53.2	11.2.2	Delete paragraph 11.2.2 and replace it with the following: "11.2.2 The performance bond and labour and material payment bond, if required, shall: .1 be issued by a duly licensed surety company, which has been approved by the *Owner* and is permitted under the *Construction Act*, .2 be issued by an insurer licensed under the *Insurance Act* (Ontario) and authorized to transact a business of suretyship in the Province of Ontario; .3 shall be in the form prescribed by the *Act*;

		.4 have a coverage limit of at least 50 per cent of the *Contract Price*, or such other percentage of the *Contract Price* as stated in the *Contract Documents*; .5 extends protection to *Subcontractors*, *Suppliers,* and any other persons supplying labour or materials to the *Project*; and .4 shall be maintained in good standing until the fulfillment of the *Contract*, including all warranty and maintenance periods set out in the *Contract Documents.*"
SC53.3	11.2.3	Add new paragraph 11.2.3 as follows: "11.2.3 It is the intention of the parties that the performance bond shall be applicable to all of the *Contractor's* obligations in the *Contract Document* and, wherever a performance bond is provided with language which conflicts with this intention, it shall be deemed to be amended to comply. The *Contractor* represents and warrants to the *Owner* that it has provided its surety with a copy of the *Contract Documents* prior to the issuance of such bonds."

SC54 GC 12.1 INDEMNIFICATION

SC54.1	12.1	Delete GC 12.1 – INDEMNIFICATION in its entirety and substitute as follows: "12.1.1 The *Contractor* shall indemnify and hold harmless the *Owner*, its parent, subsidiaries and affiliates, their respective partners, trustees, officers, directors, agents and employees and the *Consultant* from and against any and all claims, liabilities, expenses, demands, losses, damages, actions, costs, suits, or proceedings (hereinafter called "claims"), whether in respect of claims suffered by the *Owner* or in respect of claims by third parties, that directly or indirectly arise out of, or are attributable to, the acts or omissions of the *Contractor*, its employees, agents, *Subcontractors*, *Suppliers* or any other persons for whom it is in law responsible (including, without limitation, claims that directly or indirectly arise out of, or are attributable to, loss of use or damage to the *Work*, the *Owner's* property or equipment, the *Contractor's* property or equipment or equipment or property adjacent to the *Place of the Work* or death or injury to the *Contractor's* personnel).

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

SC55 GC 12.2 WAIVER OF CLAIMS

SC55.1	12.2.1	In paragraph 12.2.1 in the fourth line after the word "limitation" add the words "claims for delay pursuant to GC 6.5 DELAYS" -and- add the words "(collectively "Claims")" after "*Substantial Performance of the Work*" in the sixth line.
SC55.2	12.2.1.1	In subparagraph 12.2.1.1 change the word "claims" to "Claims" and change the word "claim" to "Claim".
SC55.3	12.2.1.2	In subparagraph 12.2.1.2 change the word "claims" to "Claims".
SC55.4	12.2.1.3	Delete subparagraph 12.2.1.3 in its entirety.
SC55.5	12.2.1.4	In paragraph 12.2.1.4 change the word "claims" to "Claims".
SC55.6	12.2.2	In paragraph 12.2.2 delete the words "in paragraphs 12.2.1.2 and 12.2.1.3" and replace them with "in paragraph 12.2.1.2" -and- change the word "claims" to "Claims" in both instances and change the word "claim" to "Claim".
SC55.7	12.2.3	Delete paragraph 12.2.3 in its entirety.
SC55.8	12.2.4	Delete paragraph 12.2.4 in its entirety.
SC55.9	12.2.5	Delete paragraph 12.2.5 in its entirety.
SC55.10	12.2.6	In paragraph 12.2.6 change the word "claim" to "Claim" in all instances in the paragraph.
SC55.11	12.2.7	In paragraph 12.2.7 change "The party" to "The *Contractor*

		-and- change the word “claim” to “Claim” in all instances in the paragraph.
SC55.12	12.2.8	In paragraph 12.2.8 delete the words “under paragraphs 12.2.1 or 12.2.3” and replace them with “under paragraph 12.2.1” -and- change both instances of the words “the party” to “the *Contractor*”. Change the word “claim” to “Claim” in all instances in the paragraph.
SC55.13	12.2.9	Delete paragraph 12.2.9 in its entirety.
SC55.14	12.2.10	Delete paragraph 12.2.10 in its entirety.

SC56 GC 12.3 WARRANTY

SC56.1	12.3.2	Delete from the first line of paragraph 12.3.2 the word, “The” and substitute with the words “Subject to paragraph 3.4.1, the…”
SC56.2	12.3.7 to 12.3.12	Add new paragraphs 12.3.7 to 12.3.12 as follows: “12.3.7 Where required by the *Contract Documents*, the *Contractor* shall provide a maintenance bond as security for the performance of the *Contractor’s* obligations as set out in GC 12.3 WARRANTY. 12.3.8 The *Contractor* shall provide fully and properly completed and signed copies of all warranties and guarantees required by the *Contract Documents*, containing: .1 the proper name of the *Owner*; .2 the proper name and address of the *Project*; .3 the date the warranty commences, which shall be at the “date of *Substantial Performance of the Work*” unless otherwise agreed upon by the *Consultant* in writing. .4 a clear definition of what is being warranted and/or guaranteed as required by the *Contract Documents*; and .5 the signature and seal (if required by the governing law of the *Contract*) of the company issuing the warranty, countersigned by the *Contractor*.

		12.3.9 Should any *Work* be repaired or replaced during the time period for which it is covered by the specified warranty, a new warranty shall be provided under the same conditions and for the same period as specified herein before. The new warranty shall commence at the completion of the repair or replacement. 12.3.10 The *Contractor* shall ensure that its *Subcontractors* are bound to the requirements of GC 12.3 – WARRANTY for the *Subcontractor's* portion of the *Work.* 12.3.11 The *Contractor* shall ensure that all warranties, guarantees or other obligations for *Work*, services or *Products* performed or supplied by any *Subcontractor, Supplier* or other person in connection with the *Work* are obtained and available for the direct benefit of the *Owner.* In the alternative, the *Contractor* shall assign to the *Owner* all warranties, guarantees or other obligations for *Work*, services or *Products* performed or supplied by any *Subcontractor, Supplier* or other person in connection with the *Work* and such assignment shall be with the consent of the assigning party, where required by law, or by the terms of that party's contract. Such assignment shall be in addition to, and shall in no way limit, the warranty rights of the *Owner* under the *Contract Documents*. 12.3.12 The *Contractor* shall commence or correct any deficiency within 2 *Working Days* after receiving a *Notice in Writing* from the *Owner* or the *Consultant*, and shall complete the *Work* as expeditiously as possible, except in the case where the deficiency prevents maintaining security or where basic systems essential to the ongoing business of the *Owner* and/or its tenants cannot be maintained operational as designed. In those circumstances all necessary corrections and/or installations of temporary replacements shall be carried out immediately as an emergency service. Should the *Contractor* fail to provide this emergency service within 8 hours of a request being made during the normal business hours of the *Contractor*, the *Owner* is authorized, notwithstanding GC 3.1, to carry out all necessary repairs or replacements at the *Contractor's* expense."

NEW PART 13 OTHER PROVISIONS

SC57 GC 13.1 OWNERSHIP OF MATERIALS

SC57.1	13.1	Add new GC 13.1 – OWNERSHIP OF MATERIALS as follows: "**GC 13.1 OWNERSHIP OF MATERIALS** "13.1.1 Unless otherwise specified, all materials existing at the *Place of the Work* at the time of execution of the *Contract* shall remain the property of the *Owner*. All *Work* and *Products* delivered to the *Place of the Work* by the *Contractor* shall be the property of the *Owner.* The *Contractor* shall remove all surplus or rejected materials as its property when notified in writing to do so by the *Consultant*."

SC58 GC 13.2 CONSTRUCTION LIENS

SC58.1	13.2	Add new GC 13.2 – CONSTRUCTION LIENS as follows: **"GC 13.2 LIENS** 13.2.1 Notwithstanding any other provision in the *Contract*, the *Consultant* shall not be obligated to issue a certificate, and the *Owner* shall not be obligated to make payment, subject to the *Owner*'s requirement to issue a *Notice of Non-Payment* (Form 1.1) to the *Contractor*, if at the time such certificate or payment was otherwise due: .1 a claim for lien has been registered against the *Project* lands by a *Subcontractor* or a *Supplier* that has not been vacated or discharged by the *Contractor* in accordance with the requirements of this *Contract*, or .2 if the *Owner* or a mortgagee of the *Project* lands has received a written notice of a lien that has not been resolved by the *Contractor* through the posting of security or otherwise. 13.2.2 In the event a construction lien arising from the performance of the *Work* is registered or preserved against the *Project* lands by a *Subcontractor* or a *Supplier*, or a written notice of a lien is given or a construction lien action is commenced

against the *Owner* by a *Subcontractor* or a *Supplier*, then the *Contractor* shall, at its own expense:

.1 within 10 calendar days of registration of the construction lien, vacate or discharge the lien from title to the premises (i.e. the *Place of the Work*). If the lien is merely vacated, the *Contractor* shall, if requested, undertake the *Owner*'s defence of any subsequent action commenced in respect of the lien, at the *Contractor*'s sole expense;

.2 within 10 calendar days of receiving notice of a written notice of a lien, post security with the Ontario Superior Court of Justice so that the written notice of a lien no longer binds the parties upon whom it was served; and

.3 satisfy all judgments and pay all costs arising from such construction liens and actions and fully indemnify the *Owner* against all costs and expenses arising from same, including legal costs on a full indemnity basis.

13.2.3 In the event that the *Contractor* fails or refuses to comply with its obligations pursuant to paragraph 13.2.2, the *Owner* shall, at its option, be entitled to take all steps necessary to address any such construction liens including, without limitation and in addition to the *Owner's* rights under paragraph 13.2.4, the posting of security with the Ontario Superior Court of Justice to vacate the claim for lien from title to the *Project* lands, and in so doing will be entitled to a full indemnity from the *Contractor* for all legal fees, security, disbursements and other costs incurred and will be entitled to deduct same from amounts otherwise owing to the *Contractor*.

13.2.4 In the event that any *Subcontractor* or *Supplier* registers any claim for lien with respect to all or part of the *Place of Work*, the *Owner* shall have the right to withhold, in addition to the statutory holdback, the full amount of said claim for lien plus either: (a) $250,000 if the claim for lien is in excess of $1,000,000 or (b) 25% of the value of the claim for lien and to bring a motion to vacate the registration of said claim for lien and any associated certificate of action in respect of that lien, in accordance with Section 44 of the *Act*, by paying into court as security the amount withheld.

		13.2.5 Nothing in this GC 13.2 serves to preclude the *Contractor* from preserving and perfecting its lien in the event of non-payment by the *Owner*."

APPENDIX 1
to the Supplementary Conditions

Project-specific requirements for a "*Proper Invoice*"

To satisfy the requirements for a *Proper Invoice*, the following criteria, as may be applicable in each case, must be included with the *Contractor's* application for payment:

.1 the written bill or request for payment must be in writing;

.2 the *Contractor*'s name and current address;

.3 the *Contractor*'s HST registration number;

.4 the date the application for payment was prepared by the *Contractor*;

.5 the period of time in which the services or materials were supplied to the *Owner*;

.6 the purchase order number provided by the *Owner*;

.7 reference to the provisions of the *Contract* under which payment is being sought (e.g. GC 5.3 – PROGRESS PAYMENTS for progress payments, GC 5.4 – SUBSTANTIAL PERFORMANCE OF THE WORK, GC 5.7 – FINAL PAYMENT for final payment, etc.);

.8 a description, including quantities where appropriate, of the services or materials, or a portion thereof, that were supplied and form the basis of the *Contractor's* request for payment;

.9 the amount the *Contractor* is requesting to be paid by the *Owner*, set out in a statement based on the schedule of values approved under GC 5.2.5, separating out any statutory or other holdbacks, set-offs and HST;

.10 a sworn Statutory Declaration in the form CCDC 9A-2018, only for second and subsequent progress payments;

.11 a current Workplace Safety Insurance Board clearance certificate;

.12 a pre-approved schedule of values, supplied by the *Contractor*, for Divisions 1 through 14 of the *Specifications* (or equivalent Construction Specifications Institute Masterformat) of the *Work*, aggregating the total amount of the *Contract Price*, including all supporting invoicing;

.13 a separate pre-approved schedule of values, supplied by each *Subcontractor*, for each of Division 15, 16, and 17 of the *Specifications* (or equivalent Construction

Specifications Institute Masterformat) of the *Work*, aggregating the total amount of the *Contract Price*, including all supporting invoicing;

.14 invoices and other supporting documentation for all claims against the cash allowance;

.15 a current, acceptable, and up to date *Construction Schedule Update*;

.16 if requested by the *Owner*, a current and valid certificate(s) of insurance as required under GC 11.1 – INSURANCE;

.17 the name, title, telephone number and mailing address of the person at the place of business of the *Contractor* to whom payment is to be directed;

.18 a current, up to date, and approved *Shop Drawing* log;

.19 in the case of the *Contractor's* application for final payment, in addition to the foregoing requirements (as applicable):

(a) any documents or materials not yet delivered pursuant to paragraph 5.4.5, together with complete and final as-built drawings;

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

(c) the *Contractor's* written certification that there are no outstanding claims, pending claims or future claims from the *Contractor* or their *Subcontractors* or *Suppliers*; and

(d) sufficient evidence of the *Contractor's* compliance with GC 3.13.3.

END OF AMENDMENTS TO CCDC 2 - 2008

SECTION 01 14 00 – WORK RESTRICTIONS

1.0 GENERAL

1.1. SECTION INCLUDES

.1 Connecting to existing services

.2 Special scheduling requirements

1.2. RELATED SECTIONS

.1 Section 01 53 00 - Temporary Construction.

.2 Section 01 33 00 - Submittal Procedures.

.3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3. EXISTING SERVICES

.1 Notify Owner and Consultant and utility companies of intended interruption of services and obtain required permission.

.2 Where Work involves breaking into or connecting to existing services, give Consultant and Owner, forty-eight (48) hours of notice for necessary interruption of mechanical or electrical service throughout course of work.

.1 Keep duration of interruptions minimum.

.2 Perform interruptions after normal working hours of occupants, preferably on weekends.

.3 Provide for vehicular, pedestrian and personnel traffic.

.4 Construct barriers in accordance with Section 01 53 00.

1.4. AFTER HOURS WORK

.1 Schedule Work with school staff through the Board's contact so as to limit disruption to school operations. Include for any overtime, to ensure orderly and continuous progression of Work and operation of school.

.2 Direct calls from Contractors to Board staff to adjust alarms and to arrange for access will not be accepted. All correspondence must be through the Project Manager.

.3 Arrange 48 hours in advance with Board to obtain an access card and adjust security alarms for after hours Work.

.4 Bidders are cautioned that the Board will be compensated by the Contractor for false alarms. Any costs associated with each false alarm will be levied against the Contractor for false fire alarm activation or security alarm activation. These costs may include, but are not limited to:

.1 Fines or penalties imposed by the local Fire Services,
.2 Fines or penalties imposed by the local Police Services,
.3 Overtime costs borne by the Board.

.5 Contractors are responsible for ensuring doors and windows are secured prior to leaving school.

.6 Unless specifically stated otherwise school activities take precedence over Contractor's activities.

1.5. SPECIAL REQUIREMENTS

.1 Schedule and perform work in occupied areas to Board Representative's approval.

.2 Schedule and perform noise generating work to Board Representative's approval.

.3 Submit schedule of special requirements or disruptions in accordance with Section 01 33 00.

.4 All Contractor personnel are restricted to the job site and necessary access routes. No personnel shall visit other areas or buildings without specific authorization.

END OF SECTION

SECTION 01 19 00 – SPECIFICATIONS AND DOCUMENTS

1.0 GENERAL

1.1. RELATED DOCUMENTS

.1 This section describes requirements applicable to all sections within Divisions 02 to 49.

1.2. WORDS AND TERMS

.1 Conform to definitions and their defined meanings in the Agreement and Definitions portion of CCDC 2 for Supplementary Words and Terms listed in Section 00 56 13.

1.3. COMPLEMENTARY DOCUMENTS

.1 Generally, drawings indicate graphically, the dimensions and location of components and equipment. Specifications indicate specific components, assemblies, and identify quality.

.2 Drawings, specifications, diagrams and schedules are complementary, each to the other, and what is required by one, to be binding as if required by all.

.3 Should any conflict or discrepancy appear between documents, which leaves doubt as to the intent or meaning, apply the Precedence of Documents article below or obtain guidance or direction from Consultant.

.4 Examine all discipline drawings, specifications, schedules, diagrams and related Work to ensure that Work can be satisfactorily executed.

.5 All specification sections of the Project Manual and Drawings are affected by requirements of Division 01 sections.

1.4. PRECEDENCE OF DOCUMENTS

.1 In the event of conflict within and between the Contract Documents, the order of priority within specifications and drawings for this project are - from highest to lowest:

- .1 the Agreement and Definitions between the Owner and the Construction
- .2 the Defined Terms, Definitions;
- .3 Supplementary Conditions;
- .4 the General Conditions;
- .5 Sections of Division 01 of the specifications;
- .6 Technical specifications Sections of Divisions 02 through 49 of the specifications.

.7 Schedules and Keynotes:
  .1 Material and finishing schedules within the specifications, then;
  .2 Material and finishing schedules on drawings, then;
  .3 Keynotes and definitions thereto, then;
.8 Drawings:
  .1 Drawings of larger scale shall govern over those of smaller scale of the same date, then;
  .2 Dimensions shown on drawings shall govern over dimensions scaled from drawings, then;
  .3 Location of utility outlets indicated on architectural detail drawings takes precedence over positions or mounting heights located on mechanical or electrical Drawings.
.9 Later dated documents shall govern over earlier documents of the same type.

1.5. SPECIFICATION GRAMMAR

.1 Specifications are written in the imperative command mode, in an abbreviated form.
.2 Imperative language of the technical sections is always directed to the Contractor identified as a primary constructor, as sole executor of the Contract, unless specifically noted otherwise.
  .1 This form of imperative command mode statement requires the primary constructor to perform such action or Work.
  .2 Perform all requirements of the Contract Documents whether stated imperatively or otherwise.
.3 Division of the Work among subcontractors, suppliers, or others is solely the prime constructor's responsibility. The Consultant(s) and specification authors assume no responsibility to function or act as an arbiter to establish subcontract scope or limits between sections or divisions of Work.

END OF SECTION

SECTION 01 21 00 – ALLOWANCES

1.0 GENERAL

1.1. RELATED SECTIONS

.1 Section 01 45 00 – Quality Control.

.2 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.2. GENERAL

.1 Allowances included herein are for items of Work which could not be fully quantified prior to Bidding.

.2 Expend each allowance as directed by the Consultant. Work covered by allowances shall be performed for such amounts and by such persons as directed by Consultant.

.3 Funds will be expended by means of Cash Allowance allocations and contingency allowance allocations.

.4 Progress payments for Work and Products authorized under allowances will be made in accordance with the payment terms set out in the Conditions of the Contract.

.5 The Contractor shall bid the work involved and submit the Bids received to the Consultant and the Board, for approval

.6 The Contractor shall submit 3 bids unless directed by the Board.

1.3. CASH ALLOWANCES

.1 Cash allowances, cover the net cost to the Contractor of services, products, construction machinery and equipment, freight, handling, unloading, storage, installation where indicated, and other authorized expenses incurred in performing the Work. Cash allowances shall not be included by a subcontractor in the amount for their subcontract work.

.2 Supply only allowances shall include:

- .1 Net cost of Products.
- .2 Delivery to Site.
- .3 Applicable taxes and duties, excluding HST.

.3 Supply and install allowances shall include:

- .1 Net cost of Products.
- .2 Delivery to Site.
- .3 Unloading, storing, handling or products on site.
- .4 Installation, finishing and commissioning of products.

.5 Applicable taxes and duties, excluding HST.

.4 Inspection and testing allowances shall include:
  .1 Net cost of inspection and testing services.
  .2 Applicable taxes and duties, excluding HST.

.5 Other costs related to work covered by cash allowances are not covered by the allowance, but shall be included in the Contract Price.

.6 Where costs under a cash allowance exceed the amount of the allowance, the Contractor will be compensated for any excess incurred and substantiated plus an allowance for overhead and profit as set out in the Contract Documents.

.7 Progress payments on accounts of work authorized under cash allowances shall be included in the monthly certificate for payment.

.8 Submit, before application for final payment, copies of all invoices and statements from suppliers and subcontractors for work which has been paid from cash allowances.

1.4. ALLOWANCES SCHEDULE

Include in the Bid Price a cash allowance of to address the cost of the following items: (Consultant to modify/edit list as required)

.1 WRDSB Signage for Metal Screen/ Interior Signage & on Glazing
$ 10,000

.2 IT/HDMI/PA Cabling & Terminations
$ 15,000

.3 White Boards throughout Classrooms
$ 5,000

.4 Door Hardware
$ 16,500
(Supply only of mechanical hardware and supply and installation of automatic operators and push buttons)

.5 Supply of TV’s and mounting brackets
$ 18,000
(Supply only)

.6 Furniture and appliances
$ 30,000

.7 Temporary Office in Lobby
$ 15,000
(Doors and Windows supplied by WRDSB)

Total of All Allowances:
$ 109,500

END OF SECTION

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PART 1 - GENERAL

1.1 Approved Alternates and Approved Equals

.1 Named Product alternates or equals, indicated by the phrases “or approved alternate by XYZ Manufacturing” or “or approved equal by XYZ Manufacturing”, shall be interpreted to mean that named Product alternate or equal, if selected for use in lieu of indicated or specified Product, meets or exceeds performance, appearance, general arrangement, dimensions, availability, code and standards compliance, and colour of specified Product. Be responsible for costs and modifications associated with the inclusion of named Product alternate or equal at no additional cost to the Owner.

.2 The process for proposing and approving alternates or equals shall be the same process as for proposing and approving substitutions (refer to paragraph 1.2 below)

.3 Confirm delivery of specified items prior to proposing alternates or equals.

1.2 Substitutions

.1 Submission of substitutes

.1 Proposal for substitutions of Products and materials must be submitted in accordance with procedures specified in this section.

.2 Consultant may review submissions, if directed by Owner, but in any case with the understanding that the Contract Time will not be altered due to the time required by the Consultant to review the submission and by the Contractor to implement the substitution in the Work.

.3 Consultant’s services to review substitutions will be performed on an additional services basis to their contract with the Owner. Costs of these services will be discounted from any reductions in the Contract Price that might be forthcoming form the substitution. Therefore, to be acceptable, a substitution must present a reduction in the construction cost at least equal to the cost to the Owner of the Consultant’s additional services to review the substitution. Contractor shall cover directly costs and administration associated with courier services, reproduction costs, and other direct costs associated with these substitution reviews.

.2 Submission requirements

.1 Description of proposed substitution, including detailed comparative specification of proposed substitution with the specified Product.

.2 Manufacturer’s Product data sheets for proposed Products.

.3 Respective costs of items originally specified and the proposed substitution.

.4 Confirmation of proposed substitution delivery, in writing by Product manufacturer.

.5 Compliance with the building codes and requirements of authorities having jurisdiction.

.6 Affect concerning compatibility and interface with adjacent building materials and components.

.7 Compliance with the intent of the Contract Documents

.8 Effect on Contract Time

.9 Reasons for the request

.3 Substitutions submitted on shop drawings without following requirements of this section prior to submission of the affected shop drawings will cause the shop drawings to be rejected.

.4 Proposed substitutions shall include costs associated with modifications necessary to other adjacent and connecting portions of the Work.

.5 Consultant’s decision concerning acceptance or rejection of proposed substitutions is final. Should it appear to the Consultant that the value of services required to evaluate the substitution exceeds

the potential reduction, the Consultant will advise the Owner that the substitution does not merit consideration before proceeding with a full evaluation. If the substitution will produce a reduction commensurate with or exceeding the value of Consultant's services to evaluate the substitution, the Consultant will request the Owner's direction to proceed with evaluation.

END OF SECTION

SECTION 01 31 00 – PROJECT MANAGING AND COORDINATION

1.0 GENERAL

1.1. RELATED SECTIONS

.1 Section 01 32 00 - Construction Progress Documentation.
.2 Section 01 33 00 - Submittal Procedures.
.3 Section 01 53 00 – Temporary Construction Facilities
.4 Section 01 61 00 – Product Requirements
.5 Section 01 78 10 – Closeout Submittals and Requirements
.6 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.2. PROJECT COORDINATION

.1 Perform coordination of progress schedules, submittals, use of site, temporary utilities, construction facilities and construction Work, with progress of Work of other contractors, under instructions of the Consultant.
.2 The Contractor shall have total control of the Work and shall effectively direct and supervise the Work so as to ensure conformity with the Contract Documents and within the Contract Time.
.3 The Contractor shall be solely responsible for the construction means, methods, sequences, and procedures and for coordinating parts of the Work under the contract.
.4 Co-ordinate progress of the Work, progress schedules, submittals, use of site, temporary utilities, construction facilities, safety regulations and fire protection, as per authorities having jurisdiction codes.
.5 The Consultant has the authority to stop the Work:
    .1 whenever they observe or are made aware of unsafe conditions.
    .2 whenever it is deemed necessary to protect the interests of the Board,
    .3 whenever materials or workmanship are in contravention to the Contract Documents

1.3. SITE SUPERVISOR AND PROJECT MANAGER

.1 If requested, the Contractor shall provide the Consultant, in writing, the name of the Project Manager and Site Supervisor, and proof of competent experience in similar projects.
.2 Performance of the Contractors Project Manager and Site Supervisor
    .1 If the Board and or the Consultant become concerned with any of: Site Safety, Project Schedule, or general compliance with the tender

documents due to the performance of the Site Supervisor or Project Manager, the Consultant and or the Board will identify the concerns in writing to the Contractor.

.2 The Contractor shall respond in writing to the Board and Consultant with a corrective action for each item within 24 hours.

.3 If it is found that any of the corrections are not immediately implemented, the Consultant and the Board shall meet with the General Contractor to review the credentials including curriculum vitae and comparable experience of a replacement Site Supervisor and or Project Manager proposed by that Contractor.

.4 All outstanding concerns initiating the replacement of the personnel will be immediately addressed to the satisfaction of the Consultant and the Board.

.3 If the Board and or the Consultant become concerned with site safety, project schedule or general compliance with the tender documents due to the performance of the Site Supervisor or the Project Manager, the Consultant or the Board will issue the concerns in writing to the Contractor. The Contractor shall respond in writing within 24 hours to the Consultant and the Board. If any of the corrections are not immediately implemented, the Consultant or the Board will schedule a meeting with the Consultant, General Contractor and the Board. At this meeting the Contractor will introduce the new Project Manager, and or Site Supervisor and present the Curriculum Vitae for each showing proof of comparable experience in similar projects. The Contractor will then address the outstanding concerns to the satisfaction of the Consultant and the Board.

.4 The Project Manager, and/or Site Supervisor shall not be replaced by the Contractor without prior written approval from the Board and the Consultant.

1.4. PERMITS

.1 **The Board will obtain & pay for all building permits, but the Contractor is responsible for all other permits, including electrical inspection and fire alarm verification.**

1.5. CONSTRUCTION DOCUMENTS

.1 The Consultant will provide the Contractor with PDF copies of both the drawings and the specification and CAD format files of the drawings at no charge to the Contractor. All printing will be at the cost of the Contractor including the AS-BUILT documents.

1.6. PRECONSTRUCTION MEETING

.1 Immediately prior to construction and upon notification by the Consultant of a time and date, the Contractor shall attend the preconstruction meeting at a location as determined by the Consultant, along with authoritative representatives of certain key subcontractors as specifically indicated in the conference notice. Agenda to include following:

.1 Appointment of official representative of participants in Work.
.2 Project communications procedures
.3 Schedule of Work, progress scheduling (including long lead items, cash allowance items) as specified in Section 01 32 00.
.4 Schedule of submission of shop drawings, samples, colour chips as specified in Section 01 33 00.
.5 Requirements for temporary facilities, washrooms, refuse bin, site sign, offices, storage sheds, utilities, fences as specified in Section 01 53 00.
.6 Delivery schedule of specified equipment as specified in Section 01 61 00.
.7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, and administrative requirements.
.8 Owner furnished products.
.9 Record drawings as specified in Section 01 78 10.
.10 Maintenance material and data as specified in Section 01 78 10.
.11 Take-over procedures, acceptance, and warranties as specified in Section 01 78 10.
.12 Monthly progress claims, administrative procedures, photographs, and holdbacks.
.13 Appointment of inspection and testing agencies
.14 Insurances and transcript of policies.
.15 Review Vendor Performance Evaluation for the Contractor and Subcontractors
.16 Hot Work Permit Process
.17 Security Access, Fire Alarm shut down procedures
.18 Any other items as required by owner, contractor or Consultant.

1.7. ON-SITE DOCUMENTS

.1 Maintain at job site at all times, one copy (written or digital) each of the following:

.1 Complete set of Contract drawings.

.2 Specifications.
.3 All Addenda.
.4 Site Instructions and Sketches
.5 Reviewed shop drawings and samples.
.6 Change Orders and Contemplated Change Orders.
.7 Other modifications to Contract.
.8 Site Instructions
.9 Colour schedule
.10 Hardware List
.11 Field test reports.
.12 Copy of approved Work schedule.
.13 Manufacturers' installation and application instructions.
.14 Progress reports and meeting minutes.
.15 Approved building permit documents.
.16 Copy of current Ontario Building Code and National Building Code.
.17 CSA Standard, CGSB Specifications. ASTM Documents and other standards referenced to in the specifications.
.18 Labour conditions and wage schedules.
.19 Applicable current editions of municipal regulations and by-laws. Current building codes, complete with addenda bulletins applicable to the Place of the Work.

1.8. SCHEDULES

.1 Within three weeks following the award of the Contract, submit a detailed, trade by trade progress schedule for the work in a bar chart form acceptable to the Consultant.
.2 Submit preliminary construction progress schedule as specified in Section 01 32 00 to Consultant coordinated with Consultant's project schedule.
.3 After review, revise and resubmit schedule to comply with revised project schedule.
.4 During progress of Work revise and resubmit as directed by Consultant.
.5 Provide schedule updates every month with request for Payment, for duration of Contract.

1.9. CONSTRUCTION PROGRESS MEETINGS

.1 Prior to the commencement of the Work, the Contractor together with the Consultant shall mutually agree to a sequence for holding regular "on site meetings".

.2 The Contractor will organize site meetings. Ensure persons, whose presence is required, are present and relative information is available to allow meetings to be conducted efficiently.
.3 Contractor, major subcontractors and consultants involved in Work are to be in attendance.
.4 Post and forward copies of progress schedules for advice of Subcontractors, Owner and Consultant.
.5 Notify parties minimum five (5) days prior to meetings.
.6 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within two (2) days after meeting.
.7 Agenda to include 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 Revision to construction schedule.
  .8 Progress schedule, during succeeding work period.
  .9 Review submittal schedules: expedite as required.
  .10 Maintenance of quality standards.
  .11 Review proposed changes for effect on construction schedule and on completion date.
  .12 Review site security issues.
  .13 Other business.
.8 Schedule additional meetings, to expedite progress, should work require it.
.9 Keep Owner and Consultant informed of progress, of delays and potential delays during all stages of Work. Do everything possible to meet progress schedule
.10 Schedule and administer pre-installation meetings when specified in sections and when required to coordinate related or affected Work.

1.10. SUBMITTALS

.1 Prepare and issue submittals to Consultant for review.
.2 Submit preliminary Shop Drawings, product data and samples for review for compliance with Contract Documents; for field dimensions and clearances, for relation to available space, and for relation to Work of other contracts. After review, revise and resubmit for transmittal to Consultant.
.3 Submit requests for payment for review, and for transmittal to Consultant.

.4 Submit requests for interpretation of Contract Documents, and obtain instructions through Consultant.
.5 Process substitutions through Consultant.
.6 Process change orders through Consultant.
.7 Deliver closeout submittals for review and preliminary inspections, for transmittal to Consultant.

1.11. RECORD (AS-BUILT) DOCUMENTS AND SAMPLES

.1 Procedures for record as-built documents and samples as specified in Section 01 78 10.
.2 Keep as-built documents and samples available for inspection by Consultant.

1.12. CLOSEOUT PROCEDURES

.1 Take-over procedures, acceptance, and warranties as specified Section 01 78 10
.2 Notify Consultant and Board when Work is considered ready for Substantial Performance.
.3 Accompany Consultant and Board on preliminary inspection to determine items listed for completion or correction.
.4 Comply with Consultant's instructions for correction of items of Work listed in executed certificate of Substantial Performance.
.5 Notify Consultant of instructions for completion of items of Work determined in Consultant's final inspection.

END OF SECTION

SECTION 01 32 00 – CONSTRUCTION PROGRESS DOCUMENTATION

1.0 GENERAL

1.1. RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.2. SCHEDULES

.1 Within seven 7 days following the award of the Contract, submit a detailed cash flow chart broken down on a monthly basis, in a manner acceptable to the Consultant. Cash flow chart shall indicate anticipated Contractor's monthly progress billings from commencement of work until completion.

.2 Update cash flow chart whenever changes occur to scheduling and in manner and at times satisfactory to Consultant.

.3 Submit schedule of values at least fourteen (14) days before the first application

.4 Submit schedules as follows:

.1 Submittal Schedule for Shop Drawings and Product Data.

.2 Submittal Schedule for Samples.

.3 Submittal Schedule for timeliness of Owner-furnished Products.

.4 Product Delivery Schedule.

.5 Cash Allowance Schedule for acquiring Products and Installation.

.6 Shutdown or closure activity.

1.3. CONSTRUCTION PROGRESS SCHEDULING

.1 Submit initial schedule to the Consultant and the Board in duplicate within seven (7) days after following the award.

.2 Schedule Format.

.1 Prepare schedule in form of a horizontal bar chart.

.2 Split horizontally for projected and actual performance.

.3 Provide horizontal time scale identifying each Working Day of each week.

.3 Schedule Submission.

.1 Consultant will review schedule and return reviewed copies within five (5) days after receipt.

.2 Submit schedules in electronic format, forward to the Consultant and Owner as a pdf. file.

.3 Resubmit finalized schedule within five (5) days after return of review copy.
.4 Submit revised progress schedule with each application for payment.
.5 Distribute copies of revised schedule to:
.1 Job site office.
.2 Subcontractors.
.3 Other concerned parties.
.6 Instruct Consultant to report to Contractor within ten (10) days, any problems anticipated by timetable shown in schedule.

.4 Submit revised schedules with Application for Payment, identifying changes since previous version.
.5 Select either of the following paragraphs to identify the type and format of schedule required.
.6 Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate the early and late start, early and late finish, float dates, and duration.
.7 Indicate estimated percentage of completion for each item of Work at each submission.
.8 Indicate submittal dates required for shop drawings, product data, samples, and product delivery dates, including those furnished by Owner and required by Allowances.
.9 Include dates for commencement and completion of each major element of construction:
.1 Site clearing.
.2 Site utilities.
.3 Foundation Work.
.4 Structural framing.
.5 Subcontractor Work.
.6 Equipment Installations.
.7 Finishes.
.10 Indicate projected percentage of completion of each item as of first day of month.
.11 Indicate progress of each activity to date of submission schedule.
.12 Indicate changes occurring since previous submission of schedule:
.1 Major changes in scope.
.2 Activities modified since previous submission.
.3 Revised projections of progress and completion.
.4 Other identifiable changes.
.13 Provide a written report to define:

.1 Problem areas, anticipated delays, and impact on schedule.
.2 Corrective action recommended and its effect.
.3 Effect of changes on schedules of other subcontractors.

1.4. PROGRESS PHOTOGRAPHS

.1 Digital Photography:
  .1 Submit electronic copy of progress photographs of project, Digital format, minimum 300 in megapixel resolution.
  .2 Identification: Name and number of project and date of exposure indicated.
  .3 Provide both interior and exterior photographs.
  .4 Number of Viewpoints: Locations of viewpoints determined by Consultant.
  .5 Frequency: Monthly with progress statement. Provide the required number of pictures to accurately reflect the submitted progress percentage.

1.5. SHOP DRAWING SUBMITTAL SCHEDULE

.1 Include schedule for submitting shop drawings, product data, samples
.2 Indicate dates for submitting, review time, resubmission time, and last date for meeting fabrication schedule.
.3 Include dates when shop drawings and samples will be required for Owner-furnished products.
.4 Include dates when reviewed submittals will be required from Consultant.
.5 Provide final signed off copies of the shop drawings in digital format to the Board.

END OF SECTION

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SECTION 01 33 00 – SUBMITTAL PROCEDURES

2.0 GENERAL

2.1. RELATED SECTIONS

.1 Section 01 32 00 - Construction Progress Documentation.

.2 Section 01 78 10 - Closeout Submittals.

.3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

2.2. ADMINISTRATIVE

.1 Submit to Consultant submittals listed for review. Submit with reasonable promptness and in orderly sequence so as to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.

.2 Work affected by submittal shall not proceed until review is complete.

.3 Present Shop Drawings, product data, samples and mock-ups in Metric (SI) units. Shop drawings containing imperial measurements will be rejected.

.4 Where items or information is not manufactured or produced in SI Metric units, converted values within the metric measurement to the next largest imperial size available. Tolerances of .0625 acceptable.

.5 Review submittals prior to submission to Consultant. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents.

.6 Submittals not stamped, signed, dated, identified as to specific project, and attesting to their being reviewed will be returned without being examined and shall be considered rejected.

.7 Shop drawings which require the approval of a legally constituted authority having jurisdiction shall be submitted by Contractor to such authority for approval. Such shop drawings shall receive final approval of authority having jurisdiction before Consultant's final review.

.8 No work, requiring a shop drawing submission, shall be commenced until the submission has received Consultant's final review. Only shop drawings bearing Consultant's review stamp are to be sent and used on the job site.

.9 Notify Consultant, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

.10 Shop drawings shall not contain substituted materials unless such substitutions have been requested in advance and approved by Consultant.
.11 Verify field measurements and affected adjacent Work are coordinated.
.12 Contractor's responsibility for errors and omissions in submission is not relieved by Consultant's review of submittals.
.13 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Consultant review.
.14 Keep one (1) reviewed copy of each submission on site.

2.3. SHOP DRAWINGS AND PRODUCT DATA

.1 The term "Shop Drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
.2 The term "design team" means Consultant and Sub-consultants whether Sub-consultants are employees of Consultant or not, and includes structural, mechanical, electrical, etc.
.3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
.4 Allow fourteen (14) days for Consultant's review of each submission.
.5 Adjustments made on Shop Drawings by Consultant are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Consultant prior to proceeding with Work.
.6 Make changes in Shop Drawings as Consultant may require, consistent with Contract Documents. When resubmitting, notify Consultant in writing of any revisions other than those requested.
.7 Accompany submissions with transmittal letter, containing:
    .1 Date.
    .2 Project title and number.
    .3 Contractor's name and address.
    .4 Identification and quantity of each shop drawing, product data and sample.
    .5 Other pertinent data.
.8 Submissions shall include:
    .1 Date and revision dates.

.2 Project title and number.
.3 Name and address of:
.1 Subcontractor.
.2 Supplier.
.3 Manufacturer.
.4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
.5 Details of appropriate portions of Work as applicable:
.1 Fabrication.
.2 Layout, showing dimensions, including identified field dimensions, and clearances.
.3 Setting or erection details.
.4 Capacities.
.5 Performance characteristics.
.6 Standards.
.7 Operating weight.
.8 Wiring diagrams.
.9 Single line and schematic diagrams.
.10 Relationship to other parts of the Work.
.9 After Consultant's review, distribute copies.
.10 Submit Shop Drawings in Pdf. format for each requirement requested in specification Sections and as consultant may reasonably request.
.11 Submit product data sheets or brochures in Pdf. format for requirements requested in specification sections and as requested by Consultant where Shop Drawings will not be prepared due to standardized manufacture of product.
.12 Delete information not applicable to project.
.13 Supplement standard information to provide details applicable to project.
.14 If upon review by Consultant, no errors or omissions are discovered or if only minor corrections are made, the drawings will be stamped as reviewed or reviewed as modified and will be returned. At this point fabrication and installation of Work may proceed. If Shop Drawings are rejected, noted copy will be returned and re-submission of corrected Shop Drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
.15 Signed drawings shall be returned to and retained by Contractor who is then responsible for distribution of copies of corrected shop drawing to

appropriate Subcontractors for appropriate action and to municipal building department for their records of those subjects required by authorities.

.16 The Consultant's review is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean the Consultant approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and this review shall not relieve the Contractor of his responsibility for meeting the requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site for information that pertains solely to fabrication processes or to techniques of construction and installation and for coordination of the work of all subtrades.

2.4. SAMPLES

.1 Submit for review to the Consultant three (3) samples as requested in respective specification Sections.

.2 Submit samples with identifying labels bearing material or component description, manufacturer's name and brand name, Contractor's name, project name, location in which material or component is to be used, and date.

.3 Deliver samples prepay any shipping charges involved for delivering samples to destination point and returning to point of origin if required.

.4 Provide samples of special products, assemblies, or components when so specified.

.5 No work requiring a sample submission shall commence until submission has received Consultant's final review.

.6 Notify Consultant in writing, at time of submission of deviations in samples from requirements of Contract Documents.

.7 Where colour, pattern or texture is criterion, submit full range of samples.

.8 Adjustments made on samples by Consultant are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Consultant prior to proceeding with Work.

.9 Make changes in samples which Consultant may require, consistent with Contract Documents.

.10 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

2.5. MOCK-UP

.1 Erect mock-ups to Section 01 45 00.

2.6. CERTIFICATES AND TRANSCRIPTS

.1 Immediately after award of Contract, and prior to commencing the work submit the performance bond and the labour and materials payment bond as described in the bid documents.

.2 Submit transcription of certified true copies of insurance immediately after award of Contract.

.3 A current WSIB clearance certificate

.4 The bidder's health and safety policy for the project.

.5 A copy of the notice of project issued by the ministry of labour for the project

.6 Building materials, components and elements specified without the use of trade or proprietary names shall meet requirements specified. If requested by Consultant, submit evidence of meeting requirements specified. Evidence shall consist of certification based on tests carried out by an independent testing agency. Certification based on previous tests for same materials, components or elements is acceptable. Certification shall be in form of written test reports prepared by testing agency.

END OF SECTION

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SECTION 01 35 17 – FIRE SAFETY PROCEDURES

1.0 GENERAL

1.1. RELATED SECTIONS

.1 Section 01 14 00 – Work Restrictions.
.2 Section 01 31 00 - Project Managing and Coordination.
.3 Section 01 33 00 - Submittal Procedures.
.4 Section 01 35 23 – Health and Safety
.5 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.2. FIRE SAFETY PLAN

.1 Contractors and their personnel will be familiar with this section and its requirements.
.2 The contractor must take all necessary precautions during the carrying out of the work to prevent the possibility of fire occurring.

1.3. FIRE PROTECTION

.1 Provide and maintain temporary fire protection equipment during performance of Work required by the governing codes, regulations and bylaws.
.2 The contractor will, at all times, when welding, brazing and performing any operation with an open flame, combustible adhesives or flammable solvents keep a portable, operable fire extinguisher within 3 meters of the operation.

1.4. HOT WORK

.1 Take all precautions to Work safely and to provide the necessary protection to persons and property from Hot Work. This includes, but is not limited to Brazing, Cutting, Grinding, Soldering, Thawing Pipe, Torch Applied Roofing and Welding. With all such activity these steps are to be followed:
  .1 Whenever possible, complete Hot Work in a welding shop or out of doors at the school.
  .2 Flammable liquids, dust lint and oily deposits to be removed from within 50-ft (15m) of Work. Remove other combustibles where possible. Otherwise protect with fire-resistive tarpaulins or metal shields.
  .3 Explosive atmosphere in area eliminated. Floors swept clean. Combustible floors wet down, covered with damp sand or fire-resistive tarpaulins.

.4 All wall and floor openings covered. Fire-resistive tarpaulins suspended beneath Work.

.5 For on-site Work (indoor and out of doors), advise the Head Custodian, Principal, Consultant (if assigned) and Project Coordinator prior to Work being performed, and of related dangers.

.6 Where the Fire Alarm system is required to be set to stand-by to discourage false alarms from smoke detectors provide a firewatch throughout the building or structure being worked on. NEVER put the fire alarm system in stand-by mode when the building is occupied by staff or students.

.7 In the event of a fire as a result of the Hot Work, notify the fire department immediately. Report incident to the head custodian, the Consultant, if assigned, and Project Coordinator immediately, whether extinguished or not. Provide a fire incident report to the Board.

.8 Barriers must be set up to protect staff and students (i.e. pylons, shields, and caution tape) from exposure to arc flash and smoke migration.

.9 Have all necessary doors, windows and/or drapes closed. Confer with the Head Custodian to shut down all fan systems in the area to reduce or eliminate smoke distribution.

.10 Provide and keep fire extinguishers handy and in good Working condition. Temporarily cover all smoke detectors in area during time of Work.

.11 Provide a fire watch/spot check for several hours after Work is completed. Uncover smoke detectors.

.12 On new construction, the requirements of the Hot Wok permit may be waived, until such time as either Substantial Completion or Occupancy is granted, whichever comes first.

.13 On additions to existing buildings, the requirements for Hot Work permits shall remain in place.

1.5. HOT WORK PERMIT

.1 **A sample Hot Work Permit is attached to the specifications – refer to Appendix 013517-A**

.2 Each permit is valid for seven (7) days only and must be renewed prior to its expiration date

.3 The contractor must obtain Hot Work Permits from the School Board’s representative prior to the start of work.

.4 The contractor must complete the form as required and must keep the form on site.
.5 Return each completed form to the School Board's representative on date of expiration.
.6 The most current version of the Permit and it's requirements shall be used for the purposes of the Work.

1.6. FIRE PROTECTION SYSTEMS

.1 Any Modifications to Fire Alarm system and it's devices including service, additions and changes in device location must be performed only by a Certified Fire Alarm Technician as per the Ontario Fire Code section 1.1, subsection 1.1.5.
.2 The Contractor will receive from the Board's contact a contact number for the monitoring service and a school system number.
.3 Bidders are cautioned that the Board will be reimbursed for the cost of false alarms. Refer to Section 01 14 00 Work Restrictions, Para. 1.4.4.
.4 An approved inspection firm shall verify all new fire alarm devices, in accordance to CSA regulations. Certificate of Verification is required before occupancy.

1.7. FIRE ALARM SHUT-DOWN PROCEDURE

.1 Do not shut the system down unless necessary. Plan the operation required to reduce system down time to the least amount possible.
.2 Wherever possible, shut down only the zone needing Work and schedule this down time in unoccupied school hours. Allow for this in your bid pricing.
.3 Discuss the possible down time with the head custodian and principal prior to any partial or whole system shut down.
.4 The school or building administration shall advise all staff of fire alarm system shut down. This will include instructions to call 911 if they see a fire and when system is back on line.
.5 Prior to alarm system shutdown and upon restoring the fire alarm system individuals supervising the shut down must contact Direct Detect at 519-741-2494 and have on hand the School System Account Number (this number can be found on the decal on the fire alarm panel). The School System Account Number will start with the prefix 209
    .1 The Contractor shall provide full detail to the monitoring company as requested including building number and name (as identified on the fire alarm monitoring panel), contact name, company name, length of time system is down. Call shall be placed just prior to any shut down.

.6 A fire patrol will need to be established and will include the following at the Contractor's expense:
  .1 Patrol all halls and high-risk areas affected.
  .2 Fire patrol shall have access to a phone and call 911 if they see a fire.
  .3 Report all other problems they encounter.
  .4 Remain on patrol until system is back on.
.7 Contact Direct Detect at 519-741-2494 and inform them when the system is put back on line.
.8 An activated system must not be reset until authorized by the Fire Department and the cause of the alarm has been investigated.

1.8. FIRE PROTECTION EQUIPMENT IMPAIRMENT

.1 Fire Protection Equipment referred to in this section includes sprinkler systems, special fire suppression systems, and kitchen hood suppression systems.
.2 The Contractor will take all precautions including restrict all Hot Work operations and shut down hazardous processes during all Fire protection equipment impairment.
.3 Do not shut the Fire protection equipment down unless necessary Plan the operation required to reduce system impairment time to the least amount possible.
.4 Wherever possible, shut down only the Fire protection equipment needing Work and schedule this impairment time for unoccupied school hours. Allow for this in your bid pricing.
.5 Discuss the possible down time with the head custodian and principal prior to any partial or whole system impairment.
.6 The school administration shall advise all staff of Fire protection equipment shut down. This will include instructions to call 911 if they see a fire and when system is back on line
.7 The Contractor will plan to use temporary protection such as extra extinguishers, charged hose lines and temporary sprinkler protection during all Fire protection equipment impairment.
.8 If the sprinkler system is restorable, either in whole or in part, the Contractor or sub-Contractor shall assign someone to restore the system promptly in the event of a fire.
.9 A fire patrol may need to be established and will include the following at the Contractor's expense:
  .1 Patrol all halls and high-risk areas affected.
  .2 Fire patrol shall have access to a phone and call 911 if they see a fire.

.3 Report all other problems they encounter.
.4 Remain on patrol until system is back on.

.10 The Contractor shall inform all sub trades that the Board has a Red Tag Permit System and it shall be used for all Fire protection equipment impairment.

.11 For ease of use, a Factory Mutual hanging wall kit has been place at all Board Fire protection equipment locations. Supplies of Red Tag Permits are provided there.

1.9. FIRE ALARM MODIFICATIONS AND MAINTENANCE

.1 Very important changes to Ontario Building Code as they relate to the Standard for the Verification of Fire Alarm Systems CAN/ULC-S537-M have taken effect December 24, 1999. (Minister's Ruling 99-BC-01)

.1 Clause 5.1; "Addition of conventional field device(s), or modification(s), to existing input circuit(s) or output circuit(s) shall require re-verification of all devices served by those input circuit(s) or output circuit(s)." If one device is added to a zone, the entire zone or in the case of a single zone panel the entire system is to be verified.

.2 Clause 5.2 "Addition of input circuit(s) or output circuit(s) to an existing fire alarm system shall require verification of the new circuit(s) in accordance with this standard, and shall also require all previously existing circuit(s) to be tested as follows:

.3 TEST: One conventional field device on each circuit shall be operated to confirm activation of all output circuits in accordance with the systems design." Even though no other zones have been touched, one device per input zone is to be tested when the Fire Alarm system is modified.

.4 Clause 5.5 "Where a transponder is added to an existing system, the transponder shall be verified in accordance with subsections 3.2, Wiring; and subsection 3.3 Control Units; and with CAN/ULC-S536, Standard for the Inspection and Testing of Fire Alarm Systems as well as re-verification of existing field devices and verification of new conventional field devices." If a new addressable device is added to a system, the new device is to be tested; as well a test must be conducted on all addressable devices on the loop.

.5 Clause 5.6 "Where an existing fire alarm system control unit is replaced with a new control unit, it shall be verified in accordance with CAN/ULC-S536, Standard for the Inspection and Testing of Fire Alarm Systems.

Replacement of any control panel will require the testing of all existing fire alarm devices.

.2 The Contractor and sub-Contractors shall include in the bid price for the above ULC Standards requirements referenced in the Ontario Building Code.

1.10. INSTALLATION AND/OR REPAIR OF ROOFING

.1 The Contractor will review with the Consultant and the Board's representative of the location of any asphalt kettles and the dates the kettles will be in use. The Contractor, in the course of performing roofing work, will ensure all personnel utilize the following precautions:

.1 Use only kettles equipped with thermometers or gauges in good working order.

.2 Locate kettles in a safe place outside of building.

.3 Maintain continuous supervision while kettles are in operation and provide metal covers for the kettles to smother any flames in case of fire.

.4 All roofing materials stored in locations no closer than 15 meters to any structures.

1.11. FIRE DEPARTMENT ACCESS

.1 Designated fire routes must be maintained. Fire Department must be advised of any work that would impede fire apparatus response.

1.12. SMOKING PRECAUTIONS

.1 Smoking is not permitted anywhere on Board properties. Workers who wish to smoke must leave the property, and not within sight of students. Any worker found to be in contravention of the Ontario Smoke Free Act will be subject to legislated fines.

1.13. FLAMMABLE LIQUIDS

.1 The handling and storage on site of flammable liquids are to be governed by the current National Fire Code of Canada.

.2 Flammable liquids such as gasoline, kerosene and naphtha may be kept for ready use in quantities not exceeding 10 imperial gallons provided they are stored in approved safety cans bearing the Underwriter's Laboratory of Canada or Factory Mutual seal of approval.

.3 Transfer of flammable liquids is prohibited within buildings.

.4 Transfer of flammable liquids must not be carried out in the vicinity of open flame or any type of heat producing devices.

.5 Flammable liquids having a flash point below 100° F (37.7°C) such as naphtha or gasoline must not be used as solvents or cleaning agents.

.6 Flammable waste liquids, for disposal, must be stored in approved containers located in a safe ventilated area. Quantities are to be kept to a minimum.

END OF SECTION

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Contractor Hot Work Permit

1. Take all precautions to Work safely and to provide the necessary protection to persons and property from Hot Work. This includes, but is not limited to Brazing, Cutting, Grinding, Soldering, Thawing Pipe, Torch Applied Roofing and Welding. With all such activity these steps are to be followed:
    A. Whenever possible, complete Hot Work in a welding shop or out of doors at the school.
    B. Flammable liquids, dust lint and oily deposits to be removed from within 50-ft (15m) of Work. Remove other combustibles where possible. Otherwise protect with fire-resistive tarpaulins or metal shields.
    C. Explosive atmosphere in area eliminated. Floors swept clean. Combustible floors wet down, covered with damp sand or fire-resistive tarpaulins.
    D. All wall and floor openings covered. Fire-resistive tarpaulins suspended beneath Work.
    E. For Work on walls or ceilings, remove combustibles away on other side.
2. For on-site Work (indoor, out of doors), advise the Head Custodian and Principal prior to Work being performed, and of related dangers.
3. In the event of a fire as a result of the Hot Work, notify the fire department and the head custodian immediately, whether extinguished or not.
4. Barriers must be set up to protect staff and students (i.e. pylons, shields, and caution tape) from exposure to arc flash and smoke migration.
5. Have all necessary doors, windows and/or drapes closed. Request of the head custodian to shut down all fan systems in the area to reduce or eliminate smoke distribution.
6. Provide and keep fire extinguishers handy and in good Working condition. Temporarily cover all smoke detectors in area during time of Work.
7. Provide a fire watch/spot check for several hours after Work is completed. Uncover smoke detectors.

Waterloo Region District School Board

Appendix - 013517-A

Facility Services

CONTRACTOR HOT WORK PERMIT

STOP!

Avoid hot work or seek an alternative method if possible.

This hot work permit is required for any temporary operation involving open flames or producing heat and/or sparks.
This includes but is not limited to: brazing, cutting, grinding, soldering, torch-applied roofing and welding.

A SEPARATE PERMIT IS REQUIRED FOR EACH AREA

Board Supervisor/ Manager/Proj. Coordinator Responsibilities:

i. Verify precautions taken in Section A
ii. Complete and retain Part 1
iii. Complete Section B prior to commencement of Hot Works
iv. Issue Part 2 to Contractor completing Hot Work & Post
v. Obtain Part 2 when Fire Monitoring complete
vi. Return Part 1 and Part 2 to Controller, Facility Services

Contractor Responsibilities:

i. Verify precautions taken in Section A
ii. Complete Section C during each day that Hot Works takes place
iii. Return Part 2 to Board Supervisor/ Manager/Proj. Coordinator

PART 1

Section A Indicate Precautions Taken

☐ Available sprinklers, hose streams, and extinguishers available and in service

Within 35' or 11m of hot work

☐ Flammable liquid, dust, lint and oily deposits removed
☐ Explosive atmosphere in area eliminated
☐ Floors swept clean
☐ All wall and floor openings covered
☐ Combustible floors covered with fire resistant sheets
☐ Protect or shut down ducts that might carry sparks/smoke

Hot work on walls, ceiling or roofs

☐ Construction is noncombustible and without combustible covering or insulation
☐ Combustible materials on other side of walls, ceilings or roofs moved away
☐ Combustible structure wetted down

Hot work on enclosed equipment

☐ Enclosed equipment cleaned of all combustible material
☐ Containers purged of flammable liquid/vapour
☐ Pressurized vessels, piping & equipment removed from service, isolated & vented

Fire watch/hot work and monitoring

☐ Fire watch will be provided during and for 1 hour after work including break
☐ Fire watch is trained and supplied with suitable extinguishers
☐ Fire watch is trained in the use of sounding fire alarm
☐ Fire watch conducted in adjoining areas, above and below the space where appropriate
☐ Monitor hot work area for an additional 2 hours after fire watch
☐ Other precautions taken (please detail):

_____
_____
_____
_____
_____

Section B Authorization Granted

Board Supervisor/Manager/Proj. Coordinator: _____
Print Name Signature

Permit Valid from / to: (max. 7 days) _____ _____
From This Date To This Date

(Maximum 7 days or until end of hot work whichever is sooner)

Section C Contractor and Location Affected

Dates: (max 7 days)	Name of Contractor conducting hot work	Name & signature of individual assigned to fire watch	Name & signature of individual assigned to fire monitoring

School: _____

Room/Area: _____

Nature of Job: _____

I verify the above location has been examined each day, the precautions listed in Section A have been taken each day, and permission is authorized for this work.
I further acknowledge that if activity is during school operational hours, that appropriate notification has been given to school administration.

Hot Works Contractor: _____
Signature

School Administrator notified: _____
Print Name

In Case of Emergency call: 911 - Then call: 519-570-0003 Ext. 4123

Refer to WRDSB Administration Procedure 4200 Hot Works/Fire Watch (Copies Available on Request)

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SECTION 01 35 23 – HEALTH AND SAFETY

1.0 GENERAL

1.1. RELATED SECTIONS

.1 Section 01 31 00 - Project Managing and Coordination.
.2 Section 01 33 00 - Submittal Procedures.
.3 Section 01 35 17 – Fire Safety Requirements
.4 Section 01 35 43 – Hazardous Materials
.5 Section 01 41 00 – Regulatory Requirements
.6 Section 01 53 00 – Temporary Construction Facilities
.7 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.2. REFERENCES

.1 Province of Ontario, including requirements for a "Prime Contractor" as defined by the Act.

1.3. SAFETY PLAN

.1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to commencing any site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.
.2 Consultant may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.
.3 Be governed by pertinent safety requirements of Federal or Provincial Governments and of municipal bodies having authority, particularly the Ontario Construction Safety Act, The Occupational Health and Safety Act for Ontario, and regulations of Ontario Ministry of Labour, and work in conjunction with proper safety associations operating under the authority of Ontario Workers' Compensation Act. Protect Owner, Owner's employees, the public and those employed on the Work from bodily injury and to protect adjacent public and private property and Owner's property from damage. Furnish and maintain protection, such as warning signs, tarpaulins, guard rails, barriers, guard lights, night lights, railings around shafts, pits and stairwells, etc. as required. Remove temporary protective measures when no longer required.

1.4. TEMPORARY WORK

.1 Temporary work requiring engineering proficiency for the design, erection, operation maintenance and removal shall be designed and bear stamp of the registered professional Engineer or Architect. Detail drawings will be submitted to the Consultant for review prior to commencing any work.

.2 Before a temporary structure is used, person responsible for design, or their representative, shall inspect structure and certify it has been constructed according to their design.

1.5. RESPONSIBILITY

.1 The "Prime Contractor" according applicable local jurisdiction, is responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.

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

.3 Should any unforeseen or peculiar safety-related factor, hazard, or condition become evident during performance of Work, and follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Health and Safety Act having jurisdiction. Advise the Board and the Consultant verbally and in writing.

.4 The Contractor shall make their own arrangements for emergency treatment of accidents. Any accidents shall be reported immediately to the Board contact.

.5 The Contractor agrees to hold the Board harmless of any and all liability of every nature and description, which may be suffered through bodily injuries, involving deaths of any persons, by reasons of negligence of the Contractor, his agents, employees, or his sub-Contractors.

1.6. SUBMITTALS

.1 Make submittals in accordance with Section 01 33 00.

.2 Submit site-specific Health and Safety Plan: Within ten (10) days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:

.1 Results of site specific safety hazard assessment.

.2 Results of safety and health risk or hazard analysis for site tasks and operation

.3 Submit one (1) copy of Contractor's authorized representative's work site health and safety inspection reports to Consultant and Owner.
.4 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
.5 Submit copies of incident and accident reports.
.6 Submit Material Safety Data Sheets (MSDS) to Consultant.
.7 Consultant's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.
.8 Medical Surveillance: Where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to Consultant.
.9 On-site Contingency and Emergency Response Plan: Address standard operating procedures to be implemented during emergency situations.
.10 File Notice of Project with the Ministry of Labour prior to commencement of Work.

1.7. SAFETY ACTIVITIES

.1 Perform site specific safety hazard assessment related to project.
.2 Schedule and administer Health and Safety meeting with Consultant prior to commencement of Work.
.3 Perform Work in accordance with Section 01 41 00 - Regulatory Requirements and this section.

1.8. HEALTH AND SAFETY COORDINATOR

.1 Employ and assign to Work, competent and authorized representative as Health and Safety Coordinator. Health and Safety Coordinator must:
  .1 have previous experience as a Health & Safety coordinator,
  .2 have working knowledge of occupational safety and health regulations,
  .3 be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work,
  .4 be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan, and
  .5 be on site during execution of Work.

1.9. POSTING OF DOCUMENTS

.1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Health and Safety Act having jurisdiction, and in consultation with Consultant.

1.10. CORRECTION OF NON-COMPLIANCE

.1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Consultant or by the Board.

.2 Provide Consultant and/or Board with written report of action taken to correct non-compliance of health and safety issues identified.

.3 Consultant and or the Board may stop Work if non-compliance of health and safety regulations is not corrected.

1.11. PROJECT/SITE CONDITIONS

.1 Work at site will involve contact with:

.1 Refer to Section 01 35 43 Hazardous Materials

1.12. HAZARDOUS WORK

.1 Blasting or other use of explosives is not permitted at the place of work.

1.13. WORK STOPPAGE

.1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.

1.14. LOCKOUT PROCEDURES

.1 All Work to be done on electrical systems or machinery, where the unexpected switching on of the system or machinery could result in personal injury to a student, staff, employee, or the Contractor’s employee, must be done in accordance with the Contractor’s standard lockout procedure.

.2 The Contractor shall provide his/her own locks for the above procedure.

.3 The lock shall include contact information for the person(s) locking out such device.

1.15. OVERHEAD LIFTING

.1 Under no circumstances will a crane or lifting device be used over a occupied space.

.2 When working adjacent to occupied spaces, ensure a clearance of one (empty) classroom, or a minimum of 10m between any occupied space and the furthest possible reach of the crane.

1.16. WARNING SIGNS AND NOTICES

.1 Notices shall be posted advising of the hazard but will not be considered a substitute for providing approved protection, separation, and space from the hazard.

1.17. FIRE PROTECTION

.1 Provide and maintain temporary fire protection equipment during performance of Work required by the governing codes, regulations and bylaws.

.2 Burning rubbish and construction waste materials is not permitted on site.

.3 Maintain placed or installed Fire Protection to protect the portions of the Work during construction.

1.18. SCENT-FREE ENVIRONMENT

.1 The Board requires that, where advised, a building may be deemed scent-free and as such, the wearing of scented products is prohibited.

.2 Any methods or materials that are found to create negative responses in staff or students shall cease and be removed under advisement of the Consultant and or the Board, until alternate methods can be determined.

END OF SECTION

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SECTION 01 35 43 – HAZARDOUS MATERIALS

2.0 GENERAL

2.1. RELATED SECTIONS

.1 Section 01 35 23 – Health and Safety Requirements.

.2 Section 01 41 00 – Regulatory Requirements.

.3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

2.2. REFERENCES

.1 Province of Ontario, including requirements for a "Prime Contractor" as defined by the Act.

2.3. ASBESTOS and OTHER REGULATED SUBSTANCES

.1 An Asbestos Audit, as prepared by MTE Consultants Inc. for this facility, is attached under Appendix 013543 A. A duplicate set is also available in the Facilities Services Departments located in the Education Centre. Unless specifically covered by a Cash Allowance or Contingency Allowance that states otherwise, include in this Contract the required removal of all asbestos containing materials (ACM) to complete the work. No claims for extra costs will be accepted for areas known to contain ACM that are within the scope of this Work.

.2 Comply with applicable legislation regarding asbestos. Should the Contractor encounter asbestos not noted in the referenced Asbestos Audit that would be disturbed during the course of the Work, they should stop the work in that immediate area and report the same to the Consultant and Board contact.

.3 In addition, Lead, Mercury, Silica, and Isocyanates are anticipated to be present in existing facilities. New construction, renovations, or alterations require compliance by the Contractor with the applicable legislation.

2.4. PROTOCOL FOR ABATEMENT WORK

.1 This Protocol establishes the requirements to be followed by all Asbestos Abatement Contractors involved with the Board. It applies to Type 1, Type 2 and Type 3 Operations as stated in the Regulations and applies to emergency and non-emergency work (directly retained or working as a sub-contractor).

.2 Asbestos Abatement Contractors must maintain appropriate insurance coverage and WISB certification.

.3 Contractors retained for asbestos abatement work shall use personnel certified by the Ontario College of Trades and must provide the Consultant and Board with proof of asbestos certification (AAS and AAW) for all supervisors / all staff involved.

.4 School Access

.1 During school hours all asbestos contractors are to report to the school office upon arrival. After school hours, ensure card-in / card-out procedures are followed and building security is maintained.

.5 Communication

.1 Establish communication contact list with email and phone numbers that shall include:

.1 Principal / Vice Principal
.2 Area Facility Manager
.3 Head Custodian
.4 Environmental Officer
.5 Manager of Mechanical, Electrical and Environmental Services
.6 Manager of Health Safety & Security
.7 Contractor staff
.8 Consultant

.2 Contact the School Principal / Vice to set up a firm date for the abatement (removal / repair). Schedule to allow at least 72 hours notice ahead of the work.

.3 Confirm the date by notifying via email the following:

.1 Principal / Vice-principal,
.2 Area Facility Manager, and
.3 Environmental Officer.
.4 Consultant

.4 Indicate the date, the start time, the anticipated completion time for the work and the work areas in the school.

.5 Identify personnel managing the project and provide current cell numbers for emergency contacts.

.6 For emergency work, as requested by Area Supervisors, Facility Managers or Environmental Officer, no notification to the school is required.

.7 Additionally, for Type 3 work also contact:

.1 Manager of Health, Safety & Security, and
.2 Notify the MOL (also for Type 2) where required by regulation.
.3 Consultant

.8 Discussions with other groups, school staff, media and others is discouraged and shall be directed to the Board Communication Officer where warranted.

.6 Asbestos Operations

.1 Emergency work shall be carried out the same day (evening/night) or under exceptional conditions the following day / evening / night. Contractors shall exercise discretion when working in the school to minimize anxiety of staff/school community. Where warranted, contact Area Supervisor, Facility Manager or Environmental Officer to obtain further direction.

.2 For non-emergency work, contractor is to assess the work on site and provide a cost estimate to the Environmental Officer, (daniela_budure@wrdsb.on.ca) and Consultant. Some work will require discussion with the Facility Manager or Environmental Officer to assess if additional work should be done as to completely remove all ACM material form the area or similar.

.3 Where the MTE report shows ACM requiring repair, remove and re-insulate where required.

.4 Before beginning any Type 1, Type 2 or Type 3 Operations, the work area must be secured, doors closed, warning signs added to all entrances, caution tape used in open areas and signs used to restrict access to the work area so as to keep persons not involved in the work from entering in the work area.

.5 Provide “Construction” warning signs on solid barriers between the Work and public areas. Install a sufficient number of “asbestos abatement” warning signs behind the barriers, posted to warn of the hazard, and that access to the work area is restricted to persons wearing protective clothing and equipment.

.6 The contactor is responsible to disable the mechanical ventilation serving the work area and positively prevent operation using Lock-out / Tag-out devices for each air handling unit /fan. Exercise caution during heating season to ensure areas of the building are maintained above freezing and ensure equipment is turned back on after abatement / air clearance completed.

.7 Contractor’s employees shall put on / take off PPE within work area marked by construction signs. No employee shall leave the work area wearing PPE.

.8 All dust and waste is to be cleaned up and removed at frequent / regular intervals as the work proceeds and immediately upon completion. No waste bags or similar are to be left behind.

2.5. SUBMITTALS

.1 Once the abatement is completed, forward a Letter of Completion to the Environmental Officer, (daniela_budure@wrdsb.on.ca). This letter shall be received no later than 72 hours after completion and shall include any sample results.

.2 For those projects requiring Air Clearance, ensure this info is sent without delay but in all cases no later than 24 hours after sampling. All Type 3 work must take into account that the initial samples may not pass and the contactor must allow one additional day to re-clean and re-sample before school is to resume operations. For those projects not under the direct supervision of a Environmental Consultant, the contactor is to expedite the air clearance sampling with the lab of their choice and carry these costs.

.3 Forward Air Clearance results to:

.1 Principal / Vice-principal,

.2 Facility Manager,

.3 Environmental Officer,

.4 Manager of Mechanical, Electrical and Environmental Services, and

.5 Manager of Health, Safety & Security.

.6 Consultant

2.6. ACKNOWLEDGEMENT

.1 The protocols for asbestos work must be read and understood by Asbestos Contractor.

.2 Submit a signed copy of the most current copy of *PROTOCOL FOR ABATEMENT WORK (ASBESTOS ABATEMENT CONTRACTORS)* to the General Contractor, the Consultant, and the Board's Environmental Officer.

END OF SECTION

June 6, 2018
MTE File No.: C34532-914

Waterloo Region District School Board
51 Ardelt Avenue
Kitchener, ON N2C 2R5

Re: 2018 Asbestos Audit Update – Smithson Public School
150 Belleview Avenue, Kitchener, Ontario

1.0 INTRODUCTION

MTE Consultants Inc. (MTE) was authorized by the Waterloo Region District School Board (WRDSB) to conduct the 2018 Asbestos Audit Update for the subject building.

The purpose of the assignment was to re-assess and document the location, type, and condition of identified asbestos-containing materials (ACM) present within the building and make appropriate recommendations for management, abatement or remedial activities, as required.

The audit was conducted in accordance with the Ontario Ministry of Labour, *Regulation 278/05-Designated Substance-Asbestos on Construction Projects and in Buildings and Repair Operations* (O. Reg. 278/05). This report shall replace previous audit reports.

2.0 SCOPE OF WORK

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

- Review of existing and historical reports and documentation pertaining to ACM within the building;
- Visual inspection to assess the condition of previously identified ACM, excluding portable structures;
- Collection of building material samples that are suspect ACM as applicable;
- Submission of samples to an accredited laboratory, as applicable;
- Photographic log of damaged materials; and
- Preparation of this report with findings and recommendations.

3.0 METHODOLOGY AND ASSESSMENT CRITERIA

This inspection was conducted by visual and laboratory identification methods for the assessment of ACM and their corresponding location, use, condition, and friability. The areas outlined in Section 2.0 were inspected limited to building components, materials and service connections. Notwithstanding that reasonable attempts were made to identify all ACMs, the possibility of concealed material exists and may not become visible until substantial demolition has occurred and therefore are currently undocumented and did not include the following.

- Locations that may be hazardous to the surveyor, such as electrical equipment;
- Where invasive inspection could cause consequential damage to the property or impair the integrity of the equipment, such as roof systems, underground services or components of mechanical equipment;
- Locations concealed by building finishes that require substantial demolition or removal for access or determination of quantities;
- Materials that is present in such an inconsistent fashion that without complete removal of finishes, the extent cannot be determined.
- Non-permanent items or personal contents, furnishings; and
- Settled dust or airborne agents unless otherwise stated.

3.1 Condition of ACM

During the audit process the general condition of ACMs were observed and noted. Materials which are damaged can pose an increased exposure risk to workers, building occupants and the public. While assessing damage can be subjective, abatement items were grouped into two categories to aid in remedial prioritization.

Monitor Annually
These are items which display minor isolated damage; however do not pose an immediate risk to workers from exposure to asbestos fibres due to the current condition of the material and/or location. No remediation is required at this time; however these items should be monitored on a yearly basis for evidence of continued degradation. Should the condition of the material change an evaluation should be completed by a competent person to determine remedial action.

Abatement Action Required
These are items which display damage and may pose potential risk to workers from exposure to asbestos fibres due to the physical condition and/or location of the material. Clean-up, repair or removal of these materials is required as soon as reasonably possible.

4.0 FINDINGS

An inspection of the building was conducted by MTE on May 30, 2018. The single-storey school building and was constructed in 1953 with additions in 1954, 1961 and 1986. The inspection did not include areas of post 1986 new construction or renovation (where all building finishes have been removed and replaced).

The Asbestos Management Database is provided in **Appendix A** and associated Figures are provided in **Appendix B**. These together provide a current summary of the ACM identified throughout the building.

A summary of the damaged ACM identified at the time of the inspection is provided in **Appendix C**.

The bulk asbestos sample location and analytical summary is provided in **Appendix C**, and Laboratory Certificates of Analysis for any sampling conducted as part of the 2018 inspection are also provided, as applicable.

4.1 Analytical Results

During this inspection, a total of 19 building material samples that are suspect ACM were collected with a total of 11 analyses being performed. The threshold of equal to or greater than 0.5% asbestos by dry weight and is classified as ACM according to O. Reg. 278/05. Samples collected were submitted for analysis to Paracel Laboratories Ltd. (Paracel), in Mississauga, Ontario. Paracel is certified under the National Voluntary Laboratory Accreditation Program to perform asbestos analysis of bulk samples by PLM. Laboratory analysis was conducted in accordance with the United States Environmental Protection Agency, Test Method EPA/600-R-93/116: Method for the Determination of Asbestos in Bulk Building Materials, June, 1993 by Polarized Light Microscopy as prescribed by O. Reg. 278/05.

Reported laboratory detections of asbestos ranged between 0.5% to 1% Chrysotile and are therefore confirmed as ACM.

4.2 Removed ACM

A summary of ACM that has been removed since the previous audit/inspection is provided in the abatement letters provided in in **Appendix D.**

4.3 Discovery of Additional ACM

No additional ACM or suspect ACM was identified.

4.4 Damaged ACM

A summary of all ACM that has been identified as requiring annual monitoring or Type 1 Operations in accordance with O. Reg. 278/05 is provided in **Table 1** of **Appendix C**. Type 1 abatement Operations will be conducted internally by trained and qualified WRDSB staff.

5.0 RECOMMENDATIONS

5.1 Remedial

Damaged ACM was identified and requires annual monitoring. At the time of the audit, all other ACM at the building was noted to be in good condition.

Type 1 Abatement Operations will be conducted internally by trained and qualified WRDSB staff. All other abatement work will be conducted by certified asbestos contractors trained and qualified to conduct the type of work required.

All asbestos work must be conducted by staff and/or contractors who are trained and experienced in the type of asbestos operations required, and should be overseen by a qualified third party Health, Safety and Environmental professional. In order to conduct Type 3 asbestos operations, contractors must be certified as Asbestos Abatement Workers AAW (Trade code 253W) and Asbestos Abatement Supervisors AAS (Trade code 253S) by The Ministry of Training, Colleges and Universities (Ministry of Advanced Education and Skills Development) as prescribed by Section 20 of O. Reg. 278/05.

5.2 Long Term Management

This audit was conducted for the long term management of ACM within the building. Prior to future construction or renovation projects, additional assessments and/or sampling may be required.

There are no requirements under current legislation to remove ACM from a building simply because it is present. However, O. Reg. 278/05 requires that an Asbestos Management Plan be implemented and maintained. Asbestos awareness training should be provided for staff that may come in contact with ACM during routine duties or in emergency situations.

ACM that will be disturbed, or will likely be disturbed, during building maintenance, renovations, construction, or demolition activities must be handled and disposed of in accordance with the procedures prescribed by O. Reg. 278/05.

ACM may also be present in concealed locations. If any construction, renovation, alteration, or maintenance activities are required or planned, invasive inspections of concealed locations for potential ACM must be performed prior to such activities. Should any suspect ACM be discovered, work should cease and the materials should not be disturbed. Suspect ACM must be treated as asbestos-containing or sampled and proven to not contain asbestos. Any activities that require disturbance of ACM must be performed in accordance with O. Reg. 278/05.

6.0 LIMITATIONS

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

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

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

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

All of which is respectfully submitted,

MTE CONSULTANTS INC.

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APPENDIX A

ASBESTOS MANAGEMENT DATABASE

School Name	Legend:	Notes:
Smithson Public School	**HM -** Homogenous Material - homogeneous with previously sampled material **SL** - Sample Location - Material Sampled **VC** - Visually Confirmed - Material not sampled, deemed ACM **NF** - Non-Friable **F**- Friable	**All quantities provided on Figures, if known. Refer to the Asbestos Audit Update Report for condition of ACM and recommended actions.**
Date Built:		**Dates provided in Material Description/Room Description columns indicates date of installation/renovation and confirms the finishes as non-ACM.**
Original: 1953		
Addition(s): 1954, 1961, 1986		

WRDSB Fixed Reference Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Asbestos Classification	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type
Structure/Additions										
	Original Building	Structure	Deck	Steel	-	Non ACM	-	-	-	-
	Original Building	Structure	Concrete	Concrete	-	Non ACM	-	-	-	-
	Original Building	Façade	Brick Veneer	Brick and Mortar	-	Non ACM	-	-	-	-
	Original Building	Not Inspected	Not Inspected	Roofing Materials	NF	Suspect ACM	VC	-	-	-
	Original Building (Room 74 O	Windows	Interior/Exterior Panes	White Sealant	NF	ACM	SL	S05ABC	3-Jul-18	1% Chrysotile
	Original Building	Windows	Interior/Exterior Frames	Silicon Sealant	-	Non ACM	-	-	-	-
	Original Building	Doors	Interior Frames	Grey Sealant	NF	ACM	SL	S06ABC	3-Jul-18	1% Chrysotile
	Original Building	Doors	Exterior Frames	Silicon Sealant	-	Non ACM	-	-	-	-
	Original Building	Mastic	Mastic	Floor Tile Mastic	-	Non ACM	HM	S09ABC	17-Jan-14	ND
	1954 Addition	Structure	Deck	Steel	-	Non ACM	-	-	-	-
	1954 Addition	Structure	Concrete	Concrete	-	Non ACM	-	-	-	-
	1954 Addition	Façade	Brick Veneer	Brick and Mortar	-	Non ACM	-	-	-	-
	1954 Addition	Not Inspected	Not Inspected	Roofing Materials	NF	Suspect ACM	VC	-	-	-
	1954 Addition	Windows	Interior/Exterior Frames	Silicon Sealant	-	Non ACM	-	-	-	-
	1954 Addition	Doors	Interior Frames	Grey Sealant	NF	ACM	SL	S03ABC	3-Jul-18	1% Chrysotile
	1954 Addition	Doors	Exterior Frames	Silicon Sealant	-	Non ACM	-	-	-	-
	1954 Addition	Mastic	Mastic	Floor Tile Mastic	-	Non ACM	HM	S06ABC	6-Nov-09	ND
	1961 Addition	Structure	Deck	Steel	-	Non ACM	-	-	-	-
	1961 Addition	Structure	Concrete	Concrete	-	Non ACM	-	-	-	-
	1961 Addition	Façade	Brick Veneer	Brick and Mortar	-	Non ACM	-	-	-	-
	1961 Addition	Not Inspected	Not Inspected	Roofing Materials	NF	Suspect ACM	VC	-	-	-
	1961 Addition	Windows	Interior/Exterior Frames	Silicon Sealant	-	Non ACM	-	-	-	-
	1961 Addition	Doors	Interior Frames	Grey Sealant	NF	ACM	SL	S02ABC	3-Jul-18	0.5% Chrysotile
	1961 Addition	Doors	Exterior Frames	Silicon Sealant	-	Non ACM	-	-	-	-

School Name	Legend:	Notes:
Smithson Public School	**HM -** Homogenous Material - homogeneous with previously sampled material **SL** - Sample Location - Material Sampled **VC** - Visually Confirmed - Material not sampled, deemed ACM **NF** - Non-Friable **F**- Friable	**All quantities provided on Figures, if known. Refer to the Asbestos Audit Update Report for condition of ACM and recommended actions.**
Date Built:		**Dates provided in Material Description/Room Description columns indicates date of installation/renovation and confirms the finishes as non-ACM.**
Original: 1953		
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WRDSB Fixed Reference Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Asbestos Classification	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type
	1961 Addition	Mastic	Mastic	Floor Tile Mastic	-	Non ACM	HM	S03ABC	17-Jan-14	ND
Level 1										
1	Classroom	Floor	Carpet	-	-	Non ACM	-	-	-	-
1	Classroom	Wall	Plaster	-	-	Non ACM	SL	S01c	6-Nov-09	ND
1	Classroom	Wall	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	ND
1	Classroom	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole (1993)	-	Non ACM	-	-	-	-
1	Classroom	Ceiling	Ceiling Tile 1' x 1'	Large and Medium Pinhole - Cellulose	-	Non ACM	-	-	-	-
2	Classroom	Floor	Vinyl Floor Tile 12"x 12"	Beige Oatmeal	-	Non ACM	HM	S06	6-Nov-09	ND
2	Classroom	Floor	Floor Tile Mastic	Black	-	Non ACM	HM	S06	6-Nov-09	ND
2	Classroom	Wall	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	ND
2	Classroom	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole (1993)	-	Non ACM	-	-	-	-
2	Classroom	Ceiling	Ceiling Tile 1' x 1'	Large and Medium Pinhole - Cellulose	-	Non ACM	-	-	-	-
3	Classroom	Floor	Vinyl Floor Tile 12"x 12"	Beige Oatmeal	-	Non ACM	HM	S06	6-Nov-09	ND
3	Classroom	Floor	Floor Tile Mastic	Black	-	Non ACM	HM	S06	6-Nov-09	ND
3	Classroom	Wall	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	ND
3	Classroom	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole (1993)	-	Non ACM	-	-	-	-
3	Classroom	Ceiling	Ceiling Tile 1' x 1'	Large and Medium Pinhole - Cellulose	-	Non ACM	-	-	-	-
4	Classroom	Floor	Vinyl Floor Tile 12"x 12"	White with Black Speck	-	Non ACM	HM	S04	6-Nov-09	ND
4	Classroom	Wall	Plaster	-	-	Non ACM	SL	S01f	6-Nov-09	ND
4	Classroom	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole (1993)	-	Non ACM	-	-	-	-
4	Classroom	Ceiling	Ceiling Tile 1' x 1'	Large and Medium Pinhole - Cellulose	-	Non ACM	-	-	-	-
4A	Workroom	Floor	Carpet	-	-	Non ACM	-	-	-	-
4A	Workroom	Wall	Concrete	Concrete Block	-	Non ACM	-	-	-	-
4A	Workroom	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole (1993)	-	Non ACM	-	-	-	-
5	Classroom	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	Non ACM	HM	S03	6-Nov-09	ND

School Name	Legend:	Notes:
Smithson Public School	**HM -** Homogenous Material - homogeneous with previously sampled material **SL** - Sample Location - Material Sampled **VC** - Visually Confirmed - Material not sampled, deemed ACM **NF** - Non-Friable **F**- Friable	**All quantities provided on Figures, if known. Refer to the Asbestos Audit Update Report for condition of ACM and recommended actions.**
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WRDSB Fixed Reference Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Asbestos Classification	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type
5	Classroom	Floor	Floor Tile Mastic	Black	-	Non ACM	HM	S03	17-Jan-14	ND
5	Classroom	Wall	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	-
5	Classroom	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole (1993)	-	Non ACM	-	-	-	-
5	Classroom	Ceiling	Ceiling Tile 1' x 1'	Large and Medium Pinhole - Cellulose	-	Non ACM	-	-	-	-
6	Classroom	Floor	Vinyl Sheet Flooring	Wood	-	Non ACM	-	-	-	-
6	Classroom	Floor	Floor Tile Mastic	Black	-	Non ACM	HM	S06	6-Nov-09	ND
6	Classroom	Wall	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	ND
6	Classroom	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole (1993)	-	Non ACM	-	-	-	-
6	Classroom	Ceiling	Ceiling Tile 1' x 1'	Large and Medium Pinhole - Cellulose	-	Non ACM	-	-	-	-
6A	Workroom	Floor	Vinyl Sheet Flooring	Wood	-	Non ACM	-	-	-	-
6A	Workroom	Wall	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	ND
6A	Workroom	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole (1993)	-	Non ACM	-	-	-	-
6B	Closet	Floor	Vinyl Sheet Flooring	Wood	-	Non ACM	-	-	-	-
6B	Closet	Floor	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	ND
6B	Closet	Wall	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole (1993)	-	Non ACM	-	-	-	-
6B	Closet	Ceiling	Ceiling Tile 1' x 1'	Large and Medium Pinhole - Cellulose	-	Non ACM	-	-	-	-
7	Classroom	Floor	Vinyl Sheet Flooring	Wood	-	Non ACM	-	-	-	-
7	Classroom	Wall	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	-
7	Classroom	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole (1993)	-	Non ACM	-	-	-	-
7	Classroom	Ceiling	Ceiling Tile 1' x 1'	Large and Medium Pinhole - Cellulose	-	Non ACM	-	-	-	-
8	Classroom	Floor	Vinyl Floor Tile 12"x 12"	Beige Oatmeal	-	Non ACM	HM	S06	6-Nov-09	ND
8	Classroom	Floor	Floor Tile Mastic	Black	-	Non ACM	HM	S06	6-Nov-09	ND
8	Classroom	Wall	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	ND
8	Classroom	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole (1993)	-	Non ACM	-	-	-	-
8	Classroom	Ceiling	Ceiling Tile 1' x 1'	Large and Medium Pinhole - Cellulose	-	Non ACM	-	-	-	-
10	Classroom	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	Non ACM	HM	S03	6-Nov-09	ND
10	Classroom	Floor	Floor Tile Mastic	Black	-	Non ACM	HM	S03	17-Jan-14	ND

School Name	Legend:	Notes:
Smithson Public School	**HM -** Homogenous Material - homogeneous with previously sampled material **SL** - Sample Location - Material Sampled **VC** - Visually Confirmed - Material not sampled, deemed ACM **NF** - Non-Friable **F**- Friable	**All quantities provided on Figures, if known. Refer to the Asbestos Audit Update Report for condition of ACM and recommended actions.**
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WRDSB Fixed Reference Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Asbestos Classification	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type
10	Classroom	Wall	Plaster	-	-	Non ACM	SL	S01e	6-Nov-09	-
10	Classroom	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole (1993)	-	Non ACM	-	-	-	-
10	Classroom	Ceiling	Ceiling Tile 1' x 1'	Large and Medium Pinhole - Cellulose	-	Non ACM	-	-	-	-
11	Library	Floor	Carpet	-	-	Non ACM	-	-	-	-
11	Library	Wall	Concrete	Concrete Block	-	Non ACM	-	-	-	-
11	Library	Wall	Drywall	Drywall Joint Compound (1954)	-	Non ACM	SL	S04A	3-Jul-18	ND
11	Library	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole (1993)	-	Non ACM	-	-	-	-
11	Library	Ceiling	Ceiling Tile 1' x 1'	Large and Medium Pinhole - Cellulose	-	Non ACM	-	-	-	-
11	Library	Ceiling	Texture Coat	-	F	ACM	SL	S07abc	6-Nov-09	0.75% Chrysotile
12	Classroom	Floor	Vinyl Floor Tile 12"x 12"	Beige Oatmeal	-	Non ACM	HM	S06	6-Nov-09	ND
12	Classroom	Floor	Floor Tile Mastic	Black	-	Non ACM	HM	S06	6-Nov-09	ND
12	Classroom	Wall	Concrete	Concrete Block	-	Non ACM	-	-	-	-
12	Classroom	Wall	Drywall	Drywall Joint Compound (1954)	-	Non ACM	SL	S04A	3-Jul-18	ND
12	Classroom	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole (1993)	-	Non ACM	-	-	-	-
12	Classroom	Ceiling	Ceiling Tile 1' x 1'	Large and Medium Pinhole - Cellulose	-	Non ACM	-	-	-	-
13	Classroom	Floor	Vinyl Floor Tile 12"x 12"	Beige Oatmeal	-	Non ACM	SL	S06abc	6-Nov-09	ND
13	Classroom	Floor	Floor Tile Mastic	Black	-	Non ACM	HM	S06	6-Nov-09	ND
13	Classroom	Floor	Floor Tile Mastic	Black	-	Non ACM	SL	S06abc	6-Nov-09	ND
13	Classroom	Wall	Concrete	Concrete Block	-	Non ACM	-	-	-	-
13	Classroom	Wall	Drywall	Drywall Joint Compound (1954)	-	Non ACM	HM	S04	3-Jul-18	ND
13	Classroom	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole (1993)	-	Non ACM	-	-	-	-
13	Classroom	Ceiling	Ceiling Tile 1' x 1'	Large and Medium Pinhole - Cellulose	-	Non ACM	-	-	-	-
13A	Work Room	Floor	Vinyl Floor Tile 12"x 12"	Beige Oatmeal	-	Non ACM	HM	S06	6-Nov-09	ND
13A	Work Room	Floor	Floor Tile Mastic	Black	-	Non ACM	HM	S06	6-Nov-09	ND
13A	Work Room	Wall	Concrete	Concrete Block	-	Non ACM	-	-	-	-
13A	Work Room	Wall	Drywall	Drywall Joint Compound (1954)	-	Non ACM	HM	S04	3-Jul-18	ND
13A	Work Room	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole (1993)	-	Non ACM	-	-	-	-

School Name	Legend:	Notes:
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13A	Work Room	Ceiling	Ceiling Tile 1' x 1'	Large and Medium Pinhole - Cellulose	-	Non ACM	-	-	-	-
14	Classroom	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	Non ACM	HM	S03	6-Nov-09	ND
14	Classroom	Floor	Floor Tile Mastic	Black	-	Non ACM	HM	S03	17-Jan-14	ND
14	Classroom	Wall	Concrete	Concrete Block	-	Non ACM	-	-	-	-
14	Classroom	Wall	Drywall	Drywall Joint Compound (1954)	-	Non ACM	HM	S04	3-Jul-18	ND
14	Classroom	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole (1993)	-	Non ACM	-	-	-	-
14	Classroom	Ceiling	Ceiling Tile 1' x 1'	Large and Medium Pinhole - Cellulose	-	Non ACM	-	-	-	-
15	Classroom	Floor	Vinyl Floor Tile 12"x12"	White with Black Speck	-	Non ACM	SL	S04abc	6-Nov-09	ND
15	Classroom	Wall	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	ND
15	Classroom	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole (1993)	-	Non ACM	-	-	-	-
15	Classroom	Ceiling	Ceiling Tile 1' x 1'	Large and Medium Pinhole - Cellulose	-	Non ACM	-	-	-	-
16	Classroom	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	Non ACM	SL	S03abc	6-Nov-09	ND
16	Classroom	Floor	Floor Tile Mastic	Black	-	Non ACM	SL	S03abc	17-Jan-14	ND
16	Classroom	Wall	Plaster	-	-	Non ACM	SL	S01a	6-Nov-09	-
16	Classroom	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole (1993)	-	Non ACM	-	-	-	-
16	Classroom	Ceiling	Drywall	Drywall - No Compound	-	Non ACM	-	-	-	-
16	Classroom	Ceiling	Mastic	Mastic from 1'x1' Ceiling Tile	-	Non ACM	SL	S02abc	6-Nov-09	ND
17	Classroom	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	Non ACM	HM	S03	6-Nov-09	ND
17	Classroom	Floor	Floor Tile Mastic	Black	-	Non ACM	HM	S03	17-Jan-14	ND
17	Classroom	Wall	Plaster	-	-	Non ACM	SL	S01A	3-Jul-18	ND
17	Classroom	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole (1993)	-	Non ACM	-	-	-	-
17	Classroom	Ceiling	Drywall	Drywall - No Compound	-	Non ACM	-	-	-	-
17	Classroom	Ceiling	Mastic	Mastic from 1'x1' Ceiling Tile	-	Non ACM	HM	S02	6-Nov-09	ND
18	Classroom	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	Non ACM	HM	S03	6-Nov-09	ND
18	Classroom	Floor	Floor Tile Mastic	Black	-	Non ACM	HM	S03	17-Jan-14	ND
18	Classroom	Wall	Plaster	-	-	Non ACM	SL	S01b	6-Nov-09	-
18	Classroom	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole (1993)	-	Non ACM	-	-	-	-

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18	Classroom	Ceiling	Drywall	Drywall - No Compound	-	Non ACM	-	-	-	-
18	Classroom	Ceiling	Mastic	Mastic from 1'x1' Ceiling Tile	-	Non ACM	HM	S02	6-Nov-09	ND
19	Classroom	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	Non ACM	HM	S03	6-Nov-09	ND
19	Classroom	Floor	Floor Tile Mastic	Black	-	Non ACM	HM	S03	17-Jan-14	ND
19	Classroom	Wall	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	-
19	Classroom	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole (1993)	-	Non ACM	-	-	-	-
19	Classroom	Ceiling	Drywall	Drywall - No Compound	-	Non ACM	-	-	-	-
19	Classroom	Ceiling	Mastic	Mastic from 1'x1' Ceiling Tile	-	Non ACM	HM	S02	6-Nov-09	ND
20	Classroom	Floor	Vinyl Floor Tile 12"x 12"	Beige Oatmeal	-	Non ACM	HM	S06	6-Nov-09	ND
20	Classroom	Floor	Floor Tile Mastic	Black	-	Non ACM	HM	S06	6-Nov-09	ND
20	Classroom	Wall	Drywall	Drywall Joint Compound (1954)	-	Non ACM	SL	S04A	3-Jul-18	ND
20	Classroom	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole (1993)	-	Non ACM	-	-	-	-
20	Classroom	Ceiling	Ceiling Tile 1' x 1'	Large and Medium Pinhole - Cellulose	-	Non ACM	-	-	-	-
21	Classroom	Floor	Vinyl Floor Tile 12"x 12"	Beige Oatmeal	-	Non ACM	HM	S06	6-Nov-09	ND
21	Classroom	Floor	Floor Tile Mastic	Black	-	Non ACM	HM	S06	6-Nov-09	ND
21	Classroom	Wall	Concrete	Concrete Block	-	Non ACM	-	-	-	-
21	Classroom	Wall	Drywall	Drywall Joint Compound (1954)	-	Non ACM	HM	S04	3-Jul-18	ND
21	Classroom	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole (1993)	-	Non ACM	-	-	-	-
21	Classroom	Ceiling	Ceiling Tile 1' x 1'	Large and Medium Pinhole - Cellulose	-	Non ACM	-	-	-	-
22	Staff Room	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	Non ACM	HM	S03	6-Nov-09	ND
22	Staff Room	Wall	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	-
22	Staff Room	Wall	Concrete	-	-	Non ACM	-	-	-	-
22	Staff Room	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole (Post 20	-	Non ACM	-	-	-	-
23	Fan Room	Floor	Wood	-	-	Non ACM	-	-	-	-
23	Fan Room	Walls	Wood	-	-	Non ACM	-	-	-	-
23	Fan Room	Walls	Drywall	Drywall	-	Non ACM	HM	S07ABC	Oct 24 2018	ND
23	Fan Room	Wall	Concrete	Concrete Block	-	Non ACM	-	-	-	-

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23	Fan Room	Deck	Metal Pan	-	-	Non ACM	-	-	-	-
23	Fan Room	Piping	Pipe Insulation	Horsehair	-	Non ACM	-	-	-	-
47	Office	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	Non ACM	HM	S03	6-Nov-09	ND
47	Office	Floor	Floor Tile Mastic	Black	-	Non ACM	HM	S03	17-Jan-14	ND
47	Office	Wall	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	-
47	Office	Ceiling	Ceiling Tile 2' x 4'	Textured - Fibreglass	-	Non ACM	-	-	-	-
47	Office	Ceiling	Mastic	Mastic from 1'x1' Ceiling Tile	-	Non ACM	HM	S02	6-Nov-09	ND
48	Storage	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	Non ACM	HM	S03	6-Nov-09	ND
48	Storage	Floor	Floor Tile Mastic	Black	-	Non ACM	HM	S03	17-Jan-14	ND
48	Storage	Wall	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	-
48	Storage	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole (1993)	-	Non ACM	-	-	-	-
49	Office	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	Non ACM	HM	S03	6-Nov-09	ND
49	Office	Floor	Floor Tile Mastic	Black	-	Non ACM	HM	S03	17-Jan-14	ND
49	Office	Wall	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	-
49	Office	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole (1993)	-	Non ACM	-	-	-	-
49	Office	Ceiling	Ceiling Tile 1' x 1'	Large and Medium Pinhole - Cellulose	-	Non ACM	-	-	-	-
50	Office	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	Non ACM	HM	S03	6-Nov-09	ND
50	Office	Floor	Floor Tile Mastic	Black	-	Non ACM	HM	S03	17-Jan-14	ND
50	Office	Wall	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	ND
50	Office	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole (1993)	-	Non ACM	VC	-	-	-
51	Washroom	Floor	Terrazzo	-	-	Non ACM	-	-	-	-
51	Washroom	Wall	Plaster	-	-	Non ACM	SL	S01d	6-Nov-09	ND
51	Washroom	Ceiling	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	ND
52	Washroom	Floor	Terrazzo	-	-	Non ACM	-	-	-	-
52	Washroom	Wall	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	ND
52	Washroom	Ceiling	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	ND
52A	Custodial Closet	Floor	Terrazzo	-	-	Non ACM	-	-	-	-

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52A	Custodial Closet	Wall	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	ND
52A	Custodial Closet	Wall	Concrete Block	-	-	Non ACM	-	-	-	-
52A	Custodial Closet	Ceiling	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	ND
52A	Custodial Closet	Ceiling	Ductwork	Uninsulated	-	Non ACM	-	-	-	-
55	Closet	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	Non ACM	HM	S03	6-Nov-09	ND
55	Closet	Floor	Floor Tile Mastic	Black	-	Non ACM	HM	S03	17-Jan-14	ND
55	Closet	Wall	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	ND
55	Closet	Ceiling	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	ND
56	Closet	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	Non ACM	HM	S03	6-Nov-09	ND
56	Closet	Floor	Floor Tile Mastic	Black	-	Non ACM	HM	S03	17-Jan-14	ND
56	Closet	Wall	Plaster	-	-	Non ACM	SL	S01g	6-Nov-09	ND
56	Closet	Ceiling	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	ND
57	Staff Room	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	Non ACM	HM	S03	6-Nov-09	ND
57	Staff Room	Wall	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	ND
57	Staff Room	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole (1993)	-	Non ACM	-	-	-	-
57	Staff Room	Ceiling	Ceiling Tile 1' x 1'	Large and Medium Pinhole - Cellulose	-	Non ACM	-	-	-	-
57A	Air Handling Unit									
58	Storage	Floor	Vinyl Floor Tile 12"x 12"	Yellow and Brown	-	Non ACM	HM	S10	6-Nov-09	ND
58	Storage	Floor	Floor Tile Mastic	Black	-	Non ACM	HM	S10	17-Jan-14	ND
58	Storage	Wall	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	ND
58	Storage	Ceiling	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	ND
59	Change Room	Floor	Vinyl Floor Tile 12"x 12"	Yellow and Brown	-	Non ACM	HM	S10	6-Nov-09	ND
59	Change Room	Floor	Floor Tile Mastic	Black	-	Non ACM	HM	S10	17-Jan-14	ND
59	Change Room	Wall	Concrete Block	-	-	Non ACM	-	-	-	-
59	Change Room	Wall	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	ND
59	Change Room	Ceiling	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	ND
65	Inst. Room	Floor	Vinyl Floor Tile 12"x 12"	Yellow and Brown	-	Non ACM	HM	S10	6-Nov-09	ND

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65	Inst. Room	Floor	Floor Tile Mastic	Black	-	Non ACM	HM	S10	17-Jan-14	ND
65	Inst. Room	Wall	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	ND
65	Inst. Room	Ceiling	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	ND
66	Stage	Floor	Wood	-	-	Non ACM	-	-	-	-
66	Stage	Wall	Concrete	-	-	Non ACM	-	-	-	-
66	Stage	Wall	Drywall	Drywall Joint Compound	-	Non ACM	SL	S07ABC	Oct 24 2018	ND
66	Stage	Wall	Wood	-	-	Non ACM	-	-	-	-
66	Stage	Ceiling	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	ND
69	Gym	Floor	Vinyl Floor Tile 9"x 9"	Brown and White	NF	ACM	SL	S09abc	6-Nov-09	0.75% Chrysotile
69	Gym	Floor	Floor Tile Mastic	Black	-	Non ACM	SL	S09abc	17-Jan-14	ND
69	Gym	Wall	Concrete	-	-	Non ACM	-	-	-	-
69	Gym	Ceiling	Ceiling Tile 2' x 4'	Textured - Fibreglass	-	Non ACM	-	-	-	-
70	Boiler Room	Floor	Concrete	Painted Concrete	-	Non ACM	-	-	-	-
70	Boiler Room	Wall	Concrete	Concrete Block	-	Non ACM	-	-	-	-
70	Boiler Room	Wall	Brick	Brick	-	Non ACM	-	-	-	-
70	Boiler Room	Ceiling	Plaster	Plaster	-	Non ACM	HM	S01	6-Nov-09	ND
70	Boiler Room	Piping	Pipe Insulation	Air Cell	F	ACM	SL	2551.750.002	8-Feb-90	>75% Chrysotile
70	Boiler Room	Piping	Pipe Fitting	Parged Cement	F	ACM	SL	2551.750.001	8-Feb-90	50-75% Chrysotile
70	Boiler Room	Piping	Pipe Insulation	Fibreglass	-	Non ACM	-	-	-	-
70	Boiler Room	Piping	Heat Shield	Cementitious	-	Non ACM	SL	0001ABC	9/18/2013	ND
71	Storage	Floor	Concrete	-	-	Non ACM	-	-	-	-
71	Storage	Wall	Concrete	-	-	Non ACM	-	-	-	-
71	Storage	Ceiling	Concrete	-	-	Non ACM	-	-	-	-
72	Custodian	Floor	Concrete	-	-	Non ACM	-	-	-	-
72	Custodian	Wall	Concrete	-	-	Non ACM	-	-	-	-
72	Custodian	Ceiling	Concrete	-	-	Non ACM	-	-	-	-
72	Custodian	Piping	Pipe Fitting	Parged Cement	F	ACM	HM	2551.750.001	8-Feb-90	50-75% Chrysotile

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WRDSB Fixed Reference Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Asbestos Classification	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type
73	Washroom	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	Non ACM	HM	S03	6-Nov-09	ND
73	Washroom	Floor	Floor Tile Mastic	Black	-	Non ACM	HM	S03	17-Jan-14	ND
73	Washroom	Wall	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	-
73	Washroom	Wall	Concrete	-	-	Non ACM	-	-	-	-
73	Washroom	Ceiling	Plaster	Plaster	-	Non ACM	HM	S01	6-Nov-09	ND
73	Washroom	Piping	Pipe Fitting	Parged Cement	F	ACM	HM	2551.750.001	8-Feb-90	50-75% Chrysotile
74	Storage	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	Non ACM	HM	S03	6-Nov-09	ND
74	Storage	Floor	Floor Tile Mastic	Black	-	Non ACM	HM	S03	17-Jan-14	ND
74	Storage	Wall	Concrete	Concrete Block	-	Non ACM	-	-	-	-
74	Storage	Wall	Brick	Brick	-	Non ACM	-	-	-	-
74	Storage	Ceiling	Plaster	Plaster	-	Non ACM	HM	S01	6-Nov-09	ND
74	Storage	Piping	Pipe Fitting	Parged Cement	F	ACM	HM	2551.750.001	8-Feb-90	50-75% Chrysotile
75	Storage	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	Non ACM	HM	S03	6-Nov-09	ND
75	Storage	Floor	Floor Tile Mastic	Black	-	Non ACM	HM	S03	17-Jan-14	ND
75	Storage	Wall	Concrete	Concrete Block	-	Non ACM	-	-	-	-
75	Storage	Wall	Brick	Brick	-	Non ACM	-	-	-	-
75	Storage	Ceiling	Plaster	Plaster	-	Non ACM	HM	S01	6-Nov-09	ND
75	Storage	Piping	Pipe Fitting	Parged Cement	F	ACM	HM	2551.750.001	8-Feb-90	50-75% Chrysotile
78	Washroom	Floor	Terrazzo	-	-	Non ACM	-	-	-	-
78	Washroom	Wall	Concrete	Concrete Block	-	Non ACM	-	-	-	-
78	Washroom	Ceiling	Drywall	Drywall Joint Compound (1954)	-	Non ACM	HM	S04	3-Jul-18	ND
79	Washroom	Floor	Terrazzo	-	-	Non ACM	-	-	-	-
79	Washroom	Wall	Concrete	Concrete Block	-	Non ACM	-	-	-	-
79	Washroom	Ceiling	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	ND
79A	Custodian Closet	Floor	Terrazzo	-	-	Non ACM	-	-	-	-
79A	Custodian Closet	Wall	Concrete	Concrete Block	-	Non ACM	-	-	-	-
79A	Custodian Closet	Wall	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	ND

School Name	Legend:	Notes:
Smithson Public School	**HM -** Homogenous Material - homogeneous with previously sampled material **SL** - Sample Location - Material Sampled **VC** - Visually Confirmed - Material not sampled, deemed ACM **NF** - Non-Friable **F**- Friable	**All quantities provided on Figures, if known. Refer to the Asbestos Audit Update Report for condition of ACM and recommended actions.**
Date Built:		**Dates provided in Material Description/Room Description columns indicates date of installation/renovation and confirms the finishes as non-ACM.**
Original: 1953		
Addition(s): 1954, 1961, 1986		

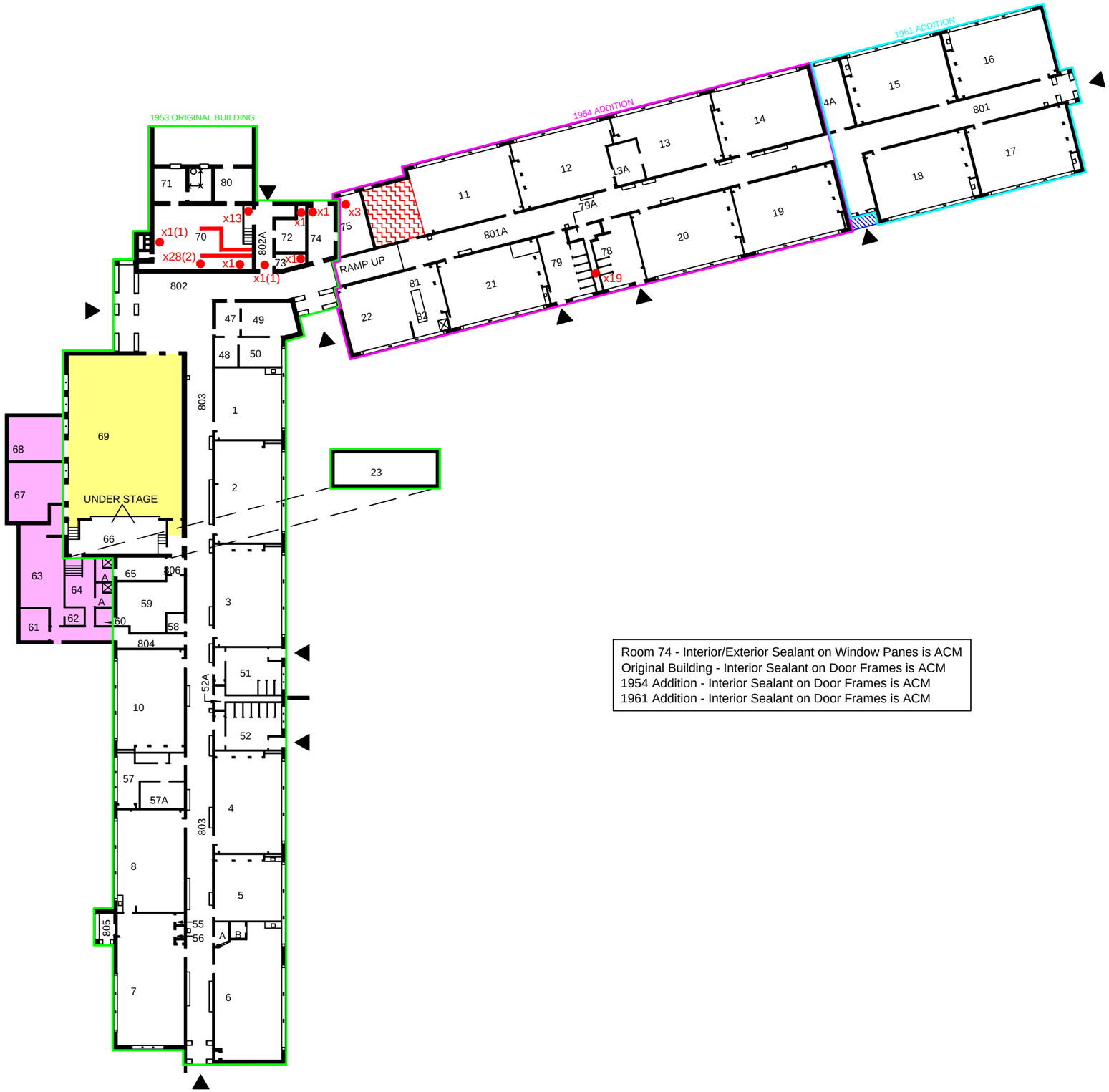
WRDSB Fixed Reference Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Asbestos Classification	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type
79A	Custodian Closet	Ceiling	Drywall	Drywall - No Compound	-	Non ACM	-	-	-	-
79A	Custodian Closet	Piping	Pipe Fitting	Parged Cement	F	ACM	HM	2551.750.001	8-Feb-90	50-75% Chrysotile
79A	Custodian Closet	Piping	Pipe Insulation	Fibreglass	-	Non ACM	-	-	-	-
80	Storage	Floor	Concrete	-	-	Non ACM	-	-	-	-
80	Storage	Wall	Concrete	-	-	Non ACM	-	-	-	-
80	Storage	Ceiling	Concrete	-	-	Non ACM	-	-	-	-
81	Staff Room	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	Non ACM	HM	S03	6-Nov-09	ND
81	Staff Room	Wall	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	-
81	Staff Room	Wall	Concrete	-	-	Non ACM	-	-	-	-
81	Staff Room	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole (Post 2(	-	Non ACM	-	-	-	-
82	Staff Room	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	Non ACM	HM	S03	6-Nov-09	ND
82	Staff Room	Wall	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	-
82	Staff Room	Wall	Concrete	-	-	Non ACM	-	-	-	-
82	Staff Room	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole (Post 2(	-	Non ACM	-	-	-	-
801	Hallway	Floor	Terrazzo	-	-	Non ACM	-	-	-	-
801	Hallway	Wall	Concrete	Concrete Block	-	Non ACM	-	-	-	-
801	Hallway	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole (1993)	-	Non ACM	-	-	-	-
801	Hallway	Ceiling	Ceiling Tile 2' x 4'	Long Fissure Random Pinhole	-	Non ACM	SL	S05abc	6-Nov-09	ND
801	Hallway	Ceiling	Transite Panel	-	NF	ACM	VC	-	-	-
801A	Hallway	Floor	Terrazzo	-	-	Non ACM	-	-	-	-
801A	Hallway	Wall	Concrete	Concrete Block	-	Non ACM	-	-	-	-
801A	Hallway	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole (1993)	-	Non ACM	-	-	-	-
801A	Hallway	Ceiling	Ceiling Tile 2' x 4'	Long Fissure Random Pinhole	-	Non ACM	SL	S05abc	6-Nov-09	ND
802	Foyer	Floor	Terrazzo	-	-	Non ACM	-	-	-	-
802	Foyer	Wall	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	ND
802	Foyer	Wall	Concrete	Concrete Block	-	Non ACM	-	-	-	-
802	Foyer	Ceiling	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	ND

School Name	Legend:	Notes:
Smithson Public School	**HM -** Homogenous Material - homogeneous with previously sampled material **SL** - Sample Location - Material Sampled **VC** - Visually Confirmed - Material not sampled, deemed ACM **NF** - Non-Friable **F**- Friable	**All quantities provided on Figures, if known. Refer to the Asbestos Audit Update Report for condition of ACM and recommended actions.**
Date Built:		**Dates provided in Material Description/Room Description columns indicates date of installation/renovation and confirms the finishes as non-ACM.**
Original: 1953		
Addition(s): 1954, 1961, 1986		

WRDSB Fixed Reference Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Asbestos Classification	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type
803	Corridor	Floor	Terrazzo	-	-	Non ACM	-	-	-	-
803	Corridor	Wall	Plaster	-	-	Non ACM	HM	S01	-	ND
803	Corridor	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole (1993)	-	Non ACM	-	-	-	-
803	Corridor	Ceiling	Ceiling Tile 1' x 1'	Large and Medium Pinhole - Cellulose	-	Non ACM	-	-	-	-
804	Corridor	Floor	Vinyl Floor Tile 12"x 12"	Yellow and Brown	-	Non ACM	HM	S10	6-Nov-09	ND
804	Corridor	Floor	Floor Tile Mastic	Black	-	Non ACM	HM	S10	17-Jan-14	ND
804	Corridor	Wall	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	ND
804	Corridor	Ceiling	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	ND
805	Vestibule	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	Non ACM	HM	S03	6-Nov-09	ND
805	Vestibule	Wall	Plaster	-	-	Non ACM	HM	S01	6-Nov-09	ND
805	Vestibule	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole (1993)	-	Non ACM	-	-	-	-
805	Vestibule	Ceiling	Ceiling Tile 1' x 1'	Large and Medium Pinhole - Cellulose	-	Non ACM	-	-	-	-

APPENDIX B

FIGURES



Room 74 - Interior/Exterior Sealant on Window Panes is ACM
Original Building - Interior Sealant on Door Frames is ACM
1954 Addition - Interior Sealant on Door Frames is ACM
1961 Addition - Interior Sealant on Door Frames is ACM

NOTES:

ALL DRAWINGS TO BE REFERENCED WITH THE ASSOCIATED REPORT, LOCATIONS AND QUANTITIES ARE APPROXIMATE.

ALL KNOWN OR SUSPECT ASBESTOS-CONTAINING MATERIALS AND/OR DESIGNATED MATERIALS ARE NOT DEPICTED ON THIS DRAWING. REFER TO THE REPORT FOR A COMPLETE LIST OF IDENTIFIED MATERIALS.

THIS FIGURE IS COLOUR DEPENDENT, PHOTOCOPIES MAY ALTER INTERPRETATION OF THE FIGURE. ALWAYS REFER TO ORIGINAL DRAWINGS AND REPORT.

Legend

- 13 — Fixed Reference Number
- No Access
- Post 1986 Construction

Asbestos-Containing Materials (ACM):

- Floor Tile
- Rolled Flooring
- Ceiling Tile
- Friable Soft Textured Ceiling
- Non-Friable Hard Textured Ceiling
- Spray-On Fire Proofing
- Transite (Asbestos Cement) Paneling
- Duct Insulation
- x2(1) — Pipe Fitting Insulation w Quantity (Brackets Indicate # of Damaged Fittings)
- Pipe Insulation (Vertical and Horizontal)
- Transite (Asbestos Cement) Pipe (Vertical and Horizontal)
- x2(1) — Duct Expansion Joints w Quantity (Brackets Indicate # of Damaged Joints)
- Friable Debris

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CLIENT
WATERLOO REGION DISTRICT SCHOOL BOARD

PROJECT
2018 ASBESTOS AUDIT UPDATE

DRAWING
SMITHSON PUBLIC SCHOOL

FIRST FLOOR

Project Manager: A. Dennett	Date: June 2018
Design By: WRDSB	Project No.: 34532-914
Drawn By: P. Semeniuk	Drawing No.: 1.0
Scale: N.T.S.	

APPENDIX C

TABLES

TABLE 1 - INTERNAL ABATEMENT MANAGEMENT

Smithson Public School

Material	WRDSB Fixed Reference Number	MTE Functional Space Number	Material Description	Approximate Quantity	Photograph - Context	Photograph - Detail	Required Action
Asbestos Friable	70	1036	Pipe Fitting Insulation	1 Fitting			Monitor Annually
Asbestos Friable	70	1036	Pipe Fitting Insulation	1 Fitting			Monitor Annually
Asbestos Friable	70	1036	Pipe Fitting Insulation	1 Fitting			Monitor Annually
Asbestos Friable	802A	1040	Pipe Fitting Insulation	1 Fitting			Monitor Annually

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

TABLE 2 - EXTERNAL ABATEMENT MANAGEMENT

Smithson Public School

Material	WRDSB Fixed Reference Number	MTE Functional Space Number	Material Description	Approximate Quantity	Photograph - Context	Photograph - Detail	Required Action
None Identified During Inspection							

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

TABLE 3: BULK ASBESTOS SAMPLING SUMMARY					
Sample #	**Location**	**Material Description**	**Asbestos Content (%)**	**Fibre Type**	**Is Material ACM**
2009 Asbestos Audit Update					
S01a	1062	Wall Plaster	ND	-	No
S01b	1059		ND	-	No
S01c	1031		ND	-	No
S01d	1014		ND	-	No
S01e	1015		ND	-	No
S01f	1009		ND	-	No
S01g	1004		ND	-	No
S02a	1062	Mastic - Above Ceiling Tile	ND	-	No
S02b			ND	-	No
S02c			ND	-	No
S03a	1062	12"x12" Floor Tile - Brown Oatmeal	ND (tile)	-	No
S03b			ND (tile)	-	No
S03c			ND (tile)	-	No
S04a	1060	12"x12" Floor Tile - White with Black Speck	ND (tile)	-	No
S04b			ND (tile)	-	No
S04c			ND (tile)	-	No
S05a	1063	2'x4' Ceiling Tile - Long Fissure Random Pinhole	ND	-	No
S05b			ND	-	No
S05c			ND	-	No
S06a	1054	12"x12" Floor Tile - Beige Oatmeal	ND (tile) ND (mastic)	- -	No No
S06b			ND (tile) ND (mastic)	- -	No No
S06c			ND (tile) ND (mastic)	- -	No No
S07a	**1047**	**Texture Coat Finish - Ceiling**	**0.75% Chrysotile**	**Friable**	**Yes**
S07b			**NA**	**Friable**	**Yes**
S07c			**NA**	**Friable**	**Yes**
S08a	**1046**	**Drywall Joint Compound - Wall**	**0.75% Chrysotile**	**Non-Friable**	**Yes**
S08b			**NA**	**Non-Friable**	**Yes**
S08c			**NA**	**Non-Friable**	**Yes**
S09a	**1028**	**9"x9" Floor Tile - Brown and White**	**0.75% Chrysotile (tile)**	**Non-Friable**	**Yes**
S09b			**NA (tile)**	**Non-Friable**	**Yes**
S09c			**NA (tile)**	**Non-Friable**	**Yes**
S10a	1022	12"x12" Floor Tile - Yellow and Brown	ND (tile)	-	No
S10b			ND (tile)	-	No
S10c			ND (tile)	-	No
S11a	Exterior	Texture Coat Finish - Exterior Overhangs	ND	-	No
S11b			ND	-	No
S11c			ND	-	No
2013 Asbestos Audit Update					
0001A	1036	Heat Shield - On Boiler	ND	-	No
0001B			ND	-	No
0001C			ND	-	No
2014 Asbestos Audit Update					
S03a	1062	12"x12" Floor Tile Brown Oatmeal - Black Mastic	ND	-	No
S03b			ND	-	No
S03c			ND	-	No
S09a	1028	9"x9" Floor Tile Brown and White - Black Mastic	ND	-	No
S09b			ND	-	No
S09c			ND	-	No
S10a	1022	12"x12" Floor Tile Yellow and Brown - Black Mastic	ND	-	No
S10b			ND	-	No
S10c			ND	-	No

TABLE 3: BULK ASBESTOS SAMPLING SUMMARY

Sample #	Location	Material Description	Asbestos Content (%)	Fibre Type	Is Material ACM
2018 Asbestos Audit Update					
S01A	1061	Plaster - Wall (1961)	ND	-	No
S02A	**1062**	**Grey Sealant on Interior Door Frames (1961)**	**0.5% Chrysotile**	**Non-Friable**	**Yes**
S02B	**1062**	**Grey Sealant on Interior Door Frames (1961)**	**NA**	**Non-Friable**	**Yes**
S02C	**1062**	**Grey Sealant on Interior Door Frames (1961)**	**NA**	**Non-Friable**	**Yes**
S03A	**1063**	**Grey Sealant on Interior Door Frames (1954)**	**1% Chrysotile**	**Non-Friable**	**Yes**
S03B	**1063**	**Grey Sealant on Interior Door Frames (1954)**	**NA**	**Non-Friable**	**Yes**
S03C	**1063**	**Grey Sealant on Interior Door Frames (1954)**	**NA**	**Non-Friable**	**Yes**
S04A	1052	Drywall Joint Compound - Wall (1954)	ND	-	No
S04B	1055	Drywall Joint Compound - Wall (1954)	ND	-	No
S04C	1047	Drywall Joint Compound - Wall (1954)	ND	-	No
S05A	**1042**	**White Sealant on Int/Ext Window Panes (1953)**	**1% Chrysotile**	**Non-Friable**	**Yes**
S05B	**1042**	**White Sealant on Int/Ext Window Panes (1953)**	**NA**	**Non-Friable**	**Yes**
S05C	**1042**	**White Sealant on Int/Ext Window Panes (1953)**	**NA**	**Non-Friable**	**Yes**
S06A	**1015**	**Grey Sealant on Interior Door Frames (1953)**	**1% Chrysotile**	**Non-Friable**	**Yes**
S06B	**1015**	**Grey Sealant on Interior Door Frames (1953)**	**NA**	**Non-Friable**	**Yes**
S06C	**1015**	**Grey Sealant on Interior Door Frames (1953)**	**NA**	**Non-Friable**	**Yes**
S07A	1052	Drywall Joint Compound - Wall (1953)	ND	-	No
S07B	1055	Drywall Joint Compound - Wall (1953)	ND	-	No
S07C	1047	Drywall Joint Compound - Wall (1953)	ND	-	No

NA: Not Analyzed due to stop positive method **ND**: No asbestos fibres detected above the laboratory minimum detection limit

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

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Certificate of Analysis

MTE Consultants Inc. (Kitchener)

520 Bingemans Centre Dr.
Kitchener, ON N2B 3X9
Attn: Aisling Dennett

Client PO:
Project: 34532-914 2018 AAU Smithson
Custody:

Report Date: 3-Jul-2018
Order Date: 21-Jun-2018

Order #: 1825533

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

Paracel ID	Client ID
1825533-01	S01A
1825533-02	S02A
1825533-03	S02B
1825533-04	S02C
1825533-05	S03A
1825533-06	S03B
1825533-07	S03C
1825533-08	S04A
1825533-09	S04B
1825533-10	S04C
1825533-11	S05A
1825533-12	S05B
1825533-13	S05C
1825533-14	S06A
1825533-15	S06B
1825533-16	S06C

Approved By:

Emma Diaz

Senior Analyst

PARACEL LABORATORIES LTD.

Order #: 1825533

Certificate of Analysis

Report Date: 03-Jul-2018

Client: MTE Consultants Inc. (Kitchener)

Order Date: 21-Jun-2018

Client PO:

Project Description: 34532-914 2018 AAU Smithson

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

Paracel I.D.	*Sample Date*	*Layers Analyzed*	*Colour*	*Description*	*Asbestos Detected:*	*Material Identification*	*% Content*
1825533-01	30-May-18	sample homogenized	White	Plaster	No	Client ID: S01A	
						Non-Fibers	100
1825533-02	30-May-18	sample homogenized	Grey	Sealant	**Yes**	Client ID: S02A	
						Chrysotile	0.5
						Non-Fibers	99.5
1825533-03	30-May-18					Client ID: S02B	
						not analyzed	
1825533-04	30-May-18					Client ID: S02C	
						not analyzed	
1825533-05	30-May-18	sample homogenized	Grey	Sealant	**Yes**	Client ID: S03A [AS-PT]	
						Chrysotile	1
						Non-Fibers	99
1825533-06	30-May-18					Client ID: S03B	
						not analyzed	
1825533-07	30-May-18					Client ID: S03C	
						not analyzed	
1825533-08	30-May-18	sample homogenized	Grey	Drywall Joint Compound	No	Client ID: S04A	
						Non-Fibers	100
1825533-09	30-May-18	sample homogenized	Grey	Drywall Joint Compound	No	Client ID: S04B	
						Non-Fibers	100
1825533-10	30-May-18	sample homogenized	Grey	Drywall Joint Compound	No	Client ID: S04C	
						Non-Fibers	100
1825533-11	30-May-18	sample homogenized	White	Sealant	**Yes**	Client ID: S05A	
						Chrysotile	1
						MMVF	5
						Non-Fibers	94
1825533-12	30-May-18					Client ID: S05B	
						not analyzed	
1825533-13	30-May-18					Client ID: S05C	
						not analyzed	
1825533-14	30-May-18	sample homogenized	Grey	Sealant	**Yes**	Client ID: S06A	
						Chrysotile	1
						Non-Fibers	99
1825533-15	30-May-18					Client ID: S06B	
						not analyzed	

PARACEL LABORATORIES LTD.

Order #: 1825533

Certificate of Analysis

Report Date: 03-Jul-2018

Client: MTE Consultants Inc. (Kitchener)

Order Date: 21-Jun-2018

Client PO:

Project Description: 34532-914 2018 AAU Smithson

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

Paracel I.D.	*Sample Date*	*Layers Analyzed*	*Colour*	*Description*	*Asbestos Detected:*	*Material Identification*	*% Content*
1825533-16	30-May-18					Client ID: S06C	
						not analyzed	

** MMVF: Man Made Vitreous Fibers: Fiberglass, Mineral Wool, Rockwool, Glasswool*

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

Analysis Summary Table

Analysis	Method Reference/Description	Lab Location	NVLAP Lab Code *	Analysis Date
Asbestos, PLM Visual Estimation	by EPA 600/R-93/116	1 - Mississauga	200863-0	29-Jun-18

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

Qualifier Notes

Sample Qualifiers :

AS-PT: Asbestos quantitation by PLM Point Count method.

Work Order Revisions / Comments

None

PARACEL LABORATORIES

Paracel ID: 1825533

ississauga Location
Kitimat Road, Unit # 15
ssauga, ON L5N 5M1

Chain of Custody
(Lab Use Only)

Client Name: MTE Consultants Inc.	Project Reference: 34532-914 2018 AAU - Smithson	TAT:
Contact Name: Aisling Dennett	Quote #: 18-226 MTE Standing Offer	[X] Regular [ ] 3 Day
Address: 520 Bingemans Centre Drive, Kitchener	PO #: N/A	[ ] 2 Day [ ] 1 Day
	Email Address: adennett@mte85.com and psemeniuk@mte85.com	[ ] Same Day
Telephone:519-743-6500		Date Required:

1825533

ASBESTOS ANALYSIS

Matrix: [ ] Air [X] Other **Regulatory Guideline:** O. Reg. 278/05

Required Analyses: [ ]PCM [X]PLM [ ]PLM 400PC [ ]PLM 1000PC [ ]Chatfield [ ]TEM

	Sample ID	Location	Matrix Description	Sampling Date	Air Volume (L)	Positive Stop? (Y / N)	Is the Sample Layered? (Y / N)	If layered, Describe Layer(s) to be Analyzed Separately* or Homogenize all **
1	S01A	1061	Plaster - Wall (1961)	30-May	-	Y	N	-
2	S02A	1062	Grey Sealant on Interior Door Frames (1961)	30-May	-	Y	N	-
3	S02B	1062	Grey Sealant on Interior Door Frames (1961)	30-May	-	Y	N	-
4	S02C	1062	Grey Sealant on Interior Door Frames (1961)	30-May	-	Y	N	-
5	S03A	1063	Grey Sealant on Interior Door Frames (1954)	30-May	-	Y	N	-
6	S03B	1063	Grey Sealant on Interior Door Frames (1954)	30-May	-	Y	N	-
7	S03C	1063	Grey Sealant on Interior Door Frames (1954)	30-May	-	Y	N	-
8	S04A	1052	Drywall Joint Compound - Wall (1954)	30-May	-	Y	N	-
9	S04B	1055	Drywall Joint Compound - Wall (1954)	30-May	-	Y	N	-
10	S04C	1047	Drywall Joint Compound - Wall (1954)	30-May	-	Y	N	-
11	S05A	1042	White Sealant on Int/Ext Window Panes (1953)	30-May	-	Y	N	-
12	S05B	1042	White Sealant on Int/Ext Window Panes (1953)	30-May	-	Y	N	-
13	S05C	1042	White Sealant on Int/Ext Window Panes (1953)	30-May	-	Y	N	-
14	S06A	1015	Grey Sealant on Interior Door Frames (1953)	30-May	-	Y	N	-
15	S06B	1015	Grey Sealant on Interior Door Frames (1953)	30-May	-	Y	N	-

*** Each layer is charged as a separate analysis** **** Homogenize = Sample is combined to a uniform mixture**

Comments:

Method of Delivery: PuLATOR

Relinquished By (Sign):

Relinquished By (Print)& Date/Time:
Paul Semeniuk June 20, 2018 2pm

Received at Depot:

Date/Time:

Received at Lab: VSpeker

Date/Time: 21/Jun 18 08:33

Verified By:

Date/Time: ~~Today~~ June 21-18 10:00

Smithson COC

PARACEL LABORATORIES L

Paracel ID: 1825533

ssissauga Location
itimat Road, Unit # 15
sauga, ON L5N 5M1

Chain of Custody
(Lab Use Only)

Client Name: MTE Consultants Inc.	Project Reference: 34532-914 2018 AAU - Smithson	TAT:
Contact Name: Aisling Dennett	Quote #: 18-226 MTE Standing Offer	[X] Regular [ ] 3 Day
Address: 520 Bingemans Centre Drive, Kitchener	PO #: N/A	[ ] 2 Day [ ] 1 Day
	Email Address: adennett@mte85.com and psemeniuk@mte85.com	[ ] Same Day
Telephone:519-743-6500		Date Required:

1825533

ASBESTOS ANALYSIS

Matrix: [ ] Air [X] Other **Regulatory Guideline:** O. Reg. 278/05

Required Analyses: [ ]PCM [X]PLM [ ]PLM 400PC [ ]PLM 1000PC [ ]Chatfield [ ]TEM

	Sample ID	Location	Matrix Description	Sampling Date	Air Volume (L)	Positive Stop? (Y / N)	Is the Sample Layered? (Y / N)	If layered, Describe Layer(s) to be Analyzed Separately* or Homogenize all **
1	S06C	1015	Grey Sealant on Interior Door Frames (1953)	30-May	-	Y	N	-
2								
3								
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* Each layer is charged as a separate analysis ** Homogenize = Sample is combined to a uniform mixture

Comments:

Method of Delivery: PUROLATOR

Relinquished By (Sign):	Received at Depot:	Received at Lab:	Verified By:
Relinquished By (Print)& Date/Time: Paul Semeniuk June 20, 2018 2pm	Date/Time:	Date/Time: 21/Jun 18 08:33	Date/Time: June 21-18 10:00

PARACEL LABORATORIES LTD.

TRUSTED.
RESPONSIVE.
RELIABLE.

15 - 6800 Kitimat Rd
Mississauga, ON, L5N 5M1
1-800-749-1947
www.paracellabs.com

Certificate of Analysis

MTE Consultants Inc. (Kitchener)

520 Bingemans Centre Dr.
Kitchener, ON N2B 3X9
Attn: Steven Nieboer

Client PO:
Project: 34532-914-Smithson Public School
Custody:

Report Date: 26-Oct-2018
Order Date: 26-Oct-2018

Order #: 1843594

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

Paracel ID	Client ID
1843594-01	S07A
1843594-02	S07B
1843594-03	S07C

Approved By:

Emma Diaz

Senior Analyst

PARACEL LABORATORIES LTD.

Order #: 1843594

Certificate of Analysis

Report Date: 26-Oct-2018

Client: MTE Consultants Inc. (Kitchener)

Order Date: 26-Oct-2018

Client PO:

Project Description: 34532-914-Smithson Public School

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

Paracel I.D.	*Sample Date*	*Layers Analyzed*	*Colour*	*Description*	*Asbestos Detected:*	*Material Identification*	*% Content*
1843594-01	24-Oct-18	sample homogenized	White	Drywall Joint Compound	No	Client ID: S07A	
						Non-Fibers	100
1843594-02	24-Oct-18	sample homogenized	White	Drywall Joint Compound	No	Client ID: S07B	
						Non-Fibers	100
1843594-03	24-Oct-18	sample homogenized	White	Drywall Joint Compound	No	Client ID: S07C	
						Non-Fibers	100

Analysis Summary Table

Analysis	Method Reference/Description	Lab Location	NVLAP Lab Code *	Analysis Date
Asbestos, PLM Visual Estimation	by EPA 600/R-93/116	1 - Mississauga	200863-0	26-Oct-18

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

Work Order Revisions / Comments

None

PARAC LABORATORIES

Paracel ID: 1843594

Mississauga Location
800 Kitimat Road, Unit # 15
Mississauga, ON L5N 5M1

Chain of Custody
(Lab Use Only)

Page 1 of 1

Client Name: MTE Consultants Inc.	Project Reference: 34532-914 - Smithson Public School	TAT:
Contact Name: Steven Nieboer	Quote #: 18-226 MTE Standing Offer	[ ] Regular [ ] 3 Day
Address: 520 Bingemans Centre Drive, Kitchener	PO #: N/A	[ ] 2 Day [ ] 1 Day
	Email Address: snieboer@mte85.com, adennett@mte85.com	[X] Same Day
Telephone:519-743-6500		Date Required: Oct 26, 2018

1843594

ASBESTOS ANALYSIS

Matrix: [ ] Air [X] Other **Regulatory Guideline:** O. Reg. 278/05

Required Analyses: [ ]PCM [X]PLM [ ]PLM 400PC [ ]PLM 1000PC [ ]Chatfield [ ]TEM

	Sample ID	Location	Matrix Description	Sampling Date	Air Volume (L)	Positive Stop? (Y/N)	Is the Sample Layered? (Y/N)	If layered, Describe Layer(s) to be Analyzed Separately* or Homogenize all **
1	S07ABC	66	Drywall Joint Compound (1953)	24-Oct	-	Y	N	-
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								

* Each layer is charged as a separate analysis ** Homogenize = Sample is combined to a uniform mixture

Comments:

Method of Delivery: Purolator

Relinquished By (Sign):	Received at Depot:	Received at Lab:	Verified By:
Relinquished By (Print)& Date/Time: Steven Nieboer, October 25, 2018	Date/Time:	Date/Time: Oct 26-18 10:00	Date/Time: Oct 26-18 10:13

APPENDIX D

ABATEMENT LETTERS

107 Whitney Pl,
Kitchener, ON, Canada.
N2G 2X8

Phone: (519) 498-0077
Fax: (519) 568 8426
E-mail: frank@asbestosmouldexperts.com

April 7th, 2015

Attention: Daniela Budure (Environmental Officer) WRDSB

Re: Confirmation of Completed Asbestos Removal for the Waterloo Region District School Board

Location: Smithson Public School – 150 Belleview Avenue Kitchener

Area: Room MTE#1036

Work Description:

Completion of MTE Asbestos Inspection report Table 01, file #34532-904 from January 14 2015.

All work done in accordance with Ont. Reg. 278/05

Completion Date: April 6th with 01 AAS and 1 AAW certified staff.

Disposal of Asbestos Waste: Erb St. Dumping & Disposal Unit Waterloo ON

License # 7549-9EZL TL

Regards,

Frank Parronchi,
Owner/President
519 498-0077

WATERLOO REGION DISTRICT SCHOOL BOARD
ATTN: JEFF CULL
51 ARDELT AVENUE
KITCHENER ON N2C 2E1

Date Received: 28-OCT-21
Report Date: 29-OCT-21 12:01 (MT)
Version: FINAL

Client Phone: 519-570-0300

Certificate of Analysis

Lab Work Order #: L2656673

Project P.O. #: NOT SUBMITTED
Job Reference: SMITHSON PS RENO
C of C Numbers:
Legal Site Desc:

Candice Hunter
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2656673-1 SA1 (SMITHSON) Sampled By: CLIENT on 27-OCT-21 Matrix: PAINT							
Metals							
Lead (Pb)	1800**		1.0	ug/g	29-OCT-21	29-OCT-21	R5632569
L2656673-2 SA2 (SMITHSON) Sampled By: CLIENT on 27-OCT-21 Matrix: PAINT							
Metals							
Lead (Pb)	4.7*		1.0	ug/g	29-OCT-21	29-OCT-21	R5632569
L2656673-3 SA3 (SMITHSON) Sampled By: CLIENT on 27-OCT-21 Matrix: PAINT							
Metals							
Lead (Pb)	3290**		1.0	ug/g	29-OCT-21	29-OCT-21	R5632569

*'De minimis' (i.e. virtually safe) level of lead paint (less than 1000 ug/g) as per October 2014 Environmental Abatement Council of Canada (EACC) publication, "Lead Guideline for Construction, Renovation, Maintenance, or Repair"

**Lead-containing paint - Paint coating containing greater than 0.1% lead by weight (1000 ug/g) and less than 0.5% lead by weight (5000 ug/g) as per October 2014 Environmental Abatement Council of Canada (EACC) publication, "Lead Guideline for Construction, Renovation, Maintenance, or Repair"

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
MET-200.2-CCMS-WT	Misc.	Metals in Paint and Miscellaneous	EPA 200.2/EPA6020A(mod)

Paint samples are digested with nitric and hydrochloric acids, followed by analysis by CRC ICPMS.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid weight of sample
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Client: WATERLOO REGION DISTRICT SCHOOL BOARD
51 ARDELT AVENUE
KITCHENER ON N2C 2E1
Contact: JEFF CULL

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	**Misc.**							
Batch R5632569								
WG3648218-2 CRM		**WT-SS-2**						
Lead (Pb)			110.0		%		70-130	29-OCT-21
WG3648218-4 LCS		**1+2**						
Lead (Pb)			108.7		%		70-130	29-OCT-21
WG3648218-1 MB								
Lead (Pb)			<1.0		mg/kg		1	29-OCT-21

Quality Control Report

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Chain of Custody (COC) / Analytical Request Form

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

L2656673-COFC

COC Number: 17 -

Page 1 of 1

Report To	Contact and company name below will appear on the final report
Company:	WRDSB
Contact:	JEFF CULL
Phone:	519-502-8345
	Company address below will appear on the final report
Street:	51 Ardelt Ave
City/Province:	Kitchener ON
Postal Code:	N2C 2R5

Report Format / Distribution	
Select Report Format:	☑ PDF ☐ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ YES ☐ NO
☑ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☐ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	
Email 2	jeff.cull@wrdsb.ca
Email 3	

Invoice To		
	Same as Report To	☑ YES ☐ NO
	Copy of Invoice with Report	☑ YES ☐ NO
Company:		
Contact:		

Invoice Distribution	
Select Invoice Distribution:	☐ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	
Email 2	

Project Information	Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	AFE/Cost Center:	PO#
Job #: Smithson PS - Reno.	Major/Minor Code:	Routing Code:
PO / AFE:	Requisitioner:	
LSD:	Location:	

ALS Lab Work Order # (lab use only): L2656673

ALS Contact: Sandie Hunter

Sampler: JEFF C.

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] ☐ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4-20%] ☐ | 3 day [P3-25%] ☐ | 2 day [P2-50%] ☐

EMERGENCY: 1 Business day [E - 100%] ☑ | Same Day, Weekend or Statutory holiday [E2 -200% (Laboratory opening fees may apply)] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	Lead Content (ppm)	SAMPLES ON HOLD	SUSPECTED HAZARD (see Special Instructions)
	Sa1	27-10-21		Paint	1	X		
	Sa 2	"		Paint	1	X		
	Sa 3	"		Paint	1	X		

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☑ NO	Lead Content (ppm)
Are samples for human consumption/ use? ☑ YES ☐ NO	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐	SIF Observations	Yes ☐	No	☐
Ice Packs	☐ Ice Cubes ☐	Custody seal intact	Yes ☐	No	☐
Cooling Initiated	☑				

INITIAL COOLER TEMPERATURES °C	FINAL COOLER TEMPERATURES °C
	13.3

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: JEFF CULL	Date: 10/28/2021	Time:	Received by:	Date:	Time:	Received by: UZ	Date: 10/28/21	Time: 13:28

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NOV 2018 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

SECTION 01 42 00 – REFERENCES

1.0 GENERAL

1.1. SECTION INCLUDES

.1 References and standards.

.2 Standards producing industry organizations and their addresses.

1.2. RELATED SECTIONS

.1 Section 01 61 00 – Product Requirements.

.2 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3. REFERENCES

.1 For Products or quality specified by association, trade, or other references or consensus standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

.2 Conform to reference standard by Ontario Building Code except where a specific date is established or required by code.

.3 Obtain copies of standards where required by product specification sections.

.4 Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of the Consultant shall be altered from the Contract Documents by mention or inference otherwise, in any reference document.

1.4. STANDARDS

.1 The following associations and organizations are cited in specification sections. Acronym, name, address, and Internet URL addresses are as follows:

.2 Canadian Organizations:

.1 **ACEC** - Association of Consulting Engineers of Canada, 130 Albert Street, Suite 616, Ottawa, ON K1P 5G4; URL: http://www.acec.ca.

.2 **AWMAC** - Architectural Woodwork Manufacturers Association of Canada, 516-4 Street West, High River, AB T1V 1B6; URL: http://www.awmac.com.

.3 **Canada Green Building Council**, 330 - 55 rue Murray Street, Ottawa, ON. K1N5M3; Tel: 613-241-1184, Fax: 613-241-5750; URL: http://www.cagbc.org.

.4 **CCA** - Canadian Construction Association, 75 Albert St., Suite 400, Ottawa, ON K1P 5E7; URL: http://www.cca-acc.com.

.5 **CCDC** – Canadian Construction Documents Committee, Refer to ACEC, CCA, CSC or RAIC; URL: http://www.CCDC.org.

.6 **CGA** - Canadian Gas Association, 20 Eglinton Avenue West, Suite 1305, Toronto, ON M4R 1K8; URL: http://www.cga.ca..

.7 **CGSB** - Canadian General Standards Board, Place du Portage, Phase III, 6B1, 11 Laurier Street, Hull, QC K1A 0S5; URL: http://w3.pwgsc.gc.ca/cgsb.

.8 **CISC** - Canadian Institute of Steel Construction, 201 Consumers Road, Suite 300, Willowdale, ON M2J 4G8; URL: http://www.cisc-icca.ca.

.9 **CLA** - Canadian Lumbermen's Association, 27 Goulburn Avenue, Ottawa, ON K1N 8C7; URL: http://www.cla-ca.ca.

.10 **CNLA** - Canadian Nursery Landscape Association, RR #4, Stn. Main,7856 Fifth Street, Milton, ON L9T 2X8; URL: http://www.canadanursery.com.

.11 **CRCA** - Canadian Roofing Contractors Association, 155 Queen Street,Suite 1300, Ottawa, ON K1P 6L1; URL: http://www.roofingcanada.com.

.12 **CSA** - Canadian Standards Association International, 178 Rexdale Blvd., Toronto, ON M9W 1R3; URL: http://www.csa-international.org.

.13 **CSC** - Construction Specifications Canada, 120 Carlton Street, Suite 312, Toronto, ON M5A 4K2; URL: http://www.csc-dcc.ca.

.14 **CSDMA** - Canadian Steel Door Manufacturers Association, One Yonge Street, Suite 1801, Toronto, ON M5E 1W7; URL: http://www.csdma.org.

.15 **CSPI** - Corrugated Steel Pipe Institute, 652 Bishop Street N, Unit 2A, Cambridge, ON N3H 4V6; URL: http://www.cspi.ca.

.16 **CSSBI** - Canadian Sheet Steel Building Institute, 652 Bishop St. N., Unit 2A, Cambridge, ON N3H 4V6; URL: http://www.cssbi.ca.

.17 **CUFCA** - Canadian Urethane Foam Contractor's Association, Box 3214, Winnipeg, MB R3C 4E7; URL: http://www.cufca.ca.

.18 **CWC** - Canadian Wood Council, 1400 Blair Place, Suite 210, Ottawa, ON. K1J 9B8; URL: http://www.cwc.ca.

.19 **EC** - Environment Canada, Conservation and Protection, Inquiry Centre, 351 St. Joseph Blvd, Hull, QC KIA 0H3; URL: http://www.ec.gc.ca.

.20 **EFC** - Electro Federation of Canada, 5800 Explorer Drive, Suite 200, Mississauga, ON L4W 5K9; URL: http://www.electrofed.com.

.21 **MPI** - The Master Painters Institute, 4090 Graveley Street, Burnaby, BC V5C 3T6; URL: http://www.paintinfo.com.

.22 **NABA** - National Air Barrier Association, PO Box 2747, Winnipeg, MB R3C 4E7; URL: http://www.naba.ca.

.23 **NLGA** - National Lumber Grades Authority, 406-First Capital Place, 960 Quayside Drive, New Westminster, BC V3M 6G2; URL: http://www.nlga.org.

.24 **NRC** - National Research Council, Building M-58, 1200 Montreal Road, Ottawa, ON K1A 0R6; URL: http://www.nrc.gc.ca.

.25 **QPL** - Qualification Program List, c/o Canadian General Standards Board, Place du Portage, Phase III, 6B1, 11 Laurier Street, Hull, QC K1A 1G6; URL: http://www.pwgsc.gc.ca/cgsb.

.26 **RAIC** - Royal Architectural Institute of Canada, 55 Murray Street, Suite 330, Ottawa, ON K1N 5M3; URL: http://www.raic.org.

.27 **SCC** - Standards Council of Canada, 270 Albert Street, Suite 2000, Ottawa, ON K1P 6N7; URL: http://www.scc.ca.

.28 **TTMAC** - Terrazzo, Tile and Marble Association of Canada, 30 Capston Gate, Unit 5 Concord, ON L4K 3E8; URL: http://www.ttmac.com.

.29 **ULC** - Underwriters' Laboratories of Canada, 7 Crouse Road, Toronto, ON M1R 3A9; URL: http://www.ulc.ca.

.3 USA Organizations:

.1 **AA** - Aluminum Association, 900 19th Street N.W., Washington, DC 20006; URL: http://www.aluminum.org.

.2 **AASHTO** - American Association of State Highway and Transportation Officials, 444 N Capitol Street N.W., Suite 249, Washington, DC 20001; URL: http://www.aashto.org.

.3 **AHA** - American Hardboard Association, 1210W Northwest Hwy, Palatine, IL 60067; URL: http://www.hardboard.org.

.4 **AITC** - American Institute of Timber Construction, 7012 S. Revere Parkway, Suite 140, Englewood, CO 80112; URL: http://www.aitc-glulam.org.

.5 **AMCA** - Air Movement and Control Association Inc., 30 West University Drive, Arlington Heights, IL 60004-1893; URL: http://www.amca.org.

.6 **ANSI** - American National Standards Institute, 25 West 43rd Street, 4th Floor, New York, NY 10036; URL: http://www.ansi.org.

.7 **APA** - The Engineered Wood Association, P.O. Box 11700, Tacoma, WA 98411-0700; URL: http://www.apawood.org.

.8 **API** - American Petroleum Institute, 1220 L St. Northwest, Washington, DC 20005-4070; URL: http://www.api.org.

.9 **ARI** - Air Conditioning and Refrigeration Institute, 4100 N Fairfax Drive, Suite 200, Arlington, VA 22203; URL: http://www.ari.org.

.10 **ASHRAE** - American Society of Heating, Refrigeration and Air-Conditioning Engineers, 1791 Tullie Circle NE, Atlanta, GA 30329; URL: http://www.ashrae.org.

.11 **ASME** - American Society of Mechanical Engineers, ASME Headquarters, 3 Park Avenue, New York, NY 10016-5990; URL: http://www.asme.org.

.12 **ASTM International**, 100 Barr Harbor Drive West, Conshohocken, PA 19428-2959; URL: http://www.astm.org.

.13 **AWCI** - Association of the Wall and Ceiling Industries International, 803 West Broad Street, Suite 600 , Falls Church, UA 22046; URL: http://www.awci.org.

.14 **AWPA** - American Wire Producer's Association, 801 N Fairfax Street, Suite 211, Alexandria, VA 22314-1757; URL: http://www.awpa.org.

.15 **AWPA** - American Wood Preservers' Association, P.O. Box 5690, Granbury TX 76049-0690; URL: http://www.awpa.com

.16 **AWS** - American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33126; URL: http://www.amweld.org.

.17 **AWWA** - American Water Works Association, 6666 W. Quincy Avenue, Denver, CO 80235; URL: http://www.awwa.org.

.18 **EIMA** - EIFS Industry Manufacturer's Association, 3000 Corporate Center Drive, Suite 270, Morrow, GA 30260; URL: http://www.eima.com.

.19 **ISAP** - International Society for Asphalt Paving, 400 Selby Avenuse, Suite 1, St. Paul, MN 55102; URL: http://www.asphalt.org.

.20 **IEEE** - Institute of Electrical and Electronics Engineers, IEE Corporate Office, 3 Park Avenue, 17th Floor, New York, NY 10016-5997;URL: http://www.ieee.org

.21 **MSS** - Manufacturers Standardization Society of the Valve and Fittings Industry, 127 Park Street, N.E., Vienna, VA 22180-4602; URL: http://www.mss-hq.com.

.22 **NAAMM** - National Association of Architectural Metal Manufacturers, 8 South Michigan Avenue, Suite 1000, Chicago, IL 60603;URL: http://www.naamm.org.

.23 **NEMA** - National Electrical Manufacturers Association, 1300 N 17th Street, Suite 1847, Rosslyn, VA 22209; URL: http://www.nema.org.

.24 **NFPA** - National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101Quincy, MA 02269-9101; URL: http://www.nfpa.org.

.25 **NFSA** - National Fire Sprinkler Association, P.O. Box 1000, Patterson, NY 12563; URL: http://www.nfsa.org.

.26 **NHLA** - National Hardwood Lumber Association, 6830 Raleigh-La Grange Road, Memphis, TN 38184-0518; URL: http://www.natlhardwood.org.

.27 **NSPE** - National Society of Professional Engineers, 1420 King Street, Alexandria, VA 22314-2794; URL: http://www.nspe.org.

.28 **PCI** - Prestressed Concrete Institute, 209 W. Jackson Blvd., Suite 500, Chicago, IL 60606-6938; URL: http://www.pci.org.

.29 **PEI** - Porcelain Enamel Institute, PO Box 920220, Norcross, GA 30010; URL: http://www.porecelainenamel.com.

.30 **SSPC** - The Society for Protective Coatings, 40 24th Street, 6th Floor, Pittsburgh, PA 15222-4656;URL: http://www.sspc.org.

.31 **TPI** - Truss Plate Institute, 583 D'Onofrio Drive, Suite 200, Madison, WI 53719; URL: http://www.tpinst.org.

.32 **UL** - Underwriters' Laboratories, 333 Pfingsten Road, Northbrook, IL60062-2096; URL: http://www.ul.com.

END OF SECTION

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SECTION 01 45 00 – QUALITY CONTROL

1.0 GENERAL

1.1. RELATED SECTIONS

.1 Section 01 21 00 - Allowances.

.2 Section 01 78 10 – Closeout Submittals and Requirements

.3 Section 01 79 00 – Demonstration and Training

.4 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.2. REFERENCES

.1 **ISO/IEC** 17025-2005 - General Requirements for the Competence of Testing and Calibration Laboratories.

.2 **SCC** (Standards Council of Canada).

1.3. INSPECTION BY AUTHORITY

.1 Allow Authorities Having Jurisdiction access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.

.2 Give timely notice requesting inspection whenever portions of the Work are designated for special tests, inspections or approvals, either when described in the Contract Documents or when required by law in the Place of the Work.

.3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.

1.4. REVIEW BY CONSULTANT

.1 Consultant may order any part of the Work to be reviewed or inspected if Work is suspected to be not in accordance with Contract Documents.

.2 If, upon review such work is found not in accordance with Contract Documents, correct such Work and pay cost of additional review and correction.

.3 If such Work is found in accordance with Contract Documents, The owner will pay cost of review and replacement.

1.5. INDEPENDENT INSPECTION AGENCIES

.1 Independent Inspection and Testing Agencies will be engaged by Contractor for purpose of inspecting and testing portions of Work.
.2 The Board may, at their discretion, request that the Consultant direct the Contractor to engage independent inspecting and or testing agencies to review or test the Work.
.3 Allocate Costs for inspections and testing to Section 01 21 00.
.4 Provide equipment required for executing inspection and testing by appointed agencies.
.5 Employment of inspection and testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
.6 If defects are revealed during inspection and/or testing, the appointed agency will request additional inspection and testing to ascertain full degree of defect. Correct defect and irregularities as advised by Consultant at no cost to Owner. Contractor shall pay costs directly to the inspection agency for retesting and re-inspection.

1.6. ACCESS TO WORK

.1 Allow inspection and testing agencies access to Work, off site manufacturing and fabrication plants.
.2 Cooperate to provide reasonable access and facilities for such access.

1.7. CONTRACTOR RESPONSIBILITIES

.1 Notify appropriate agency minimum 48 hours in advance of requirement for tests, in order that attendance arrangements can be made.
.2 Submit samples and materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in Work.
.3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.8. DUTIES & AUTHORITY OF TESTING AGENCY

.1 Testing agency is expected to do the following:
    .1 Act in a professional and unprejudiced basis and carry out inspection and testing functions to establish compliance with requirements of Contract Documents.
    .2 Check work as it progresses and prepare reports stating results of tests and conditions of work and state in each report whether specimens

tested conform to requirements of Contract Documents, specifically noting deviations.

.3 Distribute reports as follows

.1 Consultant

.2 Owner

.3 Contractor

.2 Testing agency is not authorized to amend or release any requirements of Contract Documents, nor to approve or accept any portion of work.

1.9. REJECTED WORK

.1 The Contractor shall remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Consultant as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.

.2 Make good other Contractor's work damaged by such removals or replacements promptly.

.3 If, it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, the Owner may choose to accept the condition. The difference in value between Work performed and that called for by Contract Documents shall be deducted from the Contract value via Change Order. The amount of this change shall be determined by Consultant. The Contractor shall warrant the work performed for the time period specified as if it were performed in accordance with the Contract Documents.

1.10. TESTING OF EXCAVATION & BACK FILL

.1 The Consultant must approve all Sample and fill tests prior to purchase.

.2 In coordination with the Consultant and Contractor, inspect and test backfill and fill to ensure the degree of compaction specified has been obtained.

.3 Inspect excavation at required levels in regard to bearing values for footings, foundations and floor slabs.

.4 Authorization and calculation of extra excavation work, if required, due to unsatisfactory bearing shall be adjusted by Unit Price.

1.11. CONCRETE STRENGTH TESTS

.1 Review the proposed concrete mix design and check test if considered necessary.

.2 Obtain representative samples of fresh concrete for each mix design of concrete placed in any one day as directed by the Consultant.

.3 Make standard slump tests.

.4 Mould three (3) standard 150mm diameter cylindrical test specimens from each sampling of fresh concrete. Store specimens as per best practice while they are on the site. Cure all cylinders in the laboratory under standard moisture and temperature conditions. Compression test one of the cylinders at 7 days and the remaining two at 28 days after sampling. Each concrete cylinder test report shall contain the specific location of concrete represented by sample, design strength, aggregate size, admixtures used, date, hour and temperature at time of sampling, percentage air content, unit weight and test strength of cylinder.

.5 When concrete is placed under the conditions of "Cold Weather Requirements" make one additional cylinder; store it in a heated enclosure for 24 hours and then store it on the job site in a place protected from disturbance and off the ground. Compressive test this cylinder 7 days after sampling.

.6 Determine the air content of air entrained standard weight concrete.

.7 Determine the air content and unit weight of light weight concrete by the volumetric method.

.8 Additional testing required because of changes in materials or proportions of the mix requested by the Contractor as well as any extra testing of concrete or materials occasioned by their failure to meet specification requirements or testing of the structure or performance of the structure, including load testing, shall be carried out at the Contractor's expense.

1.12. INSPECTION OF STRUCTURAL STEEL

.1 Ensure all steel has mill test reports that comply with the Specification prior to purchase.

.2 Inspect fabrication of steel in plant.

.3 Inspect erection work at site including fit-up, placing, plumbing, levelling, temporary bracing, field cutting and alterations.

.4 Shop and field inspect welded and bolted connections and painting.

.5 High strength bolts - the installation and testing of bolts shall conform to the requirements of CSA S16-1969. Check one representative connection in ten by torque testing every bolt, and check each bolt in every connection with a tap of hammer for soundness. Enforce requirements of connection type.

.6 Examine visually all welded joints for inclusions, porosity, lack of fusion penetration or even contour, undercuts and cracks. Root passes shall be checked for penetration and cracks from the back of the joint. Any suspect welds shall be checked ultrasonically.

1.13. INSPECTION OF METAL DECK

.1 Check deck for gauge, type and protective coating thickness to ensure compliance with Specification.

.2 Inspect erection work at the site including anchorage.

1.14. INSPECTION AND TESTING OF PAVING

.1 Testing shall be carried out in three stages as described below by means of sufficient site visits to ensure satisfactory results but in no case less three site visits.

.2 Test within 16 hours from time called to do so by Contractor, since paving is a critical item at the end of the project.

.3 Stage One:

- .1 Visual inspection and compaction tests of subsoil.

.4 Stage Two:

- .1 Inspection of granular sub-base (after each layer is placed or after the last layer is placed and compacted).
- .2 On site density tests.
- .3 Verify thickness of various levels. (Minimum of 4 checks shall be done on thickness in a paved area of 250m2 or less, and 1 additional check for each additional 250m2 or part thereof).
- .4 Laboratory tests: moisture content and grading of materials.

.5 Stage Three:

- .1 Inspection of asphalt installation.
- .2 Checking of thickness and density of material and checking suitability of equipment used.

.6 Standard Proctor Test shall be carried out for all projects.

.7 Further, grain size analysis and Marshall test shall be carried out if visual inspection is not satisfactory or, if there is reason to suspect materials supplied are not acceptable.

.8 All laboratory tests shall be performed according to A.S.T.M. methods, latest revisions

.9 Paving Contractor shall obtain from their supplier grading tables of materials used and submit them to the testing laboratory for approval. The paving contractor shall ensure material delivered complies with grading tables.

.10 Be responsible for all approvals given to Paving Contractor. At completion of paving project, inform Consultant all tests were performed according to the Specifications and the Contractor's performance has been approved.

.11 The Consultant will not entertain any credits for work either not performed or incorrectly performed by the contractor. If thicknesses or consistencies of sub-base are not as specified, or if asphaltic material is not as specified, then the Contractor shall remove same at their expense and provide proper specified materials.

1.15. BUILDING THERMOGRAPHIC SCAN

.1 Upon completion of the Work, the Consultant and/or Owner may arrange for an independent agency to carry out a thermographic scan of the building to determine acceptability of thermal performance of the building envelope.

.2 Consultant, prior to start of construction work, will designate a sample area of the building to include a portion of exterior wall and roof.

.3 Consultant will implement a special inspection program for this sample area to be carried out as construction progresses. Contractor shall not cover any completed work until notifying Consultant and receiving acceptance of completed work. Contractor shall remove and replace any work which is installed in contravention of this requirement.

.4 Results of thermographic scan of entire building will be evaluated and compared to those of the sample area to determine acceptance or rejection of any part of the building envelope.

.5 Contractor shall carry out remedial work as required to bring quality of any rejected portion of the building envelope to that of the sample area. Contractor shall pay for costs of any follow-up thermographic scans required to determine acceptability of remedial work. This procedure shall be repeated until all parts of the building envelope have been accepted.

1.16. TESTS AND MIX DESIGNS

.1 Furnish test results and mix designs as may be requested.

.2 The cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work shall be appraised by Consultant and may be authorized as recoverable.

1.17. MOCK-UP

.1 Prepare mock-up for Work specifically requested in specifications. Include for Work of all Sections required to provide mock-ups.

.2 Prepare mock-ups for Consultants review with reasonable promptness and in an orderly sequence, so as not to cause any delay in Work.

.3 Failure to prepare mock-ups in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.
.4 If requested, Consultant will assist in preparing a schedule fixing dates for preparation.
.5 Remove mock-up at conclusion of Work or when acceptable to Consultant. Repair any damage and clean-up at place of mock-up.
.6 Approved mock-up may remain as part of Work.

1.18. EQUIPMENT AND SYSTEMS

.1 Submit adjustment and balancing reports for mechanical and electrical systems to the consultant.
.2 Refer to Sections 01.78.10 and 01.79.00 for definitive requirements.

END OF SECTION

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SECTION 01 51 00 – TEMPORARY UTILITIES

1.0 GENERAL

1.1. RELATED SECTIONS

.1 Section 01 52 00 - Construction Facilities.

.2 Section 01 53 00 - Temporary Construction.

.3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.2. INSTALLATION AND REMOVAL

.1 Provide temporary utilities controls in order to execute work expeditiously.

.2 Location of temporary facilities shall be subject to Consultant's approval.

.3 Salvage and assist in recycling products for potential reuse wherever possible.

.4 Remove temporary facilities from site when directed by consultant.

1.3. DEWATERING

.1 Provide temporary drainage and pumping facilities to keep excavations and site free from standing water. Provide necessary pumps (including spare pumps) and temporary drainage for keeping the Work free of water throughout construction period. Locate sumps away from foundation elements. Control grading around excavation to prevent surface water from draining into excavation and from damaging adjoining property.

1.4. WATER SUPPLY

.1 Provide continuous supply of potable water for construction use until such time as permanent municipal water supply is available.

.2 Hose extensions to be provided by subcontractors requiring them.

.3 For New Builds arrange for connection with appropriate utility company and pay all costs for installation, maintenance, removal and usage costs until occupancy has been achieved.

.4 For Additions and renovations the contractor can use existing Board service unless noted otherwise.

1.5. TEMPORARY HEATING AND VENTILATION

.1 Provide temporary heating required during construction period, including unit rental costs, maintenance.

.2 Provide temporary heating fuel, if not already available on site, until such time as a permanent natural gas line is installed, and thereafter fuel costs shall be borne by the Board. The Contractor shall provide all connections and piping between the permanent fuel source and the heating appliance(s).

.3 Provide temporary heat and ventilation in enclosed areas as required to:

.1 Facilitate progress of Work.

.2 Protect Work and products against dampness and cold.

.3 Prevent moisture condensation on surfaces.

.4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.

.5 Provide adequate ventilation to meet health regulations for safe working environment.

.4 Maintain temperatures of minimum:

.1 10 degrees C in areas where construction is in progress, until takeover by Board. Contractor to ensure temporary enclosures remain sealed and penetrations are repaired or closed in a timely fashion.

.2 16 degrees C in areas where finishes are in progress.

.3 16 degrees C in building once it is enclosed.

.4 Refer to other Sections for intermittent heating requirements up to 21 degrees C. Provide insulated tarp enclosures for openings as required to enclose the building after completion of main building shell components and roof.

.5 If the Contractor fails to ensure the temporary enclosures remained sealed (including temp doors when not in use) the Consultant and or the Board shall require the contractor to pay 40% of that months usage charge

.5 Use forced hot air heaters. Open-flame type heaters or salamanders are not permitted. Ventilate direct fired heating units to the outside.

.6 Uniformly distribute heat to avoid hot and cold areas and to prevent excessive drying.

.7 Early heating of the building shell will be required to expedite interior finishing to meet the project schedule.

.8 Ventilating:

.1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.

.2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.

.3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.

.4 Ventilate storage spaces containing hazardous or volatile materials.
.5 Ventilate temporary sanitary facilities.
.6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.
.7 Provide minimum 1 air change per hour for enclosed areas receiving architectural finishes.
.8 Do not allow excessive build-up of moisture inside building.

.9 The permanent mechanical systems for the new building, when installed in safe operating conditions, may be used for temporary heating or cooling if approved in writing by the Consultant, without penalty to the warranty.

.10 Follow the requirements of "Temporary Use of New Permanent Services and Equipment" if the permanent heating system installed under the contract is intended to be used for temporary heating during the construction.

.11 Provide competent persons to operate and maintain permanent systems for duration of temporary use period.

.12 Perform required repairs and maintenance immediately after each inspection. Pay for operating costs. Upon termination of temporary use period, services and equipment shall be inspected, tested, adjusted, fitters replaced, balanced, cleaned and lubricated.

.13 Permanent services and equipment shall be turned over to Owner in new and perfect operating condition.

.14 Use of permanent systems and equipment as temporary facilities shall not affect the guarantee conditions and guarantee period for such systems and equipment. Make due allowance to ensure Owner will receive full benefits of equipment manufacturer's warranty from the date of Substantial Performance.

.15 Ensure date of Substantial Performance of the Work and Warranties for heating system do not commence until entire system is in as near original condition as possible and is certified by Consultant.

.16 Maintain strict supervision of operation of temporary heating and ventilating equipment to:
.1 Conform with applicable codes and standards.
.2 Enforce safe practices.
.3 Prevent abuse of services.
.4 Prevent damage to finishes.
.5 Vent direct-fired combustion units to outside.

.17 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

1.6. TEMPORARY POWER AND LIGHT

.1 Provide temporary electrical service and system including lighting and power system for use by all Sections.

.2 Contractor will provide a source for, and pay the costs of temporary power during construction for temporary lighting and operating of power tools until such time as permanent source is available.

.3 Contractor to ensure that the use of power from a source provided by the Board shall not exceed the capacity of the current use required for the operation of any existing facility.

.4 Install and maintain temporary electrical service and systems in accordance with Construction Safety Association's "Temporary Wiring Standards on Construction Sites", the Ontario Electrical Code and other authorities having jurisdiction.

.5 Provide at least one temporary panel on each floor with service capacity suitable for construction requirements and to authorities and utilities approval.

.6 Provide temporary wiring with lighting to all areas of each floor to provide adequate lighting.

.1 Lighting levels must be maintained at a minimum of 10 foot candles, or to suit the particular location or operation, whichever is greater.

.2 Do not use materials of the temporary service in permanent installation.

.3 Increase lighting levels equivalent to the final requirements when finishing operations are underway.

.7 Extension cords, lights, etc., required by various subcontractors and run from above outlet positions will be supplied and maintained by the party or parties requiring same.

.8 Follow requirements of "Temporary Use of New Permanent Services and Equipment" if electrical power and lighting systems installed under the contract are intended to be used for temporary electricity and lighting during the construction.

.9 Electrical power and lighting systems installed under this contract can be used for construction provided damages are made good and all lamps that have been used for more than two months are replaced with new lamps.

.10 For New Builds arrange for connection with appropriate utility company and pay all costs for installation, maintenance, removal and usage costs until occupancy has been achieved.

.11 For Additions and renovations the contractor can use existing Board service unless noted otherwise.

.12 Provide and pay for temporary power for electric cranes and other equipment requiring temporary power in excess of above noted requirements.

1.7. TEMPORARY COMMUNICATION FACILITIES

.1 Contractor to provide and pay for temporary Phone, e-mail and printer hook up, for the duration of contract until completion for use by the contractor.

.2 The site superintendent is to have e-mail access and a printer on site.

END OF SECTION

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SECTION 01 53 00 – TEMPORARY CONSTRUCTION FACILITIES

1.0 GENERAL

1.1. RELATED SECTIONS

.1 Section 01 51 00 - Temporary Utilities.

.2 Section 01 35 23 – Health and Safety

.3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.2. INSTALLATION AND REMOVAL

.1 Provide temporary construction facilities in order to execute work expeditiously.

.2 Remove temporary facilities from site when directed by Consultant.

1.3. PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

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

.2 Be responsible for damage incurred.

1.4. PROTECTION OF SURROUNDING WORK

.1 Provide protection for finished and partially finished Work from damage.

.2 Provide necessary cover and protection.

.3 Be responsible for damage incurred due to lack of or improper or inappropriate protection.

1.5. ROOF AND STRUCTURE PROTECTION

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

.2 The Contractor when indicated by the Board Contact or Consultant shall provide roof protection. Ensure all precautions are taken to avoid liability for roof damage.

.3 Typical roof protection shall consist of a layer of 1inch rigid foam insulation set directly on the roof surface and a layer of 19 mm (3/4 inch) plywood in all places under scaffold legs, ladder legs and in areas of foot traffic or falling debris.

1.6. WORK SITE ENCLOSURE & SAFETY BARRIERS

.1 Erect and maintain for the duration of the work:

.1 a minimum 1800 mm high chain link fence or self-supporting, heavy duty, interconnected fence panels (commonly referred to as Insta-fence)for a temporary site enclosure (hoarding) completely around perimeter of work site,
.2 any temporary posts shall be completely removed by the contractor prior to occupancy,
.3 under no circumstance shall t-bar posts be used on board property
.4 any additional safety devices including full hoarding as required and noted on the drawings, to protect the students, staff, public and private property from injury and damage,
.5 any additional requirements as regulated by authorities having jurisdiction, local by-laws and zoning.

.2 The Contractor is to assume full responsibility for any injury or damage caused due to failure to comply with Paragraph 1 above.
.3 Any hazardous conditions identified outside of the main fenced area will be barricaded with a fence complying to the above.
.4 Provide lockable truck entrance gate/gates and at least one (1) pedestrian door as directed and conforming to applicable traffic restrictions on adjacent streets. Equip gates with locks and keys with restricted availability, in the project office.
.5 Erect and maintain pedestrian walkways including roof and side covers, complete with signs and electrical lighting as required by law.
.6 Provide barriers around trees and plants designated to remain.
.7 Protect from damage by equipment and construction procedures.

1.7. TREE PROTECTION

.1 Protect all existing trees to remain from damage during construction period. Make good, at Contractor's expense, trees damaged during construction.
.2 Confine movement of heavy equipment, storage of same, and storage of materials to a predetermined area. Do not store materials or place equipment over root systems of any existing trees to remain.
.3 Install fencing or approved equal at limits of drip line of existing trees to remain unless directed otherwise. Where this case is not practical, and only if approved by the Consultant, the trunks shall be protected with an approved tree guard.
.4 No rigging cables shall be wrapped around or installed in trees. Do not flush concrete trucks or cement mixing machines over root systems or near trees. Flush concrete trucks or cement mixing machines in areas approved by Consultant.

.5 Areas where root systems of trees are exposed directly adjacent to a structure will be backfilled with good loam only.
.6 Whenever excavating is required within branch spread of trees that are to remain, the contractor shall contact the consultant for direction prior to the start of work.
.7 If any existing tree to remain is injured and does not survive the following year, it will, as determined by the Board, be removed in its entirety and be replaced with a tree of similar size and value, as directed by the Consultant.
.8 Should the destroyed tree be of such a size or shape that it cannot be feasibly replaced, the Contractor shall compensate the Owner for the minimum sum of five thousand dollars ($5,000.00) per destroyed tree.

1.8. GUARD RAILS AND BARRIERS

.1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs.
.2 Erect and maintain for the duration of the Work, safety devices and barricades including hoarding, as required, to protect the staff, students, public and private property, from injury and damage.
.3 The Contractor is to ensure that all requirements from authorities having jurisdiction and all requirements from the Owner are met.
.4 The Contractor is to assume full responsibility for any damage caused due to his failure to comply with paragraph 2 above.
.5 Hazardous conditions on the exterior shall be fenced.

1.9. WEATHER ENCLOSURES

.1 Provide weather tight closures to unfinished door and window openings, tops of shafts and other openings in floors and roofs.
.2 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.
.3 Design enclosures to withstand wind pressure.

1.10. DUST TIGHT BARRIERS

.1 Provide dust tight barriers and screens or partitions to localize dust generating activities, and for protection of workers, finished areas of Work and public.
.2 Maintain and relocate protection until such work is complete.
.3 Where required adjust air handling units to eliminate migration of dust.

1.11. SCAFFOLDING

.1 Erect scaffolding independent of walls and use in such a manner limiting interference with other work. When not in use, move scaffolding as necessary to permit installation of other work. Construct and maintain scaffolding in a rigid, secure and safe manner. Remove it promptly when no longer required. Protect surface on which scaffolding is bearing.

1.12. SHORING, BRACING, PILING

.1 Provide shoring, bracing, piling, sheeting and sheet piling and underpinning required to support soil banks, existing work and property in accordance with Construction Safety Act and other applicable regulations. Maintain shoring until building is strong enough and sufficiently braced to withstand pressure of backfilling. Make construction aids free of permanent work so they may be removed entirely when no longer required, without damaging the Work. Locate construction aids so adequate room is left for damp-proofing foundation walls, laying substructure drainage and other work.

.2 Shoring and false work over one tier in height shall be designed and shall bear the stamp of a registered professional engineer, having experience in this field.

1.13. HOISTING

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

.2 Machinery shall be operated by qualified operator.

1.14. OVERHEAD LIFTING

.1 Any condition requiring the use of a crane or lifting device over a Board structure must follow the requirements of Health and Safety Section 01 35 23, Paragraph 1.15 Overhead Lifting.

1.15. ELEVATORS/LIFTS

.1 When elevators/lifts are to be used by construction personnel, provide protective coverings for finish surfaces of elevator cabs and entrances.

.2 Co-ordinate use of elevator cabs with Consultant and the Board.

1.16. USE OF THE WORK

.1 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with Products.

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

1.17. CONSTRUCTION PARKING

.1 Construction personnel vehicle parking, to be confined to the work site enclosure, or.

.2 Parking will be permitted on site only where and if it does not disrupt the employees of the place of work as directed by the Board

.3 Permission to park vehicles on site does not imply any liability or responsibility for safe keeping of vehicles and contents thereof by the School Board.

1.18. ACCESS TO SITE

.1 Provide and maintain adequate access to project site.

.2 Build and maintain temporary roads where necessary and provide snow removal within the area of work, and access to the work, during period of Work. The area shall be restored to the satisfaction of the Board at the completion of the project.

.3 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contractors' use of roads.

.4 Clean roadways and taxi areas where used by Contractor's equipment.

1.19. SECURITY

.1 The Contractor shall ensure the security of the work site, contents, and built structures for the duration of the project.

.2 The Contractor shall be responsible to provide and pay for security personnel to guard site and contents of site after working hours and during holidays as required.

.3 Notify the Board of the use of security guards or systems.

.4 The Board shall not be responsible for the loss, theft, or vandalism.

1.20. OFFICES

.1 Provide and maintain, until completion of Contract, for Contractor's use, a temporary office, large enough to accommodate site administrative activities and site meetings, complete with light, heat, air conditioning, ventilation, table and chairs. Do not store materials in office area; keep clean and tidy.

.2 Provide a clearly marked and fully stocked first-aid case in a readily available location.

.3 Subcontractors may provide their own offices as necessary. Direct location of these offices.

1.21. EQUIPMENT, TOOL AND MATERIALS STORAGE

.1 Provide and maintain, in a clean and orderly condition, lockable weatherproof sheds and platforms for storage of tools, equipment and materials.

.2 Review storage areas on site with the Consultant. Store materials and equipment to ensure preservation of quality of product and fitness for the Work. Store materials and equipment on wooden platforms or other hard, clean surfaces, raised above the ground or in water tight storage sheds of sufficient size for storage of materials and equipment which might be damaged by storage in open. Locate stored materials and equipment to facilitate prompt inspection.

.3 Store packaged materials and equipment undamaged, in their original wrappings or containers, with manufacture's labels and seals intact.

.4 Locate materials not required to be stored in weatherproof sheds on site in a manner to cause least interference with work activities.

.5 Storage sheds required by subcontractors shall be provided by them.

1.22. SANITARY FACILITIES

.1 Provide weatherproof temporary toilet/sanitary facilities for work force in accordance with governing regulations and ordinances.

.2 Service temporary toilet/sanitary facilities as required by authorities but not less than weekly.

.3 Post notices and take such precautions as required by local health authorities.

.4 The use of existing washroom facilities is not allowed unless specifically approved by the Board. The Contractor will be required to clean and maintain the existing washrooms to Board standards.

.5 Except where connected to municipal sewer system, periodically remove wastes from Site.

.6 Keep toilet/sanitary facilities clean and sanitary and protect from freezing.

.7 Keep sanitary facilities clean and fully stocked with the necessary supplies at all times.

END OF SECTION

SECTION 01 61 00 – PRODUCT REQUIREMENTS

1.0 GENERAL

1.1. RELATED SECTIONS

.1 This section describes requirements applicable to all Sections within Divisions 02 to 49.

.2 Section 01 31 00 – Project Managing and Coordination

1.2. TERMINOLOGY

.1 New: Produced from new materials.

.2 Renewed: Produced or rejuvenated from an existing material to like-new condition to serve a new or existing service.

.3 Defective: A condition determined exclusively by the Consultant.

1.3. PRODUCT QUALITY

.1 The term 'new' in the following paragraph does not exclude re-manufactured products that have some or all of the materials recycled from other sources. Preference in recycling is for post-consumer recycled materials.

.2 Products, materials, equipment, parts or assemblies (referred to as Products) incorporated in Work:

.3 New Product, not damaged or defective, of best quality (compatible with specification requirements) for purpose intended. If requested, provide evidence as to type, source and quality of Products provided.

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

.5 Should any dispute arise as to quality or fitness of Products, decision rests strictly with Consultant.

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

1.4. AVAILABILITY

.1 Immediately upon receipt of Boards Purchase Order, review Product delivery requirements and anticipate foreseeable supply delays for any items.

.2 Immediately upon receipt of Boards Purchase Order the Contractor shall issue Purchase Orders and or Contracts to all Sub-trades. Provide proof to

the Consultant and the Board within 3 days. The Sub-Contractors shall identify in writing any delivery issues within 14 days of receiving the Contractors purchase order or contract. The Schedule noted in 01-31 00 1.7.1 shall incorporate all deliveries and installation.

.3 If delays in supply of Products are foreseeable, notify Consultant of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

.4 In event of failure to notify Consultant at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Consultant reserves right to substitute more readily available Products of similar character, at no increase in Contract Price or Contract Time.

1.5. STORAGE AND PROTECTION

.1 Store and protect Products in accordance with manufacturers' written instructions.

.2 Store with seals and labels intact and legible.

.3 Store sensitive Products in weather tight, climate controlled, enclosures in an environment favourable to Product.

.4 For exterior storage of fabricated Products, place on sloped supports above ground.

.5 Cover Products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of Products.

.6 Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

.7 Provide equipment and personnel to store Products by methods to prevent soiling, disfigurement, or damage.

.8 Arrange storage of Products to permit access for inspection. Periodically inspect to verify Products are undamaged and are maintained in acceptable condition.

1.6. TRANSPORTATION AND HANDLING

.1 Transport and handle Products in accordance with manufacturer's written instructions.

.2 Promptly inspect shipments to ensure that Products comply with requirements, quantities are correct, and Products are undamaged.

.3 Provide equipment and personnel to handle Products by methods to prevent soiling, disfigurement, or damage.

.4 Suitably pack, crate and protect products during transportation to site to preserve their quality and fitness for the purpose intended.

.5 Store products in original, undamaged condition with manufacturer's labels and seals intact until they are being incorporated into completed work.

.6 Protect materials from damage by extreme temperatures or exposure to the weather.

1.7. EXISTING UTILITIES

.1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to the owner.

.2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

1.8. MANUFACTURER'S WRITTEN INSTRUCTIONS

.1 Unless otherwise indicated in specifications, install or erect Products to manufacturer's written instructions. Do not rely on labels or enclosures provided with Products. Obtain written instructions directly from manufacturers.

.2 Notify Consultant in writing, of conflicts between specifications and manufacturer's instructions, so that Consultant may establish course of action.

.3 Improper installation or erection of Products, due to failure in complying with these requirements, authorizes Consultant to require removal and re-installation at no increase in Contract Price or Contract Time.

1.9. QUALITY OF WORK

.1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Consultant if required Work is such as to make it impractical to produce required results.

.2 Do not employ anyone unskilled in their required duties. Consultant and or Board reserves right to require dismissal from site any workers deemed incompetent or careless.

.3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Consultant, whose decision is final.

.4 Products, materials, systems and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with the applicable manufacturer's printed directions.

.5 Where specified requirements are in conflict with manufacturer's written directions, follow manufacturer's directions. Where specified requirements are more stringent than manufacturer's directions, comply with specified requirements.

1.10. COORDINATION

.1 Ensure cooperation of workers in laying out Work. Maintain efficient and continuous supervision.

.2 Be responsible for coordination and placement of openings, sleeves and accessories.

.3 Contractor is responsible to ensure suppliers or distributors of materials specified or alternatives accepted, which he intends to use, have materials with original schedule, and similarly it shall be the responsibility of all subcontractors and suppliers to so inform the Contractor.

.4 Contractor shall contact Consultant immediately upon receipt of information indicating materials or items, will not be available on time, in accordance with the latest approved schedule, and similarly it shall be the responsibility of all subcontractors and suppliers to so inform the Contractor.

.5 The above, in no way releases the Contractor, or their subcontractors and suppliers of their responsibility for ensuring timely ordering of materials and items required, including the necessary expediting, to complete the Work as scheduled in accordance with the Contract Documents including temp accommodations and or materials to ensure occupancy date is achieved.

1.11. CONCEALMENT

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

.2 Before installation, inform Consultant if there is interference. Install as directed by Consultant at no additional cost to the Board.

1.12. REMEDIAL WORK

.1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Coordinate adjacent affected Work as required.

.2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.13. LOCATION OF FIXTURES

.1 Inform Consultant of conflicting installation. Install as directed.

1.14. FASTENINGS - EQUIPMENT

.1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.

.2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use Type 304 or 316 stainless steel for exterior areas.

.3 Bolts may not project more than one diameter beyond nuts.

.4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

1.15. PROTECTION OF WORK IN PROGRESS

.1 Prevent overloading of any part of the Project.

.2 Do not cut, drill or sleeve any load bearing structural member, unless specifically indicated, without written approval of Consultant.

END OF SECTION

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SECTION 01 70 00 – EXAMINATION AND PREPARATION

1.0 GENERAL

1.1. RELATED SECTIONS

.1 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.2. REFERENCES

.1 Owner's identification of existing survey control points and property limits.

1.3. SUBMITTALS

.1 Submit name and address of Surveyor to Consultant.

.2 On request of Consultant, submit documentation to verify accuracy of field engineering work.

.3 Submit certificate signed by surveyor certifying that elevations and locations of completed Work conforms with Contract Documents.

1.4. QUALIFICATIONS OF SURVEYOR

.1 Qualified registered land surveyor, licensed to practise in the Place of the Work.

1.5. SURVEY REFERENCE POINTS

.1 Existing base horizontal and vertical control points are designated on Drawings.

.2 Locate, confirm and protect control points prior to starting site Work. Preserve permanent reference points during construction.

.3 Make no changes or relocations without prior written notice to Consultant.

.4 Report to Consultant when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.

.5 Require surveyor to replace control points in accordance with original survey control.

1.6. SURVEY REQUIREMENTS

.1 Establish existing and new permanent bench marks on site, referenced to established bench marks by survey control points.

.2 Record locations, with horizontal and vertical data in Project Record Documents.

.3 Establish lines and levels, locate and lay out, by instrumentation.

.4 Establish pipe invert elevations.
.5 Stake batter boards
.6 Establish foundation and floor elevations.
.7 Establish lines and levels for mechanical and electrical work.

1.7. SUBSURFACE CONDITIONS

.1 Promptly notify Consultant in writing if discovered surface or subsurface conditions at Place of Work differ materially from those indicated in Contract Documents.
.2 Advise the Consultant of a reasonable assumption of probable conditions when determined.
.3 After prompt investigation, should Consultant determine that conditions do differ materially, instructions will be issued for changes in Work.

1.8. EXAMINATION

.1 The Contractor is expected to be totally familiar with site conditions and shall assume full responsibility for the cost involved in repairing any damage to the building, site and services, city property, adjacent buildings, etc., during general construction, regardless of the extent of the damage.
.2 Inspect existing conditions, including elements or adjacent Work subject to irregularities, damage, movement, including Work during cutting and patching.
.3 The Contractor shall provide all equipment necessary to make a full and detailed site evaluation. This shall include but not be limited to ladders, flashlights and hand tools.
.4 The Contractor expressly agrees that conditions above existing suspended acoustic ceilings, but below fixed structure, unless obscured by an additional ceiling above, shall be considered exposed conditions for the purposes of making findings under the provisions of the Contract. There shall be no claims for extra costs for extra Work in these areas.
.5 After uncovering, inspect conditions affecting performance of the Work.
.6 Beginning of cutting or patching means acceptance of existing conditions.

1.9. PREPARATION

.1 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.
.2 Provide protection from elements for areas which may be exposed by uncovering work; maintain excavations free of water.

1.10. EXISTING SERVICES

.1 Before commencing work, establish location and extent of service lines in area of Work and notify Consultant of findings.

.2 Remove abandoned service lines running through within existing and new structures. Cap or seal lines at cut-off points as directed by Consultant.

1.11. LOCATION OF EQUIPMENT AND FIXTURES

.1 Inform Consultant of conflicting installations, install as directed.

.2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.

.3 Inform Consultant of impending installation and obtain approval for actual location.

.4 Submit field drawings to indicate relative position of various services and equipment when required by Consultant.

1.12. SURVEY RECORD

.1 Maintain a complete, accurate log of control and survey work as it progresses.

.2 On completion of foundations and major site improvements, prepare a certified survey showing dimensions, locations, angles and elevations of Work.

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

END OF SECTION

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SECTION 01 73 30 – EXECUTION AND CUTTING AND PATCHING

2.0 GENERAL

2.1. RELATED SECTIONS

.1 Section 01 32 00 - Construction Progress Documentation: Submittals and scheduling.

.2 Section 01 61 00 - Product Requirements.

.3 Section 01 70 00 – Examination and Preparation

.4 Individual Product Specification Sections:

.1 Cutting and patching incidental to work of the section.

.2 Advance notification to other sections of openings required in Work of those sections.

2.2. SUBMITTALS

.1 Submit written request in advance of cutting or alteration which affects:

.1 Structural integrity of any element of Project.

.2 Integrity of weather exposed or moisture resistant element.

.3 Efficiency, maintenance, or safety of any operational element.

.4 Visual qualities of sight exposed elements.

.5 Work of Owner or separate contractor.

.2 Include in request:

.1 Identification of Project.

.2 Location and description of affected Work.

.3 Necessity for cutting or alteration.

.4 Description of proposed Work and Products to be used.

.5 Alternatives to cutting and patching.

.6 Effect on work of Owner or separate contractor.

.7 Written permission of affected separate contractor.

.8 Date and time work will be executed.

2.3. TOLERANCES

.1 Monitor fabrication and installation tolerance control of Products to produce acceptable Work.

.2 Do not permit tolerances to accumulate beyond effective or practical limits.

.3 Comply with manufacturers' tolerances. In case of conflict between manufacturers' tolerances and Contract Documents, request clarification from Consultant before proceeding.

.4 Adjust Products to appropriate dimensions; position and confirm tolerance acceptability, before permanently securing Products in place.

3.0 PRODUCTS

3.1. MATERIALS

.1 Primary Products: Those required for original installation.

.2 Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 33 00.

4.0 EXECUTION

4.1. EXAMINATION

.1 Examine existing conditions prior to commencing Work, including elements subject to damage or movement during cutting and patching.

.2 After uncovering existing Work, assess conditions affecting performance of work.

.3 Beginning of cutting or patching means acceptance of existing conditions.

4.2. PREPARATION

.1 Provide temporary supports to ensure structural integrity of the Work. Provide devices and methods to protect other portions of Project from damage.

.2 Provide protection from elements for areas which may be exposed by uncovering work.

.3 Maintain excavations free of water.

4.3. CUTTING

.1 Execute cutting and fitting as needed to complete the Work. Prior to any cutting and or coring of concrete floors the contractor shall confirm the area is free of services or rebar. Notify the Consultant of any interferences.

.2 Uncover work to install improperly sequenced work.

.3 Remove and replace defective or non-conforming work.

.4 Remove samples of installed work for testing for Hazardous materials.

.5 Provide openings in the Work for penetration of mechanical and electrical work.

.6 Employ experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

.7 Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

.8 Do all cutting, patching and making good, to leave a finished condition and to make the several parts of the work come together properly. Coordinate work to keep cutting and patching to a minimum.

.9 Make cuts with clean, true, smooth edges. Fit unit to tolerance established by test standard practice for applicable work. Make patches invisible in final assembly.

.10 Cutting shall be done in a manner to keep patching to minimum. Obtain Consultant's approval of method to be used to conceal new mechanical and electrical services before beginning cutting. Chasing of concrete surfaces is not permitted.

.11 Cutting or coring of any structural concrete is to be reviewed and approved by the Consultant.

.12 Do not endanger any work by cutting, digging or otherwise altering, and do not cut nor alter any load bearing element without written authorization by Consultant. Provide bracing, shoring and temporary supports as required to keep construction safely supported at all times

.13 Any cost caused by omission or ill-timed work shall be borne by party responsible therefore.

.14 Regardless of which Section of work is responsible for any portion of cutting and patching, in each case tradesmen qualified in work being cut and patched shall be employed to ensure it is correctly done.

4.4. PATCHING

.1 Execute patching to complement adjacent Work.

.2 Fit Products together to integrate with other Work.

.3 Execute work by methods to avoid damage to other Work, and which will provide appropriate surfaces to receive patching and finishing.

.4 Employ original installer to perform patching for weather exposed and moisture resistant elements, and sight-exposed surfaces.

.5 Restore work with new Products in accordance with requirements of Contract Documents.

.6 Fit work with adequate support to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

.7 At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with firestop material.

.8 Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

.9 Complete and tightly fit all construction to pipes, ducts and conduits which pass through construction to completely prevent the passage of air.

.10 Patching and making good shall be done by trade specialists in material to be treated, and shall be made undetectable in finished work when viewed from distance of 1.5m under normal lighting.

END OF SECTION

SECTION 01 74 00 – CLEANING AND WASTE MANAGEMENT

1.0 GENERAL

1.1. RELATED SECTIONS

.1 Common Work by All Trades

.2 This section describes requirements applicable to all Sections within Divisions 02 to 49.

.3 Conduct cleaning and disposal operations to comply with local ordinances and environmental protection legislation.

.4 Store volatile wastes in covered metal containers, and remove from premises at end of each working day.

.5 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.

2.0 PRODUCTS

2.1. CLEANING PRODUCTS

.1 Cleaning Agents and Materials: Low VOC content wherever possible. The Consultant and the Board shall be notified prior to use of any exception.

3.0 EXECUTION

3.1. CLEANING DURING CONSTRUCTION

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

.2 Remove waste material and debris from the work areas and deposit in waste container at the end of each working day.

.3 Vacuum clean interior areas prior to start of finishing work. Maintain areas free of dust and other contaminants during finishing operations.

.4 Individual Subcontractors are responsible for the daily clean-up and removal of debris related to, or generated by, their own work. The overall responsibility for project cleanliness rests with the Contractor.

.5 The Contractor shall be responsible for snow removal within the construction area.

.6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.7 Wherever possible recycle materials

.8 Containers:

.1 Provide adequate number and sizes of on-site garbage and recycling containers within designated work site as required for collection of waste materials and debris on a daily basis.
.2 Provide additional waste containers when extent of work warrants.
.3 Provide and use clearly marked, separate bins for recycling.

.9 Dispose of waste materials and debris at registered waste disposal and recycling facility.

.10 Remove oily rags, waste and other hazardous substances from premises at close of each day, or more often when required.

.11 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

3.2. WASTE MANAGEMENT

.1 Audit, separate and dispose of construction waste generated by new construction or by demolition of existing structures in whole or in part, in accordance with Ontario Regulations 102/94 and 103/94 made under the Environmental Protection Act.

.2 Containers:
.1 Provide adequate number and sizes of on-site garbage and recycling containers within designated work site as required for collection of waste materials and debris on a daily basis.
.2 Provide additional waste containers when extent of work warrants.
.3 Provide and use clearly marked, separate bins for recycling.

.3 Fires, and burning of rubbish or waste on site is strictly prohibited.

.4 Burying of rubbish or waste materials on site is strictly prohibited.

.5 Disposal of waste or volatile materials such as mineral spirits, oil, gasoline or paint thinner into ground, waterways, or sewer systems is prohibited.

.6 Empty waste containers on a regular basis to prevent contamination of site and adjacent properties by wind-blown dust or debris

3.3. PREPARATION FOR FINAL CLEANING

.1 Prior to final cleaning the General Contractor shall:
.1 remove all surplus products, tools, construction machinery and equipment not required for the performance of remaining work, and thereafter remove any remaining materials, equipment, waste and debris,
.2 replace all filters installed on any equipment in operation in the area of work,

.3 remove all paint spots or overspray from all affected surfaces, and

3.4. FINAL CLEANING PRIOR TO ACCEPTANCE: INTERIOR

.1 Prior to applying for Substantial Performance of the Work, or, prior to Owner occupancy of the building or portion of the building affected by the Work, whichever comes first, conduct full and complete final cleaning operations for the areas to be occupied.

.2 Final cleaning operations shall be performed by an experienced professional cleaning company, possessing equipment and personnel sufficient to perform full building cleaning operations. Contractors “broom cleaning” is not acceptable as a “Final Clean”. The cleaning contractor shall:

.1 clean interiors of all millwork and surfaces of any furniture and equipment present,

.2 use only cleaning materials recommended by the manufacturer of the surface to be cleaned,

.3 remove all stains, spots, scuff marks, dirt, dust, remaining labels, adhesives or other surface imperfections,

.4 clean and polish all glass and mirrors and remove remaining manufacturer's and safety "X" labels,

.5 clean and polish all finished metal surfaces such as enamelled or stainless steel, chrome, aluminum, brass, and bronze,

.6 clean and polish all vitreous surfaces such as plumbing fixtures, ceramic tile, porcelain enamel, or other such materials,

.7 clean all ceramic tile surfaces in accordance with the manufacturer's instructions,

.8 vacuum, clean and dust behind grilles, louvres and screens,

.9 steam clean all unprotected carpets immediately prior occupancy by Owner, and

.10 clean all equipment and fixtures to a sanitary condition.

.3 For any areas to be occupied after the owner’s initial occupancy, provide full cleaning operations as outlined above prior to turning over to owner,

.4 The Board’s supplies and equipment must not be used for any cleaning operations including, but not limited to: garbage cans, mops, brooms, rags, ladders, chemicals etc.

3.5. FINAL CLEANING PRIOR TO ACCEPTANCE: EXTERIOR

.1 For areas effected by construction final exterior cleaning operations shall be performed by the General Contractor or competent sub-contractor. Contractor’s “broom cleaning” only is not acceptable.

.2 Final exterior cleaning shall include:
   .1 broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds,
   .2 remove dirt and other disfiguration from exterior surfaces,
   .3 sweep and wash clean paved areas,
   .4 replace filters of mechanical equipment for all equipment that was in use during construction,
   .5 clean all roofs, gutters, downspouts, areaways, drywells, and drainage systems,
   .6 remove debris and surplus materials from crawl areas and other accessible concealed spaces.
   .7 remove overspray

END OF SECTION

SECTION 01 78 10 – CLOSEOUT SUBMITTALS AND REQUIREMENTS

1.0 GENERAL

1.1. RELATED SECTIONS

.1 Section 01 78 10 – Appendix 1 and 2 – WRDSB Warranty Card

1.2. TAKE-OVER PROCEDURES

.1 Take over procedures will be in strict accordance with the requirements as set out in this Section.

1.3. SUBSTANTIAL PERFORMANCE

.1 Prior to requesting a Substantial Performance deficiency inspection submit 2 hard copies, 1 digital copy of the Operating and Maintenance Manuals for Consultants approval.

.2 Application for Substantial Performance must include.

.1 One (1) electronic copy of inspection and acceptance certificates required from regulatory agencies, including but not limited to.

.1 Certificates of Approval of the Work by the local Building Department.

.2 Electrical Inspection Certificate of Inspection.

.3 Fire Alarm Verification Certificate.

.3 Advise Consultant in writing, when project has been substantially completed. If Consultant agrees this stage has been reached, the Consultant shall prepare a complete list of deficiencies and submit copies of this list to Contractor and the Board.

1.4. COMMENCEMENT OF LIEN PERIODS

.1 The date of publication of the Certificate of Substantial Performance of the Work, provided to the contractor by the Consultant, shall be the date for commencement of the lien period.

1.5. TOTAL PERFORMANCE

.1 Prior to requesting a final inspection submit written certificate that the following have been performed:

.1 Work has been completed and inspected for compliance with Contract Documents and is ready for final inspection

.2 Defects have been corrected and deficiencies have been completed.

.3 Equipment and systems have been tested and are fully operational. Submit two copies of the balancing reports
.4 Certificates required by the contractor have been submitted.
.5 Operation of systems have been demonstrated to Owner's personnel.
.6 Submit Record drawings.
.7 Submit maintenance materials.
.8 Provide certified site survey

.2 When items noted above are completed, request final inspection of Work by consultant, and building inspector. If Work is deemed incomplete by Consultant, complete outstanding items and request re-inspection.

1.6. PAYMENT OF SUBSTANTIAL PERFORMANCE HOLDBACK

.1 Prior to the release of lien holdback provide one copy of the following by the Contractor and each subcontractor:
.1 Statutory Declaration or Declaration of Last supply
.2 Workplace Safety and Insurance Board “Certificate of Clearance”.

.2 The Contractor shall submit an application for payment of the holdback amount.

.3 After the receipt of an application for payment which will include a Statutory Declaration and WSIB Clearance from the, the Consultant will issue a certificate for payment of the holdback amount.

1.7. FINAL PAYMENT

.1 When the Contractor considers final deficiencies and defects have been corrected and it appears requirements of Contract have been completed, make application for final payment.

.2 When the Consultant finds the Contractor's application for final payment valid, the Consultant will issue a final certificate of payment

.3 The Board reserves the right to charge the Contractor for school access card(s) that have not been returned.

.4 The cost to reprogram or replace the card(s) access system is estimated at $50.00 (fifty dollars) for each card issued, $30.00 (thirty dollars) for each keybox key, plus $35.00 (thirty five dollars) administration fee.

1.8. CLOSEOUT SUBMITTALS

.1 Prepare instructions and data using personnel experienced in maintenance and operation of described products and submit to Consultant for review.

.2 Copy will be returned to contractor with Consultant's comments.

.3 Revise content of documents as required prior to final submittal.

.4 Two (2) weeks prior to Substantial Performance of the Work, submit to the Consultant, the final copies of operating and maintenance manuals.
.5 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.
.6 If requested, furnish evidence as to type, source and quality of products provided.
.7 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
.8 Pay costs of transportation.

1.9. OPERATION AND MAINTENANCE MANUAL FORMAT

.1 Provide two copies of operating and maintenance data, prepared on 215 X 280mm sheets in printed or typewritten form, contained in 3-ring binders with soft vinyl covers for materials and equipment which require special maintenance or operating procedures.
.2 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder at the front of each volume.
.3 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
.4 Arrange content by the divisions of the specifications under Section numbers and sequence of Table of Contents.
.5 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
.6 Include the following in each manual:
    .1 Complete list of subcontractors and suppliers, their addresses and telephone numbers. Provide 24 hour emergency telephone number for such subcontractors as Plumbing, Electrical, Sprinklers, Fire System, Heating, etc.
    .2 Specified warranties for contractor, each subcontractor and supplier.
    .3 WRDSB Warranty Card
    .4 Copy of finish hardware list, complete with all amendments and revisions and lock manufacturer's descriptive and service literature.
    .5 Schedule of paints and coatings. Include sufficient explanation to fully identify each surface with the applicable paint or coating used. Enclose copy of colour schedule.
    .6 Maintenance instructions for finished surfaces.
    .7 Brochures, cuts of equipment and fixtures.
    .8 Operating and maintenance instructions for equipment.

.9 Submit copies of letters from manufacturers of equipment and systems indicating their technical representatives have inspected and tested systems and are satisfied with methods of installation, connection and operations. These letters shall state names of persons present at testing, methods used and list of functions performed.

.10 Submit one complete set of reviewed shop drawings of architectural, structural, mechanical and electrical items, folded to 215 x 280mm size, contained in heavy duty manila envelopes, numbered and labelled. Follow specification format with no more than one Section per envelope, hard copy and PDF.

.11 Relevant certificates issued by authorities having jurisdiction

.12 Computer disc or flash drive with all the above documentation in PDF format

1.10. RECORDING ACTUAL SITE CONDITIONS

.1 Record information on set of black line opaque drawings, and within the Project Manual.

.2 Annotate with coloured felt tip marking pens, maintaining separate colours for each major system, for recording changed information.

.3 Record information concurrently with construction progress. Do not conceal Work of the Project until required information is accurately recorded.

.4 Contract drawings and shop drawings: legibly mark each item to record actual construction, including:

.1 Measured 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 catalogue number of each product actually installed, particularly optional items and substitute items.

.2 Changes made by Addenda and change orders.

.6 Other Documents: Maintain warranties, test reports and samples required by individual specifications sections.

1.11. RECORD (AS-BUILT) DOCUMENTS AND SAMPLES

.1 Store AS-BUILT documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.

.2 Label AS-BUILT documents and file in accordance with section number listings in List of Contents of the Project Manual. Label each document AS-BUILT DOCUMENTS in neat, large, printed letters.

.3 Maintain AS-BUILT documents in clean, dry and legible condition. Do not use as-built documents for construction purposes.

.4 Keep as-built documents and samples available for inspection by Consultant.

1.12. RECORD DRAWINGS

.1 Prior to Substantial Performance of the Work, update the marked up information from the AS-BUILT documents to a master set of drawing.

.2 Submit one set of completed AS-BUILT documents to the Consultant for review.

.3 Documents will be returned to contractor with Consultant's comments.

.4 Revise content of documents as required prior to final submittal.

.5 After the review is completed resubmit to the Consultant for Consultant to produce electronic record drawings for the owner to use.

1.13. SPARE PARTS

.1 Provide spare parts, in quantities specified in individual specification sections.

.2 Provide items of same manufacture and quality as items in Work.

.3 Receive and catalogue all items. Submit inventory listing to Consultant. Include approved listings in Maintenance Manual.

.4 Obtain receipt for delivered products and submit prior to final payment.

1.14. REPLACEMENT (MAINTENANCE) MATERIALS

.1 Deliver to site, unload and store where directed, replacement (maintenance) materials as required elsewhere in these Specifications. Obtain signed receipt from Owner’s Representative for delivered materials and include copy of receipt in Operation and Maintenance manuals.

.2 Package materials so they are protected from damage and loss of essential properties.

.3 Label packaged materials for proper identification of contents.

1.15. SPECIAL TOOLS

.1 Provide special tools, in quantities specified in individual specification section.

.2 Provide items with tags identifying their associated function and equipment.
.3 Receive and catalogue all items. Submit inventory listing to Consultant. Include approved listings in Maintenance Manual

1.16. FINAL SITE SURVEY

.1 Submit final site survey certificate in accordance with Section 01 70 00, certifying that elevations and locations of completed Work are in conformance Contract Documents.

1.17. WARRANTIES AND BONDS

.1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
.2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
.3 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. The date of Substantial Performance of the Work shall be the date for commencement of the warranty period.
.4 Verify that documents are in proper form, contain full information, and are notarized.
.5 Co-execute submittals when required.
.6 Retain warranties and bonds until time specified for submittals.

END OF SECTION

SECTION 01 78 40 – MAINTENANCE REQUIREMENTS

1.0 GENERAL

1.1. SECTION INCLUDES

.1 Equipment and systems.
.2 Materials and finishes.
.3 Spare parts
.4 Maintenance manuals.
.5 Special tools.
.6 Storage, handling and protection.
.7 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.2. RELATED SECTIONS

.1 Section 01 45 00 - Quality Control.
.2 Section 01 78 40 – Maintenance Requirements.
.3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3. 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
.2 Panel board 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, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
.5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly 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 list, illustrations, assembly drawings, and diagrams required for maintenance.
.10 Provide installed control diagrams by controls manufacturer.
.11 Provide coordination 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 and balancing reports as specified in Section 01 45 00.
.15 Additional requirements: As specified in individual specification sections.

2.0 PRODUCTS

2.1. MATERIALS AND FINISH

.1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations.
.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 recommended schedule for cleaning and maintenance.
.4 Building Envelope: include copies of drawings of building envelope components, illustrating the interface with similar or dissimilar items to provide an effective air, vapour and thermal barrier between indoor and outdoor environments. Include an outline of requirements for regular inspections and for regular maintenance to ensure that on-going performance of the building envelope will meet the initial building envelope criteria.
.5 Additional Requirements: as specified in individual specifications sections.

2.2. SPARE PARTS

.1 Provide spare parts, in quantities specified in individual specification sections.
.2 Provide items of same manufacture and quality as items in Work.
.3 Receive and catalogue all items. Submit inventory listing to Consultant. Include approved listings in Maintenance Manual.
.4 Obtain receipt for delivered products and submit prior to final payment.

2.3. MAINTENANCE MATERIALS

.1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
.2 Provide items of same manufacture and quality as items in Work.
.3 Receive and catalogue all items. Submit inventory listing to Consultant. Include approved listings in Maintenance Manual.
.4 Obtain receipt for delivered products and submit prior to final payment.

2.4. SPECIAL TOOLS

.1 Provide special tools, in quantities specified in individual specification section.
.2 Provide items with tags identifying their associated function and equipment.
.3 Receive and catalogue all items. Submit inventory listing to Consultant. Include approved listings in Maintenance Manual.

3.0 EXECUTION

3.1. DELIVERY TO SITE

.1 Deliver to place of work and store.
.2 General Contractor to receive and acknowledge delivery from contractors and sub-contractors of all parts and materials assembled for maintenance requirements. Provide a summary inventory list to the Consultant and/or the Board after all materials are gathered and verification of location. Signatures of receipt will not be accepted from anyone except the General Contractor’s representative.

3.2. STORAGE, HANDLING AND PROTECTION

.1 Consult with the Board to determine location for storage.
.2 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.
.3 Store in original and undamaged condition with manufacturer's seal and labels intact.
.4 Store components subject to damage from weather in weatherproof enclosures.
.5 Store paints and freezable materials in a heated and ventilated room.
.6 Remove and replace damaged products at own expense and to satisfaction of Consultant.

END OF SECTION

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SECTION 01 79 00 – DEMONSTRATION AND TRAINING

1.0 GENERAL

1.1. SECTION INCLUDES

.1 Procedures for demonstration and instruction of Products, equipment and systems to Owner's personnel.

.2 Seminars and demonstrations.

1.2. RELATED SECTIONS

.1 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3. DESCRIPTION

.1 At Substantial Performance, at a time acceptable to Owner and Consultant, but not before operations and maintenance manual have been reviewed and accepted by the consultant; contractor shall give a complete demonstration in the presence of consultant; Sub-consultants, Owner and Owner's personnel of operation and maintenance of systems and equipment once they are 100% complete.

.2 Owner will provide list of personnel to receive instructions and will coordinate their attendance at agreed-upon times.

1.4. COMPONENT DEMONSTRATION

.1 Manufacturer to provide authorized representative to demonstrate operation of equipment and systems.

.2 Instruct Owner's personnel, and provide written report that demonstration and instructions have been completed.

1.5. SUBMITTALS

.1 Submit schedule of time and date for demonstration of each item of equipment and each system one (1) week prior to designated dates, for Consultant's approval.

.2 Submit reports within forty eight (48) after completion of demonstration, that demonstration and instructions have been satisfactorily completed.

.3 Give time and date of each demonstration, with list of persons present.

1.6. CONDITIONS FOR DEMONSTRATIONS

.1 Equipment has been inspected and put into operation in accordance with manufacturer's instructions and contract requirements.
.2 Testing, adjusting, and balancing have been performed in accordance with manufacturer's instructions and contract requirements, and equipment and systems are fully operational.
.3 Provide information packages as required for use in demonstrations and instructions.

2.0 PRODUCTS

2.1. NOT USED

.1 Not used.

3.0 EXECUTION

3.1. PREPARATION

.1 Verify that suitable conditions for demonstration and instructions are available.
.2 Verify that designated personnel are present.
.3 Prepare agendas and outlines.
.4 Establish seminar organization.
.5 Explain component design and operational philosophy and strategy.
.6 Develop equipment presentations.
.7 Present system demonstrations.
.8 Accept and respond to seminar and demonstration questions with appropriate answers.

3.2. PREPARATION OF AGENDAS AND OUTLINES

.1 Prepare agendas and outlines including the following:
  .1 Equipment and systems to be included in seminar presentations.
  .2 Name of companies and representatives presenting at seminars.
  .3 Outline of each seminar's content.
  .4 Time and date allocated to each system and item of equipment.
  .5 Provide separate agenda for each system.

3.3. SEMINAR ORGANIZATION

.1 Coordinate content and presentations for seminars.
.2 Coordinate individual presentations and ensure representatives scheduled to present at seminars are in attendance.

.3 Arrange for presentation leaders familiar with the design, operation, maintenance and troubleshooting of the equipment and systems. Where a single person is not familiar with all aspects of the equipment or system, arrange for specialists familiar with each aspect.

.4 Coordinate proposed dates for seminars with Owner and select mutually agreeable dates.

3.4. EXPLANATION OF DESIGN STRATEGY

.1 Explain design philosophy of each system. Include following information:

.1 An overview of how system is intended to operate.

.2 Description of design parameters, constraints and operational requirements.

.3 Description of system operation strategies.

.4 Information to help in identifying and troubleshooting system problems.

3.5. DEMONSTRATION AND INSTRUCTIONS

.1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment.

.2 Instruct personnel in all phases of operation and maintenance using operation and maintenance manuals as the basis of instruction.

.3 Instruct personnel on control and maintenance of sensory equipment and operational equipment associated with maintaining energy efficiency and longevity of service.

.4 Review contents of manual in detail to explain all aspects of operation and maintenance.

.5 Prepare and insert additional data in operations and maintenance manuals when the need for additional data becomes apparent during instructions.

END OF SECTION

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PART 1- GENERAL

Work Included in Section

.1 Various demolition and removals of existing and for provision of new work, as shown on architectural drawings.

.2 Restoration of damaged or disturbed Work.

.3 Removal of surplus materials from the site.

1.2 Related Sections

.1 Architectural demolition requirements for existing and new work - Divisions 2 through 16.

1.3 Qualifications

.1 Work of this Section shall be executed by a company with competency in the skills required to perform such tasks. Work shall be performed in accordance with industry standards specified herein, warranty requirements, and in accordance with generally accepted industry best practices.

1.4 Examination

.1 Examine existing property. Determine nature and extent of materials to be removed.

.2 Examine adjacent properties. Determine extent of protection required.

1.5 Salvage

.1 Unless otherwise noted, materials from demolition shall become property of Contractor who shall promptly remove all salvageable material and debris from Site.

.2 Do not sell material on Site.

.3 The Owner will review Site prior to commencement of demolition and instruct the Contractor, in writing, as to the items to be retained for re-use or be turned over to the Owner.

.4 Store material to be salvaged, neatly on wooden pallets, where directed by Owner.

.5 Remove and store indicated items for future use by Owner. Remove, handle andtransport such items to storage area designated on Drawings or to an area within the site designated by Owner. Perform such work carefully and with diligence to prevent any damage to the items during removal and in storage.

1.6 Maintaining Traffic Hauling Operations

.1 Maintain and preserve Owner's access requirements within, to and from existing building in areas where demolition and removal work is being carried out.

.2 Do not close, obstruct, place or store material in Owner's driveways and passageways. Conduct operations with minimum interference with roads, streets, driveways, user traffic and passageways.

1.7 Hauling Operations

.1 Maintain roadways and paving in the hauling areas clean on a daily basis and as required by Municipal authorities.

1.8 Safety Requirements

.1 Undertake Work and effect arrangements required by authorities having jurisdiction for protection of public.

.2 Coordinate posting of danger signs conspicuously around property. Close doorways and thoroughfares giving access to area of demolition with barricades.

.3 Provide a competent, experienced supervisor in charge of the Work and on Site while Work is in progress.

.4 Demolition of spray or trowel-applied asbestos can be hazardous to health. Stop work and notify the Construction Manager immediately should material resembling spray or trowel-applied asbestos be encountered in the course of demolition work, which has not already been identified. Do not proceed until written instructions have been received from the Owner.

.5 Should any suspect designated substance not already identified, be encountered, cease work in the immediate area and immediately report, to the Owner. Owner is responsible for removal of designated substances.

1.9 Life and Fire Safety

.1 Provide fire extinguishers in acceptable locations to fire prevention authorities and of type suitable to enable personnel to cope with fire occurring during progress of Work.

1.10 Demolition Drawings

.1 Submit for approval; drawings, diagrams or details showing sequence of disassembly work and supporting structures.

.2 Submissions, if required, are to bear stamp of qualified professional engineer registered in Province of Ontario.

1.11 Protection

.1 Prevent movement, settlement or damage of adjacent structures, services, walks, paving, parts of existing building to remain. Make good damage caused by demolition.

.2 Take precautions to support affected structures and, if safety of building being demolished or adjacent structures or services appears to be endangered, cease operations and notify Owner.

.3 Provide temporary weather enclosures to requirements of Division 1.

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

.5 Provide and maintain necessary fire extinguishers throughout the work to the approval of the Fire Marshal, and located at convenient and accessible points.

.6 Protect work to remain against damage of any kind.

.7 Protect building floors and roofing against damage from operations under this Section, including lifting, moving, rolling, etc., of materials. Use 12.7 mm (1/2”) thick plywood covers with ends mechanically joined, over floor for any such handling. Over roof, provide 19 mm (3/4”) thick plywood under laid with 1” thick polystyrene insulation board adhered to same. Provide same when working from, or over roof surfaces. Be responsible for repairs to flooring or roofing for any damage caused. Execute such repairs to the satisfaction of, and at no cost to Owner.

PART 2 - PRODUCTS

Not applicable

PART 3 – EXECUTION

3.1 INSPECTION

.1 Visit and examine the site and note all characteristics and features affecting the Work of this Section.

.2 Ensure all services, whether buried; built-in or exposed are properly identified as to position, type of service, size, direction of flow.

.3 Inspect materials, equipment, components to be re-used or turned over to the Owner. Note their condition and advise the Consultant in writing of any defects or conditions which would affect their removal and re-use.

3.2 PREPARATION

.1 Prevent movement, settlement or damage of elements of the existing building which are to remain. Provide bracing, shoring and supports as required. Protect existing surfaces not to be restored from damage during concrete removal procedures.

.2 Cut and/or cap existing services within the work area, if any, prior to start of Work as required, but do not affect the services of areas not under construction or essential to the ongoing operation of the building.

.3 In all cases, exercise all reasonable care during removal operations to avoid damaging items to be salvaged, re-used, or items that are not part of the Scope of Work.

.4 Seal off all work areas to prevent dust and debris from affecting other areas outside of work area. Prevent public access to areas being repaired.

.5 Tape and/ or seal and provide protection to all mechanical and electrical services and all fire alarm and security devices still functioning adjacent to the work areas to prevent damage resulting from dust, water, or impact.

.6 Cover floor drains as required to prevent concrete, abrasive blasting debris or any other material from entering the drains. Ensure that all drains continue to operate as required during construction.

.7 Remove or protect in place all surface mounted or permanent fixtures not to be demolished from damage during demolition procedure.

.8 Apply filter cloth to all exhaust and ventilation vents within work area to prevent dust generated by the construction activity from escaping.

.1 Contractor shall clean, or replace filter cloth if the filter cloth becomes unsuitably dirty as determined by Consultant.

3.3 Demolition

.1 Execute Work in accordance with requirements of authorities having jurisdiction.

.2 At end of each day's work, leave Site in a safe condition and erect safety barriers and lights as required. Ensure that no parts of existing structure are in danger of collapsing.

.3 Perform demolition work where not specifically indicated, but required to make provisions for new Work.

.4 Provide any additional materials, labour and services required, not specifically mentioned or shown on Drawings, but necessary for proper completion of Work.

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

.6 Leave work in safe condition so that no part is in danger of toppling or falling. Protect interiors of areas not to be demolished from exterior elements.

.7 Demolition of concrete shall be performed by percussive techniques to prevent damage to the embedded reinforcing to remain and the supporting structural steel framing below.

.8 Provide shoring to support the slab when removals reduce its load-carrying capacity, as directed by the Consultant. No payment will be made for such shoring as it is to be included in the cost of repair as outlined in these documents.

.9 Materials forming permanent part of the building that require removal become contractor's property and must be removed from site daily, unless such materials are otherwise specified or shown on Drawings to be reused under this Contract (or turned over to Owner). Remove materials not suitable for reuse as shown on Drawings (as specified) from site.

.10 Leave building in a "broom-clean" condition on completion of work to Owner's satisfaction.

.11 Clean existing surfaces specified to receive new applied finishes to assure proper adherence.

.12 Clean existing surfaces to receive paint finish to paint manufacturer's written specifications and/or recommendations.

.13 Confine operations and workers to those parts of the building which are defined on Drawings, and exercise great care not to damage existing construction beyond that necessary for the carrying out new work and make good any such damage in every respect.

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

.15 All required re-painting due to damage, overspray, etc. is the Contractor’s responsibility.

3.4 WASTE DISPOSAL

.1 Disposal of waste products and material is to be in strict accordance with the product manufacturer’s material safety data sheets and in accordance with the governing waste control regulations.

.2 The existing drainage system is not to be used to dispose of project wastes and / or materials

.3 Store volatile wastes or material in covered metal containers. All wastes which create hazardous conditions must be removed from the premises daily.

END OF SECTION

PART 1 - GENERAL

1.1 General Instructions

.1 Read and be governed by Conditions of the Contract and Sections of Division 1.

1.2 Section Includes:

.1 Design, labour, Products, equipment and services necessary for the miscellaneous and metal fabrication Work in accordance with the Contract Documents.See Architectural Drawings and Details

1.3 Quality Assurance

.1 Execute Work of this Section only by a Subcontractors who has adequate plant, equipment, and skilled Workers to perform Work expeditiously, and is known to have been responsible for satisfactory installations similar to that specified during a period of at least the immediate past five years.

1.4 Reference

.1 ASTM A123, Specification for Zinc (Hot Dip Galvanized) Coatings on Iron & Steel Products.

.2 ASTM A153, Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.3 ASTM A307, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.

.4 ASTM A653/A653M, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc- Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.

.5 CAN/CSA-G40.20/G40.21-M, General Requirements for Rolled or Welded Structural Quality Steel/ Structural Quality Steels.

.6 CAN/CSA G164-M, Hot Dip Galvanizing of Irregularly Shaped Articles.

.7 CAN/CSA S16.1-M, Limit States Design of Steel Structures.

.8 CSA S136.1-M, Commentary on CAN/CSA S136-M, Cold Formed Steel Structural Members.

.9 CSA W47.1, Certification of Companies for Fusion Welding of Steel Structures.

.10 CSA W48, Filler Metal and Allied Materials for Metal Arc Welding.

.11 CSA W59-M, Welded Steel Construction (Metal Arc Welding).

.12 CAN/CSA W117.2-M, Safety in Welding, Cutting and Allied Processes.

.13 CAN/CGSB 1.40-M, Primer, Structural Steel, Oil Alkyd Type.

.14 CGSB 1-GP-181, Organic Zinc Rich Primer.

.15 CGSB 85-GP-16M, Painting Galvanized Steel.

.16 Steel Structures Painting Council (SSPC), Steel Structures Painting Manual, Vol. 2.

1.5 Design Criteria

.1 Work of this Section which functions to resist forces imposed by dead and liveloads shall conform to requirements of jurisdictional authorities.

.2 Design Work of this Section and applicable Shop Drawings shall be carried out by a qualified professional engineer licensed to practice in the Place of Work.

.3 Design details and connections, where not shown on Drawings, in accordance with CAN/CSA-S16.1 and CSA S136.1.

1.6 Shop Drawings

.1 Submit Shop Drawings in accordance with Section 01 33 00.

.2 Clearly indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

.3 Shop Drawings shall be sealed by a qualified professional engineer licensed to designs structures and registered in Place of the Work.

1.7 Delivery. Storage and Handling

.1 Label, tag or otherwise mark Work supplied for installation by other Sections to indicate its function, location in building and shop drawing designation.

.2 Protect Work from damage during delivery, storage and handling

PART 2 - PRODUCTS

2.1 Materials

.1 General:

.1 Unless detailed or specified otherwise, standard Products will be acceptable if construction details and installation meet intent of Drawings and Specifications.

.2 Include materials, Products, accessories, and supplementary parts necessary to complete assembly and installation of Work of this Section.

.3 Incorporate only metals that are free from defects which impair strength or durability, or which are visible. Install only new metals of best quality, and free from rust or waves and buckles, and that are clean, straight, and with sharply defined profiles.

.2 Structural shapes, plates, and similar items: CAN/CSA-G40.20/G40.21-M, Grade 350W. Hollow structural sections: CAN/CSA-G40.20/G40.21-M, Grade 350W, Class H.

.3 Galvanized sheet steel: ASTM A653/A653M Grade A, Z275 Commercial Quality zinc coating, size and shape as shown.

.4 Welding materials: CSA W48 and CSA W59-M.

.5 Fasteners: Conforming to ASTM A307, Grade A, in areas not exposed to view, use unfinished bolts with hexagon heads and nuts. In areas exposed to view, use bolts, nuts, washers, rivets, lock washers, anchor bolts, machine screws and machine bolts Z275 zinc coated in accordance with ASTM A653/A653M. Supply bolts of lengths required to suit thickness of material being joined, but not Projecting more than 6 mm beyond nut, without the use of washers.

.6 Primer paint: CAN/CGSB-1.40-M or CPMA 1.73a.

.7 Galvanized primer paint: Inorganic zinc rich primer. For use on galvanized fabrications where touch up is to remain unpainted in finished Work; Carbozinc 11WB by Carboline Company, Catha-Coat 305 by Devoe Coatings or Zinc Clad XI by Sherwin Williams.

.8 Drilled inserts: Mega by ITW Construction Products or HSL by Hilti Inc. heavy-duty anchors, sizes as shown.

2.2 FABRICATION

.1 Verify dimensions of existing Work before commencing fabrications and report any discrepancies to the Consultant.

.2 Fit and assemble Work in shop where possible. Execute Work in accordance with details and reviewed Shop Drawings.

.3 Use self-tapping shake-proof screws on items requiring assembly by screws or as indicated. Use screws for interior metal Work. Use welded connections for exterior metal Work unless otherwise found acceptable by the Consultant.

.4 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush. Seal exterior steel fabrications against corrosion in accordance with CAN/CSA S16.1-M.

.5 Execute shop welding to requirements specified.

.6 Carefully make and fit details. Take special care with exposed finished Work to produce a neat and correct appearance to the Consultant's acceptance.

.7 Assemble members without twists or open joints.

.8 Correctly size holes for connecting Work of other trades where such can be determined prior to fabrication. Where possible, show holes on Shop Drawings. Place holes not to cause appreciable reduction in strength of member.

.9 Draw mechanical joints to hairline tightness and seal countersunk screw and access holes for locking screws with metal filler where these occur on exposed surfaces.

2.3 FABRICATED ITEMS

.1 Provide metal fabrication items indicated below and items not indicated to be supplied under other Sections. The following items includes miscellaneous and metal fabrication including but not limited to the items listed below.

.2 Refer to Drawings for details of metal fabrication Work and related items not specifically listed in this Section.

.3 Where Work is required to be built into Work of other Sections supply such members to respective Sections.

.4 Roof Hatch, Ships Ladder, Roof Access Ladder, and Roof Hatch Guardrail System :

.1 Roof Hatch by Bilco, Single Leaf Roof Scuttle, Type NB

.2 Ships Ladder and Roof Access Ladder to Ontario Provincial Standards (OPSS)

.3 Roof Hatch Guardrail System Surround 4SP3054L by Fixfast USA

.5 Perforated sheet metal screen :

.1 Perforated sheet metal .375" x .500" stagger 51% open area by Accurate screen & grating, typ.

.6 Miscellaneous steel brackets, supports and angles

.1 Supply and install or supply for installation by trades responsible, all loose steel brackets, supports and angles where indicated, except where such brackets, supports and angles are specified under Work of other Sections. Drill for countersunk screws, expansion anchors and anchor bolts.

.2 Unless otherwise specified, prime paint for interior installation; galvanized finish for exterior installation.

2.4 ANCHORS AND FASTENING

.1 Use weld studs of size not larger than 10 mm for attaching miscellaneous materials and equipment to building steel. If weight of item requires larger fasteners use clips or brackets and secure by welding or through bolting.

.2 Use self drilling expansion type concrete anchors for attaching to masonry and concrete

.3 Use steel beam clamps of two bolt design to transmit load to beam web. Do not use C and I clamps.

2.5 WELDING

.1 Perform welding by electric arc process.

.2 Execute welding to avoid damage or distortion to Work. Execute welding in accordance with following standards:

.1 CSA W48 - for Electrodes. If rods are used, only coated rods are allowed.

.2 CSA W59-M and CSA W59S1-M for design of connections and Workmanship.

.3 CAN/CSA W117.2-M - for safety.

.3 Thoroughly clean welded joints and expose steel for a sufficient distance to perform welding operations. Finish welds smooth. Supply continuous and ground welds which will be exposed to view and finish paint.

.4 Test welds for conformance and remove Work not meeting specified standards and replace to Consultant's acceptance.

2.6 SHOP PAINTING

.1 Clean steel to SSPC SP6 and remove loose mill scale, weld flux and splatter.

.2 Shop prime steel with one coat of primer paint to dry film thickness of 0.07 mm. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7 deg C. Paint items under cover and leave under cover until primer is dry. Follow paint manufacturer's recommendations regarding application methods, equipment, temperature, and humidity conditions.

.3 Shop prime galvanized steel in accordance with CGSB 85-GP-16M.

.4 Clean but do not paint surfaces being welded in field.

.5 Do not paint surfaces embedded in concrete, but clean as if they were to be primed.

.6 Do not prime machine finished surfaces, but apply an effective anti-rust compound.

.7 Take precautions to avoid damage to adjacent surfaces.

2.7 HOT DIP GALVANIZING

.1 After fabrication, hot dip galvanize specific miscellaneous steel items as indicated. Plug relief vents air tight. After galvanizing, remove plugs, ream holes to proper size and re-tap threads. Straighten shapes and assemblies true to line and plane after galvanizing. Repair damaged galvanized surfaces with zinc rich primer in accordance with manufacturer's printed directions.

.2 Hot-dip galvanize members in accordance with CAN/CSA G164-M and requirements of the following ASTM, with minimum coating weights or thicknesses as follows:

.1 Rolled, pressed and forged steel shapes, plates, bars and strips: ASTM A123; average weight of zinc coating per square/metre of actual surface, for 4.8 mm and less thickness members 600 g/m_2 for 6 mm and heavier members 640 g/m_2.

.2 Iron and steel hardware: ASTM A153; minimum weight of zinc coating, in ounces per square foot of surface, in accordance with ASTM A153,Table 1 for the various classes of materials used in the Work.

PART 3 - EXECUTION

3.1 Examination

.1 Take site measurements to ensure that Work is fabricated to fit surrounding construction, around obstructions and Projections in place, or as shown on Drawings, and to suit service locations.

3.2 Installation

.1 Install Work plumb, true, square, straight, level, and accurately and tightly fitted together and to surrounding Work and as required for proper performance.

.2 Include with Work of this Section anchor bolts, high tensile bolts, washers and nuts, expansion bolts, toggles, straps, sleeves, brackets, clips, and other items necessary for secure installation as required by loading and jurisdictional authorities. Weld to CAN/CSA-S16.1-94.

.3 Countersink holes Provided for wood screws where wood is attached to Work of this Section.

.4 Attach Work to interior concrete and masonry with corrosion resistant expansion bolts to support load with a safety factor of three (3).

.5 Attach Work to exterior concrete and masonry with non-shrink epoxy grout to support load with a safety factor of three (3).

.6 Insulate between dissimilar metals or between metal, and masonry or concrete with bituminous paint to prevent electrolytic action.

.7 Grout metal posts, pickets, balusters, and the like, in metal sleeves cast into concrete, with non-shrink quick setting epoxy anchor cement, unless detailed otherwise. Fabricate sleeves of 75 mm (3") minimum depth.

.8 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.

3.3 Field Painting

.1 Paint bolt heads, washers, nuts, field welds and previously unpainted items. Touch up shop primer damaged during transit and installation, with primer to match shop primer.

3.4 Adjustment and Cleaning

.1 Remove damaged, dented, defaced, defectively finished, or tool marked components and replace with new.

3.5 Protection

.1 Maintain protection of Work of this Section from time of installation until final finishes are applied or to final cleanup.

.2 Protect prime and finish painted and galvanized surfaces from damage.

END OF SECTION

PART 1.0 - GENERAL

1.1 REFERENCE STANDARDS

.1 CSA O80 Series, Wood Preservation.

.2 CAN/CSA O141, Softwood Lumber.

.3 CSA O121, Douglas Fir Plywood.

.4 CSA O151, Canadian Softwood Plywood.

.5 CSA O153, Poplar Plywood.

.6 CAN/CSA 0325.0 (R1998), Construction Sheathing.

.7 CAN 0437 Series-93, Standard on OSB and Waferboard.

.8 CSA B111, Wire Nails, Spikes and Staples.

.9 National Lumber Grades Authority (NLGA) Standard Grading Rules for Canadian Lumber, Latest Edition.

1.2 INSTALLER QUALIFICATIONS

.1 Maintain a qualified crew of carpenters for the work of this Section. Only qualified journeymen shall be engaged in framing and each journeyman shall have an Ontario Certificate of Proficiency.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Protect materials from moisture upon delivery.

.2 Store materials on raised supports. Cover materials with waterproof covering. Provide adequate air circulation and ventilation.

.3 Do not store seasoned materials in wet or damp areas.

.4 Store all materials in a dry environment. Do not cover materials having a moisture content of over 15%.

1.4 DESIGN REQUIREMENTS

.1 Stairs:

.1 Design stair(s), including stringers and treads to carry a minimum uniform live load as stipulated by OBC

.2 Design handrails/guardrails to resist lateral loads as stipulated by OBC.

PART 2.0 - PRODUCTS

2.1 LUMBER MATERIALS

.1 Lumber: Except as otherwise specified, lumber shall be softwood, S-P-F, S4S, kiln-dried, moisture content 15% or less, not finger jointed, and in accordance with the following standards:

.1 CAN/CSA O141.

.2 Graded and stamped in accordance with the National Lumber Grades Authority (NLGA) Standard Grading Rules for Canadian Lumber and by an agency certified by Canadian Lumber Standards Accreditation Board.

.2 Furring, Blocking, Strapping, Nailing Strips, Grounds, Rough Bucks: S-DRY, douglas fir species.

.1 Board Sizes: “Standard” grade to NLGA, Paragraph 114c.

.2 Dimension Sizes: “Standard” grade to NLGA, Paragraph 122c.

.3 Roofing Curbs, Nailers, Blocking, Cants: as specified in 2.1.2 above.

.4 Wood Trim: kiln-dried spruce, comb faced fascia material.

2.2 PRESSURE PRESERVATIVE TREATED WOOD

.1 Pressure Preservative Treated lumber:

.1 Lumber graded and stamped in accordance with applicable grading rules and standards of associations or agencies approved to grade lumber by Canadian Lumber Standards Accreditation Board in accordance with CAN/CSA O80.20M.

.2 Species: Pine or Spruce-Pine

.3 Grade: No.2 or better structural posts and lumber, pieces may be grade stamped or shipment certified by letter of compliance.

.4 Grading authority: NLGA, paragraph 131CC

.5 Material having twisted grain or structural defects affecting integrity of lumber will not be acceptable for this project.

.6 Use only material with radius edges, minimum 6 mm.

.7 Kiln dry lumber materials to 8% moisture content or less.

.2 Pressure Preservative Treated Plywood: Treated in accordance with CAN/CSA O80.9M using water-borne preservative to obtain minimum net retention of 4 kg/m³ of wood. Plywood or laminated materials shall be manufactured with exterior grade adhesives. After treatment, plywood shall be kiln dried to moisture content of 8% or less.

.3 Water-borne preservative treated wood shall have maximum moisture content of 19% after treatment.

.1 SCAQMD Rule #1113 - Architectural Coatings.

.2 Maximum allowable VOC limit 350g/L.

.4 Provide coatings that do not contain chemical listed in GS-II.

2.3 FASTENERS

.1 Roof Nailers: CSP material, “Sheathing” grade.

.2 Nail, Spikes and Staples: to CSA B111 and as follows:

.1 Use common spiral nails and spiral spikes, except where specified otherwise, for interior work.

.2 Fasteners in contact with borate treated lumber: hot-dipped galvanized finished steel.

.3 Fasteners in contact with ACQ treated lumber: stainless steel.

.3 Underlayment Fasteners:

.1 Nails: galvanized, annular ringed, length to provide minimum 85% penetration into subfloor, but not enough to anchor underlayment to joists.

.4 Bolt, Nut, Washer, Screw and Pin Type Fasteners: hot-dipped galvanized finished steel for all fasteners in contact with borate treated lumber or stainless steel for all fasteners in contact with ACQ treated lumber, unless specified otherwise.

.5 Joist Hangers: hot-dipped galvanized finished steel for all hangers, plates, straps, etc. in contact with borate treated lumber or stainless steel for all such connectors in contact with ACQ treated lumber.

.6 Do not combine stainless steel fasteners with galvanized hardware or vice-versa.

2.4 PRESERVATIVE TREATMENT

.1 Treat following items in accordance with applicable CAN/CSA O80 commodity standard using alkaline copper quat type C (ACQ-C) or copper azole type B (CAB) preservative to obtain minimum net retention of 4.0 kg/m3 of wood. Materials shall be kiln-dried after treatment.

.1 All dimension lumber and panel materials directly exposed to moisture (i.e. deck boards, trellis and similar such framing, exposed stairs).

.2 Treat following items in accordance with applicable CAN/CSA 080 commodity standard using “Advance Guard” borate-pressure treatment to obtain minimum net retention of 2.7 kg/m3 of wood. Materials shall be kiln-dried after treatment. Lumber shall carry the Canadian Wood Preserver’s Bureau Quality Mark (“Advance Guard” quality mark).

.1 New lumber and panel materials inside, outside and crossing the wall moisture barrier.

.2 Items in contact with concrete or masonry.

.3 Furring, blocking, strapping, etc. for rainscreen cavity provisions.

.4 Roofing curbs, nailers, blocking, and cants.

.3 Inspection of products treated with preservative by vacuum-pressure impregnation will be carried out by an accredited inspection agency of the Canadian Wood Preservers Bureau (CWPB).

.4 All treated lumber and plywood shall bear an identifying stamp in accordance with the CWPB, CSA 080 or AWPA requirements.

.5 Following water-borne preservative treatment, dry material to maximum moisture content of 15%.

PART 3.0 - EXECUTION

3.1 FIELD TREATMENT OF PRESERVATIVE TREATED AND EXISTING PRODUCTS

.1 Field treat surfaces exposed by cutting, trimming or boring of preservative-treated items with liberal application of preservative and in accordance with AWPA M4.

.2 Apply preservative in accordance with manufacturer’s instructions. Apply by dipping, by brush or by spray to completely saturate and maintain wet film on surface for minimum three minute soak on lumber and one minute soak on plywood. Allow to dry 24 hours prior to covering.

3.2 ERECTION OF FRAMING MEMBERS

.1 Install members true to line, levels and elevations, square and plumb. Space uniformly.

.2 Construct continuous members from pieces of longest practicable length.

.3 Install spanning members with "crown-edge" up.

.4 Install blocking to facilitate installation of finishing materials, fixtures, specialty items and trim.

.5 Select exposed framing for appearance. Install lumber and panel materials so that grade-marks and other defacing marks are concealed or are removed by sanding where materials are left exposed.

.6 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.

.7 Countersink bolts where necessary to provide clearance for other work.

.8 Install foam sill gaskets between wood and concrete.

3.3 WOOD FURRING AND BLOCKING

.1 Provide wood furring and blocking at locations indicated on Drawings and as specified.

3.4 NAILING STRIPS, GROUNDS AND ROUGH BUCKS

.1 Install rough bucks, nailer and linings to rough openings as required to provide backing for frames and other work.

.2 Erect all wood framing members level and plumb. Construct to framing member's full height without splices.

3.5 WOOD TRIM AND FASCIAS

.1 Install wood trim and fascia boards using finishing nails set slightly below the surface.

.2 Mitre joints to disguise shrinkage.

END OF SECTION

PART 1 - GENERAL

1.1 Definition

.1 Architectural woodwork: Shall mean custom fabricated cabinetry, counters/countertops, wood door frames and custom fabricated wall/ceiling panels.

1.2 Quality Assurance

.1 The "Quality Standards" of the Architectural Woodwork Manufacturers Association of Canada (AWMAC), Edition 3, 2017 together with authorized additions and amendments, shall be used as a reference standard and shall form part of this Project Specification.

.2 Where modifications to the AWMAC Quality Standards contained within the Manual are included in this Project Specification, then such modifications shall govern in case of conflict.

.3 Any reference in Custom or Premium grade in this Specification shall be as defined in the AWMAC Quality Standards.

.4 Any 'item not given a specific quality grade shall be Premium grade as defined in the AWMAC Quality Standards.

.5 All architectural woodwork to be used in the Project shall meet the requirements of the AWMAC Quality Standards for the particular grade specified.

.6 References in this Specification to part and item numbers mean those parts and items contained within the AWMAC Quality Standards Manual.

.7 Woodwork Manufacturer Qualifications:

.1 Member in Good Standing of AWMAC.

.2 Minimum 5 years of production experience similar to this project, whose qualifications indicate ability to comply with requirements of this Section.

1.3 Submittals

.1 Shop Drawings:

.1 Prepare and submit to the Consultant for review Shop Drawings for architectural woodwork in accordance with 01 33 00.

.2 Shop Drawings shall show wood and metal construction details of all architectural details of all general arrangements, locations of all service outlets: typical and special installation conditions; materials being supplied and all connections, attachments, anchorage and location of exposed fastenings, as applicable, field measured dimensions and coordination with other trade Contractors.

.3 Shop Drawings shall incorporate plans, elevations, sections and details for all architectural woodwork included in this Section.

.4 No Work shall be fabricated until the Shop Drawings have been reviewed and all other related submittals, and samples as required by the Specifications, have been approved by the Consultant.

.5 Submission of Consultant’s Drawings for Shop Drawings is not acceptable.

.2 Samples:

.1 Provide 3 samples of each plastic laminate, melamine and solid polymer surface to Consultant for review.

.3 Brochures:

.1 Submit manufacturer's descriptive literature of specialty items not manufactured by the architectural woodwork manufacturer as required by the Consultant.

1.4 Product Handling and Storage

.1 The architectural woodwork manufacturer and the Contractor shall be jointly responsible to make certain that architectural woodwork are not delivered until the building and storage areas are sufficiently dry so that the architectural woodwork will not be damaged by excessive changes in moisture content.

.2 Architectural woodwork delivery, storage, and handling shall be in accordance with AWMAC Quality Standards.

.3 Delivered, materials which are damaged in any way or do not comply with these Specifications will be rejected by the Consultant and shall be removed from the job site and replaced with acceptable materials.

1.5 Pre-Installation Meeting

.1 Before framing is completed hold a meeting with the contractor, paneling manufacturer, paneling installer, and framing sub-contractor.

.1 Review locations of backing required for paneling installation as shown on paneling shop drawings.

.2 Review method of attachment for backing to wall system.

1.6 Warranty

.1 Warrant labour, materials and Workmanship against defects and deficiencies for a period of two (2) years after the date of Substantial Performance.

PART 2-PRODUCTS

2.1 Components

.1 **Plastic Laminate (Plam)**: 1.6 mm thick, (allow for a 4 colours)

.1 Manufacturer: Abet Laminati, Wilsonart, Nevamar, Pionite or Formica

.2 Colour: to be selected by Consultant from full colour range

.2 **Solid Polymer Fabrication (SO/QTZ)**: Solid, mineral based, non porous surfacing material, acrylic; not coated, laminated or of composite construction; in accordance with ANSI Z124 Type 6 and meeting the following:

.1 Properties:

.1 Tensile strength (ASTM D638-84): 6000psi.

.2 Tensile modulus (ASTM D638-84): 1.5 x 10 psi.

.3 Elongation (ASTM D638-84): 0.4%

.4 Hardness (Rockwell “M” Scale): 94.

.5 Hardness (Barcol Impressor): 60.

.6 Gloss – 60 deg. Gardner 9ANSI Z124-80, HUD Bulletin UM-73-84): 5 – 20.

.7 Colour stability (NEMA LD3): no change 200 hours.

.8 Wear, cleanability (ANSI Z124-80, HUD Bulletin UM-73-84): pass.

.9 Fire hazard (ASTM E84):

.1 Flame spread: maximum 15.

.2 Smoke developed: maximum 25.

.10 Water absorption (ASTM D570-81): 0.04% @ 24 hours/0.4% @ long term for 19 mm thickness sample.

.11 Stain resistance (ANSI Z124).

.2 Acceptable Manufacturers:

.1 Quartz by Corian or equivalent.

.3 Colour: Allow for 1 colour to be selected by Consultant from price group 4.

.3 **Wood Veneer (WV)**: plain sliced white birch with clearcoat finish.

.4 Melamine panels:

.1 Melamine overlay, thermo-fused under heat and pressure to medium density M-3 grade particle-board core. Overlay shall be bonded to both faces where exposed on two sides. When panel material requires surfaces on one side only, reverse side shall be overlaid with a plain buff balancing sheet.

.2 Acceptable Products: Panolam by Wanderosa Wood Products; Flakeboard by Wanderosa Wood Products, Panval by Uniboard, or equivalent.

.5 Plywood: veneer core, softwood, 19 mm thick typical unless otherwise indicated.

.1 Softwood: to CSA 0151.

.2 Fir to CSA0121-M1978.

.3 Hardwood plywood: to CSA O115.

.4 Poplar plywood (PP): to CSA O153, standard construction

.5 Where plywood is used for wall construction, the Flame Spread rating must be 150 or less on any exposed surface, or any surface that would be exposed by cutting through the material in any direction.

.6 Where plywood is used in ceiling construction, the Flame Spread rating must be 25 or less on any exposed surface, or any surface that would be exposed by cutting through the material in any direction.

.6 Particle board: Medium density, moisture resistant, type M-3 to ANSI A-208.1

.7 PVC edging.

.1 3.2mm thick, colour and pattern through full thickness of material to match panel finish with rounded edges.

.8 Sealant: As per 07 92 00.

2.2 Millwork Hardware

.1 As per Drawings/details.

2.3 Millwork Finishing - General

.1 Finish all interior millwork surfaces in plastic laminate, unless otherwise indicated.

2.4 Fabrication - General

.1 Obtain all on-Site dimensions before fabricating items. Obtain all relevant data and incorporate provisions for items of equipment enclosed by millwork.

.2 Verify wall alignment prior to proceeding with fabrication. Site conditions at variance with reviewed Shop Drawings shall be specifically noted on reviewed Drawings and forwarded to Consultant. Variances, due to Site conditions necessitating revisions to Shop Drawings shall be accepted prior to fabrication.

.3 Fabricate running members in maximum standard lengths obtainable for the particular species wherever possible.

.4 Fit all joints tight. Locate joints at points which will not interfere with, affect strength or detract from appearance of materials.

.5 Securely fasten intersecting framing members together at corners in an approved manner. Reinforce as required for rigid assembly designed for applicable loads.

.6 Wherever practicable, install, fit and adjust all hardware specified, in shop.

.7 Incorporate adequate provisions for scribing and fitting to adjoining surfaces in a manner acceptable to Consultant.

.8 Provide for and incorporate provisions to recognize inherent shrinkage characteristics of materials specified.

.9 Casework core material: 19 mm veneer core plywood.

.10 Casework edge trim: Plastic laminate with plastic laminate millwork and solid wood lippings with wood veneer millwork.

.11 Plastic laminate finish at all exposed surfaces, including cabinet/drawer interiors unless noted otherwise.

2.6 Accessories

.1 Nails and staples: to CSA B111; galvanized to CAN/CSA-G164 for exterior work, interior humid areas and for treated lumber; stainless steel finish elsewhere.

.2 Wood screws: to CSA B35.4 stainless steel, type and size to suit application.

.3 Splines: wood.

.4 Adhesive: recommended by manufacturer.

.5 Use least toxic sealants, adhesives, sealers, and finishes necessary to comply with requirements of this section.

PART 3 - EXECUTION

3.1 Job Conditions

.1 Job conditions for installation of architectural woodwork shall be as specified under AWMAC Quality Standards.

3.2 Installation

.1 Cabinet and Casework: Install in accordance with Section 10.4 of the AWMAC Quality Standards.

.3 Finish Hardware: Install finish hardware in accordance with Section 10.3 of the AWMAC Quality Standards.

.4 All cutting and fitting of trim around fixtures and receptacles to be done as no extra cost to Contract.

.5 Scribe countertops to wall during installation. Install silicone sealant at backsplash/wall junction at time of installation. Colour to Consultant’s selection.

3.3 Adjusting & Touch Up

.1 Adjust all moving and operating parts to function smoothly and correctly.

.2 Fill and retouch all nicks, chips and scratches. Replace all un-repairable damaged items

3.4 Cleanup

.1 Upon completion of installation, clean installed items of pencil and ink marks, and broom clean area of operation.

END OF SECTION

1.0 GENERAL

1.1 SUMMARY

.1 Section Includes: Furnishing of all labour, materials, services and equipment necessary for the supply and installation of metal flashings, sheet metal work, trim and associated accessories as indicated on Drawings and as specified herein.

1.2 REFERENCES

.1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), "Sheet Metal Work Architectural Manual".

.2 ASTM A653/A653M, "Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process".

.3 ASTM C920, Specification for Elastomeric Joint Sealants.

.4 CAN/CGSB 37.5-M, Cutback Asphalt Plastic Cement.

.5 CSA A231.1/A231.2, Precast Concrete Paving Slabs/Precast Concrete Pavers.

.6 CSA B111, Wire Nails, Spikes and Staples.

.7 CRCA Roofing Manual, Canadian Roofing Contractors Association.

1.3 SUBMITTALS

.1 Make submittals in accordance with Section 01 33 00, indicating:

.1 Proposed method of shaping, forming, jointing.

.2 Fastening, and application of flashing and sheet metal work.

.2 Product Data: Submit manufacturer's Specifications, application instructions, details and maintenance instructions.

.3 Samples: Submit duplicate 300 mm (12") long samples of each type of sheet metal part made from gauge specified with colour finish.

2.0 PRODUCTS

2.1 SHEET METAL MATERIALS

.1 All materials under Work of this Section, including but not limited to, sealants are to have low VOC content limits.

.2 Prepainted sheet steel: ASTM A653/A653M; Classification LFQ, Grade A, Z275 zinc coating designation, 0.60 mm minimum base steel thickness, commercial quality, prefinished with 8,000+ Series coating system by U.S. Steel Canada, Pre-Coat 8000+ by Dofasco Inc. or Colourite WeatherX by Vicwest Steel. Colour: Colour as selected by Consultant.

2.2 MISCELLANEOUS MATERIALS & ACCESSORIES

.1 Plastic cement: CAN/CGSB 37.5-M.

.2 Sealant: ASTM C920, Type S, Grade NS, Class 25; High-performance, medium-modulus, one-part, neutral-cure silicone sealant. ‘CWS’ by Dow Corning and/ or equivalent.

.3 Starter strips: Starter strips to be continuous, of same material as flashing used, 1.2 mm thick.

.4 Fasteners: CSA B111; Flat head roofing nails of length, type and thickness suitable for metal flashing application.

.5 Washers: of same material as sheet metal, 1 mm thick with rubber packings.

.6 Touch-up paint: Same colour and material as prepainted sheet steel, as recommended by prefinished coating manufacturer.

.7 Scuppers: Fabricate scuppers from copper sheet. Provide with soldered joints, size scuppers as shown on Drawings. Make watertight connections between scupper and adjacent roof and wall construction or other flashings. Shop coat as specified.

.8 Metal Accessories: Provide sheet metal clips, straps, anchoring devices and similar accessory units as required for installation of Work, matching or compatible with material being installed, non-corrosive, size and gauge required for performance. All screws and parts shall be compatible to prevent electrolysis.

2.3 FABRICATION

.1 Fabricate copings, flashings, curb counter flashings, starter strips, and miscellaneous flashings in accordance with CRCA and to details shown.

.2 Breakform prepainted sheet material to shapes shown. Make end joints where adjacent lengths of metal flashing meet, in accordance with jointing method specified.

.3 Form pieces in 2400 mm maximum lengths. Make allowance for expansion at joints.

.4 Hem exposed edges 13 mm minimum on underside for appearance and stiffness. Mitre and seal corners with sealant

2.4 DOWNPIPES, GUTTERS & SCUPPERS

.1 Downpipes & Gutters: Galvanized steel, 0.457 mm (26 ga.) minimum base metal thickness, Z275 (G90) designation zinc-coated steel conforming to ASTM A653/A653M-97. Prefinished - finish and colour to match flashings.

.2 Accessories: Provide matching goosenecks, preformed mitred corners, straps, hangers and necessary accessories and fastenings.

.3 Scuppers:

.1 Form scuppers from prefinished sheet metal in accordance with CRCA requirements.

.2 Form 200 mm wide x 400 mm long x 150 mm high custom scupper boxes in sheet metal and clad in prefinished metal. Quantities as indicated on Drawings.

.3 Provide all necessary fastenings.

3.0 EXECUTION

3.1 INSTALLATION

.1 Comply with manufacturer's installation instructions and recommendations, CRCA Standards Manual.

.2 Form Work neatly to size, shape and dimensions shown or required for the Work. Make angles and lines in true alignment. Erect Work straight, sharp, plumb and level in true plan, free of bulges and waves. Verify dimensions at the building. After soldering, remove flux or acid with neutralizing chemical, wash surface with water and then let dry, ready installation as applicable. Where welding is employed or indicated, employ mechanics skilled in welding metal being Worked; grind exposed welds smooth to match adjacent surfaces and remove slag and splatter before priming. Use concealed fastenings except where approved before installation.

.3 Make allowances for expansion and contraction for material being used. Shop form, lap and solder or weld corners and angles into one piece 450 mm (1'-6") minimum each way from corner or angle. Hem drip legs of copings and flashings at 45 degrees and secure drips with nailed or screwed concealed continuous edge strips of same gauge and material. Use concealed fastenings wherever possible. Make "S-lock" type seams or "Standing" type seams. Make joints with opening away from prevailing winds. Install with joints and seams which will be permanently weatherproof.

.4 Provide roof penetration flashings of prefinished steel sheet. Construct over curbs Projecting above roof surface. Edges shall lap roofing at least 100 mm (4"). Form hemmed drip on bottom edge. Turn up inside top edge to prevent run in over top. Corners shall be mitred and welded. Fasten down with lead headed or washered screws.

.5 Coping Flashings: Slope coping flashings to shed water to the inside of the roof.

.6 Expansion Provisions: Where lapped or bayonet-type expansion provisions in Work cannot be used, or would not be sufficiently weatherproof, form expansion joints of intermeshing hooked flanges, not less than 25 mm (1") deep, filled with mastic sealant (concealed within joints).

.7 Sealant Joints: Where movable, non-expansion type joints are required for proper performance of Work, form metal to Provide for proper installation of elastomeric sealant, in compliance with industry standards.

.8 Underlayment: Where metal is to be installed directly on cementitious or wood substrates, install a course of paper slip sheet over a course of composite membrane underlayment. Overlap seams of composite membrane underlayment at least 65 mm (2-1/2"). Roll entire membrane firmly and completely as soon as possible to minimize bubbles. Seal all terminations with a trowelled bead of mastic.

.9 Bed flanges of Work in a thick coat of bituminous roofing cement where required for waterproof performance.

3.2 DOWNPIPES

.1 Install downpipe system in accordance with manufacturer’s printed instructions.

.2 Install downpipes and Provide goosenecks back to wall. Secure downpipes to wall as detailed.

.3 Install concrete splash pans at end of any downpipes spilling out on roof.

3.3 CLEANING & PROTECTION

.1 Clean exposed metal surfaces, removing substances which might cause corrosion of metal or deterioration of finishes.

.2 Protection: Installer shall advise of required procedures for surveillance and protection of flashings and sheet metal Work during construction, to ensure that Work will be without damage or deterioration, other than natural weathering, at time of substantial completion.

END OF SECTION

1.0 GENERAL

1.1 DOCUMENTS

.1 This Section of the Specifications forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 SUMMARY

.1 Section Includes: Furnishing of all labour, materials, services and equipment necessary for the supply and installation of firestopping as indicated on drawings and as specified.

1.3 REFERENCES

.1 CAN4-S115-M85, "Standard Method of Fire Tests of Firestop Systems".

1.4 SUBMITTALS

.1 Make submittals in accordance with Section 01 33 00 – Submittals Procedures.

.2 Product Data: Submit three copies of manufacturer's specification and installation instructions for each type of material required. Include data substantiating that materials comply with specified requirements.

.3 Shop Drawings: Submit shop drawings to show proposed material, reinforcement, anchorage, fastenings and method of installation. Construction details should accurately reflect actual job conditions.

.4 Samples: Submit duplicate 300 mm x 300 mm (12" x 12") samples showing actual firestop material proposed for project.

1.5 DELIVERY, STORAGE, & HANDLING

.1 Comply with manufacturer's recommendations for handling, storage and protection during installation.

.2 Do not allow materials to become wet or soiled, or covered with ice or snow.

1.6 JOB CONDITIONS

.1 Examine substrate and the conditions under which the insulation work is to be performed. Do not proceed with firestopping work until unsatisfactory conditions have been corrected.

1.7 FIRE-RESISTANCE RATINGS

.1 Ratings of firestop systems shall be not less than the fire-resistance ratings noted on drawings and required by authorities having jurisdiction for firestopping of the floor, wall, ceiling and roof assemblies involved.

.2 Ratings of firestop assemblies for service penetrations shall be not less than the fire resistance rating of the floor, wall, ceiling or roof assembly being penetrated.

.3 Use only ULC tested firestopping assemblies as approved by the Consultant prior to firestop installations.

2.0 PRODUCTS

2.1 MATERIALS

.1 Firestopping Systems: In accordance with CAN4-S115-M85. All firestopping systems installed shall be from single manufacturer. Trade Contractors shall coordinate with General Contractor.

.1 Accepted Products:

.1 "Fire & Smoke Containment Systems" by Tremco Ltd., Construction Division.

.2 "Fire barrier Firestop Systems" by A/D Fire Protection Systems Inc.

.3 "Fire Protection Products" by Electrical Products Division/3M.

.4 "Firestop Systems" by Hilti (Canada) Limited.

.5 Equivalent products per Specification 01 25 00.

.2 Asbestos-free materials and systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of CAN4-S115-M85 and not to exceed opening sizes for which they are intended.

.3 Firestop System Rating: Equal to fire separation rating as noted on drawings.

.2 Service Penetration Assemblies: Certified by ULC in accordance with CAN4-S115-M85 and listed in ULC Guide No. 40 U19.

.3 Service Penetration Firestop Components: Certified by ULC in accordance with CAN4-S115-M85 and listed in ULC Guide No. 40 U19.13 and ULC Guide No. 40 U19.15 under the Label Service of ULC.

.4 Fire-resistance rating of installed fire stopping assembly not less than the fire-resistance rating of surrounding floor and wall assembly.

.5 Firestopping at openings intended for ease of re-entry such as cables: Elastomeric or resilient seal; do not use cementitious or rigid seal at such locations.

.6 Firestopping at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: Elastomeric or resilient seal; do not use a cementitious or rigid seal at such locations.

.7 Primers: To manufacturer's recommendation for specific material, substrate, and end use.

.8 Water (if applicable): Potable, clean and free from injurious amounts of deleterious substances.

.9 Damming and backup materials, supports and anchoring devices: To manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.

.10 Sealants for vertical joints: Non-sagging.

3.0 EXECUTION

3.1 PREPARATION

.1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials. Ensure that substrates and surfaces are clean, dry and frost free.

.2 Prepare surfaces in contact with firestopping materials to manufacturer's instructions.

.3 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour barrier.

.4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.2 INSTALLATION

.1 Install firestopping material and components in accordance with ULC certification and manufacturer's instructions.

.2 Seal holes or voids made by through penetrations, poke-through termination devices, and un-penetrated openings or joints to ensure continuity and integrity of fire separation are maintained.

.3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.

.4 Tool or trowel exposed surfaces to a neat finish.

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

3.3 INSPECTION

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

3.4 SCHEDULE

.1 Firestop at:

.1 Edges of floor slabs and rated roof slabs at slab edge covers, aluminum windows/curtain wall.

.2 Deflection space at top of fire-resistance rated masonry and gypsum board walls.

.3 Intersections of fire-resistance rated masonry walls to concrete and to gypsum board walls and of fire-resistance rated gypsum board walls to concrete and to masonry.

.4 Penetrations through fire-resistance rated masonry, concrete and gypsum board walls.

.5 Penetrations through fire-resistance rated floors, ceilings and roofs.

.6 Openings and sleeves installed for future use through fire separations.

.7 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.

.8 Firestopping around mechanical and piping assemblies penetrating fire separations by Division 20 - Mechanical. Firestopping systems and products to be coordinated with this specification section.

.9 Firestopping around electrical assemblies penetrating fire separations by Division 26 - Electrical. Firestopping systems and products to be coordinated with this specification section.

3.5 CLEAN-UP

.1 Remove excess materials and debris and clean adjacent surfaces immediately after application.

.2 Remove temporary dams after initial set of fire stopping and smoke seal materials.

END OF SECTION.

PART 1 – GENERAL

1.1 General Instructions

.1 Read and be governed by Conditions of the Contract and Sections of Division 1.

1.2 Quality Assurance

.1 Execute Work of this Section using an applicator who has adequate plant, equipment and skilled workers to perform it expeditiously. Company shall have past experience in the manufacture or fabrication of the products specified herein and shall have completed projects of similar scope and type.

1.3 Submittals

.1 Submit manufacturer's and product name for each sealant which will be used for Project, before commencing Work.

.2 Test sealant in contact with samples of materials to be caulked to ensure that proper adhesion will be obtained and no staining of the material will result. Prepare sample joints at the site of each type of sealant for each joint condition. Do not proceed with Work until each mock-up joint has been accepted.

.3 Provide 2440 mm (96") long sealant joint mock-up for review prior to commencement of work in accordance with Section 01 33 00. Accepted joint will establish minimum acceptable quality of workmanship and will serve as the standard by which subsequent Work will be compared for acceptance.

1.4 Environmental Conditions

.1 Sealant and substrate materials: Conform to sealant manufacturer's specifications and recommendations.

1.5 Warranty

.1 Warrant labour, materials and workmanship against defects and deficiencies for a period of three (3) years.

PART 2 - PRODUCTS

2.1 Materials

.1 General:

.1 All materials under Work of this Section, including but not limited to, primers and sealants are to have low VOC content limits.

.2 Use materials as received from manufacturers, without additives or adulterations. Use one manufacturer's Product for each kind of Product specified.

.2 Sealant **Type A**: ASTM C920, Type M, Grade NS, Class 25; Two-part, Polyurethane non-sag type, in standard colours selected.

.1 Sikaflex 2C-NS by Sika Canada Inc.

.2 Dymeric 240 by Tremco Ltd.

.3 Sealant **Type B**: ASTM C920, Type S, Grade NS; One-part mildew-resistant silicone, in standard colours selected.

.1 786 Mildew Resistant Silicone Sealant by Dow Corning Inc.

.2 Tremsil 200 Silicone Sealant by Tremco Ltd.

.4 Sealant **Type C**: ASTM C834; Pure acrylic siliconized sealant; in standard white colour (paintable).

.1 Tremflex 834 Silconized Sealant by Tremco Ltd.

PART 3 – EXECUTION

3.1 Supervision

.1 Unless specified otherwise herein comply with the recommendations and directions of the manufacturer whose materials are being used on the Work.

3.2 Preparation

.1 Clean contact surfaces of all joints and spaces to be sealed in strict accordance with manufacturer's instructions.

.2 Ensure that surfaces are structurally sound, cured, dry, free from frost, free from dust, grease, loose mortar, other contaminants or laitance which may adversely affect the adhesion of the sealing materials. Use dry clean compressed air stream if necessary to clean out the joint.

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

.4 Wipe metal surfaces to be caulked, except precoated metals, with cellulose sponges or clean rags soaked with cleaning material, and wipe dry with clean cloth. Where application temperature is less than -7° C, use MEK. Clean precoated metals with solutions or compounds which will not injure finish and which are compatible with primer and sealant.

.5 Test all materials for indications of staining or poor adhesion before any sealing is commenced. Submit reports in writing to Consultant of results.

3.3 Masking

.1 Where necessary to prevent contamination or marring surfaces of adjacent materials, mask areas adjacent to joints with masking tape prior to priming or sealing application. Remove tape immediately after joint has been completed and an initial set achieved.

3.4 Mixing

.1 Adhere to manufacturer's printed directions for mixing, work life, and all characteristics of sealant to be used.

.2 Mix materials using equipment recommended by manufacturer.

3.5 Installation

.1 Read other Sections of Specifications for extent of caulking prescribed by those Sections. Do all other sealant work specified or required.

.2 Do not thin or adulterate sealant.

.3 When surfaces of adjacent materials are to be painted, do all sealant work before these surfaces are painted.

.4 Check to make sure shop paint is compatible with primer and sealant. When incompatible, inform Consultant and change primer and sealant to compatible type acceptable to Consultant.

.5 Check form release agent used on concrete for compatibility with primer and sealant. If they are incompatible inform Consultant and change primer and sealant to compatible type, or clean concrete to sealant manufacturer's acceptance.

.6 Install joint backing material, filler strips, gaskets, bond breakers and similar type material of comparable performance characteristics. Install bond breaker tape or packing over asphalt impregnated fibre board as recommended by sealant manufacturer.

.7 Where joints are 12.7 mm (1/2") or deeper, insert backing material in continuous 30% compression with setback from finished face of adjoining materials equal to required depth of caulking (width/depth ratio) as specified herein.

.8 On horizontal traffic surfaces, support joint filler against vertical movement which might result from traffic loads, including foot traffic.

.9 Prime surfaces to receive sealants as required by manufacturer's specifications to ensure positive and permanent adhesion, and to prevent staining.

.10 Pack joints tightly with sealant backing set at depth specified for sealant. Fill other voids with filler.

.11 Install bond breaker tape in bottom of joints in lieu of sealant backing where proper depth cannot be obtained when backing is installed.

.12 Maintain correct sealant depth. Sealant depth shall be 1/2 the width of the joint, maximum depth shall be 12.7 mm (1/2"), minimum depth shall be 6 mm(1/4"). Comply with manufacturer's written recommendations.

.13 Apply sealants using pressure-operated guns fitted with suitable nozzles in accordance with manufacturer's directions. Apply sealants in such manner as to ensure good adhesion to sides of joints and to completely fill all voids in joints.

.14 Apply sealants so that surfaces of joints are smooth, full bead, free from ridges, wrinkles, sags, air pockets and embedded impurities. Tool sealant surfaces to produce a smooth surface.

.15 Remove droppings and excess sealant as Work progresses, before material achieves initial set.

.16 Install sealant materials and primers when surfaces are prepared, and ambient temperature and weather conditions are prevalent, consistent with manufacturer's recommendations.

3.6 Cleaning

.1 Clean adjacent surfaces which have been soiled or otherwise marred, in an approved manner, to completely remove all evidence of misplaced material.

.2 Remove masking tape, soils and all sealant compounds which may have been deposited on surfaces near joint.

3.7 Interior Sealant Schedule

.1 Movement and control joints on exposed insitu concrete walls.

.2 Interior control and expansion joints in floor and wall surfaces.

.1 Perimeters of exterior door and window frames, for air seal.

.3 Joints at tops of non-load bearing masonry walls at the underside of insitu concrete.

.4 Perimeter joints of washroom fixtures such as urinals, water closets, with mildew resistant sealant.

.5 Exposed interior control joints in gypsum board.

.6 Counter/wall junctions at plastic laminate counters with mildew resistant sealant.

.7 Seal interface between rubber tread/nosing/risers and stair stringers with mildew resistant silicone sealant.

END OF SECTION

PART 1 - GENERAL

1.1 Work Included

As detailed or scheduled in the contract documents, supply of:

.1 Steel frame products including frames, transom frames (glazed or paneled), sidelight and window assemblies, fire-rated and non-rated.

.2 Steel doors, swing type, flush, with or without embossed face sheets, with or without glazed or louvered openings, fire-rated, with or without temperature rise ratings, and non-rated.

1.2 References

.1 ANSI/NFPA 80-1999, Standard for Fire Doors and Fire Windows

.2 ASTM A653/A653M-05a, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process

.3 ASTM C553-02, Specification for Mineral Fiber Blanket Insulation for Commercial and Industrial Applications

.4 ASTM C578-05, Specification for Rigid, Cellular Polystyrene Thermal Insulation

.5 ASTM C591-01, Specification for Un-Faced Pre-formed Rigid Cellular Polyisocyanurate Thermal Insulation

.6 ASTM C592-04, Specification for Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction

.7 ASTM C1289-05a, Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board

.8 CAN4-S104-M80, Standard Method for Fire Tests of Door Assemblies

.9 CAN4-S106-M80, Standard Method for Fire Tests of Window and Glass Block Assemblies

.10 CGSB 41-GP-19MA (1984), Rigid Vinyl Extrusions for Windows and Doors

.11 CSA W59-2003, Welded Steel Construction (Metal Arc Welding)

.12 CSDMA, Recommended Dimensional Standards for Commercial Steel Doors and Frames, 2000

.13 CSDMA, Selection and Usage Guide for Steel Doors and Frames, 1990

.14 CSDMA, Recommended Specifications for Commercial Steel Door and Frame Products – 08 11 00, 2006

.15 Architectural Woodwork Manufacturers Association of Canada (AWMAC)

.1 Quality Standards for Architectural Woodwork (Latest addition).

1.3 Submittals

.1 Submit shop drawings in accordance with Section 01330.

.2 Indicate each type of door, frame, steel, construction and core.

.3 Indicate material thickness, mortises, reinforcements, anchorages, locations of exposed fasteners, openings (glazed, paneled or louvered) and arrangement of standard hardware.

.4 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule of the Architect.

.5 Contractor responsible for coordination and installation of products provided under this Section shall;

.1 Verify and provide to the contractor responsible for the supply of steel door and frame products, actual opening sizes and field conditions by field measurement before fabrication. Submittal drawings shall reflect measurements and conditions provided, and product manufactured accordingly. Coordinate field measurements with fabrication and construction schedules to avoid delays.

.2 Verify that substrate conditions, whether existing or installed under other Sections, are as detailed in the Architect's drawings, and are acceptable for product installation in accordance with the manufacturer's instructions.

.6 Manufacturer shall not proceed with fabrication without receipt of approved submittal drawings and approved hardware schedule.

1.4 Thermal Performance

.1 Maximum overall U-Value of exterior glazed steel frame assemblies shall not exceed 1.6 W/m2K.as determined in accordance with CAN/CSA-A440.2

.2 Maximum air leakage rate for exterior glazed steel frame assemblies shall not exceed 1.0 L/s*m2 at 75Pa as determined in accordance with AAMA/WDMA/SCA 101/IS.2/A440.

1.5 Warranty

.1 Materials and workmanship shall be warranted by the manufacturer for a period of one (1) year from date of substantial performance.

PART 2 - PRODUCTS

2.1 Glass and Glazing

.1 Refer to Specification 08800.

2.2 Fabrication – Hollow Metal Frame Products

.1 Frame products shall be 16 gauge. Exterior transom frames, sidelight and window assemblies shall be welded type construction, thermally broken.

.2 Frame product shall be mortised, blanked, reinforced, drilled and tapped at the factory for templated hardware only, in accordance with the approved hardware schedule and templates provided by the hardware supplier.

.3 Mortised cutouts shall be protected with steel guard boxes.

.4 Frame product shall be reinforced only, where required, for surface mounted hardware, anchor hinges, thrust pivots, pivot reinforced hinges, or non-templated hardware. Drilling and tapping is by others, on site, at time of installation.

.5 Provide anchorage appropriate to floor, wall and frame construction. Each wall anchor shall be located immediately above or below each hinge reinforcement on the hinge jamb and directly opposite on the strike jamb. For rebate opening heights up to and including 1520 mm (60") provide two (2) anchors, and an additional anchor for each additional 760 mm (30") of height or fraction thereof, except as indicated below. Frames in previously placed concrete, masonry or structural steel shall be provided with anchors located not more than 150 mm (6") from the top and bottom of each jamb, and intermediate anchors at 660 mm (26") on centre maximum. Fasteners for such anchors shall be provided by others.

.6 Minimum reinforcing, anchor and other component gauges shall be in accordance with Table 1 of the CSDMA, "Recommended Specifications for Commercial Steel Door and Frame Products".

.7 Each door opening shall be prepared for single stud rubber door silencers, three (3) for single door openings, two (2) for double door openings, except on gasketed frame product.

.8 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.

.9 Fire-rated frame products shall be provided for those openings requiring fire protection as determined and scheduled by the Architect. Frames, transom and sidelight assemblies shall be listed for conformance with CAN4-S104. Window assemblies shall be listed for conformance with CAN4-S106. All fire-rated frame products shall bear the label of, and be listed by a nationally recognized testing agency having a factory inspection service. Labeling shall be in accordance with NFPA 80, the listing authority's policies and label materials, and shall identify the manufacturer. Fire-rated frame products shall be constructed as listed for labeling in the Follow-Up Service Procedures/Factory Inspection Manuals issued by the listing agency to individual manufacturers

.10 Provide grout guards fabricated from not less than 0.016 in. (0.4 mm) thick steel at all hardware mortises on frame product to be grouted.

2.2.1 Welded Type

.1 Frame product shall be accurately mitered or mechanically jointed.

.2 As defined in Appendix 2 of the CSDMA, "Recommended Specifications for Commercial Steel Door and Frame Products", frame product perimeter corner joints shall be:

.1 Face welded; continuously welded on the profile faces, with exposed faces filled and ground to a smooth, uniform, seamless surface.

.3 Joints at mullions, sills and center rails shall:

.1 Be coped accurately, butted and tightly fitted.

.2 At intersecting flush profile faces, be securely welded, filled and ground to a smooth, uniform, seamless surface.

.3 At intersecting recessed profile faces, be securely welded to concealed reinforcements, with exposed hairline face seams.

.4 At all other intersecting profile elements, have exposed hairline face seams.

.4 Welding shall conform to CSA W59.

.5 Where frame product is to be installed prior to the adjacent partition, a floor anchor shall be securely attached to the inside of each jamb profile. Each floor anchor shall be provided with two (2) holes for securing to the floor. For conditions that do not permit the use of a floor anchor, an additional wall anchor, located within 150 mm (6") of the base of the jamb, shall be substituted.

.6 Weld in two (2) temporary jamb spreaders per door opening to maintain proper alignment during shipment and handling, which shall not be used for installation.

.7 Glazing stops shall be formed steel channel, minimum 16 mm (0.625") height, accurately fitted, butted at corners and fastened to frame sections with counter-sunk oval head sheet metal screws.

.8 When required due to site access, when advised by the contractor responsible for coordination or installation, as specified on the Architect's drawings or due to shipping limitations, frame product for large openings shall be fabricated in sections as designated on the approved submittal drawings, with splice joints for field assembly and welding by others.

.9 Prior to shipment, mark each frame product with an identification number as shown on the approved submittal drawings.

.10 Refer to drawings/details/schedules for frame depth/throat opening sizes

PART 3 - EXECUTION

.1 Site Storage and Protection of Materials

.1 Doors and frame product shall be removed from their wrappings or coverings upon receipt on site, be stored in a vertical position, and be spaced with blocking to permit air circulation between them.

.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.

.3 All damages incurred during shipment shall be noted on the carrier's Bill of Lading and immediately reported, in writing, to the supplier.

.4 Any scratches or disfigurement of doors or frame product caused by shipping or handling shall be promptly cleaned and touched-up with a zinc-rich primer.

.5 All materials shall be properly stored on planks or dunnage, out of water and covered to protect from damage from any cause.

.2 Installation

.1 Prior to installation, remove temporary shipping spreaders.

.2 Prior to installation, the area of floor on which the frame is to be installed, and within the path of the door swing, shall be checked and corrected for flatness.

.3 Door and frame product shall be checked for correct size, swing, rating and opening number.

.4 Caulk perimeter of frames between frame and adjacent material.

.5 Set frames plumb, square, level and at correct elevation.

.6 Fire-rated door and frame product shall be installed in accordance with the terms of their listings, NFPA-80, or the local Authority Having Jurisdiction (AHJ).

.7 Secure anchorages and connections to adjacent construction.

.8 Brace frames rigidly in position while building-in. Install wood spreaders at third points of frame rebate height to maintain frame width. Provide vertical support at centre of head for openings exceeding 1200 mm (48") in width.

.9 During the setting of frame product, check and correct as necessary for opening width, opening height, square, alignment, twist and plumb, in accordance with the CSDMA, "Recommended Dimensional Standards for Commercial Steel Doors and Frames".

.10 Grout guards and junction boxes are intended to protect hardware mortises and tapped holes from masonry grout of 4 in. (101 mm) maximum slump consistency that is hand troweled in place.

.11 Frame products are not intended or designed to act as forms for grout or concrete. Grout hollow metal sections in "lifts" or take precautions otherwise to ensure that frames are not deformed or damaged by the hydraulic forces that occur during this process.

.12 Keep hollow metal surfaces free of grout, tar, and/or other bonding materials or sealers. Promptly clean grout, tar, and/or other bonding materials or sealers off of frame product and doors.

.13 Remove wood spreaders after frames have been built-in.

.14 Make allowance for deflection to ensure structural loads are not transmitted to frame product.

.15 Install doors, and hardware in accordance with hardware templates and manufacturer's instructions.

.16 Adjust operable parts for correct clearances and function.

.17 Install louvers, glazing and door silencers.

.18 Finish paint in accordance with Section 09900.

END OF SECTION

1.0 - GENERAL

1.1 References

.1 Architectural Woodwork Manufacturers Association of Canada (AWMAC)

.2 ANSI / WDMA I.S.1A - Window and Door Manufacturers Association (WDMA).

.3 CAN / CSA-0132.2.0-90 – General requirements for wood flush doors.

.4 ASTM E 2074-00 - Standard Methods of Fire Tests for Door Assemblies.

.5 UNDERWRITERS' LABORATORIES - UL 10B (Neutral Pressure) and UL 10C (Positive Pressure) - Fire Tests of Door Assemblies, and ULC S-104 Standard Methods of Fire Tests of Door Assemblies.

.6 NFPA 80 - Fire doors and other opening protectives

1.2 Shop Drawings

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Illustrate door opening information, such as: location, size, types, construction, swings, undercuts, special beveling, hardware location and preparation requirement, blocking for hardware in mineral core doors, fire ratings, identify cutouts, factory finish, glass and other pertinent data.

.3 Product Data. Indicate door core materials, thickness, construction, veneer species.

1.3 Samples

.1 Provide samples of door face veneer/finish for Architect’s approval.

1.4 Quality Assurance

.1 Manufacturer: Company specializing in manufacturing products specified in Section with a minimum of five years documented experience. Must be a member in good standing of the Architectural Woodwork Institute (AWI) and Quality Certification Program Certified (QCP). B.

.2 Quality Standard: Meet or exceed WDMA I.S.1-A Premium Grade

.3 Fire Ratings: Fire-rated wood doors to comply with NFPA 80 requirements according to building code standards having local jurisdiction.

.1 Neutral Pressure Testing – CAN/ULC S104; UL10B, NFPA252, and

.2 ASTM E-152. 2) Positive Pressure Testing – UBC 7-2-97 or UL10C.

.4 Label Certification: All doors requiring fire-rating will carry ULC label. Manufacturer's certification labels may be used for door size variations if approved by AHJ (Authority Having Jurisdiction).

1.5 Storage and Protection

.1 Protect doors from dampness. Arrange for delivery after work causing abnormal humidity has been completed.

.2 Store doors in well ventilated room, off floor, in accordance with manufacturer's recommendations.

2.0 – PRODUCTS

2.1 Wood Flush Doors

.1 Solid core, flush interior doors 44mm (1 ¾”) thick, solid core construction, WDMA workmanship for veneer faces, vertical edges, crossbands, horizontal edges and dimensional tolerances. Extra Heavy Duty Performance Level.

2.2 Materials

.1 Door Construction Grade: Except as otherwise shown on the drawings fabricate the work of this section to WDMA “Premium Grade”

.2 Door facing:

.1 MDF or hardboard overlay for paint finish.

.3 Doors to be one piece core construction, no voids. Stiles and rails to be electronically glue bonded to particle core prior to abrasive sanding.

.4 Core material to be structural composite lumber.

.5 Edge: hardwood painted/stained to match door face finish.

.6 Adhesive: Type II (water resistant) for interior doors.

.7 Finish: satin clear coat finish.

2.3 Fabrication

.1 Construction: SCLC 5.

.2 Doors edge construction: Type A

.3 Size of doors; type, size, and location of lights and louvers; astragals, edging, flashing, and specialty hardware; as indicated on Door Schedule/Details.

.4 Fire-rated doors of construction standard of manufacturer and conform to requirements of applicable labeling agencies.

.5 Provide blocking as required for surface mounted hardware to prevent need for through bolting.

.6 Bevel vertical edges of single acting doors [3 mm in 50 mm] on lock side and [1.5 mm in 50 mm] on hinge side.

2.4 Door Construction

.1 No added urea-fomaldehyde in wood components and adhesives.

3.0 - EXECUTION

3.1 Installation

.1 Unwrap and protect doors in accordance with CAN/CSA-O132.2 Series, Appendix A.

.2 Install doors and hardware in accordance with manufacturer's printed instructions [and CAN/CSAO132.2 Series, Appendix A].

.3 Adjust hardware for correct function.

3.2 Adjustment

.1 Re-adjust doors and hardware just prior to completion of building to function freely and properly.

END OF SECTION

PART 1 – GENERAL

1.1 SUMMARY

1. Provide labour, materials, products, equipment and services to complete the interior aluminum glazed partition, door and sidelite frames work specified herein. This includes, but is not necessarily limited, to:
   .1 Interior aluminum partition framing
   .2 Interior aluminum swing doors
   .3 Auxiliary materials required for a complete installation

1.2 REFERENCES

1. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
2. All reference amendments adopted prior to the Bid Closing date of this Project shall be applicable to this Project.
3. All materials, installation and workmanship shall comply with all applicable requirements and standards.
4. American National Standards Institute (ANSI)
   1. ANSI ICC A117.1: Accessible and Usable Buildings and Facilities
5. ASTM International
   1. ASTM A123/A123M: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
   2. ASTM A153/A153M: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
   3. ASTM A653/A653M: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
   4. ASTM B209: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
   5. ASTM B221: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
6. CSA Group
   .1 CSA B651: Accessible Design for the Built Environment
   2. CAN/CSA G164: Hot Dip Galvanizing of Irregularly Shaped Articles.
7. Underwriters Laboratories of Canada (ULC)
   1. CAN/ULC S114: Standard Method of Test for Determination of Non-Combustibility in Building Materials
   2. CAN/ULC-S702: Standard for Mineral Fibre Thermal Insulation for Buildings

1.3 ADMINISTRATIVE REQUIREMENTS

1. Pre-installation Meetings: Schedule, and conduct pre-installation meeting at Project Site, in order to coordinate work of this Section, with work of related Subcontractors.
   1. Ensure attendance of Subcontractor performing work of this Section and representatives of manufacturers and fabricators involved in, or affected by, installation and coordination with other materials and installations that have preceded or will follow. Meeting shall coincide with a regularly scheduled construction site meeting.

2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration.
3. Record significant discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.

2. Scheduling:
    1. Ensure Product lead times does not exceed five weeks from taping of gypsum board around openings.

1.4 ACTION SUBMITTALS

1. Product Data: Submit in accordance with Division 01 for the following:
    1. Submit manufacturer's instructions, printed product literature and data sheets for the glazed interior aluminum door frames work and include product characteristics, performance criteria, physical size, finish and limitations.
    2. Shop Drawings: Submit in accordance with Division 01 for interior aluminum door frames work. Include plans, elevations, sections, full-size details, anchorage, locations of accessory items and attachments to other work. Indicate field measurements on Shop Drawings.
    3. Samples (for initial selection): Submit Samples in accordance with Division 01 for units with factory-applied colour finishes. Submit two complete sets of colour chips representing manufacturer's full range of available colours and patterns.
    4. Warranties: Submit sample of extended warranties specified in this Section for Consultant’s review.

1.5 CLOSEOUT SUBMITTALS

1. Maintenance Data: Submit operation and maintenance data for each type of glazed interior aluminum door and frame to include in maintenance manuals. Include warranty certificates.

1.6 QUALITY ASSURANCE

1. Installer Qualifications: Installation must be performed by an installer who has been trained or otherwise authorized by manufacturer.
2. Manufacturer Qualifications: Provide Products from a manufacturer with minimum 20 years of experience and capable of providing glazed interior aluminum door frames that meet or exceed performance requirements indicated.
3. Source Limitations: Obtain primary components of glazed interior aluminum door frames, including framing and accessories, from single manufacturer. Obtain secondary components and accessories from sources acceptable to manufacturer of primary materials.

1.7 DELIVERY, STORAGE AND HANDLING

1. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions and recommendations. Inspect components for damage upon delivery.
2. Storage: Store products in a secure enclosed area protected from the elements, in manufacturer’s packaging until ready for installation.
3. Handling: Handle materials with care and avoid dents, scratches or damage to products. Remove labels, stickers or protection after installation.

1.8 PROJECT CONDITIONS

1. Field Measurements: Verify actual locations of openings by field measurements performed by the installer prior to commencement of fabrication. Ensure recorded measurements provided by the

installer are indicated on Shop Drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.9 WARRANTY

1. Extended Warranty: Provide manufacturer’s standard warranty which covers Products specified in this Section that fail in materials or workmanship within specified warranty period.
    1. Warranty Period: 5 years from date of Substantial Performance of the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

1. Materials specified in this Section are based on Products as supplied by PC350 Architectural Glass Walls.
2. Substitution of equivalent products in accordance with requirements of Section 01 25 00.

2.2 DESIGN AND PERFORMANCE REQUIREMENTS

1. Provide manufacturer's standard extruded-aluminum framing members formed using controlled 6063 T5 alloy billets to ensure compliance to dimensional tolerances and to maintain colour uniformity.
2. Ensure systems are self-supporting and do not require additional structural supports or blocking.
3. Ensure systems are stick-built on site and are capable of being cut and assembled to meet variations within openings.
4. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

2.3 MATERIALS

1. Aluminum Components:
    1. Sheet and Plate: ASTM B209M (ASTM B209).
    2. Extrusions: ASTM B221M (ASTM B221), Alloy and temper 6063-T5 or as recommended by aluminum frame manufacturer for strength, corrosion resistance, and application of required finish.
    3. Thickness: not less than 3.2 mm (0.125 inch) on exposed surfaces, and 4.75 mm (0.187 inch) on internal webs.
2. Steel Members: Hot-dip galvanize all steel items to comply with the following:
    1. ASTM A653/A65M for sheet steel,
    2. ASTM A153/A 153M for steel and iron hardware,
    3. ASTM A123/A 123M or CAN/CSA-G164 for other steel products.

2.4 ALUMINUM PARTITION FRAMING SYSTEM

1. Door and Glazing Frames: Manufacturer’s standard glazing frame system with the following characteristics:
    1. Face Profile: 45 mm (1-3/4 inch)
    2. Rabbet wall thickness: 1.78 mm (0.070 inch)
    3. Trims (Batten Covers): Extruded aluminum, in 32 mm (1-1/4 inch) or 45 mm (1-3/4 inch) size, with removable snap-in casing trims and without exposed fasteners.
    4. Glazing System: Retained mechanically with gaskets on four sides.
    5. Fabrication Method: Field-fabricated stick system.

6. Throat Size: to suit adjacent partitions as scheduled and/or detailed
7. Acceptable Products: “Elite Door Frame System” and Half Inch Glazing Channel by PC350.

2.5 SWING DOOR SYSTEMS

1. Provide 44.5-mm (1-3/4-inch) thick aluminum swing doors with extruded-aluminum tubular rail and stile members.
2. Door Height: as scheduled
3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.
4. Framing Members for sidelites, and transom frames: Manufacturer's standard extruded aluminum frames as specified in this Section, reinforced for hinges and strikes as required to support imposed operational loads.
5. Door Hardware: Provide quantity, item, size, finish or colour as required by application. As a minimum, include hinges, closers, automatic door bottoms, and weatherstripping as applicable and recommended by manufacturer and complying with the following:
    1. Hinges: Manufacturer’s standard 5 knuckle, ball bearing, full mortise stainless steel hinges finished to match frame finish. Provide minimum of three hinges for frames up to 2340 mm (92 inches), and minimum of four hinges for frames above 2340 mm (92 inches).
    2. Door Pull: Manufacturer’s standard 25 mm (1 inch) diameter stainless steel offset pull.
    3. Automatic Door Bottom: Manufacturer’s standard sponge neoprene gasket material held in place by aluminum housing that automatically activates when plunger depresses against door stop or jamb. Door bottom must be designed to seal out draft, sound and light. Mount on bottom rail of doors.
        1. Basis-of-Design: “CT-54” by KN Crowder.
    4. Closer: Concealed, max 140-degree opening single acting cylinder and standard arm in top rail of door.
        .1 Basis of Design: LCN 3130 by Ingersoll Rand
    .5 Lever set: per Specification 08 71 00.

.6 Door System Dimensions

.1 Top Rail: 140mm; bottom Rail: 140mm. Basis of design: PC350, P5 low profile

.2 Throat size: to suit adjacent partitions as scheduled and/or detailed

2.6 GLAZING

.1 Refer to Specification 08 81 00 Interior Glass Glazing

2.7 ALUMINUM BASEBOARDS

.1 100mm tall aluminum baseboard with concealed cleat, finish to match aluminum partition system.

2.8 ACCESSORIES

1. Fasteners and Accessories: Manufacturer's standard non-corrosive, non-bleeding fasteners compatible with adjacent materials.
2. Glazing Gaskets: Manufacturer's standard elastomeric glazing gaskets, setting blocks, and shims or spacers.
3. Glazing Sealants: ASTM C920, Type S, Grade NS, Class 25, Use NT, permanently elastic, non-shrinking, and non-migrating silicone type recommended by manufacturer.
4. Mineral Wool: CAN/ULC-S702, Type 1; non-combustible mineral wool tested in accordance with requirements of CAN/ULC-S114.

2.9 FABRICATION

1. Fabricate jambs and prepare for hardware, with concealed reinforcement plates, drilled and tapped as required, and fastened within frame with concealed screws.
2. Provide concealed corner reinforcements and alignment clips for accurately fitted hairline joints at butted or mitered connections.

2.10 FINISH

1. Finish: Manufacturer’s standard baked-enamel or powder-coat finish.
2. Colour and Gloss: As selected by Consultant from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

1. Examine installations areas including, walls, floors, openings, and ceilings, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
    1. Verify that wall thicknesses do not exceed tolerances allowed by throat sizes required for installation.
    2. Verify rough opening dimensions, levelness of floors, and operational clearances.
    3. Verity that steel studs at openings have been installed inverted in order to accept jambs.
    4. Verify that openings have been provided unfinished.
    5. Verify that gypsum board provided around openings has been finished to a minimum Level 4 in accordance with ASTM C840 as specified in Section 09 21 00.
2. Do not proceed with installation unless unsatisfactory conditions have been corrected.

3.2 INSTALLATION

1. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing glazed interior aluminum doors and frames, accessories, and other components.
2. Do not install defective or damaged parts or components. Return such component parts to manufacturer for repair or replacement.
3. Do not cut or trim component parts during installation in a manner that would damage finish, decrease strength or result in visual defects.
4. Use fasteners and anchors suitable for substrate and project conditions. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
5. Pack mineral wool insulation in frames to minimize sound transmission through the frame for enhanced STC.
6. Install frames rigid, square, straight, plumb, and level. Fit joints to produce hairline joints free of burrs and distortion. Conceal evidence of drilling, cutting, and fitting.
7. Install operating components to produce smooth operation and tight fit at contact points. Install surface-mounted hardware according to manufacturers' written instructions using concealed fasteners.

3.3 ADJUSTING, CLEANING, AND PROTECTION

1. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set self-closing mechanisms on doors such that they close from the 90 deg open position in no less than four seconds.
2. Touch-up, repair or replace damaged products.
3. Clean exposed surfaces of frames, hardware, and fittings

END OF SECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

.1 Comply with requirements listed in Division 1

.2 Furnish, deliver and install finish hardware.

.3 It is intended that the following list of hardware will cover finish hardware to complete the project. Bring to the Architect's attention any omissions, discrepancies that will affect work in this section during the bidding period.

1.2 QUALITY ASSURANCE

.1 Meet all requirements of the local building code and all other applicable regulations.

.2 Qualified suppliers must have in their employ a Certified A.H.C. (Architectural Hardware Consultant) as licensed by the Door and Hardware Institute. The supplier must have a minimum of two (2) years experience furnishing hardware for similar projects. Only firms that can extend manufacturers warranty to the project are to be considered as suppliers.

.3 Inspection of supplied Finishing Hardware will be done by a Certified A.H.C. A complete Site Inspection Report will be issued to the Architect.

1.3 SUBMITTALS

.1 Upon request, provide mounted samples of hardware items to be supplied.

.2 Prepare and submit two (2) copies of a detailed hardware schedule listing product numbers, size and finishes. Include two (2) sets of catalog cuts.

.3 Furnish other sections with two (2) complete sets of hardware templates for related fabricating and installation.

.4 Submit for owner review and comments two (2) key schedules listing the door number, hardware heading or item, and the key group.

.5 Where electrical hardware is to be supplied, provide wiring diagrams showing all wire termination points. Where electrical hardware is to be supplied and installed provide the contractor with riser diagrams listing the correct wire runs and back box sizes as well as 115 VAC requirements.

.6 Where required in Division 1, provide two (2) operating manuals for the owners use. Include copies of the hardware schedule, templates, installation instructions and all maintenance data.

1.4 PRODUCT DELIVERY, HANDLING, AND STORAGE

.1 Deliver each hardware item in its original package complete with all fasteners, keys, templates, and installation instructions required for installation.

.2 Clearly mark each container with the door opening number and the hardware schedule item or heading number.

.3 The contractor must store hardware delivered in a secure area. The storage area must contain adequate shelf space to hold all the hardware off the floor. Ensure the area is kept dry and clean.

.4 When requested, package items of hardware separately for delivery to other fabricators for their installation.

1.5 WARRANTY

.1 Provide a written warranty for a period of two (2) years for all hardware supplied and a five (5) year warranty for the door closers.

.2 When requested provide extended warranties listed in Division 1.

PART 2 PRODUCTS

2.1 See Hardware Schedule

2.2 Door hardware shall be supplied by one of the following approved suppliers:

.1 Knell's Door & Hardware

.2 Commercial Doors and Hardware

.3 Empire Hardware Co. Ltd.

.4 Rivett Hardware.

.5 Upper Canada Hardware.

PART 3 EXECUTION

3.1 INSPECTION

.1 The consultant will inspect all the door openings to ensure the specified products are supplied and installed in accordance with the manufacturers instructions. A written report will be furnished to the Architect detailing openings where products are missing, installed incorrectly or in need of proper adjustment.

3.2 INSTALLATION

.1 The general contractor shall obtain a copy of ANSI/DHI A115.1G-94,"Installation Guide for Doors and Hardware". It is the intent of this document to be used as a reference guide in the proper handling, storage, and installation of finishing hardware, and doors and frames. This document can be obtained through the Door and Hardware Institute.

.2 Other trades installing hardware must follow all manufacturers instructions including door closer adjustment, handing of locksets as required, and degree of door swing. Advise the consultant if door frames are not square and plumb and prevent proper door hardware installation.

.3 Use only the original manufactures fasteners for the installation of all hardware products. Drill and tap doors and frames, where required, to properly install finishing hardware products.

.4 Mount hardware to suit door elevations. Unless otherwise directed by the consultant, install hardware at the following mounting heights:

Locksets	40"	(1015mm)
Exit device	40"	(1015mm)
Push/Pull	42"	(1065mm)
Deadlock	48"	(1200mm)

.5 Manufacturers of specified products are responsible to instruct hardware installers in the proper installation methods of their products.

3.3 FIELD QUALITY CONTROL

.1 Verify each door leaf opens closes and latches. Inspect fire rated openings to ensure they are installed in compliance with NFPA 80 requirements. Test access control system and electrified hardware devices for proper operation, owner to sign off on verification of operation. Verify electric door release hardware operates properly upon activation of the fire alarm system.

.2 Perform bi-monthly on-site inspections during hardware installation and provide inspection reports listing progress of work, unacceptable work and corrective measures. Repair or replace as directed by the Consultant.

.3 Before completion of the work but after the hardware has been installed, submit a certificate to the architect stating that final inspection has been made and that hardware has been checked for installation and operation by a technician from the manufacturer and hardware consultant

3.4 ADJUSTING AND CLEANING

.1 Check and make final adjustments to each operating item of hardware on each door to ensure proper operation and function.

.2 Adjust doors with self-closing devices or automatic closing devices for operation after the HVAC system is balanced and adjusted. Adjust spring power of non sized door closers to close and latch the door.

.3 Hardware to be left clean and free of disfigurements.

.4 Instruct owner personnel in the proper operation, adjustment and maintenance of hardware.

.5 Check locked doors against approved keying schedule.

3.5 PROTECTION

.1 Protect hardware from damage during construction. Wrap locks, panic hardware, and fire exit hardware, door pull trim with kraft paper or plastic bubble materials to protect finish from damage until date of substantial completion. Remove and reinstall or where necessary, use temporary hardware to maintain finish in new condition and maintain manufacturer’s warranty.

3.6 HARDWARE SCHEDULE

.1 Refer to drawings/schedules.

END OF SECTION

DOOR INDEX

Mark	Heading #	Mark	Heading #	Mark	Heading #
LOOSE1	LOOSE1				
D101	01				
D102	02				
D102A	03				
D103	04				
D104	05				
D104A	06				
D105	04				
D106	07				
D108	08				
D109	12				
D114	09				
D115	04				
D116A	10				
D117	11				
D118	11				

Hardware Finishes

Finish	Description
26D	SATIN CHROMIUM
626	SATIN CHROMIUM PLATED
630	SATIN STAINLESS STEEL
689	POWDER COAT, ALUMINUM
C26D	SATIN CHROMIUM
C32D	STAINLESS STEEL, SATIN
SP28	LACQUER SPRAYED ALUMINUM
US32D	SATIN STAINLESS STEEL

HARDWARE SCHEDULE - CODE # 5196

SMITHSON PS 2022 RENO

150 BELLEVIEW AVE.

Heading # 01

1 SGL DOOR D101 EXISTING CORRIDOR TO RECEPTION/ADMIN 101 | o | LH

1095 x 2050 x 45 WD Door/ HMF Frame | NON-RTD Door/NON-RTD Frame

3	HINGE, 4 1/2, HVY WT	TA786 114MM X 102MM	26D	MCK
1	CYLINDRICAL LOCK WITH THRU BOLTS	ND75P6D X RHO X XN12-035 X 13-247 X 10-025	626	SCH
1	ELECTRIC STRIKE	5000C-12/24D-630	630	ES-CD
1	AUTO OPERATOR	MICOM KIT 18139 WIRED (SW800 ADO & 2 BUTTONS-INSTALLED)		G&A
1	KICK PLATE	GSH 80A X 2-SIDED TAPE X 203MM X 1057MM	C32D	GAL
1	FLOOR STOP	GSH 209	C26D	GAL
2	KEYING	MASTERKEY CYLINDER (MASTERKEYING CYLINDER BY G & A)		G&A

120V AC TO HEAD, CONDUIT, WIRING, PULL-STRINGS AND BACK BOXES BY OTHERS.

Heading # 02

1 SGL DOOR D102 RECEPTION/ADMIN 101 TO HEALTH ROOM 102 | o | RH

965 x 2134 x 45 WD Door/ WDF Frame | NON-RTD Door/NON-RTD Frame

3	HINGE, 4 1/2, HVY WT	TA786 114MM X 102MM	26D	MCK
1	PRIVACY SET, WITH THRU BOLTS	ND40S X RHO X 13-248 X 10-025	626	SCH
1	KICK PLATE	GSH 80A X 2-SIDED TAPE X 203MM X 927MM	C32D	GAL
1	FLOOR STOP	GSH 209	C26D	GAL

Heading # 03

1 SGL DOOR D102A HEALTH ROOM 102 FROM BF WC 106 | o | RHR

965 x 2134 x 45 WD Door/ HMF Frame | NON-RTD Door/NON-RTD Frame

3	HINGE, 4 1/2, HVY WT	TA786 114MM X 102MM	26D	MCK
1	CYLINDRICAL LOCK WITH THRU BOLTS	ND80P6D X RHO X 13-247 X 10-025	626	SCH
1	CYLINDRICAL DEAD LOCK	B660P X 12-631 X 10-094	626	SCH
1	ELECTRIC STRIKE	5000C-12/24D-630	630	ES-CD
1	KICK PLATE	GSH 80A X 2-SIDED TAPE X 203MM X 927MM	C32D	GAL
1	FLOOR STOP	GSH 209	C26D	GAL
2	KEYING	MASTERKEY CYLINDER (MASTERKEYING CYLINDER BY G & A)		G&A

TIE STRIKE INTO "PUSH TO LOCK" FUNCTION OF THE AUTOMATIC OPERATOR SYSTEM USED ON OPENING 106 (HEADING#07).
INSTALL THUMBTURN SIDE OF DEADBOLT ON HEATH ROOM SIDE.

HARDWARE SCHEDULE - CODE # 5196

SMITHSON PS 2022 RENO

150 BELLEVIEW AVE.

Heading # 04

1 SGL DOOR D103 RECEPTION/ADMIN 101 TO PRINCIPAL'S OFFICE 103 | º | LH

1 SGL DOOR D105 RECEPTION/ADMIN 101 TO OFFICE 105 | º | RH

1 SGL DOOR D115 EXISTING CORRIDOR TO CUSTODIAL OFFICE 109 | º | LH

965 x 2134 x 45 HMD Door/ HMF Frame — NON-RTD Door/NON-RTD Frame

9	HINGE, 4 1/2, HVY WT	TA786 114MM X 102MM	26D	MCK
3	CYLINDRICAL LOCK WITH THRU BOLTS	ND53P6D X RHO X 13-247 X 10-025	626	SCH
3	KICK PLATE	GSH 80A X 2-SIDED TAPE X 203MM X 927MM	C32D	GAL
3	FLOOR STOP	GSH 209	C26D	GAL
3	KEYING	MASTERKEY CYLINDER (MASTERKEYING CYLINDER BY G & A)		G&A

Heading # 05

1 SGL DOOR D104 RECEPTION/ADMIN 101 TO MEETING ROOM 104 | º | LH

965 x 2134 x 45 WD Door/ WDF Frame — NON-RTD Door/NON-RTD Frame

3	HINGE, 4 1/2, HVY WT	TA786 114MM X 102MM	26D	MCK
1	CYLINDRICAL LOCK WITH THRU BOLTS	ND75P6D X RHO X XN12-035 X 13-247 X 10-025	626	SCH
1	OVERHEAD STOP/HOLDER, SURFACE	904S	US32D	GLY
1	KICK PLATE	GSH 80A X 2-SIDED TAPE X 203MM X 927MM	C32D	GAL
2	KEYING	MASTERKEY CYLINDER (MASTERKEYING CYLINDER BY G & A)		G&A

INSTALL "CORRIDOR" SIDE OF INTRUDER FUNTION LOCK ON OFFICE SIDE OF OPENING.

Heading # 06

1 SGL DOOR D104A EXISTING CORRIDOR TO MEETING ROOM 104 | º | RH

1067 x 2134 x 45 HMD Door/ HMF Frame — 45 MIN Door/45 MIN Frame

3	HINGE, 4 1/2, HVY WT	TA786 114MM X 102MM	26D	MCK
1	CYLINDRICAL LOCK WITH THRU BOLTS	ND75P6D X RHO X XN12-035 X 13-247 X 10-025	626	SCH
1	OVERHEAD STOP/HOLDER, SURFACE	905S	US32D	GLY
1	CLOSER, REGULAR ARM	4040XP.RWPA.689	689	LCN
1	KICK PLATE	GSH 80A X 2-SIDED TAPE X 203MM X 1029MM	C32D	GAL
2	KEYING	MASTERKEY CYLINDER (MASTERKEYING CYLINDER BY G & A)		G&A

HARDWARE SCHEDULE - CODE # 5196

SMITHSON PS 2022 RENO

150 BELLEVIEW AVE.

Heading # 07

1 SGL DOOR D106 EXISTING CORRIDOR TO BF WC 106 | º | LH

965 x 2134 x 45 HMD Door/ HMF Frame | NON-RTD Door/NON-RTD Frame

3	HINGE, 4 1/2, HVY WT	TA786 114MM X 102MM	26D	MCK
1	CYLINDRICAL LOCK WITH THRU BOLTS	ND80P6D X RHO X 13-247 X 10-025	626	SCH
1	ELECTRIC STRIKE	5000C-12/24D-630	630	ES-CD
1	PUSH PLATE	CBH 973 X 5 X 20 X TAPE X [C/W 3-1/4 LEVER HOLE ENGRAVED PUSH TO OPEN 1 HIGH]	C32D	CBH
1	AUTO OPERATOR	MICOM KIT 18138 ECONOMICAL UNIVERSAL WASHROOM (SW800 ADO, IND & EMERG CALL-INSTALLED)		G&A
1	KICK PLATE	GSH 80A X 2-SIDED TAPE X 203MM X 927MM	C32D	GAL
1	FLOOR STOP	GSH 209	C26D	GAL
1	KEYING	MASTERKEY CYLINDER (MASTERKEYING CYLINDER BY G & A)		G&A

120V AC TO HEAD, CONDUIT, WIRING, PULL-STRINGS AND BACK BOXES BY OTHERS.
TIE IN THE ELECTRIC STRIKE FORM HEALTH ROOM 102 (HEADING#03) TO THE PUSH TO LOCK FUNCTION.

Heading # 08

1 SGL DOOR D108 EXISTING CORRIDOR TO STAFF WC 107 | º | LH

965 x 2134 x 45 WD Door/ HMF Frame | 45 MIN Door/45 MIN Frame

3	HINGE, 4 1/2, HVY WT	TA786 114MM X 102MM	26D	MCK
1	PRIVACY SET, WITH THRU BOLTS	ND40S X RHO X 13-248 X 10-025	626	SCH
1	KICK PLATE	GSH 80A X 2-SIDED TAPE X 203MM X 927MM	C32D	GAL
1	FLOOR STOP	GSH 209	C26D	GAL

Heading # 09

1 SGL DOOR D114 EXISTING CORRIDOR TO CUSTODIAL CLOSET 108 | º | RH

965 x 2134 x 45 HMD Door/ HMF Frame | NON-RTD Door/NON-RTD Frame

3	HINGE, 4 1/2, HVY WT	TA786 114MM X 102MM	26D	MCK
1	CYLINDRICAL LOCK WITH THRU BOLTS	ND80P6D X RHO X 13-247 X 10-025	626	SCH
1	KICK PLATE	GSH 80A X 2-SIDED TAPE X 203MM X 927MM	C32D	GAL
1	FLOOR STOP	GSH 209	C26D	GAL
1	KEYING	MASTERKEY CYLINDER (MASTERKEYING CYLINDER BY G & A)		G&A

HARDWARE SCHEDULE - CODE # 5196

SMITHSON PS 2022 RENO

150 BELLEVIEW AVE.

Heading # 10

1 SGL DOOR D116A STAFF WORK ROOM 110 FROM IT CLOSET 110A — o — LHR

965 x 2134 x 45 WD Door/ WDF Frame — NON-RTD Door/NON-RTD Frame

3	HINGE, 4 1/2, HVY WT	TA786 114MM X 102MM	26D	MCK
1	ELECTRIC POWER TRANSFER	EPT 10	SP28	VON
1	CYLINDRICAL LOCK WITH THRU BOLTS	ND80P6D X RHO X 13-247 X 10-025	626	SCH
1	CYLINDER	20J200V1-26-DQM (FUNCTION OTHER THAN CLASSROOM/ INTRUDER)	626	G&A
1	ELECTRIC STRIKE	5000C-12/24D-630	630	ES-CD
1	OVERHEAD STOP/HOLDER, SURFACE	904H	US32D	GLY

Heading # 11

1 SGL DOOR D117 BOILER ROOM TO ELECTRICAL ROOM — o — LH

1 SGL DOOR D118 BOILER ROOM FROM TRANSFORMER ROOM — o — LHR

914 x 2134 x 45 EXST Door/ HMF Frame — 45 MIN Door/45 MIN Frame

6	HINGE, 4 1/2, HVY WT	TA786 114MM X 102MM	26D	MCK
2	CYLINDRICAL LOCK WITH THRU BOLTS	ND80P6D X RHO X 13-247 X 10-025	626	SCH
2	OVERHEAD STOP/HOLDER, SURFACE	904S	US32D	GLY
2	CLOSER, REGULAR ARM	4040XP.RWPA.689	689	LCN
2	KICK PLATE	GSH 80A X 2-SIDED TAPE X 203MM X 927MM	C32D	GAL
2	KEYING	MASTERKEY CYLINDER (MASTERKEYING CYLINDER BY G & A)		G&A

Heading # 12

1 SGL DOOR D109 EXISTING CORRIDOR TO SPEC. ED. 109 — o — RH

965 x 2134 x 45 HMD Door/ HMF Frame — 45 MIN Door/45 MIN Frame

3	HINGE, 4 1/2, HVY WT	TA786 114MM X 102MM	26D	MCK
1	CYLINDRICAL LOCK WITH THRU BOLTS	ND75P6D X RHO X XN12-035 X 13-247 X 10-025	626	SCH
1	KICK PLATE	GSH 80A X 2-SIDED TAPE X 203MM X 927MM	C32D	GAL
1	FLOOR STOP	GSH 209	C26D	GAL
2	KEYING	MASTERKEY CYLINDER (MASTERKEYING CYLINDER BY G & A)		G&A

HARDWARE SCHEDULE - CODE # 5196

SMITHSON PS 2022 RENO

150 BELLEVIEW AVE.

Heading # LOOSE1

1 LOOSE1 o

x x Door/ Frame

6	HINGE, 4 1/2, STD WT	MPB79 114MM X 102MM	26D	MCK
2	CYLINDRICAL LOCK WITH THRU BOLTS	ND53P6D X RHO X 13-247 X 10-025	626	SCH
2	FLOOR STOP	GSH 209	C26D	GAL

HARDWARE FOR TEMPORARY OFFICES CREATED IN THE VESTIBULE OVER MARCH BREAK.

PART 1 - GENERAL

1.1 Summary

.1 Design, labour, Products, equipment, tools, and services necessary for glass and glazing Work in accordance with the Contract Documents.

.2 Decorative surface glazing films.

1.2 References

.1 Canadian Door and Window Manufacturers, Certification Program.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-12.1-M90, Tempered or Laminated Safety Glass.

.2 CAN/CGSB-12.2-M91, Flat, Clear Sheet Glass.

.3 CAN/CGSB-12.3-M91, Flat, Clear Float Glass.

.4 CAN/CGSB-12.4-M91, Heat Absorbing Glass.

.5 CAN/CGSB-12.5-M86, Mirrors, Silvered.

.6 CAN/CGSB-12.6-M91, Transparent (One-Way) Mirrors.

.7 CAN/CGSB-12.8-97, Insulating Glass Units.

.8 CAN/CGSB-12.9-M91, Spandrel Glass.

.9 CAN/CGSB-12.10-M76, Glass, Light and Heat Reflecting.

.10 CAN/CGSB-12.11-M90, Wired Safety Glass.

.11 CAN/CGSB-12.12-M90, Plastic Safety Glazing.

.12 CAN/CGSB-12.13-M91, Patterned Glass.

.13 CAN/CGSB-12.20-M, Structural Design of Glass for Buildings

.3 Flat Glass Manufacturers Association (FGMA), Glazing Manual

1.3 Submittals

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures. Where indicated, Shop drawings shall be sealed by a qualified professional engineer licensed to designs structures and registered in Place of the Work.

.2 Samples:

.1 Submit following samples in accordance with Section 01 33 00.

.2 Submit one 300 x 300mm sample of ultra clear low iron glass

1.4 Closeout Submittals

.1 Provide maintenance data including cleaning instructions for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 Quality Assurance

.1 Installer shall comply with GANA (Glass Association of North America) - Glazing Manual other relevant standards, guidelines, and the Ontario Building Code

.2 Tempered glass:

.1 Tempered and heat strengthened glass shall be horizontally treated; vertical treatment will not be acceptable. Fabrication and treatment shall be such that distortion lines (where they occur) run horizontally (parallel to sill and head) after installation.

.2 Tempered glass shall bear the manufacturer's identification as to thickness. Such identification for glazing shall be permanently etched so as to be visible after glass has been installed. Glass other than fully tempered (FT) glass shall not have etched labels.

.3 Identification: Label each pane of glass and glass unit with type, thickness, quality, and colour of glass and with manufacturer's trade name

.4 Glazing: Glazing compounds and methods shall conform with applicable requirements of GANA Glazing Manual.

.5 Where glass and glazing is located less than 1m (40") above finished floor, it shall be designed as a guardrail as per OBC 4.1.5.14. and shall be tempered.

PART 2 – PRODUCTS

2.1 General:

.1 Glazing to be used for interior glass doors and partitions shall be heat treated to strengthen glass in bending to not less than 4.5 times annealed strength. Glass shall have minimal waviness or distortion and with all areas free of tong marks

2.2 Materials

.1 Ultra Clear Tempered Glass **(TGL)**: Ultra clear, low iron glass, tempered for indoor use shall conform to ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3

.1 Type 1: 12mm thick TGL all interior glass screens up to 3200mm in height

.2 Type 2: 16mm thick TGL all interior glass screens over 3200mm in height

.2 Laminated tempered glass **(LGL)**: to CAN/CGSB-12.1, Category II:

.1 Consisting of one layer of minimum 4 mm thick tempered glass, .9mm thick clear PVB interlayer, and one layer of minimum 3 mm thick clear tempered glass.

PART 3.0 - EXECUTION

3.1 Installation of Glazing

.1 Obtain field dimensions for each opening that is to receive glass and cut each glass to provide the optimal bit on, and clearance from, the sash or frame.

.2 Clean the surfaces that are to receive the glass and glazing materials. Surfaces shall be free of dirt, corrosion, residue, oils, and any other substance that may impair adhesion of glazing materials.

.3 Clean contact surfaces with solvent and apply primers to surfaces to receive tapes and sealants in accordance with the glass manufacturer's written instructions.

.4 Ensure all finishes are fully dry before installing the glazing.

.5 Seal porous glazing channels or recesses with substrate compatible primer or sealer. Prime surfaces scheduled to receive glazing compound.

.6 Do not perform glazing when ambient temperature is below 4 degrees Celsius

.7 Ensure humidity level is low before installation.

.8 Install glazing according to manufacturers' specifications.

.9 Ensure space between double-glazing is perfectly clean before installing the second panel.

3.2 General Glazing requirements:

.1 Comply with the general provisions of GANA Glazing Manual and the Ontario Building Code for minimum glazing requirements, and ensure that minimum frame lap (minimum grip of glass) and

edge clearances are provided as required for the size of openings. Provide for expansion and contraction of glass as required.

.2 Conform with the manufacturers' latest published installation instructions and recommendations for glazing of tempered glass, laminated glass, and insulating glass. Follow manufacturer's latest published instructions for protection of edges and sizing of glass.

.3 Provide setting blocks at quarter points along the bottom of the glass pane. Blocks shall support the glass 1.5875 mm above the metal. Provide spacers to hold glass in centre between stops

.4 Provide spacers for glass panes where length plus width is greater than 1270 mm

.1 Locate spacers directly opposite each other on both inside and outside faces of the glass. Install correct size of spacers and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements

.2 Provide 3.2 mm minimum bite of spacers on glass and use thickness equal to sealant width.

.5 Adjust glazing channel dimensions as required by conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

.6 Protect glass edges from damage during handling and installation. Remove damaged glass from project site and dispose in accordance with municipal waste management and recycling requirements. Glass is considered to be damaged if edge damage, or other imperfections that, when installed, could weaken the glass and impair performance and/or appearance.

.8 Glazing of hollow metal doors and frames: glass shall be set around all edges with glazing gaskets hereinbefore specified. Provide setting blocks and spacers blocks as required. Set gasket legs on both sides of glass. Gasket shall be continuous, notched only at top rail in the centre. Compress gasket at least 15 percent to form a tight seal.

.9 For indoor glass panels: - set glass panes with proper orientation so that coating faces the correct specified direction

3.4 Finishing

.1 Immediately remove sealant and compound droppings from finished surfaces. Remove labels after work is completed.

3.5 Cleaning and Replacement

.1 Upon completion of glazing, remove paint spots, splatters, and other blemishes from glass

.2 Assure that each light is identified as to type and grade of glass

.3 Remove and replace glass panes that are cracked or broken and where distortion is evident and distracting, as determined by the Consultant.

.4 Remove paper labels, wash, and polish glass just before acceptance by Consultant.

.5 Protect glass against damage from subsequent construction activities and damage.

END OF SECTION

PART 1 - GENERAL

1.1 Description of System

.1 Metal stud framing includes non-load bearing steel studs framing members for interior framing systems (eg., partition walls, framed bulkheads, furring, etc.) as well as interior suspension systems (eg., supports for ceilings, suspended bulkheads, etc.). Systems shall be engineered to resist lateral loading and support adjacent building components where indicated.

1.2 References

.1 CSA S136 North American Specification for the Design of Cold-Formed Steel Structural Members

.2 AISI North American Standard for Cold-Formed Steel Framing – Product Data

.3 ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

.4 ASTM A641/A641M Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire

.5 ASTM A792/A792M Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process

.6 ASTM A1003 Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-coated for Cold-Formed Framing Members

.7 ASTM C645 Standard Specification for Nonstructural Steel Framing Members

.8 ASTM C754 Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products

.9 ASTM E90 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

.10 ASTM E413 Classification for Rating Sound Insulation

.11 ASTM E488 Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements

.12 ASTM E1190 Standard Test Methods for Strength of Power-Actuated Fasteners Installed in Structural Members

.13 CAN/ULC S101 Standard Methods of Fire Endurance Tests of Building Construction and Materials

.14 CSSBI LSF Technical Bulletin Volume 7, Number 1 Maximum Height Tables for Interior Non-Load Bearing Partitions.

1.3 Quality Assurance

.1 Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate nonload bearing interior steel framing, provide materials and construction identical to those tested in assembly indicated according to CAN/ULS-S101.

.2 STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413.

.3 Retain a Professional Engineer registered in the province of Ontario to design the Lightweight Steel Framing System where indicated in drawings; to prepare, seal and sign all shop drawings; and to perform field review. Shop drawings shall show both design and installation requirements.

1.4 Design Criteria

.1 Conform to the requirements of fire-rated assemblies as scheduled in drawings/details which have been tested in accordance with CAN/ULC-S101 and provide fire resistance ratings as indicated.

.2 For Interior non-load bearing studs, conform to minimum design thickness, web depth and flange width as outlined in CSSBI Maximum Height Tables for interior non-load bearing partitions.

.3 A non-load bearing (non-structural) member is defined as a member in a steel-framed system which is limited to transverse (out-of-plane) load of not more than 480 PA, a superimposed axial load, exclusive of sheathing materials, of not more than 1460 N/m, or a superimposed axial load of not more than 890 N.

.4 A load bearing (structural) stud may be used in a non-load bearing application; however, non-load bearing members (studs or track) may never be used in a load bearing (axial and/or wind loading) applications.

.5 Track for interior walls and non-load bearing walls located at exterior walls shall have a thickness of not less than the thickness of the corresponding studs and shall have not less than 31.8 mm flanges.

.6 Connections between light steel framing members shall be by sheet metal screws, welding or crimping.

.7 Load bearing assemblies/applications/details:

.1 Design shall be based on Limit States Design principles using factored loads and resistances.

.2 Loads and load factors shall be in accordance with the National Building Code of Canada.

1.5 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit shop drawings clearly indicating all construction details including connections and anchor requirements. Indicate type, size and spacing of fastening devices. Indicate design loads. Include seal and signature of Professional Engineer registered in the Province of Ontario for all components requiring structural design.

PART 2 - PRODUCTS

2.1 Materials

.1 Non-load bearing Steel Framing, General

.1 Steel sheet components shall comply with ASTM C645 requirements for metal, unless otherwise indicated.

.2 Steel for non-load bearing members shall have metallic coatings that conform to ASTM A653M or ASTM A792M with minimum metallic coating weights (mass) of Z120 and AZM150 respectively. Alternative coatings shall be permitted to be used if proven to have equivalent corrosion protection.

.3 Framing members shall comply with the AISI North American Standard for Cold-Formed Steel Framing (Product Data) for conditions indicated.

.2 Suspension System Components

.1 Tie wire shall comply with ASTM A641/A641M zinc-coated, soft-annealed, 1.21 mm minimum diameter, or of a material and size having equivalent corrosion resistance and strength.

.2 Hanger attachments to concrete: Anchors shall be fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 2 times that imposed by construction as determined by testing by an independent testing agency according to ASTM E488.

.1 Type: Post-installed, expansion anchor

.3 Power-actuated fasteners, suitable for application indicated, shall be fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type

indicated, and capable of sustaining, without failure, a load equal to 2 times that imposed by construction as determined by testing by an independent testing agency according to ASTM E1190.

.3 Hanger wire shall comply with ASTM A641/A641M zinc-coated, soft-annealed, 3.77 mm minimum diameter, or of a material and size having equivalent corrosion resistance and strength.

.4 Carrying Channels

.1 Channels shall conform to ASTM C754 and shall be cold-firmed from steel with minimum 228 MPa yield strength and 1.37 mm base steel thickness.

.2 Channels shall have a minimum coating of Z120 galvanizing in accordance with ASTM A653/A653M. Other coatings (eg. Aluminum-zinc alloy to ASTM A792/A792M) providing equal or better corrosion protection may also be used.

.3 Carrying channels shall have minimum 12.7 mm wide flanges and minimum depth of 38 mm.

.5 Furring Members

.1 Furring channels shall comply with the AISI North American Standard for Cold-Formed Steel Framing (Product Data) and shall have a minimum base steel thickness of 0.455 mm and with minimum 12.7 mm wide flanges and a depth of 19.1 mm.

.2 Steel stud shall be manufactured from steel in accordance with the AISI North America Standard for Cold-Formed Steel Framing (Product Data) and shall have a minimum base Steel thickness of 0.455 mm and depth as indicated on drawings.

.3 Hat-shaped, rigid furring channels shall comply with the AISI North American Standard for Cold-Formed Steel Framing (Product Data) and shall have a minimum base steel thickness of 0.455 mm and minimum depth of 22.2 mm. The minimum width of furring attachment flanges shall be 12.7 mm.

.4 Resilient furring channels are designed to reduce sounds transmission and shall have a minimum depth of 12.7 mm.

.6 Steel Framing for Framed Assemblies

.1 Steel studs and track shall be in accordance with the AISI North American Standard for Cold-Formed Steel Framing (Product Data) and shall have minimum base steel thickness of 0.455 mm and a depth as indicated on drawings.

.2 Slip-Type Head Joints: Where indicated, provide one of the following:

.1 Deflection Track: steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and width to accommodate depth of studs.

.2 Single Long-Leg Track: track complying with the AISI North American Standard for Cold-Formed Steel Framing (Product Data) with 50.8 mm deep flanges in thickness not less than indicated for studs, installed with studs frication-fit into top track and with continuous bridging located within 305 mm of the top studs to provide lateral bracing.

.3 Double-Track System: track complying with AISI North American Standard for Cold-Formed Steel Framing (Product Data), inside track with 50.8 mm deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction fit inside track.

.3 Flat Strap and Backing Plate

.1 Sheet steel for blocking and bracing in length and width indicated.

.2 Minimum base steel thickness is 0.455 mm.

.4 Channel bridging shall comply with the AISI North American Standard for Cold-Formed Steel Framing (Product Data) and shall have a minimum base steel thickness of 0.455 mm with minimum 12.7 mm wide flanges and depth of 19.1 mm.

.5 Hat-shaped, rigid furring channels shall comply with the AISI North American Standard for Cold-Formed Steel Framing (Product Data) and shall have minimum base steel thickness of 0.455 mm, a minimum depth of 22.2 mm. The minimum width of furring attachment flanges shall be 12.7 mm.

.6 Resilient furring channels are designed to reduce sound transmission and shall have a minimum depth 12.7 mm.

.7 Furring channels shall comply with the AISI North American Standard for Cold-Formed Steel Framing (Product Data) and shall have a minimum base steel thickness of 0.455 mm and with minimum 12.7 mm wide flanges and a depth of 19.1 mm.

.1 Furring Brackets: adjustable, corrugated-edge of steel sheet with minimum base steel thickness of 0.79 mm.

.2 Tie wire shall comply with ASTM A641/A641M zinc-coated, soft-annealed, 1.21 mm minimum diameter, or of material and size having equivalent corrosion resistance and strength.

.9 Z-shaped Furring: with slotted web or non-slotted web, face flange of 31.8 mm, wall attachment flange of 22.2 mm, and depth steel thickness of 0.455 mm, and depth required to fit insulation thickness indicated.

.10 Fasteners for Metal Framing: of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates in accordance with ASTM C1002.

.11 Isolation strip at exterior walls: provide one of the following:

.1 Asphalt-saturated organic felt: ASTM D226, Type 1 (no. 15 asphalt felt), perforated.

.2 Foam gasket: adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 3.2 mm thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 Examination

.1 Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.

.1 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Preparation

.1 Suspended Assemblies: coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangars at spacing required to support the work and that hangars will develop their full strength.

.1 Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

.2 Coordination with Sprayed Fire-Resistive Materials

.1 Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling track to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 600 mm o.c.

.2 After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 Installation, General

.1 Installation Standard: ASTM C754, except comply with framing sizes and spacing indicated.

.1 Gypsum Plaster Assemblies: also comply with requirements in ASTM C841 that apply to framing installation.

.2 Portland Cement Plaster Assemblies: also comply with requirements in ASTM C1063 that apply to framing installation.

.3 Gypsum Veneer Plaster Assemblies: also comply with requirements in ASTM C844 that apply to framing installation.

.4 Gypsum Board Assemblies: also comply with requirements in ASTM C840 that apply to framing installation.

.2 Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

.3 Install bracing at terminations in assemblies.

.4 Do not bridge building control and expansion joints with non-load bearing steel framing members. Frame both sides of joints independently.

3.4 Installing Suspension Systems

.1 Install suspension system components in sizes and spacings indicated on drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.

.2 Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

.3 Suspended hangers from building structure as follows:

.1 Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

.1 Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

.2 Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

.1 Size supplemental suspension members and hangers to support ceiling loads Within performance limits established by referenced installation standards.

.3 Wire Hangers: secure by looping and wire tying, either directly to structure or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.

.4 Do not attach hangers to steel roof deck unless otherwise approved.

.5 Do not attach hangers to permanent mental forms. Furnish cast-in-place hanger inserts that extend through forms.

.6 Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.

.7 Do not connect or suspend steel framing from ducts, pipes, or conduit.

.4 For fire-resistance-rated assemblies, wire tie furring channels to supports.

.5 Installation Tolerances: install suspension systems that are level to within 3 mm in 3.6 m measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.5 Installing Framed Assemblies

.1 Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

.2 Install studs so flanges within framing system point in same direction.

.1 Space studs as follows:

.1 Single-layer application: 406 mm o.c., unless otherwise indicated.

.2 Multilayer application: 406 mm o.c., unless otherwise indicated.

.3 Tile backing panels: 406 mm o.c., unless otherwise indicated.

.4 Radiused locations: 150mm o.c. or as recommended by drywall manufacturer.

.3 Install track floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions of structure.

.1 Slip-Type Head Joints: where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies die to deflection of structure.

.2 Door Openings: screw vertical studs at jambs to jamb anchor clips to door frames; install track section (for cripple studs) at head and secure to jamb studs.

.1 Install two studs at each jamb, unless otherwise indicated.

.2 Install cripple studs at head adjacent to each jamb stud, with a minimum 12.7 mm clearance from jamb stud to allow for installation of control joint in finished assembly.

.3 Other Framed Openings: frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

.4 Fire-Resistance-Rated Partitions: install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

.5 Sound-Rated Partitions: install framing to comply with sound-rated assembly indicated.

.6 Fire dampers: framing at fire dampers shall comply with manufacturer requirements as necessary to fulfill UL/ULC requirements for a complete installation capable of maintaining the scheduled fire resistance rating.

.4 Direct Furring

.1 Screw to wood framing.

.2 Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or power-driven fasteners spaced 610 mm o.c.

.5 Z-Furring Members

.1 Erect insulation as specified and hold in place with Z-furring members spaced 610 mm o.c.

.2 Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or power-driven fasteners spaced 610 mm o.c.

.3 At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 305 mm from corner and but insulation to fit,

.6 Installation Tolerance: install each framing member so fastening surfaces vary not more than 3 mm from the plane formed by faces adjacent framing.

END OF SECTION

PART 1 - GENERAL

1.1 References

.1 American Society for Testing and Materials (ASTM)

.1 ASTM C1396 Standard Specification for Gypsum Board

.2 ASTM C 475-94, Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

.3 ASTM C 514-94, Specification for Nails for the Application of Gypsum Board.

.4 ASTM C 557-93a, Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.

.5 ASTM C 840-95, Specification for Application and Finishing of Gypsum Board.

.6 ASTM C 954-93, Specification for Steel Drill Screws for the Application of Gypsum Board.

.7 ASTM C 1047-94, Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.

.8 ASTM C1177-08, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing

.9 ASTM C1178M -08, Standard Specification for Coated Glass Mat Water Resistant Gypsum Backing Panel

.10 ASTM C1658-06, Standard Specification for Glass Mat Gypsum Panels

.11 ASTM C1629M-06, Standard Classification for Abuse Resistant Non Decorated Interior Gypsum Panel Products and Fiber Reinforced Cement Panels

.12 ASTM D3273-00, Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

.2 CAN/CGSB-71.25-M88, Adhesive, for Bonding Drywall to Wood Framing and Metal Studs.

.3 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102-1988, Building Materials and Assemblies, Standard Method of Test for Surface Burning Characteristics of.

1.2 Site Environmental Requirements

.1 Maintain temperature minimum 10C, maximum 21C for 48 hours prior to and during application of gypsum boards and joint treatment, and for at least 48 hours after completion of joint treatment.

.2 Apply board and joint treatment to dry, frost free surfaces.

PART 2 - PRODUCTS

2.1 Materials

.1 Standard Gypsum Board: to ASTM C1396, Type X, 15.9mm (5/8" thick, 1200mm (4'-0") wide x maximum practical length. Use mould and moisture resistant gypsum board in areas where panels may come in contact with moisture.

.2 Mould and Moisture Resistant Gypsum Board: Glass mat facers with water resistant treated gypsum core to ASTM C1658, Type X, 15.9mm(5/8") thick, 1200mm (4'0") wide x maximum practical length. Score of 10 (no mould growth) as per ASTM D3273

.3 Tilebacker: Acrylic coated glass mat facers with water resistant gypsum core to ASTM C1178, 15.9mm (5/8") thick unless noted otherwise, 1200mm (4'0") wide x maximum practical length. Score of 10 (no mould growth) as per ASTM D3273, or Cement Board to ASTM C1325. Use at all locations scheduled to receive tile.

.1 Provide Type X Fire Rated sheathing where scheduled/detailed

.4 Exterior Gypsum Sheathing Board: fiberglass mat on face/back/long edges manufactured to ASTM C1177, 15.9mm (5/8") thick unless noted otherwise, 1200mm wide x maximum practical length. Score of 10 (no mould growth) as per ASTM D3273, Microbial Resistance: will not support microbial growth as per ASTM D6329.

.1 Horizontal Soffit Board manufactured to ASTM C 931/C 931M, 5/8" (15.8mm) thickness.

.2 Sheathing to ASTM C1177, 5/8" (15.8mm) thickness unless noted otherwise.

.3 Provide Type X sheathing at fire rated assemblies and as scheduled/detailed.

.5 Abuse Resistant Gypsum Board; Heavy duty glass mat facers with dense water resistant treated gypsum core to ASTM C1658 and ASTM C1629, Type X, 15.9mm(5/8") thick, 1200mm (4'0") wide x maximum practical length. Score of 10 (no mould growth) as per ASTM D3273)

.6 Impact Resistant Gypsum Board: Heavy duty glass mat facers, dense water resistant gypsum core and embedded fiberglass mesh enforcement, to ASTM C1658 and ASTM C1629,Type X, 15.9mm(5/8") thick, 1200mm (4'0") wide x maximum practical length. Score of 10 (no mould growth) as per ASTM D3273)

.7 Shaftliner: Glass Mat faced with water resistant treated gypsum core to ASTM C1658, Type X, 25mm (1') thick, 610mm (2'0") wide x maximum practical length. Score of 10 (no mould growth) as per ASTM D3273

.8 Steel drill screws: to ASTM C 1002.

.9 Stud adhesive: to CAN/CGSB-71.25 ASTM C 557.

.10 Laminating compound: as recommended by manufacturer, asbestos-free.

.11 Shadow gap: Bailey D300 Metal trim, CGC Dur-a-bead or Nicolson Rollforming No 114, fillable edge trim, 0.55mm (0.022") base thickness commercial grade sheet steel with zinc wiped coating to ASTM A 525-93; perforated flanges; one piece length per location. To be used at the junction of all dissimilar materials and/or as detailed.

.12 Corner bead: Bailey D100-90, 90-degree corner trim fillable edge trim, 0.55mm (0.022") base thickness commercial grade sheet steel with zinc wiped coating to ASTM A 525-93; perforated flanges; one piece length per location.

.13 Control joints: No 093 Zinc Control Joints by CGC Inc or Nicholson Rollforming. To be installed where indicated on drawings.

.14 Sealants: in accordance with Section 07 90 00 - Joint Sealers.

.15 Acoustic sealant: concealed purpose made, non-skinning, non hardening type to CAN/CGSB-19.21-M87, as manufactured by Tremco or Monsey-Bakor, USE Hickson

.16 Sound attenuation insulation (acoustic batt insulation type 'C')

.1 Mineral or fiberglass sound attenuation batt or boards to ULC S702 and as required by fire rated tests.

.2 Thickness: full stud thickness or as otherwise stated on the Drawings and Schedule.

.17 Joint compound: to ASTM C 475, asbestos-free. Latex resin base, possessing good adhesion, mixed with fresh, unadulterated water having no detrimental effects on compounds. Type recommended by manufacturer for application indicated.

.18 Joint reinforcing tape; for gypsum board; 50mm (2") x 0.3mm (0.01")thick perforated paper with chamfered edges. Use fiberglass joint reinforcing tape at all areas where gypsum board may come in contact with moisture.

.19 1 hour rated walls to be filled with absorptive material processed from rock or slag with a mass of at least 2.8 kg/m^2 for 89mm thickness and completely filling the wall cavity.

PART 3 - EXECUTION

3.1 Erection

1 Do application and finishing of gypsum board in accordance with ASTM C 840 except where specified otherwise.

.2 Do application of gypsum sheathing in accordance with ASTM C 1280.

.3 Erect hangers and runner channels for suspended gypsum board ceilings in accordance with ASTM C 840 except where specified otherwise.

.4 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.

.5 Install work level to tolerance of 1:1200.

.6 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, grilles.

.7 Install 19 x 64 mm furring channels parallel to, and at exact locations of steel stud partition header track.

.8 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.

.9 Furr above suspended ceilings for gypsum board fire and sound stops and to form plenum areas as indicated.

.10 Install wall furring for gypsum board wall finishes in accordance with ASTM C 840, except where specified otherwise.

.11 Furr openings and around built-in equipment, cabinets, access panels, on four sides. Extend furring into reveals. Check clearances with equipment suppliers.

.12 Furr duct shafts, beams, columns, pipes and exposed services where indicated

3.2 Application

.1 Do not apply gypsum board until bucks, anchors, blocking, electrical and mechanical work are approved.

.2 Apply 12 mm (1/2”) diameter bead of acoustic sealant continuously around periphery of each face of partitioning to seal gypsum board/structure junction where partitions abut fixed building components. Seal full perimeter of cut-outs around electrical boxes, ducts,in partitions where perimeter sealed with acoustic sealant.

3.3 Installation

.1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure at 150mm oc using contact adhesive for full length.

.2 Install casing beads around perimeter of suspended ceilings.

.3 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.

.4 Install insulating strips continuously at edges of gypsum board and casing beads abutting metal window and exterior door frames, to provide thermal break.

.5 Install shadow mould at gypsum board/ceiling juncture as indicated. Minimize joints; use corner pieces and splicers.

.6 Construct control joints of preformed units two back-to-back casing beads set in gypsum board facing and supported independently on both sides of joint.

.7 Provide continuous polyethylene dust barrier behind and across control joints.

.8 Locate control joints where indicated at changes in substrate construction at approximate 10m spacing on long corridor runs at approximate 15m spacing on ceilings.

.9 Install control joints straight and true.

.10 Construct expansion joints as detailed, at building expansion and construction joints. Provide continuous dust barrier.

.11 Install expansion joint straight and true.

.12 Splice corners and intersections together and secure to each member with 3 screws.

.13 Install access doors to electrical and mechanical fixtures specified in respective Sections.

.1 Rigidly secure frames to furring or framing systems.

.14 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.

.15 Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.

.16 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.

.17 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.

.18 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.

.19 Mix joint compound slightly thinner than for joint taping.

.20 Apply thin coat to entire surface using trowel or drywall broadknife to fill surface texture differences, variations or tool marks.

.21 Allow skim coat to dry completely for walls receiving high gloss paint and where indicated.

.22 Remove ridges by light sanding or wiping with damp cloth.

.23 Fasten board to metal support members by metal gypsum board screws at, 9.5mm (0.374”) minimum to , and 12.7mm (1/2”) maximum from, center of joints. Space screw:

.1 At ceilings of fire rated board at 200mm (8”) o.c. at edges and in field unless indicated otherwise.

.2 At walls of fire rated board at 200mm (8”) o.c. at edges and 305mm (12”) o.c. in field Locate screws opposite one another in adjacent panels unless indicated otherwise.

.3 At typical board walls at 400mm (16”) o.c. at edges and field unless noted otherwise.

.4 At typical board ceilings at 305mm (12”) o.c. at edges and field unless noted otherwise.

.24 When installing fiberglass mat faced mould and moisture resistant gypsum board do so as per manufacturers recommendations. Tape joints with self adhesive fiberglass tape and embed the tape in setting type compound. Finish joint with two layers of all purpose joint compound. High build primer should be applied to surface before painting. As with regular paper faced gypsum board, in areas where gloss paint is to be applied or in areas of critical light a skim coat should be applied to the surface before priming and painting.

3.4 Schedules

.1 Construct fire rated assemblies where indicated on drawings

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Labour, Products, equipment and services necessary for tile Work in accordance with the Contract Documents.

1.2 REFERENCES

.1 ANSI A108/A118/A136.1, Installation of Ceramic Tile.

.2 ASTM C144, Specification for Aggregate for Masonry Mortar.

.3 CAN/CSA A3000, Cementitious Materials Compendium.

.4 TTMAC Specification Guide 09 30 00 Tile Installation Manual.

.5 TTMAC, Maintenance Guide.

1.3 SUBMITTALS

.1 Product data:

.1 Submit copies of manufacturer's Product data in accordance with Section 01 33 00 indicating:

.1 Performance criteria, compliance with appropriate reference standard, characteristics, limitations and warranties.

.2 Product transportation, storage, handling and installation requirements.

.2 Shop drawings:

.1 Submit shop drawings in accordance with Section 01 33 00 indicating:

.1 Tile layout, patterns, and colour arrangement.

.2 Perimeter conditions, junctions with dissimilar materials.

.3 Setting details.

.4 Product data sheets for all accessories and components.

.3 Samples:

.1 Submit following sample panels in accordance with Section 01 33 00.

.1 Each colour, texture, size, and pattern of tile.

.2 Adhere tile samples to 400 x 400 x 12.5 mm thick cement board complete with selected grout colour in joints.

.4 Certificates: Submit manufacturer's certificates stating that materials supplied are in accordance with this specification.

.5 Closeout submittals: Submit recommended maintenance instructions and listing of recommended maintenance Products for incorporation into Operations and Maintenance Manuals in accordance with Section 01 78 00 Closeout Submittals.

1.4 QUALITY ASSURANCE

.1 Perform Work of this Section by a company that has demonstrated competence and experience on installations of similar complexity and scope.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials in adequate crates or containers with manufacturer’s name and product description clearly marked.

.2 Handle and store tiles in a manner to avoid chipping, breakage or the instruction of foreign matter. Take precautions to protect the mortar and grout admixtures from freezing or from excessive heat.

1.6 SITE CONDITIONS

.1 Do not install Work of this Section outside of the following environmental ranges without the Consultant's and Product manufacturer's written acceptance:

.1 Ambient air and surface temperature: 15^0C to 45^0C.

.2 Precipitation: None.

.2 Install temporary protection and facilities to maintain the Product manufacturer's, and specified, environmental requirements for 7 Days before, during, and 7 Days after installation.

1.7 MAINTENANCE

.1 Submit extra tile amounting to 3% of gross area covered, allowing proportionately for each pattern and type specified and which are part of the same Production run as installed Products. Store maintenance Products as directed by the Consultant.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 General: All materials under Work of this Section, including but not limited to, primers, and sealers are to have low VOC content limits.

.2 Tile:

.1 Porcelain Floor Tile (POR)

.1 Quebec series through full body porcelain tile, manufactured by Olympia. Size 5cm x 5cm. Colour: to be selected by Consultant from Price Group 2, allow for up to 2 colours.

.2 Keystones series series through full body porcelain tile, manufactured by Daltile. Size 5cm x 5cm. Colour: to be selected by Consultant from Price Group 2, allow for up to 2 colours.

.3 Equivalent product as per Specification 01 25 00.

.2 Ceramic Wall Tile (CER)

.1 Vitra RAL Pro Colour Series wall tile as distributed by Olympia Tile. Format 10cm x 10cm, allow for 2 colours to be selected by Consultant.

.2 Colour & Dimension Series Wall Tile as distributed by Olympia Tile. Format 4” x 4”, allow for 2 colours to be selected by Consultant.

.3 Colour Wheel Collection - Classic glazed ceramic wall tile as distributed by Daltile. Format 4.25” x 4.25”, allow for 2 colours to be selected by Consultant.

.4 Equivalent product as per Specification 01 25 00.

.3 Thresholds: profile with sloped exposed surface, 5/32" (4 mm) tall leading edge, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer. Material: brushed stainless steel finish Type 304. Height: to suit site conditions. Acceptable product: Schluter RENO-U.

.4 Wall edge trim: L-shaped profile with top section width to suit tile thickness and vertical wall section that together form the visible surface, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer. Material: Brushed stainless steel Type 304. Acceptable product: Schluter SCHIENE.

2.2 MOARTAR, ADHESIVE AND GROUT MATERIALS

.1 Cement: CAN/CSA A3000, Type GU.

.2 Hydrated Lime: to ASTM C207, Type S.

.3 Sand: ASTM C144, passing 16 mesh.

.4 Water: Potable and free of minerals and other contaminants which are detrimental to mortar and grout mixes.

.5 Polymer additive: Keralastic by Mapei Inc or approved alternative by Latricrete International or Flextile.

.6 Mortar

.1 Single component polymer modified mortar to ANSI 118.4 and 118.11. Acceptable product: Ker 121 by Mapei, 50 PM Mortar by Flextile or approved equal

.7 Grout:

.1 Floors and bases (below 3 mm joint width): ‘Keracolor U’ by Mapei Inc. or approved alternative by Latricrete International.

.2 Floors and bases (3 mm to 10 mm joint width): ‘Ultra/Color’ by Mapei Inc. or approved alternative by Latricrete International.

.3 Walls (1.5 mm to 3 mm joint width): ‘Ker 800' by Mapei Inc. or approved alternative by Latricrete International.

.4 Walls (over 3 mm joint width): ‘Ultra/Colour’ by Mapei Inc. or approved alternative by Latricrete International.

2.3 WATERPROOF MEMBRANE

.1 A solvent-free, ready-to-use, ultra-quick drying, one-component, synthetic resin based paste in water dispersion capable of forming a waterproof layer to walls and floors before the installation of tile finish. To be installed to floors and walls of all washrooms and/or as indicated in drawings.

.1 Acceptable product: Mapelastic Aquadefense by Mapei or equivalent per Specification 01 25 00.

2.5 SEALER

.1 Provide water based penetrating sealer suitable for sanded and non-sanded cementitious grout joints at all locations.

.1 Acceptable product: Mapei UltraCare Grout Sealer or equivalent per Specification 01 25 00.

2.5 ACCESSORIES

.1 Primer: To meet specified requirements of adhesive manufacturer.

.2 Cleaner: To conform to #1000 Series of Terrazzo, Tile and Marble Association of Canada.

.3 Joint backing: Round, closed cell, foam rod, oversized by 30% to 50%, Shore A hardness of 20, tensile strength 140 to 200 kPa.

.4 Tile sealant: In accordance with Section 07 92 00.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

.1 Clean and dry surfaces thoroughly. Remove oil, wax, grease, dust, dirt, paint, tar, primers, form release agents, curing compound, and other foreign material from substrate surfaces which may prevent or reduce adhesion.

.2 Neutralize any trace of strong acids or alkali from the substrate.

3.2 CONTROL JOINTS

.1 Continue control, construction, and cold joints in the structural substrate up through the tile finish, and align with mortar joints where possible. Review joint locations on Site with the Consultant.

.2 Install joint widths to match grout joint widths, except where a minimum width is indicated.

.3 Install control joints in the following typical locations:

.1 Aligned over changes in type of substrate.

.2 At the restraining perimeters such as walls and columns.

.3 Interior areas (not subject to sunlight): 6 mm minimum width, at 7320 mm o.c. maximum.

.4 Interior areas (subject to sunlight): 6 mm minimum width, at 3660 mm o.c maximum.

.5 As indicated on the Contract Drawings.

.4 Seal control joints in accordance with Section 07 92 00.

3.3 LEVELLING BED

.1 Install a levelling bed on uneven substrate surfaces, level and plumb substrates in accordance with the following tolerances:

.1 Vertical surfaces: 3 mm in 2.4 m maximum .

.2 Horizontal surfaces: 6 mm in 3 m from finished levels of the surface, or better.

.2 Clean structural substrate control joints and blow-clean with compressed air. Grout fill control joints flush to slab with levelling bed.

3.4 WATERPROOF MEMBRANE INSTALLATION

.1 Preparation: Substrates must be well-cured, sound, clean, dry and free of oil, grease, cement laitance, old paint and any other substance which could compromise the bond. Cementitious substrates must be stable and dry with no rising damp. Surface dust must be completely removed. Apply separate smoothing and levelling layers if required, as recommended by manufacturer.

.2 Application: Apply in two even, coats (approx. 0.4 mm per coat) with a long-haired roller, brush or trowel. Wait until the first coat is dry, making sure the product becomes darker with a matt finish, before applying the second coat diagonally to the first (approximately 1 hour at +23°C and 50% relative humidity of the air and with substrates having residual humidity lower than 3%). The final thickness of the two coats must be at least 0.8 mm in order to create a robust, flexible and continuous film. Make sure there are no interruptions in the film caused by imperfections in the substrate.

3.5 GENERAL INSTALLATION REQUIREMENTS

.1 Install tiles in accordance with manufacturer's instructions and TTMAC Specification Guide 09 30 00 Tile Installation Manual. Manufacturer's installation instructions govern over TTMAC Installation Manual.

.2 Lay out Work to produce a symmetrical pattern with minimum amount of cutting. Ensure cut tile at room perimeter is not less than ½ full size.

.3 Install trim to be placed under tile in locations indicated on Drawings.

.4 Apply exterior grade mortar bed to substrate with flat trowel and press firmly into surface, apply additional mortar using notched trowel.

.5 Set tiles in place and rap or beat with a beating block as necessary to ensure a proper bond and to level surface. Align tile for uniform joints and allow to set until firm. Clean excess mortar from surface of tile with a wet cloth or sponge while mortar is fresh.

.6 Adjust joints between units uniform, plumb, straight, even, and true, with adjacent tile flush. Align grout joints in both directions unless indicated otherwise.

.7 Align floor, base and wall grout joints.

.8 Install tile accessory fittings for a complete and fully coordinated tile assembly.

.9 Install wall tile full height unless indicated otherwise.

.10 Cut and fit tile neatly around piping, fittings, projections and around recesses items e.g. washroom accessories. Where surface mounted equipment and accessories are installed on tile surfaces, extend tile over surfaces. Cut edges smooth, even, and free from chipping; chipped and broken edges are not acceptable.

.11 Do not proceed with grouting until minimum 48 hours after tile has set, to prevent displacement of tiles.

.12 Apply grout in accordance with grout manufacturer's directions to produce watertight, filled joints without voids, cracks and excess grout. Thoroughly compact and tool floor grout. Finish grout flush to edge thickness of tile and remove excess grout with soft burlap or sponge moistened with clean water.

3.6 CLEANING

.1 Clean off excess grout with soft burlap or sponge moistened with clean water.

.2 Polish floor and wall tile after grout has cured in accordance with TTMAC recommendations in the Maintenance Guide; do not use acid for cleaning.

.3 Re-point joints after cleaning as required to eliminate imperfections, then re-clean as necessary. Avoid scratching tile surfaces.

3.6 JOINT BACKING AND TILE SEALANT

.1 Install joint backing under sealant as necessary.

.2 Install tile sealant around piping and fittings extending through tiled surfaces.

.3 Seal tile control joints.

.4 Seal internal tile to tile junctions. Tool to a smooth, flush surface, free from air bubbles and contamination.

3.8 PROTECTION

.1 Prevent traffic over tiled areas, and protect tiled assemblies from weather, freezing, and water immersion, for 72 hours minimum, after final installation.

.2 Prevent direct impact, vibration and heavy hammering on adjacent and opposite walls for 24 hours minimum, after final installation.

.3 Cover work temporarily with building paper properly lapped and taped at joints until work has been approved by Consultant.

END OF SECTION

PART 1 - GENERAL

1.1 References

.1 American Society for Testing and Materials (ASTM):

.1 ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

.2 ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.

.3 ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

.4 ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

.5 ASTM C 635 Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

.6 ASTM C 636 Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.

.7 STM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials.

.8 ASTM E 1414 Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum.

.9 ASTM E 1111 Standard Test Method for Measuring the Interzone Attenuation of Ceilings Systems.

.10 ASTM E 1264 Classification for Acoustical Ceiling Products.

.11 ASTM E 1477 Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers.

.12 ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

.13 ASTM E 119 Standard Test Methods for Fire Tests of Building Construction and Material.

.2 ASHRAE Standard 62.1-2004, "Ventilation for Acceptable Indoor Air Quality"

1.2 Equivalent Products

.1 As per Section 01 25 00 – Product Substitution Procedures.

.2 Submittals which do not provide adequate data for the product evaluation will not be considered. The proposed substitution must meet all requirements of this section, including but not necessarily limited to, the following: Single source materials suppliers (if specified); Underwriters' Laboratories Classified Acoustical performance; Panel design, size, composition, color, and finish; Suspension system component profiles and sizes; Compliance with the referenced standards.

1.3 SUBMITTALS

.1 Product Data: Submit manufacturer's technical data for each type of acoustical ceiling unit and suspension system required.

.2 Samples: Minimum 6 inch x 6 inch samples of specified acoustical panel; 8 inch long samples of exposed wall molding and suspension system, including main runner and 4 foot cross tees.

.3 Shop Drawings: Layout and details of acoustical ceilings. Show locations of items which are to be coordinated with, or supported by the ceilings.

.4 Certifications: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards. For acoustical

performance, each carton of material must carry an approved independent laboratory classification of NRC, CAC, and AC.

.5 If the material supplied by the acoustical subcontractor does not have an Underwriter's Laboratory classification of acoustical performance on every carton, subcontractor shall be required to send material from every production run appearing on the job to an independent or NVLAP approved laboratory for testing, at the architect's or owner's discretion. All products not conforming to manufacturer's current published values must be removed, disposed of and replaced with complying product at the expense of the Contractor performing the work.

1.4 QUALITY ASSURANCE

.1 Single-Source Responsibility: Provide acoustical panel units and grid components by a single manufacturer.

.2 Fire Performance Characteristics: Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.

.1 Surface Burning Characteristics: As follows, tested per ASTM E 84 and complying with ASTM E 1264 for Class A products.

a. Flame Spread: 25 or less

b. Smoke Developed: 50 or less

.2 Fire Resistance Ratings: As indicated by reference to design designations in UL Fire Resistance Directory, for types of assemblies in which acoustical ceilings function as a fire protective membrane and tested per ASTM E 119.

a. Protect lighting fixtures and air ducts to comply with requirements indicated for rated assembly.

.3 Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

.2 Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.

.3 Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

1.6 PROJECT CONDITIONS

.1 All ceiling products and suspension systems must be installed and maintained in accordance with manufacturer written installation instructions for that product in effect at the time of installation and best industry practice. Prior to installation, the ceiling product must be kept clean and dry, in an environment that is between 32°F (0°C) and 120°F (49°C) and not subject to Abnormal Conditions. Abnormal conditions include exposure to chemical fumes, vibrations, moisture from conditions such as building leaks or condensation, excessive humidity, or excessive dirt or dust buildup.

1.7 WARRANTY

.1 Acoustical Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace acoustical panels that fail within the warranty period. Failures include, but are not limited to:

.1 Acoustical Panels: Sagging and warping as a result of defects in materials or factory workmanship.

.2 Grid System: Rusting and manufacturer's defects

.3 Acoustical Panels designated as inherently resistive to the growth of micro-organisms installed with corresponding suspension systems: Visible sag and will resist the growth of mold/mildew and gram positive and gram negative odor and stain causing bacteria.

.2 Warranty Period Humiguard:

.1 Acoustical panels: Ten (10) years from date of substantial completion.

.2 Grid: Ten (10) years from date of substantial completion.

.3 Acoustical panels and grid systems with HumiGuard Plus or HumiGuard Max performance supplied by one source manufacturer is thirty (30) years from date of substantial completion.

.3 The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

1.8 MAINTENANCE

.1 Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.

.1 Acoustical Ceiling Units: Furnish quantity of full-size units equal to 5.0 percent of amount installed, for each ceiling type/pattern.

.2 Exposed Suspension System Components: Furnish quantity of each exposed suspension component equal to 2.0 percent of amount installed, for each ceiling type/pattern.

.3 Linear Acoustic Baffles: Furnish quantity of full-size units equal to 5.0 percent of amount installed, for each ceiling type/pattern.

PART 2-PRODUCTS

2.1 MANUFACTURERS

.1 Ceiling Panels: Model numbers for acoustic ceiling tiles and grid as manufactured by Armstrong World Industries, are listed to establish a standard of quality for design, function, materials, performance, workmanship, and appearance. The following manufacturers may be submitted for evaluation by the architect by following the conditions of the Product Substitutions Section 01 25 00. The architect shall be the sole judge as to the acceptability of all products submitted for substitution.

.1 CertainTeed.

.2 Canadian Gypsum Company (CGC).

2.2. ACOUSTICAL CEILING UNITS

.1 ACT Tile TYP 1

.1 Surface Texture: Medium

.2 Composition: Wet formed mineral fibre

.3 Color: White

.4 Size: 24in X 48in X 5/8in

.5 Edge Profile: Square

.6 Noise Reduction Coefficient (NRC): 0.55.

.7 CAC: .33

.8 Fire Performance: ASTM E84 and CAN/ULC S102 surface burning characteristics. Flame Spread Index 25 or less. Smoke Developed Index 50 or less (UL labeled.)

.9 Flame Spread: ASTM E 1264; Type XII, Form 2, Pattern E Fire Class A

.10 Light Reflectance (LR): ASTM E 1477; White Panel: Light Reflectance: 0.80.

.11 Antimicrobial Protection: Inherent - Resists the growth of mold/mildew and bacterial growth.

.12 Acceptable Product: Cortega 823 as manufactured by Armstrong World Industries, or equivalent.

.2 ACT Tile TYP 2

.1 Surface Texture: Moisture Resistant

.2 Composition: Wet formed mineral fibre

.3 Color: White

.4 Size: 24in X 24in X 5/8in

.5 Edge Profile: Square

.6 Noise Reduction Coefficient (NRC): 0.50.

.7 CAC: .35

.8 Fire Performance: ASTM E84 and CAN/ULC S102 surface burning characteristics. Flame Spread Index 25 or less. Smoke Developed Index 50 or less (UL labeled.)

.9 Flame Spread: ASTM E 1264; Type XII, Form 2, Pattern E Fire Class A

.10 Light Reflectance (LR): ASTM E 1477; White Panel: Light Reflectance: 0.81.

.11 Antimicrobial Protection: Inherent - Resists the growth of mold/mildew and bacterial growth.

.12 Acceptable Product: Moisture Resistant Dune or Ortega 824 as manufactured by Armstrong World Industries, or equivalent.

2.3 SUSPENSION SYSTEMS FOR ACOUSTICAL CEILING UNITS

.1 Components: All main beams and cross tees shall be commercial quality hot-dipped galvanized (galvanized steel, aluminum, or stainless steel) as per ASTM A 653. Main beams and cross tees are double-web steel construction with 15/16 IN type exposed flange design. Exposed surfaces chemically cleansed, capping pre-finished galvanized steel (aluminum or stainless steel) in baked polyester paint. Main beams and cross tees shall have rotary stitching (exception: extruded aluminum or stainless steel).

.1 Structural Classification: ASTM C 635 LD.

.2 Color: White Aluminum and match the actual color of the selected ceiling tile, unless noted otherwise.

.3 Acceptable Product: Prelude XL 15/16" Exposed Tee as manufactured by Armstrong World Industries, Inc.

.2 Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.

.3 Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper, pre-stretched, with a yield stress load of at least time three design load, but not less than 12 gauge.

.4 Edge Moldings and Trim: Metal or extruded aluminum of types and profiles indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations, including light fixtures, that fit type of edge detail and suspension system indicated. Provide moldings with exposed flange of the same width as exposed runner.

.5 Accessories

.1 Shadow molding with ½” (13mm) reveal, exposed flange same width as exposed runners, to be used at interface with walls/bulkheads.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer's printed recommendations. (Exception: HumiGuard Max Ceilings)

3.2 PREPARATION

.1 Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less than half width units at borders, and comply with reflected ceiling plans. Coordinate panel layout with mechanical and electrical fixtures.

.2 Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other sections.

.1 Furnish concrete inserts and similar devices to other trades for installation well in advance of time needed for coordination of other work.

3.3 INSTALLATION

.1 Install suspension system and panels in accordance with the manufacturer's instructions, and in compliance with ASTM C 636 and with the authorities having jurisdiction.

.2 Suspend main beam from overhead construction with hanger wires spaced 4-0 on center along the length of the main runner. Install hanger wires plumb and straight.

.3 Install wall moldings at intersection of suspended ceiling and vertical surfaces. Miter corners where wall moldings intersect or install corner caps.

.4 For reveal edge panels: Cut and reveal or rabbet edges of ceiling panels at border areas and vertical surfaces.

.5 Install acoustical panels in coordination with suspended system, with edges resting on flanges of main runner and cross tees. Cut and fit panels neatly against abutting surfaces. Support edges by wall moldings.

3.4 INTERFACE WITH OTHER WORK

.1 Co-ordinate ceiling work to accommodate components of other sections, such as light fixtures, diffusers, speakers, sprinkler heads, to be built into acoustical ceiling components.

3.5 ADJUSTING AND CLEANING

.1 Replace damaged and broken panels.

.2 Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage.

.1 Ceiling Touch-Up Paint, (Item #5760, 8oz. bottles) (Item #5761, quart size cans), "global white" latex paint should be used to hide minor scratches and nicks in the surface and to cover field tegularized edges that are exposed to view.

.3 Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

.1 Section Includes:

.1 Non-perforated felt ceiling panels

.2 Suspension systems

.3 Accessories; provide other necessary items including devices for attachment overhead construction, secondary members, splines, splices, connecting clips, wall connectors, wall angles, and other devices required for a complete installation.

.4 Supplemental support framing: Provide fully engineered secondary framing as required to meet code, conforming to layout shown in drawings, to support direct-hung felt ceilings suspension system.

.2 This Section covers the general requirements only for Acoustical Felt Ceilings as shown on the drawings. The supplying and installation of additional accessory features and other items not specifically mentioned herein, but which are necessary to make a complete installation, shall also be included or clarified accordingly.

1.3 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 E 84 – "Standard Test Method for Surface Burning Characteristics of Building Materials"

.2 E 488 – "Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements"

.3 B 209 – "Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate"

.4 C 423 – "Sound Absorption and Sound Absorption Coefficients by Reverberation Room Method"

.5 E 580 – "Standard Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Moderate Seismic Restraint"

.6 C 635 – "Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings"

.7 C 636 – "Recommended Practice for Installation of Metal Ceiling Suspensions Systems for Acoustical and Lay-in Panels"

.8 A 641 – "Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire"

.9 A 653 – "Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip process"

.10 E 1264 – "Classification for Acoustical Ceiling Products"

.11 E 1477 – "Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by use of Integrating-Sphere Reflectometers"

.12 D 1044 – "Practice for Abrasion Resistance"

.13 D 1002 – "Practice for Adhesion Resistance"

.2 Cradle-to-Cradle Bronze Certified

1.4 SUBMITTALS

.1 Product Data: Manufacturer's detailed installation instructions and maintenance data.

.2 Product Certification: Manufacturer's certifications that products comply with specified requirements and governing codes including product data, laboratory test reports and research reports showing compliance with specified standards.

.3 Test Reports: Certified reports from independent agency substantiating structural compliance to governing code requirements.

.4 Certificates:

.1 Certified data attesting fire rated materials comply with specifications.

.5 Shop Drawings: Submit shop drawings for reflected ceiling plans (RCP's), drawn to scale, and indicating penetrations and ceiling mounted items. Show the following details:

.1 Reflected Ceiling Plan(s): Indicating felt ceiling layout, ceiling mounted items and penetrations.

.2 Suspension System, Carrier and Component Layout.

.3 Details of system assembly and connections to building components.

.6 Samples for Verification: Full-size units (or as specified below) of each type of ceiling assembly indicated; in sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics. Submit samples for each type specified.

.1 11" long felt panel units.

.2 11" long samples of each suspension component.

1.5 QUALITY ASSURANCE

.1 Manufacturer/Installer Qualifications:

.1 Provide felt ceiling system and suspension system components produced by a single manufacturer to provide consistent quality in appearance and physical properties, without delaying the work.

.2 Perform installations using a firm with installers having no less than 3 years of successful experience on projects of similar size and requirements.

.2 Regulatory Requirements:

.1 Fire Rating Performance Characteristics: Install system to provide a flame spread of 0 - 25, complying with certified testing to ASTM E 84.

.2 Installation Standard for Suspension System: Comply with ASTM C 636.

.3 Pre-installation Conference: Conduct a conference, prior to start of installation, to review system requirements, shop drawings, and all coordination needs. Pre-installation conference to be coordinated to coincide with regularly scheduled, bi-weekly site meeting.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver system components in manufacturer's original unopened packages, clearly labeled.

.2 Store components in fully enclosed dry space. Carefully place on skids, to prevent damage from moisture and other construction activities.

.3 Handle components to prevent damage to surfaces and edges, and to prevent distortion and other physical damage.

1.7 PROJECT CONDITIONS

.1 Begin system installations only after spaces are enclosed and weather-tight, and after all wet work and overhead work have been completed.

.2 Prior to starting installations, allow materials to reach ambient room temperature and humidity intended to be maintained for occupancy.

1.8 WARRANTY

.1 Provide specified manufacturer's warranty against defects in workmanship, discoloration, or other defect considered undesirable by the Architect or Employer.

.2 This warranty shall remain in effect for a minimum period of one (1) year from date of Substantial Performance.

1.9 MAINTENANCE & EXTRA MATERIALS

.1 Maintenance Instructions: Provide manufacturer's standard maintenance and cleaning instructions for finishes provided.

.2 Extra Materials: Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents. Only typical system components are included with attic stock.

.1 Acoustical Felt Ceiling Pan Units: Full-size units equal to two percent (2%) of amount installed.

.2 Ceiling Suspension System Components: Quantity of each grid and exposed component equal to two percent (2%) of amount installed.

PART 2 PRODUCTS

2.1 MANUFACTURER

.1 HeartFelt™ linear felt panel ceiling system manufactured by Hunter Douglas and distributed by CertainTeed

.2 Equivalent products as per Specification 01 25 00.

2.2 SYSTEM MATERIALS

.1 Linear felt panel ceiling system for interior installations:

.2 Panel Profile Type: .090" thick PES (polyester) felt with square edges; 1-9/16" wide, 2-3/16" deep with open reveal to form a 2-3/8"module.

.2 Panel length: 8'-0” (2440mm)

.3 Linear Suspension System:

.1 Carrier: Roll-formed aluminum section with hook-shaped tabs spaced to receive ceiling panels. All tabs at the same height for Ceiling panel to remain on same plain. Finish: black.

.4 Hangers:

.1 Hanger Wire: 12 gage galvanized carbon steel hanger wire.

.2 Threaded Rod

.3 Aircraft Cable

.5 Wall Trims:

.1 60mm carrier track.

.2 HL55 perimeter J-Trim, depth to suit felt profile.

.6 Panel Finish:

Colour: allow for 3 colours to be selected by Consultant from standard colour range.

2.3 ACCESSORY MATERIALS

.1 Panel Splice: Formed aluminum insert designed to slide into and bite into ends of two ceiling panels.

PART 3- EXECUTION

3.1 EXAMINATION

.1 Examine substrates and structural framing to which acoustical felt panels attach or abut, with installer present, for compliance with requirements specified in this and other Sections that affect installation and anchorage, and other conditions affecting performance of felt panel ceilings.

.2 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

.1 Coordination: Furnish layouts for cast-in-place anchors, clips, and other ceiling anchors whose installation is specified in other Sections.

.2 Measure each ceiling area and establish layout of acoustical felt pan units to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width units at borders, and comply with layout shown on reflected ceiling plans.

.3 Survey substrate for wall attachment to assure squareness and proper elevation for wall panel installation.

3.3 INSTALLATION

.1 General: Install acoustical felt pan ceilings, per manufacturers shop drawings provided, per manufacturer's written instructions and to comply with publications referenced below.

.1 CISCA "Ceiling Systems Handbook"

.2 Standard for Ceiling Suspension System Installations - ASTM C 636

.3 Standard for Ceiling Suspension Systems Requiring Seismic Restraint - ASTM E 580

.2 Suspend ceiling hangers from building's approved structural substrates and as follows:

.1 Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.

.2 Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, counter-splaying, or other equally effective means.

.3 Where width of ducts and other construction within ceiling plenum produce hanger spacings that interfere with location of hangers at spacing required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Utilize supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

.4 Where used secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure; that are appropriate for substrate; and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.

.5 Space hangers not more than 48" on-center, along each member supported directly from hangers, unless otherwise indicated; and provide hangers not more than 12" from ends of each member. Supply supporting calculations from licensed Structural Engineer verifying hanger spacing meets all requirements, when spacing exceeds those recommended.

.6 Level grid to 1/8" in 10' from specified elevation(s), square and true.

.7 Adjust suspension system runners so they are square (within .5 degree from 90 degrees) and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

.3 Secure bracing wires to ceiling suspension members and to supports acceptable to Architect/Engineer and/or inspector. Suspend bracing from building's structural members and/or structural deck, as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs (unless directed otherwise).

.4 Scribe and cut acoustical felt panel units for accurate fit at penetrations by other work through ceilings. Stiffen edges of cut units as required to eliminate evidence of buckling or variations in flatness exceeding referenced standards for stretcher-leveled felt sheet.

.5 Install acoustical felt panel units in coordination with suspension system. Fit adjoining units to form flush, tight joints. Scribe and cut units for accurate fit at borders and around construction penetrating ceiling.

3.4 ADJUST AND CLEAN

.1 Adjust components to provide uniform tolerances.

.2 Replace all ceiling panels that are creased, faded, or otherwise damaged.

.3 Clean exposed surfaces with vacuum or dusting. If necessary, panels can be wet cleaned with water, or non-solvent, non-abrasive commercial type cleaner.

END OF SECTION

PART 1 - GENERAL

1.1 References

.1 American Society for Testing and Materials (ASTM):

.1 ASTM F 2195 Standard Specification for Linoleum Tile Floor Covering.

.2 ASTM F 1869 Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

.3 ASTM F 2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes

.4 ASTM F 1861 Standard Specification for Resilient Wall Base.

.5 ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

.6 ASTM F 1482 Standard Practice for Installation and Preparation of Panel Type Underlayments to Receive Resilient Flooring.

.7 ASTM E 648 Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.

.8 ASTM E 662 Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.

.9 ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials.

.10 ASTM E 492 Standard Test Method for Laboratory Measurement of lmpact Sound Transmission through Floor-Ceiling Assemblies Using the Tapping Machine.

.11 ASTM E 989 Standard Classification for Determination of lmpact Insulation Class (llC).

.2 National Fire Protection Association (NFPA):

.1 NFPA 253 Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.

.2 NFPA 258 Test Method for Specific Optical Density of Smoke Generated by Solid Materials.

.3 International Standards and Training Alliance (Install):

.1 Install Resilient Certification.

1.2 Submittals

.1 Product Data: Submit manufacturer's current printed Product literature, Specifications, installation instructions, and field reports in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop Drawings: Submit Shop Drawings to indicate materials, details, and accessories in accordance with Section 01 33 00 - Submittal Procedures including but limited to the following:

1. Submit a cut diagram indicating seam locations and roll direction. Use mitered seam layouts for corners when changing directions 180 degrees (e.g. when running material down corridors which bisect at a right angle), unless approved otherwise.

.3 Samples: Submit duplicate 12" x 12" (300 mm x 300 mm) sample pieces of sheet material.

1.3 Closeout Submittals

1 Provide maintenance data and warranty for resilient flooring for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

.1 Installer Qualifications: Installer experienced in performing Work of this section who has specialized in installation of Work similar to that required for this Project.

.1 Engage installer certified by flooring manufacturer

.2 Certificate: Submit certificate indicating installer qualification.

.2 Regulatory Requirements:

.1 Fire Performance Characteristics: Provide resilient linoleum sheet flooring with the following fire performance characteristics as determined by testing Products in accordance with ASTM method indicated below by a certified testing laboratory or another testing and inspecting agency acceptable to authorities having jurisdiction:

Critical Radiant Flux: Class 1 Rating per NFPA 253 (ASTM E 648) (0.45 watts/cm² or greater).

Smoke Density: Less than 450 per NFPA 258 (ASTM E 662).

.2 Provide slip resistant sheet vinyl safety flooring in compliance with the following:

.1 Ontario Building Code (OBC), latest edition.

.2 Workplace Safety Insurance Board (WSIB).

.3 Mock-Ups: Install at Project site a job mock-up using acceptable Products and manufacturer approved installation methods. Obtain Owner's and Consultant's acceptance of finish color, texture and pattern, and Workmanship standard. Comply with Division 1 Quality Control (Mock-Up Requirements) Section.

.1 Mock-Up Size: 3m x 3m, location as directed by Consultant.

.2 Incorporation: Mock-up may be incorporated into final construction upon Owner's approval.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 General: Comply with Division 1 Product Requirements Sections.

.2 Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

.3 Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

.4 Storage and Protection: Store materials protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

.1 Material should be stored in areas that are fully enclosed and weathertight. The permanent HVAC should be fully operational, controlled and set at a minimum of 68º F (20º C) for at least 48 hours prior to the installation.

1.6 PROJECT CONDITIONS

.1 Environmental Requirements/Conditions: In accordance with manufacturer's recommendations, areas to receive flooring should be clean, fully enclosed and weathertight. The permanent HVAC must be fully operational, controlled and set at a minimum of 68º F (20º C) for a minimum of seven days prior to, during, and seven days after the installation. The flooring material should be conditioned in the same manner for at least 48 hours prior to the installation. Areas to receive flooring shall be adequately lighted to allow for proper inspection of the substrate, installation and seaming of the flooring, and for final inspection.

.1 Temperature Requirements: Maintain air temperature in spaces where Products will be installed for time period before, during, and after installation as recommended by manufacturer.

.1 Temperature Conditions: 68º F (20º C) for a minimum of seven days prior to, during, and seven days after the installation.

1.7 SEQUENCING AND SCHEDULING

.1 Finishing Operations: Install tile flooring after finishing operations, including painting and ceiling operations, have been completed.

.2 Concrete Curing: Do not install tile flooring over concrete substrates until substrates have cured and are dry to bond with adhesive as determined by resilient flooring manufacturer's recommended bond, moisture test, and pH test.

.1 It is the Flooring Contractor’s responsibility to verify suitability of substrate.

1.8 WARRANTY

.1 Project Warranty: Refer to "Conditions of the Contract" for Project warranty provisions.

.2 Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.

.1 Warranty Period: Five (5) year limited warranty commencing on Date of Substantial Completion.

1.9 MAINTENANCE

.1 Extra Materials: Deliver to Owner extra materials from same Production run as Products installed. Package Products with protective covering and identify with descriptive labels. Comply with Division 1 Closeout Submittals (Maintenance Materials) Section.

.1 Quantity: Furnish quantity of flooring units equal to 5% of amount installed for each colour/pattern. Extra material to be Provided from same dye lot as installed material.

.2 Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage and protection of extra materials.

PART 2 - PRODUCTS

2.1 RESILIENT LINOLEUM TILE FLOORING (RES)

.1 Product Performance Requirements

.1 Description: Homogeneous tile linoleum of primarily natural materials consisting of linseed oil, wood flour, and rosin binders, mixed and calendered onto a polyester backing to ensure optimum dimensional stability. Pattern and color shall extend throughout total thickness of material.

.2 Size: 50cm x 50cm; 50 cm x 25cm and 100cm x 25cm as indicated on drawings

.3 Gauge: 2.5mm (1/10”)

.4 Backing: Polyester

.5 Pattern and Color: As selected by Consultant from manufacturer's full pattern/color range. Allow for 2 colours.

.6 Adhesive: As recommended by manufacturer

.7 Heat Welding Rod: colour-matched solid colour as recommended by manufacturer.

2 Resilient Tile Flooring must:

.1 not be manufactured or formulated with heavy metals including cadmium (Cd), chromium (Cr), lead (Pb), mercury (Hg), and nickel (Ni);

.2 not contain >0.01% by weight of arsenic (As);

.3 not contain >1% by weight of tin (Sn), and zinc (Zn);

.4 be manufactured with recycled content; and

.5 not contain or be manufactured with materials derived from species listed under CITES.

.4 The manufacturing process must adhere to Lifecycle Assessment Standards as per CAN/CSA-ISO 14040.

2.2 ACCESSORIES

.1 Resilient base: continuous, top set, complete with premoulded end stops and external corners:

.1 Type: rubber (100% PVC free, phthalate free and Red list chemical free).

.2 Style: cove.

.3 Thickness: 3.17mm.

.4 Height: 101.6mm.

.5 Lengths: cut lengths minimum 2400mm.

.6 Colour: To be determined by Consultant from full colour range.

.7 Acceptable Products: Pinnacle by Roppe, Optimum Edge TS by Mannington or Baseworks by Johnsonite

.3 Metal transition strips:

1. For edging between resilient sheet flooring and all other floor materials always use a flush anodized aluminum metal edging. Exact model number to be determined by the Contractor based on site conditions and height differential and to be approved by Architect prior to installation.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: Comply with manufacturer's Product data, including Product technical bulletins, Product catalog installation instructions, and Product carton instructions for installation.

3.2 EXAMINATION

.1 Site Verification of Conditions: Verify substrate conditions (which have been previously installed under other sections) are acceptable for Product installation in accordance with manufacturer's instructions (i.e. moisture tests, bond test, pH test).

.2 Material Inspection: In accordance with manufacturer's installation requirements, visually inspect materials prior to installation. Material with visual defects shall not be installed.

3.3 PREPARATION

.1 Adjacent Surfaces Protection: Protect adjacent Work areas and finish surfaces from damage during Product installation.

.2 Surface Preparation:

.1 General: Prepare floor substrate in accordance with manufacturer's instructions.

.2 Floor Substrate: Floors shall be sound, smooth, flat, permanently dry, clean, and free of all foreign materials including, but not limited to, dust, paint, grease, oils, solvents, curing and hardening compounds, sealers, asphalt and old adhesive residue.

.3 Level all rough surfaces and fill cracks and marks with a patching compound compatible with Resilient Flooring.

.4 Mechanically remove all surface contaminants such as paint, oil, grease, varnish, adhesive as well as various other products such as treatment compounds.

.5 Concrete Moisture Testing: Conduct moisture tests on <u>all</u> concrete floors regardless of the age, grade level or the presence of existing flooring. Conduct calcium chloride tests in accordance with ASTM F 1869. Measure the internal relative humidity of the concrete slab in accordance with ASTM F 2170. One test of each type should be conducted for every 1,000 square feet of flooring (minimum of 3). The tests should be conducted around the perimeter of the room, at columns, and anywhere moisture may be evident. Concrete moisture vapor emissions must not exceed 5.0 lbs. per 1,000 square feet in 24 hours when using Forbo T 940 adhesive. Concrete internal relative humidity must not exceed 75% when using Forbo T 940 adhesive. A diagram of the area showing the location and results of each test should be

submitted to the Consultant, General Contractor or End User. If the test results exceed these limitations, the installation must not proceed until the problem has been corrected.

.6 Concrete pH Test: Perform pH tests on concrete floors regardless of the age or grade level. If the pH is greater than 10, it must be neutralized prior to beginning the installation.

3.4 INSTALLATION OF RESILIENT TILE FLOORING (RES)

.1 Adhesive Flooring Installation: Begin laying tiles at the starting point, ensuring that the tile is laid exactly along the layout lines. Because the tiles must be installed into wet adhesive, do not spread the adhesive in an area larger that the tile can be installed while the adhesive is still wet. The successful installation of border tiles is best accomplished by following one of two strategies. (1) When laying out tile, determine the edge of a field tile a comfortable distance from each wall and then snap chalk lines around the perimeter of the room. When spreading adhesive, use these lines as a guide to stop spreading adhesive and install the field tile up to the adhesive spread lines. Once the field tiles have been installed, the border tiles and be “dry” fitted (before spreading the adhesive). After the border tiles have been cut, adhesive can be applied in the area of the border tiles and the tiles can be placed immediately into the wet adhesive. (2) Plan the sequence of spreading adhesive so that the border tiles can be cut and placed into the adhesive before the adhesive Working time has been exceeded. Immediately after installation, roll the tile with a 100 pound roller in both directions and repeat as necessary to ensure adequate transfer of adhesive to the backing.

.1 Adhesive Material Installation: Use trowel as recommended by flooring manufacturer for specific adhesive. Spread at a rate of approximately 150 ft^2/gallon, as recommended by flooring manufacturer.

.2 Installation Techniques:

.1 Where demountable partitions and other items are indicated for installation on top of finished flooring, install flooring before these items are installed.

.2 Scribe, cut, fit flooring to butt tightly to vertical surfaces, permanent fixtures and built-in furniture, including pipes, outlets, edgings, thresholds, nosings, and cabinets.

.3 Extend flooring into toe spaces, door reveals, closets, and similar openings.

.4 Install flooring on covers for telephone and electrical ducts, and similar items occurring within finish floor areas. Maintain overall continuity of color and pattern with pieces of flooring installed on these covers.

.5 Do not install resilient flooring over expansion joints. Use expansion joint covers manufactured for use with resilient flooring. Refer to other specification sections for expansion joint covers.

.6 Adhere resilient flooring to substrate without producing open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections in completed installation.

.1 Use adhesive applied to substrate in compliance with flooring manufacturer’s recommendations, including those for trowel notching, adhesive mixing, and adhesive open and Working times.

.7 Roll resilient flooring as required by resilient flooring manufacturer.

.3 Finish Flooring Patterns: As selected by Consultant.

3.5 APPLICATION of RUBBER BASE

.1 Lay out base to keep number of joints at minimum.

.2 Clean substrate and prime with one coat of adhesive.

.3 Apply adhesive to back of base.

.4 Set base against wall and floor surfaces tightly by using 3 kg hand roller.

.5 Install straight and level to variation of 1:1000.

.6 Scribe and fit to door frames and other obstructions. Use premoulded end pieces at flush door frames.

.7 Cope internal corners. Use premoulded corner units for right angle external corners. Use formed straight base material for external corners of other angles.

.10 Heat weld base in accordance with manufacturer's printed instructions.

3.6 CLEANING

.1 Cleaning: Remove temporary coverings and protection of adjacent Work areas. Repair or replace damaged installed Products. Clean installed Products in accordance with manufacturer's instructions prior to Owner's acceptance. Remove construction debris from Project site and legally dispose of debris.

.1 Remove visible adhesive and other surface blemishes using cleaning methods recommended by floor manufacturer.

.2 Sweep and vacuum floor after installation.

.3 Do not wash floor until after time period recommended by flooring manufacturer.

.4 Damp mop flooring to remove black marks and soil.

3.7 PROTECTION

.1 Protection: Protect installed Product and finish surfaces from damage during construction. Remove and legally dispose of protective covering at time of Substantial Completion.

3.8 INITIAL MAINTENANCE PROCEDURES

.1 General: Include in Contract Sum Amount cost for initial maintenance procedures, and execute procedures after flooring installation as recommended by flooring manufacturer.

END OF SECTION

PART 1 – GENERAL

1.1 Work included in this section includes:

.1 Inspection of surfaces and prevailing conditions

.2 Divider strips

.3 Portland cement terrazzo mixes

.4 Application of Portland cement mixes

.5 Floors, wainscots & partition bases, stair treads and risers

.6 Curing

.7 Surfacing and grinding

.8 Slurry handling and removal

.9 Cleaning and Sealing

1.2 Quality Assurance

.1 Installer: employ skilled mechanics, trained and experienced in terrazzo work. The work of the sub-contractor to be executed by a company that is a member in good standing with TTMAC. This work to be done under proper supervision by persons skilled in the method. If installer is not a contractor member of TTMAC, installer must have at least five (5) years proven experience and submit a list of completed projects of similar magnitude and scope to the Consultant. Note: a list of current members is available from the TTMAC office, tel: 1.800.201.8599, www.ttmac.com

.2 Supplier: a member in good standing with the Terrazzo, Tile and Marble Association of Canada, providing materials meeting the minimum standards of TTMAC.

1.3 References

.1 Do terrazzo work in accordance with the latest Terrazzo Specification Guide 09 66 00 produced by TTMAC.

1.4 Submittals

.1 Submit three (3) samples 150mm x 150mm of each colour and type of terrazzo for approval by Consultant. Submit samples (300mm in length) of all specified divider strips and control joints.

.2 For precast terrazzo submit shop drawings showing all dimensions, anchors, supports and relation to structure and work by others.

.3 Provide a copy of the latest edition of TTMAC maintenance guide in the Operation and Maintenance Manual.

.4 Show locations of all expansion, control, cold or seismic joints on drawings. Note and detail conditions where the terrazzo flooring meets adjacent floors. Clearly note the depth and area of depressed concrete that may receive an underbed. All terrazzo colours and strip sizes must be clearly noted.

1.5 Delivery, Storage and Handling

.1 Deliver, store and handle products in a manner to avoid damage. Store materials in a clean, dry, heated location. Material must be conditioned to ambient temperatures for a period of 24 hours prior to installation.

1.6 Project/Site Conditions

.1 Examine areas where the work of this section is to be located.

.2 Do not place terrazzo until unacceptable conditions have been corrected.

.3 Protect work during installation and protect finished corners exposed to construction operations and traffic.

1.7 Pre-Installation Meetings

.1 Pre-installation Conference: [Prior to installation of concrete substrates, conduct] [Conduct] conference at [Project site] <Insert location> to comply with requirements in Section [01 31 00 Project Management and Coordination] [01 31 19 Project Meetings] <Insert section number and title>. Review methods and procedures related to terrazzo including, but not limited to, the following:

1. Inspect and discuss installation procedures, joint details, jobsite conditions, substrate specification, vapor barrier details and coordination with other trades.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment and facilities needed to make progress and avoid delays.
3. Review special terrazzo designs and patterns.
4. Review dust control procedures.
5. Review plans for concrete curing and site drying to enable timely achievement of suitable slab moisture conditions.
6. Review concrete substrate tolerance requirements for acceptable terrazzo installation.

1.7 Warranty

.1 Provide one year warranty from date of substantial completion.

PART 2 – PRODUCTS

2.1 Materials

.1 Cement: Portland cement to CAN CSA-A5-03

.2 Sand: Sharp, screened sand: ASTM C-144

.3 Water: Clean, potable, free from oil, acids, alkali or organic matter.

.4 Marble, granite, plastic or glass chips: clean and sound.

.5 Colour pigments: non fading mineral pigments.

.6 Slip resistant material: No 36 grit aluminum oxide.

.7 Slip resistant channel strips: Brass or zinc 10mm x 10mm, 20 gauge dove-tailed shaped channels with anchor tape.

.8 Reinforcing mesh: 50mm x 50mm mesh size, fabricated from 1.6mm thick galvanized steel wire fabric/welded mesh. ASTM A821/ASTM A185.

.9 Divider strips: 25mm to 32mm deep anchorage devices, except where specified otherwise.

.10 Core dividers: Metal or plastic with a 38mm radius to control shrinkage at wall base or as colour separation.

.11 Cleavage Plane: .1mm/4 mil thick polyethylene film to CAN/CGSB-51.43-M86.

.14 Sealers and Maintenance products to be as per manufacturer instructions and must be U/L listed as slip resistant.

.1 Cleaners: Conforming to CAN/CGSB-2.107-92

.2 Sealers: Conforming to CAN/CGSB-25.20-95

.3 Floor finish: Conforming to CAN/CGSB-25.21-95

2.2 Mixes/Proportions

.1 Underbed: One part Portland cement to four parts sand by volume. Wet and mix thoroughly to a low slump and to provide workability. Adjust water volume depending on moisture content of sand to obtain consistency and workability.

.2 Scratch coat (by volume): One part Portland cement, four parts sand and a latex additive if required. Adjust water volume depending on moisture content of sand to obtain consistency and workability.

.3 Slurry bond coat: Mix Portland cement and water to a creamy paste consistency. Latex additive may be included to increase bond.

.4 Underbed for walls (vertical surfaces): One part Portland cement to three parts sand by volume. Latex additive may be included to increase bond. Adjust water volume depending on moisture content of sand to obtain consistency and workability.

.5 Standard Terrazzo Topping: two parts cement to three parts aggregate. Chip size ratio 70% No.2 and 30% No. 1.

Colour:

.1 Match existing.

3.1 Inspection

.1 Verify existing conditions are ready to receive work.

.2 Verify substrate surfaces are clean, dimensionally stable, cured and free of contaminants such as oil, sealers and curing compounds.

.3 Verify that concrete has been allowed to cure for a minimum of 28 days.

.4 Verify that concrete slabs scheduled to receive epoxy bonded terrazzo or floating terrazzo have a steel trowel finish. Concrete scheduled to receive bonded terrazzo must have a screed finish. Ensure concrete slabs have been finished to a tolerance not exceeding 6mm in 3000mm from the required plane.

.5 Notify Consultant in writing of unacceptable substrate conditions. Commencing installation implies acceptance of existing conditions.

3.2 Preparation

.1 Bonded Terrazzo: substrate to be laitance free. Clean and thoroughly saturate slab, remove excess water prior to installation. Apply a slurry bond coat of cement and water to the substrate and proceed immediately to install the underbed. The addition of a latex additive will improve the bond.

.2 Floating Terrazzo: broom clean base slab and fill all voids with loose sand over rough screed surface. Apply polyethylene sheet over sand. Overlap joints 100mm. Install underbed with reinforcing mesh with joints overlapping 100mm. Wire mesh must be kept minimum 19mm above substrate.

.3 Epoxy Bonded Terrazzo: concrete to be sound with steel trowel finish and free of laitance. Shotblasting, sandblasting, grinding, scarifying are recommended methods of surface preparation. Substrate must be primed with an epoxy bonding agent. Terrazzo topping to be installed while bonding agent is tacky.

.4 Protect other work from dust generated by shot blasting and grinding operations. Control dust to prevent air pollution and comply with environmental protection regulations.

1. Erect and maintain temporary enclosures and other suitable methods to limit dust migration and to ensure adequate ambient temperatures and ventilation conditions during installation.

3.3 Installation

.1 Underbed: install underbed over properly prepared substrate and screed to required levels. The levels should allow for the thickness of the terrazzo topping in order to provide a flat and continuous transition between terrazzo and adjacent flooring. Permit underbed to cure for a minimum 48 hours prior to installation of terrazzo topping.

.2 Divider strips: install divider strips in underbed while still in plastic state. Set divider strips true and level to required pattern. Terrazzo panels created by the installation of divider strips to be no greater than 1200mm x 1200mm. Structural movement joints must be addressed by mechanical devices. Divider strips are not intended to replace or to be used as structural expansion joints.

3.4 Installation of Terrazzo Toppings

.1 Standard Terrazzo Topping: Allow underbed to sure for 48 hours, sweep or vacuum underbed, saturate with water and remove excess. Apply a cement slurry bond coat and immediately follow with application of terrazzo topping mix. Wet terrazzo topping mixture, mix thoroughly and spread with trowel level to top of strips. Sprinkle topping with dry aggregate chips. Roll with heavy rollers to compact topping until excess cement and water has been extracted. Hand trowel topping surface flush with top of divider strips to close all voids and pin holes. Control cure a minimum 48 hours. After floor has sufficiently cured, grind with No. 24 grit abrasive stones or with diamond plugs. Follow initial grind with No. 80 grit or finer stones, to a maximum of 120 grit, until all grout is removed from surface. Let surface dry thoroughly and apply sealer as per manufacturer recommendation.

.2 Epoxy Bonded Terrazzo: clean base slab, remove laitance by shotblasting, sandblasting, grinding or scarifying. Clean thoroughly. Moisture content in slab not to exceed manufacturer’s recommendations. Install divider strips and base bead top strips where required. Mix and install epoxy bonding agent following specifications of the supplier of the epoxy and under the direction of manufacturer’s representative. Install terrazzo topping as in 3.4.1, omitting water saturation of concrete slab and slurry bond coat.

3.5 Patching

.1 Remove and replace all defective or damaged work promptly and when directed by Consultant.

3.6 Cleaning/Sealing

.1 As per TTMAC Maintenance Guide.

3.7 Protection

.1 Provide appropriate protection to completed terrazzo work. Protect work of other trades. Prohibit traffic during installation and for 48 hours after completion. Protect floor from impact and vibration for a minimum of 48 hours after installation. Protect base form impact, vibration, heavy hammering on adjacent/opposite walls.

END OF SECTION

PART 1 – GENERAL

1.01 SUMMARY

.1 Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections apply to this Section.

1.02 SUBMITTALS

.1 Shop Drawings showing the extent of product, seam direction and accessories shall be submitted to Architect for approval prior to installation. Check pattern match, if any, for matching during installation and possible waste factors in ordering required amounts. Should also indicate columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required. Copy of approved shop drawings to be available on job site during installation.

.2 Floor schedule using same room designations indicated on drawings.

.3 Product Data: Provide data on specified products, describing physical and performance characteristics, sizes, patterns, colors available, and method of installation.

.4 Verification Samples: Submit samples illustrating color and pattern for each carpet material specified.

.5 Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

.6 Maintenance Data: Include maintenance procedures, recommendations for maintenance materials and equipment, and suggested schedule for cleaning.

.7 Manufacturer's Product Warranty.

.8 Verification of reclamation and recycling program.

1.03 QUALITY ASSURANCE

.1 Manufacturer Qualifications

1. Company specializing in manufacturing specified carpet with minimum 15 years documented experience.

.2 Upon request, manufacturer to provide representative to assist in project start-up and to inspect installation while in process and upon completion. Representative will notify designated contact if any installation instructions are not followed.

.3 Single Source Responsibility: Obtain each type of product from one source and by a single manufacturer.

.2 Installer Qualifications

1. Flooring contractor to be a specialty contractor normally engaged in this type of work and shall have prior experience in the installation of these types of materials.

.2 Flooring contractor possessing Contract for the product installation shall not sub-contract the labor without written approval of the Project Manager.

.3 Flooring contractor will be responsible for proper product installation, including floor testing and preparation as specified by the manufacturer and JOB CONDITIONS herein.

.4 Flooring contractor to provide Owner a written installation warranty that guarantees the completed installation to be free from defects in materials and workmanship for a period of one year after job completion.

1.04 DELIVERY, STORAGE, & HANDLING

.1 Deliver materials to the site in manufacturer's original packaging listing manufacturer's name, product name, identification number, and related information.

.2 Store in a dry location, between 65 degrees F and 90 degrees F and a relative humidity below 65%. Protect from damage and soiling. Stack carpet rolls horizontally on a flat surface, stacked no higher than two rolls.

.3 Make stored materials available for inspection by the Owner's representative.

.4 Store materials in area of installation for minimum period of 48 hours prior to installation.

1.05 PROJECT CONDITIONS

.1 Sub-floor preparation is to include all required work to prepare the existing floor for installation of the product as specified in this document and Manufacturer's installation instructions.

.2 All material used in sub-floor preparation and repair shall be recommended by the carpet manufacturer and shall be chemically and physically compatible with the carpet system being bid.

.3 Maintain minimum 65 degrees F ambient temperature and 65% Relative Humidity for 72 hours prior to, during, and 48 hours after installation.

.4 Do not install flooring until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete, and ambient temperature and humidity conditions are and will be continuously maintained at values near those indicated for final occupancy.

1.06 EXTRA MATERIALS

.1 Provide additional equivalent to 5% of each pattern/colour provided under the base contract, from the same dye lot. Deliver extra material to site.

1.07 WARRANTY

.1 Warranty to be sole source responsibility of the Manufacturer. Second source warranties and warranties that involve parties other than the carpet manufacturer are unacceptable.

.2 If the product fails to perform as warranted when properly installed and maintained, the affected area will be repaired or replaced at the discretion of the Manufacturer.

.3 Warranty shall not exclude carpet product installed on stairs provided it is properly installed and maintained.

.4 The non-prorated Lifetime Limited warranty shall specifically warrant against :

.1 Excessive Surface Wear: More than 15% loss of pile fiber weight

.2 Excessive Static Electricity: More than 3.0 kV per AATCC 134

.3 Resiliency Loss of the Backing: More than 10% loss of backing resiliency

.4 Delamination

.5 Edge Ravel

.6 Zippering

.5 Tuft Bind warranty in lieu of edge ravel and zippering is not acceptable.

PART 2 – PRODUCTS

2.01 RECYCLED CONTENT

.1 Product must contain a minimum of 7% recycled content by weight. This percentage is calculated by dividing the weight of recycled content in one square yard of finished carpet by the total weight

of one square yard of finished product and multiplying by 100. [(Recycle Content Weight) / (Total Product Weight) x 100].

.2 Product must contain 7% post-consumer recycled content by weight from recycled post consumer carpet. This ensures that carpet is diverted from landfills for the production of the product and that virgin resource use in the product is reduced.

.3 Recycled content must be certified by a neutral, independent, third party organization such as Scientific Certification Systems. Product must carry product label certifying overall recycled content (including post-industrial and post-consumer content). Report percentage of post-industrial and post-consumer recycled content as a percentage of total product weight.

2.02 PRODUCT RECYCLABILITY

.1 Manufacturer must fully comply with the US Federal Trade Commissions' "Guides for the Use of Environmental Marketing Claims" (CFR Title 16 part 260) with respect to advertising, labeling, product inserts, catalogs and sales presentations of all its flooring products submitted and sold.

.2 Product must meet FTC Guides for recyclability and must be one hundred percent (100%) closed-loop recyclable back into flooring. A manufacturer cannot claim that a product or any portion of a product is recyclable if it is incinerated, even if incineration is used to produce heat and power (i.e. waste-to-energy) per FTC guides 16 CFR section 260.7 (d) example 3.

.3 Recyclability of product installed must be the same as that claimed by manufacturer and required by Project requirements.

2.03 RECYCLING PROGRAM

.1 Manufacturer must have a collection and recovery system for product and a fully established, currently operational recycling program at time of bid per FTC Guides Section 260.7 (d).

.1 Manufacturer must be able to reclaim and recycle 100% of installed carpet. Like material as installed must be 100% recycled.

.2 Manufacturer must have written guarantee that 100% of the recovered vinyl backed carpet will be recycled and that no portion of the product will be land filled or incinerated (including waste-to-energy).

2.04 FIBER

.1 Nylon Fiber: Bulked Continuous Filament (BCF) Nylon in a loop pile construction: Dynex/Dynex SD.

.2 For yarn containing recycled content, report post consumer and post industrial recycled content of the pile face yarn per total yarn weight i.e. [(Recycle Content in Pile Face Yarn) / (Total Weight of Pile Face Yarn) x 100]

.3 Fiber to contain carbon-core filament for permanent static control. Topical treatments are not acceptable.

.4 Durable soil protection should be applied to the fiber during product manufacturing to resist fiber soiling. Application Rate: 2% of Face Weight.

2.05 CUSHION CHARACTERISTICS

.1 Primary Backing: Synthetic Non-Woven.

.2 Secondary Backing: Powerbond Closed Cell Cushion

.1 Product Size: 6-Foot Width Roll Goods

.2 Cushion Type: Closed Cell Cushion

.3 Cushion Thickness: .156 inch thick

.4 Cushion Density (ASTM D-1667): Min. 18.5 lbs/cu ft

.5 Compression Set (ASTM D-1667): Maximum 10%

.6 Compression Force Deflection (ASTM D-1667): Minimum 7 lbs/sq. inch @ 25%; Maximum 25 lbs/sq. inch at 25%

.7 Moisture Barrier: Impermeable to moisture and airflow. Moisture Penetration by Impact @ 10 psi: No penetration of backing after 10,000 impacts. Provide independent test results. The British Spill Test is NOT an acceptable measurement for moisture barrier.

.8 Seam Method: Chemical weld; molecularly bound seams to be impermeable to moisture and airflow

.9 Seam Integrity: Moisture Penetration by Impact at SEAMS @ 10 psi; No penetration after 10,000 impacts. Provide independent test results. The British Spill Test is NOT an acceptable measurement for moisture barrier.

.10 Seam Integrity: Phillips Chairs Test: No seam separation after 50,000 cycles; Provide independent test results

.11 Face yarn fully fused to secondary backing system that will not delaminate

.12 Delamination: No delamination per ASTM D3936

.13 Product must not contain pesticides (US EPA Registered Antimicrobials). Installation adhesives are exempt from this section.

2.06 PRODUCT SPECIFICATIONS

.1 Basis of design: Plexus Colour IV Powerbond as manufactured by Tarkett

.1 Equivalent products per 01 25 00.

.2 Material characteristics

.1 Colour: to be selected by Consultant from full colour range

.2 Construction: Symtex®

.3 Gauge: 1/13

.4 Stitch Rate: 12.0/ inch

.5 Tuft Density: 153.6 tufts/sq inch

.6 Pile Height Average: 0.135”

.7 Pile Thickness: 0.083”

.8 Density Factor (UM44D): 10,410 oz/cu yd.

.9 Fiber System: Dynex SD®/Dynex® Nylon with Static Control & Eco- Ensure

.10 Dye Method: 50% Solution/50% Yarn Dyed

.11 Static Coefficient of Friction: ASTM C-1028; Passes ADA requirements.

.12 Static Propensity: AATCC 134: 3.5 kv or less

.13 Acoustic Requirements: Noise Reduction Coefficient (NRC): 0.22 Minimum

.14 Seam Integrity: No seam separation after 50,000 cycles per Phillips Chair Test

.15 Cushion Compression Set: Maximum 10%

.16 Cushion Compression Force Deflection: Minimum 7 lbs/sq. inch @ 25%; Maximum 25 lbs/sq. inch at 25%

.17 Cushion Density 18.5 lbs per cubic foot

.18 Cushion Thickness: 0.156 inch

.1 Total Weight: 82.7 (Non-RS) oz/sq yd +/- 5%

.2 Environmental Impact: No pesticides added to product (US EPA Registered Antimicrobials)

2.07 ACCESSORIES

.1 Materials recommended by Manufacturer for patching, priming, seam welding, etc.

.2 Resilient Base: 100% PVC free, continuous, top set, complete with pre-moulded end stops and external corners:

.1 Type: rubber (100% PVC free, phthalate free and Red list chemical free).

.2 Style: toeless.

.3 Thickness: 3.17mm.

.4 Height: 101.6mm.

.5 Lengths: cut lengths minimum 2400 mm.

.6 Colour: To be determined by Consultant from full colour range

.7 Acceptable products: Pinnacle by Roppe, Optimum Edge TS by Mannington or Baseworks by Johnsonite.

.3 Metal transition strips:

1. For edging between carpet and all other floor materials always use a flush anodized aluminum metal edging. Exact model number to be determined by the Contractor based on site conditions and height differential and to be approved by Architect prior to installation.

PART 3 - EXECUTION

3.01 EXAMINATION / PREPARATION

.1 Prepare sub-floor to comply with criteria established in Manufacturer's installation instructions. Use only preparation materials that are acceptable to the Manufacturer.

.1 Remove all deleterious substances from substrate(s) that would interfere with or be harmful to the installation (i.e. floor wax).

.2 Remove sub-floor ridges and bumps. Fill cracks, joints, holes, and other defects.

.2 Verify that sub-floor is smooth and flat within specified tolerances and ready to receive carpet.

.3 Verify that substrate surface is dust-free and free of substances that would impair bonding of product to the floor.

.4 Verify that concrete surfaces are ready for installation by conducting moisture and pH testing. Results must be within limits recommended by Manufacturer.

.5 There will be no exceptions to the provisions stated in the Manufacturer's installation instructions.

3.02 INSTALLATION - GENERAL

.1 Install product in accordance with Manufacturer's installation instructions. Product must have low VOC, factory applied, "dry" adhesive. Product must meet the requirements of CRI's Green Label Plus (GLP) program for carpet. Provide documentation.

.2 Adhesive must meet the requirements of CRI's Green Label Plus program for adhesive. Provide documentation.

.3 Adhesives must be below the VOC content limits specified by the South Coast Air Quality Management District Rule #1168. Provide documentation.

.4 No US EPA registered pesticides (antimicrobials) are to be added to the product. Antimicrobial treatments are registered with the EPA as preservatives of the products only, and no health benefit should be claimed or expected. If antimicrobials are added then third party documentation with a seal is required stating that the pesticides used will cause NO HARM to the occupants. Installation adhesives are exempt from this section.

.5 Product as installed to be securely attached to the floor in compliance with Americans with Disabilities Act (ADA), Section 4.5.3.

.6 Verify product match before cutting to ensure minimal variation between dye lots.

.7 Layout product and locate seams in accordance with shop drawings.

.1 Locate seams in area of least traffic, out of areas of pivoting traffic, and parallel to main traffic. Minimize cross seams.

2. Do not locate seams perpendicular through door openings.

3. Align run of pile *in same direction as anticipated traffic and* in same direction on adjacent pieces.

4. Locate change of color or pattern between rooms under door centerline.

5. Provide monolithic color, pattern, and texture match within any one area.

.8 Install product tight and flat on sub-floor, well-fastened at edges, with a uniform appearance.

.9 Double-cut product seams with accurate pattern match. Make cuts straight, true, and unfrayed.

.10 Seal seams with manufacturer's recommended seam sealer as stated in installation instructions. Make sure the seam is fully sealed.

.11 Roll with appropriate roller for complete contact of product with adhesive to sub-floor.

.12 Trim carpet neatly at walls and around interruptions.

.13 Completed product is to be smooth and free of bubbles, puckers, and other defects.

3.03 PROTECTION & CLEANING

.1 Remove excess adhesive and/or seam sealer from floor and wall surfaces without damage.

.2 All rubbish, wrappings, debris, trimmings, etc. to be removed from site and recycled or disposed of properly.

.3 Clean and vacuum surfaces using a beater brush/bar commercial vacuum.

.4 After each area of is installed, protect from soiling and damage by other trades.

END OF SECTION

PART 1 - GENERAL

1.1 Related Sections.

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 60 00 - Basic Product Requirements.

.3 Section 01 78 00 - Closeout Submittals.

1.2 References

.1 Architectural Painting Specifications Manual, Master Painters Institute (MPI).

.2 Systems and Specifications Manual, SSPC Painting Manual, Volume Two, Society for Protective Coatings (SSPC).

.3 Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings) of the Environmental Protection Agency (EPA).

.4 National Fire Code of Canada.

1.3 Quality Assurance

.1 Contractor shall have past experience in the manufacture or fabrication of the products specified herein and shall have successfully completed projects of similar scope and type.

.2 Qualified journeymen who have a "Tradesman Qualification Certificate of Proficiency" shall be engaged in painting work. Apprentices may be employed provided they work under the direct supervision of a qualified journeyman in accordance with trade regulations.

.3 Conform to latest MPI requirements for interior painting work including preparation and priming.

.4 Materials primers, paints, fillers, thinners, solvents, etc. shall be in accordance with MPI Painting Specification Manual "Approved Product" listing and shall be from a single manufacturer for each system used.

.5 Other paint materials such as linseed oil, shellac, turpentine, etc. shall be the highest quality product of an approved manufacturer listed in MPI Painting Specification Manual and shall be compatible with other coating materials as required.

.6 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements when requested by Consultant.

.7 Standard of Acceptance:

.1 Walls: No defects visible from a distance of 1000 mm at 90 degrees to surface.

.2 Ceilings: No defects visible from floor at 45degrees to surface when viewed using final lighting source.

.3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

1.4 Environmental Performance Requirements

.1 Provide paint products meeting MPI "Environmentally Friendly" ratings based on VOC (EPA Method 24) content levels.

1.5 Scheduling of Work

1 Submit work schedule for various stages of painting to Consultant for approval. Submit schedule minimum of 48 hours in advance of proposed operations.

.2 Obtain written authorization from Consultant for any changes in work schedule.

.3 Schedule painting operations to prevent disruption of occupants in and about the building.

1.7 Quality Control

.1 When requested by Consultant prepare and paint designated surface, area, room or item in each colour scheme to requirements specified herein, with specified paint or coating showing selected colours, gloss/sheen, textures and workmanship to MPI Painting Specification Manual standards for review and approval. When approved, surface, area, room and/or items shall become acceptable standard of finish quality and workmanship for similar on-site work.

1.8 Delivery, Handling and Storage

.1 Deliver, store and handle materials in accordance with Section 01 60 00 - Basic Product Requirements.

.2 Labels shall clearly indicate:

.1 Manufacturer's name and address.

.2 Type of paint or coating.

.3 Compliance with applicable standard.

.4 Colour number in accordance with established colour schedule.

.3 Remove damaged, opened and rejected materials from site.

.4 Provide and maintain dry, temperature controlled, secure storage.

.5 Observe manufacturer's recommendations for storage and handling.

.6 Store materials and supplies away from heat generating devices.

.7 Store materials and equipment in a well ventilated area with temperature range 7C to 30C.

.8 Store temperature sensitive products above minimum temperature as recommended by manufacturer.

.9 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Consultant. After completion of operations, return areas to clean condition to approval of Consultant.

.10 Remove paint materials from storage only in quantities required for same day use.

.11 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.

.12 Fire Safety Requirements:

.1 Provide one 9 kg Type ABC dry chemical fire extinguisher adjacent to storage area.

.2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

.3 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

1.9 Site Requirements

.1 Heating, Ventilation and Lighting:

.1 Ventilate enclosed spaces

.2 Perform no painting work unless adequate and continuous ventilation and sufficient heating facilities are in place to maintain ambient air and substrate temperatures above 10 C for 24 hours before, during and after paint application until paint has cured sufficiently.

.3 Where required, provide continuous ventilation for seven days after completion of application of paint.

.4 Coordinate use of existing ventilation system with Contractor and ensure its operation during and after application of paint as required.

.5 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.

.6 Perform no painting work unless a minimum lighting level of 323 Lux is provided on surfaces to be painted. Adequate lighting facilities shall be provided by General Contractor.

.2 Temperature, Humidity and Substrate Moisture Content Levels:

.1 Unless specifically pre-approved by the specifying body, Paint Inspection Agency and the applied product manufacturer, perform no painting work when:

.1 Ambient air and substrate temperatures are below 10 C.

.2 Substrate temperature is over 32 C unless paint is specifically formulated for application at high temperatures.

.3 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's prescribed limits.

.4 The relative humidity is above 85% or when the dew point is less than 3 C variance between the air/surface temperature.

.5 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.

.2 Perform no painting work when the maximum moisture content of the substrate exceeds:

.1 12% for concrete and masonry (clay and concrete brick/block).

.2 15% for wood.

.3 12% for plaster and gypsum board.

.3 Conduct moisture tests using a properly calibrated electronic Moisture Meter, except test concrete floors for moisture using a simple "cover patch test".

.4 Test concrete, masonry and plaster surfaces for alkalinity as required.

.3 Surface and Environmental Conditions:

.1 Apply paint finish only in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.

.2 Apply paint only to adequately prepared surfaces and to surfaces within moisture limits noted herein.

.3 Apply paint only when previous coat of paint is dry or adequately cured.

.4 Additional Interior Application Requirements:

.1 Apply paint finishes only when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.

.2 Apply paint in occupied facilities during silent hours only. Schedule operations to approval of Owner such that painted surfaces will have dried and cured sufficiently before occupants are affected

1.10 Extra Materials

1 Submit maintenance materials in accordance with Section 01 78 00 – Closeout Submittals.

.2 Submit – (one) four litre can of each type and colour of primer, stain, and finish coating. Identify colour and paint type in relation to established colour schedule and finish system.

.3 Deliver to Contractor and store where directed.

PART 2 - PRODUCTS

2.1 Materials

.1 Paint and fillers shall be manufacture's premium quality, of type and brand herein specified and listed under "Paint Product Recommendations" premium grade as covered in the association manual, latest edition, for specific uses and only as supplied by **Pratt & Lambert Co., Benjamin Moore & Co., Para Paints Canada Inc., ICI Paints (Canada) Inc, (Glidden), Sherwin Williams Canada Inc., Pittsbugh Paints**. Paint material such as linseed oil, shellac, turpentine and the like, and any of the materials not specifically mentioned herein but required for first class work with finish specified shall be highest quality product of approved manufacturer. Where specific products are indicated in painting schedule, use product manufacturer as specified.

.2 Paint materials for paint systems shall be products of a single manufacturer.

.3 Only qualified products with "Environmentally Friendly" rating are acceptable for use on this project.

.4 Water-borne surface coatings must be manufactured and transported in a manner that steps of process, including disposal of waste products arising therefrom, will meet requirements of applicable governmental acts, by-laws and regulations including, for facilities located in Canada, Fisheries Act and Canadian Environmental Protection Act (CEPA).

.5 Water-borne surface coatings must not be formulated or manufactured with aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavelant chromium or their compounds.

.6 Water-borne surface coatings and recycled water-borne surface coatings must have a flash point of 61.0 C or greater.

.7 Both water-borne surface coatings and recycled water-borne surface coatings must be made by a process that does not release:

.1 Matter in undiluted production plant effluent generating a 'Biochemical Oxygen Demand' (BOD) in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.

.2 Total Suspended Solids (TSS) in undiluted production plant effluent in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.

.8 Water-borne paints and stains, recycled water-borne surface coatings and water borne varnishes must meet a minimum "Environmentally Friendly" rating.

.9 Recycled water-borne surface coatings must contain 50 % post-consumer material by volume.

.10 Recycled water-borne surface coatings must not contain:

.1 Lead in excess of 600.0 ppm weight/weight total solids.

.2 Mercury in excess of 50.0 ppm weight/weight total product.

.3 Cadmium in excess of 1.0 ppm weight/weight total product.

.4 Hexavelant chromium in excess of 3.0 ppm weight/weight total product.

.5 Organochlorines or polychlorinated biphenyls (PCBS) in excess of 1.0 ppm weight/weight total product.

.11 The following must be performed on each batch of consolidated post-consumer material before surface coating is reformulated and canned. These tests must be performed at a laboratory or facility which has been accredited by the Standards Council of Canada.

.1 Lead, cadmium and chromium are to be determined using ICP-AES (Inductively Coupled Plasma - Atomic Emission Spectroscopy) technique no. 6010 as defined in EPA SW-846.

.2 Mercury is to be determined by Cold Vapour Atomic Absorption Spectroscopy using Technique no. 7471 as defined in EPA SW-846.

.3 Organochlorines and PCBs are to be determined by Gas Chromatography using Technique no. 8081 as defined in EPA SW-846.

2.2 Finishes and Colours

.1 Generally and unless otherwise specified herein or noted on Finish Schedules the quantity of colors and finishes shall be based on the following criteria. Consultant will provide Colour Schedule after Contract award.

.2 Interior Colours will be based upon the selection of three (3) base colours and three (3) accent colours. No more than six colours will be selected for the entire project and no more than three colours will be selected in each area. Include for 25% dark tones.

.3 Exterior colors will be based on two (2) base colors and two (2) accent colors with a maximum of two (2) deep or bright colors. No more than four (4) colors will be selected for the entire project. Note that this does not include pre-finished items by others, e.g. flashings, aluminum or vinyl windows, aluminum doors, etc

.4 Selection of colours will be from manufacturers full range of colours.

.5 Where specific products are available in a restricted range of colours, selection will be based on the limited range.

.6 Second coat in a three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 Mixing and Tinting

1 Perform colour tinting operations prior to delivery of paint to site. On-site tinting of painting materials is allowed only with Consultant's written permission.

.2 Paste, powder or catalyzed paint mixes shall be mixed in strict accordance with manufacturer's written instructions.

.3 Where thinner is used, addition shall not exceed paint manufacturer's recommendations. Do not use kerosene or any such organic solvents to thin water-based paints.

.4 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 Gloss/Sheen Ratings

.1 Paint gloss shall be defined as the sheen rating of applied paint, in accordance with the following values:

Gloss Level	Description	Units @ 60 degrees	Units @ 85 degrees
G1	Matte of Flat finish	0 to 5	10 max
G2	Velvet Finish	0 to10	10 to 35
G3	Eggshell Finish	10 to 25	10 to 35
G4	Satin Finish	20 to 35	35 min
G5	Semi-Gloss Finish	35 to 70	
G6	Gloss Finish	70 to 85	
G7	High Gloss Finish	➢ 85	

.2 Gloss level ratings of painted surfaces shall be as specified herein and as noted on Finish Schedule

2.5 Interior Painting Systems

.1 Plaster and Drywall: Int 9.2A Latex (G3) finish over latex sealer

.2 Plaster and Gypsum Board Ceilings: Int 9.2A Latex (G1) finish over latex sealer

.3 Wood trim: Int 6.4A (G5) finish over alkyd sealer.

.4 Concrete Unit Masonry: Int 4.2J Epoxy Modified Latex (G3) finish over latex primer.

.5 Structural steel & metal fabrications: Int 5.1E (G5) finish.

.6 Galvanized metal/zinc coated steel: Int 5.3L (G5) finish

.7 Use fire retardant paint on fire rated plywood sheets behind electrical panels.

All Finishing System Codes are from the Ontario Painting Contractors Association.

PART 3 - EXECUTION

3.1 General

.1 Perform preparation and operations for interior painting in accordance with MPI Painting Specifications Manual except where specified otherwise.

.2 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.2 Existing Conditions

1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Consultant damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.

.2 Conduct moisture testing of surfaces to be painted using a properly calibrated electronic moisture meter, except test concrete floors for moisture using a simple "cover patch test" and report findings to Consultant. Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

.3 Maximum moisture content as follows:

.1 Stucco, Plaster and Gypsum Board: 12%.

.2 Concrete: 12%.

.3 Clay and Concrete Block/Brick: 12%.

.4 Wood: 15%.

3.3 Protection

.1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore such surfaces as directed by Consultant.

.2 Protect items that are permanently attached such as Fire Labels on doors and frames.

.3 Protect factory finished products and equipment.

.4 Protect passing pedestrians, building occupants and general public in and about the building.

.5 Removal of electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings shall be done prior to undertaking any painting operations by General Contractor. Items shall be securely stored and re-installed after painting is completed by General Contractor.

.6 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.

.7 As painting operations progress, place "WET PAINT" signs in occupied areas to approval of Consultant

3.4 Cleaning and Preparation

.1 Clean and prepare surfaces in accordance with MPI Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:

.1 Remove dust, dirt, and other surface debris by vacuuming, wiping with dry, clean cloths or compressed air.

.2 Wash surfaces with a biodegradable detergent and bleach where applicable and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.

.3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.

.4 Allow surfaces to drain completely and allow to dry thoroughly.

.5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.

.6 Use trigger operated spray nozzles for water hoses.

.7 Many water-based paints cannot be removed with water once dried. However, minimize the use of kerosene or any such organic solvents to clean up water-based paints.

.2 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.

.3 Where possible, prime surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.

.1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.

.2 Apply wood filler to nail holes and cracks.

.3 Tint filler to match stains for stained woodwork.

.4 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.

.5 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted by brushing with clean brushes, blowing with clean dry compressed air, or vacuum cleaning.

.6 Touch up of shop primers with primer as specified in applicable section. Major touch-up including cleaning and painting of field connections, welds, rivets, nuts, washers, bolts, and damaged or defective paint and rusted areas, shall be by supplier of fabricated material.

.7 Do not apply paint until prepared surfaces have been accepted by Consultant.

3.5 Application

1 Method of application to be as approved by Consultant. Apply paint by brush or roller. Conform to manufacturer's application instructions unless specified otherwise.

.2 Brush and Roller Application:

.1 Apply paint in a uniform layer using brush and/or roller of types suitable for application.

.2 Work paint into cracks, crevices and corners.

.3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.

.4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces shall be free of roller tracking and heavy stipple unless approved by Consultant

.5 Remove runs, sags and brush marks from finished work and repaint.

.3 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access and only when specifically authorized by Consultant.

.4 Apply coats of paint as a continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.5 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.6 Sand and dust between coats to remove visible defects.

.7 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges and behind wall mounted items.

3.6 Mechanical/Electrical Equipment

.1 Unless otherwise specified, paint finished area exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as noted otherwise.

.2 Boiler room, mechanical and electrical rooms: paint exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment.

.3 Other unfinished areas: leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.

.4 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

.5 Do not paint over nameplates.

.6 Keep sprinkler heads free of paint.

.7 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.

.8 Paint fire protection piping red, if required.

.9 Paint disconnect switches for fire alarm system and exit light systems in red enamel.

.10 Paint natural gas piping yellow.

.11 Paint both sides and edges of backboards for telephone and electrical equipment before installation. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

.12 Do not paint interior transformers and substation equipment.

3.7 Field Quality Control

.1 Advise Consultant when surfaces and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.

3.8 Restoration

.1 Clean and re-install all hardware items removed before undertaking painting operations.

.2 Remove protective coverings and warning signs as soon as practical after operations cease.

.3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.

.4 Protect freshly completed surfaces from paint droppings and dust to approval of Consultant. Avoid scuffing newly applied paint.

.5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Consultant.

END OF SECTION

PART 1 - GENERAL

1.1 References

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-11.3-[M87], Hardboard.

.2 CGSB 41-GP-30M-[82], Wall coverings, Vinyl-Coated Fabrics.

.2 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102-[M88], Surface Burning Characteristics of Building Materials and Assemblies.

1.2 Submittals

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

1.3 Regulatory Requirements

.1 Surface burning characteristics of materials: listed and labeled by an organization accredited by Standards Council of Canada.

PART 2 - PRODUCTS

2.1 Materials

.1 Whiteboards (WB) to be e3 environmental ceramicsteel magnetic porcelain whiteboard writing surface. Sizes: 1200mm H x 2400mm L unless noted otherwise on drawings.

.2 Bulletin Boards (BB) to be a homogeneous tackable surface material made of primary natural materials consisting of linseed oil, cork, rosin binders and dry pigments mixed and calendared onto a natural jute backing. The uni-color extends throughout the thickness of the material. Acceptable material: Krommenie bulletin board as manufactured by Forbo.

.3 Accessories

.1 Edge Trim: 300 Series Futura heavy duty aluminum trim

.2 Extruded aluminum chalktray

.3 Mounting adhesive: to manufacturer's recommendation.

.4 Approved suppliers:

.1 ASI Visual Display Products

.2 Global School Products

2.2 Fabrication

.1 Fabricate bulletin board panels to sizes indicated on architectural drawings

.2 Bulletin boards to be factory laminated to minimum ¼” thick mdf substrate.

2.3 Schedule

.1 As indicated in the drawings.

PART 3 - EXECUTION

3.1 Installation

.1 Install whiteboards in accordance with manufacturer's instructions, parallel to floor with uniform vertical surface, plumb and level, to provide rigid, secure surface.

3.2 Cleaning

.1 Clean surfaces after installation using manufacturer's recommended cleaning procedures.

END OF SECTION

PART 1. GENERAL

1.1 SUMMARY

.1 This section includes toilet and bath accessories in accordance with the Contract Documents. The Work of this Section shall include but not be limited to the following:

1. Surface, partition and recessed mounted toilet and bath accessories indicated on the Drawings and Schedules.

1.2 SUBMITTALS

.1 Comply with requirements of Section regarding submittals.

.2 Provide required number copies of:

.1 Product data sheets.

.2 Installation instructions.

.3 Service and parts manual

1.3 WORK INCLUDED

.1 Toilet Room Accessories

1.4 REFERENCES (INCLUDING BUT NOT LIMITED TO)

.1 Ontario Building Code (latest edition)

1.5 QUALITY ASSURANCE

.1 Model numbers for toilet room accessories manufactured by Bobrick Washroom Equipment Inc, are listed to establish a standard of quality for design, function, materials, workmanship, and appearance. The following manufacturers may be submitted for evaluation by the architect by following the conditions of the Alternatives Section 01 25 00. The architect shall be the sole judge as to the acceptability of all products submitted for substitution.

.1 Frost

.2 American Specialties, Inc.

.3 Bradley

.2 Accessories with tumbler locks shall be keyed alike with the exception of coin boxes in vending equipment.

.3 Regulatory Requirements

.1 Operation of accessories shall comply with guidelines set forth by the Ontario Building Code. Documentation and samples to be provided to architect upon request.

.4 Samples

.1 Upon request submit one sample of each item specified. If more than one manufacturer is specified, submit one sample of each item for architect's review.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

.1 Deliver items in manufacturer's original unopened protective packaging.

.2 Store materials in original protective packaging to prevent physical damage or wetting.

.3 Handle so as to prevent damage to accessories.

1.7 WARRANTY

.1 Furnish one year guarantee against defects in material and workmanship on all accessories.

.2 In addition to the above the following shall apply:

.1 Welded stainless steel framed mirrors shall have a fifteen year guarantee against silver spoilage.

PART 2 - PRODUCTS

2.1 TOILET ROOM ACCESSORIES SCHEDULE

.1 Provide the following toilet and bath accessories in the locations indicated on the drawings/schedules:

Type	Model/Series	Description
W1	941-1830	18”x30” Tilted Mirror, stainless steel frame, 1 per toilet room
W2	N/A	Soap Dispenser: Owner supplied, Contractor installed
W3	N/A	Paper Towel Dispenser: Owner supplied, Contractor installed
W4a	1001-NP	24” straight grab bar, concealed mounting snap flange, 1 per accessible toilet room
W4b	1003-NP 30x30	30”x30” 90-degree grab bar, concealed mounting snap flange, 1 per accessible toilet
W6	N/A	Toilet Paper Dispenser: Owner supplied, Contractor installed
W7	Frost 1150	Surface mounted coat cook, 2 per toilet room
W8	Global SS Medical Cabinet	Stainless Steel medical cabinet w/double key locks, 14”x3”x17”

PART 3 - EXECUTION

3.1 INSPECTION

.1 Check wall open for dimensions, plumbness of blocking or frames that would affect installation of recessed accessories. For surface mounted accessories check condition of wall and confirm installation of backing within wall.

.2 Verify spacing of plumbing fixtures and toilet compartments that affect installation of toilet room accessories.

3.2 INSTALLATION

.1 Install accessories at locations and heights indicated, straight, plumb and level and in accordance with manufacturer's installation instructions.

.2 Install items with non-corrosive anchoring devices.

.3 Installation methods shall conform to manufacturer's recommendations for backing and proper support.

.4 Conceal evidence of drilling, cutting, and fitting to room finish.

.5 Fit flanges of accessories snugly to wall surfaces.

3.3 ADJUSTMENT AND CLEANING

.1 Upon completion of the work, or when directed, remove all traces of protective coatings or paper.

.2 Adjust accessories for proper operation. Test mechanisms, hinges, locks and latches and where necessary adjust and lubricate.

.3 Clean and polish exposed surfaces prior to final installation.

.4 Deliver accessories schedule, keys, and parts manual as part of project closeout documents. For owner's permanent records, provide two sets of the following items of manufacturer's literature:

.1 Technical data sheets of each item used for the project.

.2 Service and parts manuals.

.3 Name of local representative to be contacted in the event of need of field service or consultation.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS:

.1 The conditions of the Contract Division 1 apply to this section in full, as if repeated herein.

.2 All depths of materials indicated on the drawings and in these specifications refer to minimum required depth of materials, after compacting.

1.2 SCOPE OF WORK:

.1 Excavation, backfill and site grading for this Work includes but is not necessarily limited to the following:

1. Stripping and disposal off-site of native topsoil that is surplus or has been indicated by the Consultant to be undesirable.

.2 All required excavation.

.3 Stockpiling and reuse of on-site fill material approved by the Consultant.

.4 Disposal off-site of cut material that is surplus or has been indicated by the Consultant to be undesirable.

.5 Supplying imported topsoil and granular materials as well as trucking them to the site.

.6 Filling, backfilling and compacting granular materials, amended native topsoil or imported topsoil to attain indicated final grades.

1.3 SOURCE OF FILL:

.1 The Consultant must approve the soils and granular materials for use. If testing is required, it is to be paid for by the Contractor.

1.4 DISPOSAL OF EXCAVATED MATERIALS:

.1 All excavated sub-grade material generated by construction, may be used as fill on-site unless otherwise rejected by the Consultant, in which case it is to be disposed of legally off-site at a location determined and paid for by the Contractor.

.2 All surplus sub-grade material generated by construction and not required to attain indicated final grades is to be disposed of legally off-site at a location determined and paid for by the Contractor.

.3 Refer to Geotechnical Report for results of toxicity characteristic leaching procedure analysis. Any additional required testing of excavated material to be disposed of off-site shall be arranged and paid for by the Contractor.

1.5 INSPECTIONS AND TESTING:

.1 The Contractor shall engage a third party testing and inspections consultant satisfactory to the Owner for the testing/inspections outlined below. Cost for testing/inspections consultant shall be paid for from the project cash allowance.

.2 The Contractor shall provide washed sieve gradation analysis for all aggregates and granular materials to be used in accordance with MTO Laboratory Testing Manual Section LS-602 and related standards.

.3 The Contractor shall carry out field inspections and compaction testing of all compacted sub-grade and base materials in accordance with MTO Laboratory Testing Manual Section LS-623 and related standards.

.4 The Contractor shall maintain a record showing the location and result of inspections and testing conducted. These records shall be submitted to the Consultant when requested, or prior to proceeding with work that depends upon the work of this Section.

PART 2 - PRODUCTS

2.01 SOIL, GRANULAR & BACKFILL MATERIALS:

.1 Granular 'A' and 'B': All structural backfill material shall be manufactured granular crushed from limestone rock, described as Granular 'A' and Granular 'B', conforming to the requirements of Ontario Provincial Standard Specification OPSS 1010, "Material Specifications for Aggregates - Granular A, B, M and Select Subgrade Material". **Reclaimed concrete material (RCM) is <u>not</u> acceptable.**

.2 19mm (or 20mm) crushed stone ("crusher run") shall be clean, durable, angular crushed gravel or stone conforming to the following limits:

Sieve Designation	% Passing
19.0mm	100%
4.75mm	40-80%
2.36mm	27-65%
600µm	12-35%

.3 19mm (or 20mm) clear stone shall be clean, durable, angular crushed gravel or stone conforming to the following limits:

Sieve Designation	% Passing
19.0mm	100%
4.75mm	2%

.4 Fill Material: Selected material from excavation or other sources, approved by the Consultant for use intended, unfrozen and free from rocks larger than 75mm, cinders, ashes, sods, refuse, contaminants or other deleterious materials.

2.02 OTHER MATERIALS:

.1 All other materials not specifically described but required for a complete and proper installation, shall be selected by the Contractor, subject to the review of the Consultant.

PART 3 - EXECUTION

3.01 REMOVAL OF TOPSOIL:

.1 Remove all topsoil from areas to be excavated or regraded. Strip topsoil when it is dry enough to prevent contamination with sub-grade material.

.2 Do not handle topsoil in wet or frozen condition.

.3 Stockpile any available topsoil on-site where directed. Piles shall not exceed 2000mm in height.

3.02 EXCAVATION:

.1 Provide, install and maintain adequate fences and barricades.

.2 Excavate to lines, grades, elevations and dimensions indicated on the Drawings.

.3 Remove concrete, masonry, rubble and other obstructions encountered during excavation and dispose of legally off-site.

.4 Excavation required within proximity of underground utility lines or within the dripline of trees designated to remain are to be made by hand.

.5 Excavation must not interfere with normal 45° plane of bearing from the bottom of any footing.

.6 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic material.

3.03 DEWATERING:

.1 Keep excavations free of water while Work is in progress.

.2 Avoid excavation below groundwater table if quick condition or heave is likely to occur. Prevent piping or bottom heave of excavations by groundwater lowering, or other means.

.3 Protect open excavations against flooding and damage due to surface run-off.

.4 Dispose of accumulated water in a manner not detrimental to public and private property, or any portion of Work completed or under construction.

.5 Provide flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers.

3.04 OVER-EXCAVATION:

.1 Where excavations are made below the indicated intended elevations, backfill with lean concrete, unshrinkable fill, crushed stone or granular material as directed by the Consultant. Compact to provide a firm, unyielding sub-grade at no additional cost to the Owner.

3.05 BACKFILL:

.1 Do not place, spread or compact any backfill materials during unfavourable weather. Unfavourable weather includes temperatures below 0°C and/or precipitation.

.2 Do not commence any backfill operation without adequate compaction equipment.

.3 Protect the site of the backfilling and storage of backfill materials from freezing.

.4 Prior to placing backfill, scarify the sub-grade surface to a depth of 50mm.

3.06 COMPACTION:

.1 All layers of backfill material shall be compacted to not less than the minimum density specified. The Contractor is not to proceed until approval of compaction has been granted.

.1 Refer to Pavement Design section of Geotechnical report and City of Toronto Pavement Structural Design Guidelines for specific compaction requirements.

3.07 STORAGE AND STOCKPILING OF MATERIALS:

.1 Stockpiled and imported materials to be stored away from existing trees, drainage areas and access points.

3.08 SITE GRADING:

.1 Perform all rough and finish grading and backfilling required to achieve the finished elevations indicated on the Drawings.

.2 Ensure that the finished ground slopes are as indicated on the Drawings.

.3 Regrade all areas that retain or pond water.

.4 All areas shall be rough graded within a tolerance of plus or minus 50mm.

END OF SECTION

PART 1 – GENERAL

1.1 General Instructions

.1 Read and be governed by Conditions of the Contract and Sections of Division 1.

1.3 Quality Assurance

.1 Subcontractors qualifications:

.1 Paving Work shall be done only by skilled Workers, with suitable machinery, supervised by foremen experienced in type of Work specified.

.2 Execute the Work of this Section by a Subcontractors who has equipment adequate for Project, and skilled Workers so that Work is performed expeditiously; and is known to have been responsible for satisfactory installations similar to that specified.

.3 Materials and mixes that vary to a minor degree from those specified in this Section will be acceptable if they are based on standards of the engineering department of a jurisdiction having authority at the location of the Project and which are approved.

.2 Perform Work on public property in accordance with design and material requirements of applicable local authorities which are imposed in addition to requirements specified in this Section.

.3 Comply with requirements of Ontario Provincial Standard Specifications (OPSS) 310 and 1150.

1.4 Delivery, Storage and Handling

.1 Commence placing and perform compaction of granular base courses only when subgrade temperature is at least 2°C and rising.

.2 Commence laying of asphalt binder courses only when base surfaces are at least 2°C, and the temperature is rising.

.3 Commence laying of asphalt surface courses only when binder course surfaces are completely dry, at least 7°C and the temperature rising.

.4 Suspend paving operations if temperature drops below specified minimums.

1.5 Submittals

.1 A copy of the batch ticket from the asphalt plant shall be supplied certifying that aggregate and asphalt meet specifications and record the weight of each load.

1.6 Warranty

.1 Provide a labour, material and Workmanship warranty against defects such as ponding, cracking in surfaces, excess settlement areas, for a period of two (2) years.

PART 2 – PRODUCTS

2.1 Granular Base and Sub Base

.1 As per Specification 31 23 00

2.2 Asphaltic Material

.1 Asphaltic Material HL3A as conforming to the requirements of Ontario Provincial Standard Specification OPSS 1150.

2.3 Pavement Composition

Pavement Layer	Minimum Thickness	Compaction Requirements
Surface	40 mm SP9.5 (HL-3 Fine)	OPSS 310 (TS -310)
Binder	135 mm SP19.0 D (HL-8)	OPSS 310 (TS-310)
Granular Base	150 mm Granular A (TS 1010)	100% SPMDD (ASTM D-698)
Granular Subbase	150 mm Granular B Type II (TS 1010)	100% SPMDD (ASTM D-698)
Total	475mm	

PART 3 – EXECUTION

3.01 INSTALLATION:

.1 All work shall conform to OPSS and Details.

.2 The Contractor is to ensure that the sub-grade has been approved by the Consultant prior to placing granular materials.

.3 Lay granular base parallel to the final grade and compact to 98% Standard Proctor Density. Ensure there are no dips or uneven slopes. Ensure all areas are sloped to drain. Granular base to extend 150mm beyond edge of asphalt.

.4 All asphalt edges not contained by hard edges shall have uniform lines with a hand tamped 45° angle. All pathway edges shall have a “smooth”, curvilinear appearance. The Consultant reserves the right to request that sections of pathway be reworked to achieve the desired appearance.

.5 Exercise care to prevent contamination of materials.

3.02 MAINTENANCE:

.1 Maintain all asphalt up until the date of acceptance by the Owner.

.2 Maintenance shall include all repair work necessary to keep asphalt paving at required grades and to keep surface clean and intact until final acceptance.

.3 The Contractor shall keep all pathways clean and clear of any mud tracks or other debris both on and off the site.

3.03 Field Quality Control

.1 An inspection and testing company will be selected to verify that compaction of granular base courses conform to specified requirements.

.2 Payment for inspection and testing will be by cash allowance.

3.04 Adjustment and Cleaning

.1 Replace defective asphalt pavements with patches cut into pavement, in rectangular areas, and with joints made as specified.

END OF SECTION

1. GENERAL

1.1 General

1. This Specification Section forms part of Contract Documents and is to be read, interpreted and coordinated with other parts.

2. General Conditions, Supplements, Amendments and this section shall govern plumbing sections (i.e. 22 00 00 to 22 99 99 sections) of work (read in conjunction with the Instructions to Tenderers or Bidders). This section covers items common to 22 00 00 series sections and is intended only to supplement the requirements of Division 1.

3. Plumbing drawings are diagrammatic and approximately to scale. They establish scope of plumbing work and general location and orientation of plumbing facilities. Plumbing facilities shall be installed generally in locations and generally along routings shown, close to building structure with minimum interference with services. Piping shall be concealed within walls, ceilings or other spaces and shall be routed to maximize head room and intended use of space through which they pass, unless specifically noted otherwise.

1.2 Related Work

1. Electrical Division 26
2. HVAC Division 23
3. Controls Division 15

1.3 Codes, Standards and Approvals

1. Installation, workmanship and testing shall conform to the following standards:
    1. The Ontario Building Code 2012.
    2. Canadian Gas Association, CGA B149.1-M10, Natural Gas and Propane Installation Code.
    3. CAN/CSA Standard Z305.1-92 “Non-flammable Medical Gas Piping Systems”

1.4 Shop Drawings

1. Shop drawings are required for all materials and equipment including, but not limited to, the following:
    1. Cleanouts and access panels.
    2. Floor drains.
    3. Hot heaters.
    4. Hydrants/hose bibbs.
    5. Valves.

6. Water hammer arrestors.
7. Fire stopping.

1.5 Maintenance Data

1. Refer to Section 23 05 00 Common Work Results for HVAC.

2. Comprehensive description of operation of systems, including function of each item of equipment within systems.

3. Operating electrical switchgear schedule indicating location of equipment.

4. Lubrication schedule indicating recommended lubricants and grades (grease or oil) for lubricated equipment components.

1.6 Record Drawings (As Built Drawings)

1. Section 23 05 00 Common Work Results for HVAC shall apply to Plumbing Systems.

2. In addition, as a minimum, during the construction period, keep on site clean set of drawing marked up, IN COLOUR, to reflect as built state, for examination by Consultant on regular basis. Include elevations, rough-in details and details and detailed locations of hidden services, including locations of maintenance items and their associated identification code (i.e. Values). Underground services and/or concealed piping shall be dimensionally located and noted (use gridlines or structure as the reference).

3. At the time of 'Substantial Performance' submit to Consultant one complete full sized COLOUR photocopy of Record Drawing information produced as per above section.

1.7 Temporary Usage of Plumbing Equipment

1. Plumbing equipment and systems shall not be used without written permission of Consultant and under no circumstances shall be used prior to testing and inspection.

1.8 Building Operation during Construction

1. To minimize operational difficulties for building's staff, Contractor shall cooperate with Owner throughout entire construction period and particularly ensure that noise and service disruptions are minimized.

2. Convenient access for staff and public to building must be maintained. Minor inconveniences and interruption of services will be tolerated, provided advance notice is given, but Contractor shall coordinate his work with Owner.

2. PRODUCTS

2.1 Hangers and Supports

1. Refer to Section 22 05 29 for Hangers and Supports for Plumbing Piping and Equipment.

2.3 Pipe Sleeves and Escutcheons

1. Provide and locate pipe and duct sleeves.

2. Provide detailed information on openings required in pre-cast members for mechanical work. Cast holes larger than 100 mm diameter and field cut holes smaller than 90 mm diameter.

3. Provide separate sleeves for piping passing through walls, floors, roof and ceilings. Sleeves shall be 1.00 mm galvanized iron and standard weight steel piping sleeves in concrete beams, foundation walls and footings. Plastic sleeves may be used in concrete wall form work where permitted by Authorities having Jurisdiction.

4. Sleeves shall be sized large enough to allow for movement due to expansion and to provide for continuous pipe insulation where not passing through fire rated assemblies.

5. Sleeves passing through basement walls or potentially wet floors shall be set with integral "puddle flanges".

6. Provide link seal wall gasket to seal exposed sides of opening between pipe and sleeve on foundation walls with caulking fill. Provide water proofing mastic seal on concealed side of opening.

7. For finished floor areas, provide pipe sleeves 25 mm above floor with annular fin.

8. Install chrome-plated escutcheons with set screws where insulated or uninsulated piping passes through finished floor, ceiling and wall surfaces. Copper piping shall not be in contact with ferrous metals. Use cast- iron or galvanized sheet metal escutcheons for equipment rooms.

9. Coordinate installation of concrete curbs around duct openings in mechanical room floors with General Contractor.

10. Provide plastic grommets, equivalent to Pipe Tytes or Greenlee 712-M, for pipes passing through metal stud partitions.

3. EXECUTION

3.1 Pressure Piping Installation

1. General

1. Install piping straight, parallel and close to walls and ceilings, with fall of not less than 1:50 for gravity piping and with slope to drain cocks, fixtures or equipment for pressure piping, unless otherwise indicated on drawings. Use standard fittings for direction changes. Provide drain cocks as required.

2. Install groups of piping parallel to each other, spaced to permit application of insulation, identification and service areas, on trapeze hangers.

3. Where pipe size differs from connection size to equipment, install reducing fitting close to equipment. Reducing bushings are not permitted.

4. Brass and copper pipe and tubing shall be free from surface damage. Replace damaged pipe or tubing.

5. Ream ends of pipe and tubes before installation.

6. Install copper pipe to not contact with dissimilar metal and not be crimped or collapsed. Joints on cast or ductile iron pressure service piping shall be made electrically conductive.

7. Install flanges or unions and shut-off valves to permit removal of equipment without disturbing piping systems.

8. Clean ends of pipes or tubing and recesses of fittings to be jointed. Assemble joints without binding.

9. Install piping to connections at fixtures, equipment, outlets and other appurtenances requiring service. Trap and vent waste connections to fixtures. Grade all vents to drain back to waste piping.

10. Plug or cap pipe and fittings to keep out debris during construction.

11. Joint material shall be compatible with type of pipe used.

12. Non-corrosive lubricant or teflon tape shall be applied on male thread of threaded joints.

13. Flush and clean out piping systems after testing.

2. Equipment Drainage:

1. Install drain valves at low points.
2. Extend equipment drain piping to discharge into floor or hub drain.

3. Expansion and Contraction and Building Seismic Joints:

    1. Support piping to prevent stress or strain.
    2. Install pressure piping with loops and offsets to permit expansion and contraction without damaging pressure piping system.

4. Buried Piping:

    1. Lay pipe on compacted bedding of clean, coarse sand, free from clay, snow or ice, organic matter or stones.
    2. Do not lay pipe in water or when conditions are unsuitable.

3.2 Hangers and Supports

1. Refer to section 22 05 29 for Hangers and Supports for Plumbing Piping and Equipment.

3.3 Pipe Sleeves and Escutcheons

1. Install chrome-plated escutcheon plate on exposed piping passing through walls, floors and ceilings in finished areas.

2. Sleeves shall be concentric with pipe and, except at fire separations, shall be sized to allow for the continuity of insulation.

3. Extend sleeves 50 mm above floor slabs in wet areas. Wet areas include equipment rooms, janitor's rooms, kitchen areas, utility rooms, bath areas and washrooms.

4. Extend sleeves through outside walls to 25 mm beyond the exterior face and caulk with flexible caulking compound.

5. Remove removable plastic sleeves are used prior to pipe penetration and sleeve the resulting hole.

6. Extra high vertical risers for cold water and hot water systems with many horizontal branch takeoffs passing through sleeves set in rigid structure adjacent to main risers, set sleeves to accommodate long term structural movement to avoid imposing stress on these systems.
7. Provide fire stopping at all plumbing pipe penetrations through floors, fire rated walls and partitions and as required to suite field requirements. Refer to Section 23 05 00 and Section 23 07 19.

3.4 Core Drilling and Cutting

1. Arrange and pay for cost of core drilling and cutting for plumbing systems.

2. Verify location of existing service runs and structural reinforcement within existing concrete floors and walls prior to core drilling and cutting. Coring and cutting of structural building components shall only take place upon specific written approval of Structural Engineer. Provide repairs to existing services damaged as result of core drilling.

3. Penetrations up to 150 mm nominal pipe size in precast concrete may be cored on site by plumber. Locate larger penetrations and arrange to have pre-cored with pre-cast Manufacturer prior to shipping to construction site.

3.5 Piping Expansion

1. Install piping systems, including all take-offs, so that the piping and connected equipment will not be distorted by expansion, contraction or settling.

2. Install anchors where necessary to control expansion. Install expansion joints or loops on hot water piping where required.

3.6 Testing and Inspection

1. Refer to Section 22 05 93 – Testing, Adjusting and Balancing for Plumbing.

2. Furnish labour, materials, instruments, etc. necessary for required tests. Work shall be inspected by local plumbing inspector and review by Consultant.

3. Correct leaks by remaking joints. Retest systems until no leaks are observed.

4. Do not cover any plumbing system before being inspected and approved by Plumbing Inspector.

5. If plumbing system or part thereof is covered before being inspected or approved, Contractor will uncover system upon the direction of the Plumbing Inspector or Consultant.

3.7 Substantial Performance Requirements

1. The following items must be completed, with documentation, prior to the date of Substantial Performance:

    1. All pipe expansion compensators and flexible connections checked by Supplier with an inspection report submitted to the Commissioning Agent and this Consultant.
    2. All plumbing fixtures have been tested, adjusted, cleaned and in proper operation.
    3. All plumbing access doors and panels are in place and not painted closed.
    4. Potable water systems have been cleaned, flushed, chlorinated, and copies of final chlorination and water quality tests have been submitted to the Commissioning Agent and this Consultant.
    5. All backflow prevention stations and devices have been tested, with test reports

submitted to the Commissioning Agent and this Consultant.

6. All domestic hot water recirculation systems have been balanced and maximum wait time at fixtures verified, with written balancing report submitted to the Commissioning Agent and this Consultant.
7. Final Plumbing Inspector's sign-off to be submitted to this Consultant.
8. Final gas inspection sign-off to be submitted to this Consultant.
9. Final As-built Record Drawings have been submitted for review to this Consultant.

END OF SECTION

GENERAL

1. Related Work

    1. This Specification Section forms part of Contract Documents and is to be read, interpreted and coordinated with other parts.

2. Scope of Work

    1. Refer to Section 23 05 19 Meters and Gauges for HVAC Piping. Comply with requirements of Section as related to general requirements, products and execution.

    2. In addition to piping, equipment and systems listed in Section 23 05 20, provide thermometers and pressure gauges complying with requirements of Section 23 05 20, on plumbing piping systems and equipment including the following:

        1. Domestic cold water
        2. Natural gas.

    3. Provide thermometers in brass or stainless steel wells at heat exchangers, water heaters, and other equipment intended to change temperature of fluid.

    4. Provide pressure gauges complete with isolation ball valves on both sides of pressure reducing valves, backflow prevention stations, pumps, compressors and other equipment intended to change pressure of fluid.

END OF SECTION

1. GENERAL

1.1 Related Work

1. This Specification Section forms part of Contract Documents and is to be read, interpreted and coordinated with other parts.

2. Refer to Section 22 05 48 Vibration Isolation for Plumbing Piping and Equipment, and Section 22 05 49 Seismic Restraint Systems for Plumbing Piping and Equipment.

1.2 Scope of Work

1. Refer to Section 23 05 29 Hangers and Supports for HVAC Piping and Equipment. Comply with requirements of Section as related to general requirements, products and execution.

    1. Acceptable Products: Hubbard Enterprises – Holdrite Systems or equivalent

2. In addition to piping, equipment and systems listed in Section 23 05 29 provide hangers and supports complying with requirements of Section 23 05 29 on plumbing piping and equipment including:

    1. Domestic cold water
    2. Domestic hot water and recirculation.
    3. Sanitary waste and venting.
    4. Natural gas.

END OF SECTION

1. GENERAL

1.1 Related Work

1. This Specification Section forms part of Contract Documents and is to be read, interpreted and coordinated with other parts.

1.2 Scope of Work

1. Refer to Section 23 05 53 Identification for HVAC Piping and Equipment. Comply with requirements of Section as related to general requirements, products and execution.

2. In addition to piping, equipment and systems listed in Section 23 05 53, provide identification on plumbing piping, valves and equipment, including the following:

    1. Domestic cold water
    2. Domestic hot water
    3. Sanitary waste and venting.
    4. Natural gas.
    5. Trap primer access points.

1.3 Pipe Identification Colour Schedule (not all may apply)

Service	Identification Lettering Colour	Primary	Secondary Colour
Cold Water Service	C.W.	green	-
Domestic Cold Water	D.C.W.	light blue	-
Domestic H.W. Supply 60°C	D.H.W.S. 60°C	yellow	black
Hot Water Return	H.W.R.	yellow	black
Hot Water Supply	H.W.S.	yellow	black
Natural Gas	Gas	yellow	orange
Sanitary Drain	SAN	None	None (-)
Plbg Vent	PVent	None	(-)

END OF SECTION

1.0 GENERAL

.1 Read Basic Mechanical Requirements

.2 Product data

.1 Submit product data sheets for valves.

.3 Piping, valves and accessories shall be rated to suit system operating pressure up to 1380 kPa (200 Psi).

2.0 PRODUCTS

.1 Domestic hot, cold, tempered, and recirculating piping, within building:

.1 All copper water tubing to bear certification markings indicating compliance with the Plumbing Code. Certification markings on the tubing may be made by a testing agency accredited for that purpose by the Standards Council of Canada.

.2 Copper tube, hard drawn, type L to ASTM B88M-85 CSA HC-66 above ground.

.3 Boosted pressure water risers to be roll grooved copper.

.2 Fittings

.1 Brass or bronze flanges and flanged fittings to ANSI B16.24-1979.

.2 Brass or bronze threaded fittings to ANSI B16.15-1978.

.3 Cast bronze to ANSI B16.18-1984 CSA B158 or wrought copper and bronze to ANSI B16.22-1980 CSA B158.

.4 Roll groove full flow standard radius cast bronze for sizes NPS 2 1/2 to 6 to ANSI AWWA C606.

.3 Joints

.1 Flanged joints to be made up with

.1 Rubber gaskets 1.6 mm (1/16 in) thick to ANSI A21.11-1980 or AWWA C111-80.

.2 Bolts and nuts to be heavy series, hexagonal head pattern with washers to ASTM A307-83a.

.2 Copper to copper couplings to be made up with

.1 Tin antimony brazing filler, 95:5 to ASTM B-32-83.

.2 Silver brazing alloy

.4 Roll groove joints to be made up with roll groove positive clamp gasketted couplings or roll groove flange adapters for copper piping to ANSI AWWA C606.

.1 All joints NPS3 and over to be made with roll ground joints.

.5 Gate valves

.1 Not used

.6 Globe valves

.1 NPS 3 and under, brazed

.1 Rising stem to MSS SP-80, class 125, bronze body, renewable composition disc, union bonnet.

.2 Lock shield handles as indicated.

.2 NPS 3 and under, threaded

.1 Rising stem to MSS SP-80, class 150, bronze body, renewable composition disk, union bonnet.

.2 Lock shield handles as indicated.

.7 Butterfly valves for working pressures up to 300 psi for grooved end pipe, with CRN. (Not to be used for main incoming domestic water service shutoff valve).

.1 NPS 2 1/2 and over

.1 ANSI/NSF 61 classified, Class 150 long neck design, malleable or ductile iron body, aluminium bronze disk, EPDM Grade "E" liner for 93EC (200EF) working temperature. Lever handle up to NPS 3 and gear operators NPS 4 and over.

.8 Swing check valves for working pressures up to 150 psi.

.1 Up to NPS 3, brazed

.1 To MSS SP-80, class 125, Y-pattern bronze body, bronze swing disc, integral seat, screw-in cap.

.2 Up to NPS 3, threaded

.1 To MSS SP-80, class 125, Y-pattern bronze body, bronze swing disc, integral seat, screw-in cap.

.3 NPS 2 1/2 and over, flanged

.1 To MSS SP-70, class 125, cast iron body, flat faced flange, bolted cover, renewable bronze seat ring, bronze swing disc.

.9 Ball valves for working pressures up to 300 psi.

.1 Up to NPS 2, brazed

.1 Minimum 400 psi WOG, two-piece bronze or brass body, full port stainless steel ball & stem, PTFE seat and seals, blowout proof stem.

.2 Up to NPS 2, threaded

.1 Minimum 400 psi WOG, two-piece bronze or brass body, full port stainless steel ball & stem, PTFE seat and seals, blowout proof stem.

.10 Drain valves

.1 On mains NPS 4 and under

.1 NPS 3/4 screwed ball valve of appropriate pressure rating with hose thread, cap and chain.

.2 On mains NPS 5 and over

.1 NPS 1 1/4 screwed ball valve of appropriate pressure rating with hose thread, cap and chain.

.11 Double regulating valves (DRV)

.1 NPS 2 and under, threaded; for working pressure up to 240 psi

.1 Bronze body, rising stem, screwed bonnet, parabolic slotted regulating disk, flow measurement ports and tamper-proof setting.

.2 NPS 2 and under, sweat end; for working pressure up to 175 psi

.1 Bronze body, rising stem, screwed bonnet, parabolic slotted regulating disk,

flow measurement ports and tamper-proof setting.

3.0 EXECUTION

.1 Installation

.2 Connect to fixtures and equipment.

.3 Isolate equipment, fixtures and branches with ball valves.

.4 Install piping close to building structure to minimize furring and conserve headroom. Group piping and run parallel to walls.

.4 Lay buried tubing in accordance with AWWA Class "B" bedding.

.5 Cut square, ream and clean tubing and tube ends.

.6 Prepare roll groove joints using shop or field rolled grooves and provide anchors, guides and supports in accordance with coupling manufacturer's instructions.

.7 Clean inside of brazing fittings and outside of mating pipe with emery paper and coat with flux.

.8 Braze joints with a blow torch or oxy-acetylene flame using a single or double tip torch, depending on fitting size.

.9 Use silver brazing filler made up of 95% tin and 5% antimony for pipe up to and including NPS 3 in.

.10 Use silver brazing alloy for pipe NPS 4 and over, and on every size of underground copper piping.

.11 Remove working parts of valves during brazing.

.12 Balance recirculation system using lock shield globe valves.

.13 Supply chemicals and provide temporary tanks, piping and pumping equipment and disinfect potable water systems before use.

END OF SECTION

1.0 GENERAL

1.1 Read Basic Mechanical Requirements.

1.2 Provide plumbing specialty and accessories as shown on plans and equipment schedules on mechanical drawings to suit architectural and landscaping finishes.

1.3 Product data:

.1 Submit product data sheets for floor drains, area drains, hub drains, roof drains, trench drains, terrace drains, driveway drains, cleanouts, wall hydrants, water hammer arrestors, back flow preventers, hose bibs, water make-up assemblies, pressure reducing station, pressure reducing valves, strainers, traps, trap seal primers, water hammer shock absorbers…etc.

2.0 PRODUCTS

2.1 Floor, combination floor drains, roof drains and cleanouts to conform to CSA standard CAN3-B79-M79. All products shall be of one manufacture, except where otherwise noted.

.1 All floor drains shall be complete with trap seal primer.

2.2 Floor Drains, Trench Drains and Specialties – General

.1 Supply and install all floor drains, funnel floor drains, etc., of types noted, as indicated on the drawings.

.2 Provide floor drains, where shown or directed, complete with strainer and accessories noted or required to complete installation. Set each drain to required level to approval.

.3 Contractor shall supply and install where detailed on drawings a Trap Priming Systems as specified below.

.4 All floor drains to be cast iron body c/w trap priming tapping, to be automatically primed.

2.3 Floor Drains

.1 Floor Drains in Finished Areas – Adjustable Strainer (FD)

.1 Floor drain shall be duco coated cast iron body, reversible flashing clamp with seepage openings and adjustable 5" (127mm) diameter nickel bronze 1/4" (6.35mm) thick strainer, secured with S.S. screws, with 4" (102mm) diameter nickel bronze grating. Provide ½" (13mm) trap primer connection.

.2 Scupper Drains (SD)

.1 Shall be NPS 100 size pit drain, 90 degree or 45 degree outlet to suit each application, complete with removable sloping front grate and bronze backwater valves.

.3 Hub Drains (HD)

.1 Shall be NPS100 size round nickel bronze funnel, chrome plated, chrome plated in areas where exposed, in trap body.

2.4 Backwater Valves

.1 Not used

2.5 Cleanouts

.1 Provide cleanouts for drains 50 ft. apart in all straight runs of sewer up to 4" and 100 ft. for 6" at the end of all branches, at the base of all riser lines, on all exposed or accessible traps (expect water closet traps), at all points on the system where so indicated or required by Code, or where necessary because of interruption of general line of flow.

.2 Cleanouts shall be full size up to 4" and not less than 4" for larger pipes. Full size "y" or "TY" branches shall be provided for cleanouts on drains and their branches. Cleanout plugs shall be gasketed and fastened with brass hex bolts.

.3 All cleanouts shall be made accessible and wherever necessary branch connections shall extend to finished surfaces of floors.

.4 Exposed areas and accessible pipe chases: Cast iron caulking ferrule with neoprene jacket and plug secured to body with cap screws.

.5 Care shall be taken to locate all Barrett type cleanouts above any curbs, bases, etc.

Barretts shall be covered with access doors as specified.

.6 Cleanouts in waterproofed areas shall have flashing clamp devices to receive the waterproofing membrane.

.7 Cleanouts – Heavy Duty Floor Cleanout in Finished Areas (CO)

.1 Floor cleanouts shall be all duco coated cast iron body and removable positive gasket seal and test closure plug and heavy duty 6" (150mm) with extra heavy cover and frame, secured with stainless steel screws, C.O. cast in cover.

.2 For water-proofed areas provide 'F-C' flange), vandal Proof Top, extra heavy duty round nickel bronze top

.3 For unfinished areas provide bronze covers.

.4 Line size for NPS 2, NPS 3, NPS 4 and NPS 4 in larger lines.

.5 Adjustable access cover in areas as follows:

.6 Finished: Nickel bronze frame and round or square nickel bronze access cover.

.7 Unfinished: Cast iron frame heavy duty scoriated cast iron round or square tractor cover and internal plug.

2.6 Water Hammer Arrestors

.1 Stainless steel or copper construction with nested bellows and precharged air chamber.

.2 Selected in accordance with Plumbing and Drainage Institute Standard PD1-WH201, “Water Hammer Arresters”.

2.7 Back Flow Preventers – Reduced Pressure Zone (RPZ) Type

.1 Not used

2.8 Vacuum Breakers

.1 Atmospheric type vacuum breakers (AVB) may not be used where subjected to continuous line pressure for 12 hours or more.

.2 Conform to CSA B.64.1.1 NPS 1/4 to NPS 3

.3 Atmospheric type (AVB) with single float and disc and large atmospheric port.

.4 Pressure type vacuum breakers can be operated continuously at line pressure. Pressure type vacuum breakers larger than NPS 2 require two check valves.

.5 Pressure type (PVB) NPS 1/2 to NPS 2: Conform to CSA B.64.1.2: spring loaded single float and disc with independent first check, shut off valves and ball type test cocks.

.6 Hose connection type (HCVB) NPS 3/4: Conform to CSA B.64.2, non-removable single check with atmospheric vent vacuum breaker. To be non-removable once installed.

.7 Vacuum breaker - hose connection type (HCVB): NPS ¾.

1. Non-removable body with single check.

2. Atmospheric vent vacuum breaker.

3. Vacuum breaker for wall hydrants subject to freezing:

2.9 Water Make Up Assemblies

.1 Not used

2.10 Strainers

.1 "Y" pattern with bronze, cast iron or steel bodies and screwed or flanged to match pressure class and size restrictions as specified for globe valves in section of piping system where strainer is to be installed.

.2 Stainless steel baskets with 0.8 mm (1/32 in or 20 mesh) diameter perforations for strainers up to NPS 3 size and 3.2 mm (1/8 in) diameter perforations for strainers NPS 4 and larger.

.3 Baskets with 3.2 mm (1/8 in) diameter perforations to be made from 0.9 mm (0.037 in) stock reinforced with 13 mm x 0.9 mm (1/2 in) x 0.037 in) bands of the same material spot welded to baskets.

2.11 Temperature and Pressure (T&P) Relief Valves

.1 CGA design certified at all settings.

.2 ASME IV rated for 1035 kPa (150 psi) pressure relief, factory set.

.3 Temperature relief setting 99EC (210EF).

.4 Bronze body, stainless steel spring, stainless steel or epoxy coated thermostat.

.5 Manual lifting lever.

3.0 EXECUTION

3.1 Installation general

.1 Install in accordance with Canadian Plumbing Code, provincial codes, and local authority having jurisdiction except where specified otherwise.

.2 Install in accordance with manufacturer's instructions and as specified.

3.2 Cleanouts

.1 Install as required by Code at base of soil and waste stacks, rainwater leaders and where indicated.

.2 Extend cleanouts flush to wall or finished floor unless serviceable from below floor.

.3 Install cleanouts located in floors clear of obstructions.

3.3 Water Hammer Arrestors

.1 Install on branch supplies to each fixture or group of fixtures, sized in accordance with manufacturer's instructions, and where indicated.

3.4 Backflow preventers

.1 Install in accordance with CSA B64.10, where indicated and as required by Code for proper functioning of equipment and/or systems.

.2 Pipe discharge through air gap fitting to nearest drain or service sink.

3.5 Vacuum breakers

.1 Install on equipment, hydrants, hose bibbs, fixture connections, and where indicated.

.2 Pipe discharge to nearest drain or service sink.

3.6 Temperature and Pressure (T&P) relief valves

.1 To match kW (Btu/h) rating of appliance on which it is installed.

3.7 Water make-up assemblies

.1 Install with shut-off valve upstream and 115 mm (4 1/2 in) pressure gauge downstream.

.2 Pipe discharge from relief valve to nearest floor drain.

3.8 Pressure reducing valves

.1 Install with shut-off valve upstream and 115 mm (4 1/2 in) pressure gauge downstream.

3.9 Strainers

.1 Install with sufficient space to remove basket.

3.10 Backwater valve

.1 Install as required by Code.

.2 Contractor to provide extension pipe to cover where required.

END OF SECTION

1.0 GENERAL

.1 Read Mechanical General Requirements, as part of this Section.

.2 Reserved

.3 Provide pipe and fittings for building interior service as required and specified in this section. Piping is exposed (not buried).

.4 Approval must be confirmed by local Plumbing and Building Authorities (prior to installation) for the systems as indicated.

Contractor shall contact the pipe and fittings system manufacturer prior to the installation to obtain precise installation instructions. As well, site meetings shall be arranged and include, the Contractor, Manufacturer and Building Inspector.

.5 Where combustible materials are specified, the manufacturer (Ipex Inc.) to be contacted for proper installation, joining methods and firestopping recommendations.

Provide piping manufacturer approved firestopping on piping and fittings at locations where they pass through fire rated building elements.

.6 Ensure compatibility, performance and material quality, by providing piping and fitting drainage system components produced by the same manufacturer.

2.0 PRODUCTS

.1 Pipe and fittings system provided by this section to be approved by the Local Authorities.

Use only products that bear all necessary labels, markings and listings. DO NOT install a system that does not meet the requirements of the Building Code.

.2 Combustible Pipe and Fittings Requirements:

.1 All combustible pipe, fittings and associated adhesives located within a concealed space described in the O.B.C., 3.6.4.3. (1)(a) used as a Plenum (OBC 3.6.4.3) shall be IPEX “System XFR 15/50” or equal alternate and shall be Tested and Listed to CAN/ULC-S102.2-M and have a “*flame-spread rating*” not greater than “25” and a “*smoke developed classification*” not greater than “50”.

.3 Expansion and Contraction Compensation Requirements:

.1 Piping system shall be capable of accommodating expansion and contraction of the drainage system.

.2 Provide manufacturer's Expansion Compensators sized to offset a minimum of 3" expansion rate per 100 FT of straight piping. Confirm expansion rates with the manufacturer.

.3 Consult pipe system manufacturer for specific details regarding recommended compensation methods, aalternatively including properly calculated expansion loops are acceptable.

.4 Operating Drainage System Temperature Requirements:

.1 Does not use PVC piping when drainage systems discharge temperature may exceed 48.9 C (120F), such as drainage from mechanical rooms, or other hot processes.

.6 Combustible Piping Penetrations Requirements:

.1 All combustible piping penetrations through Vertical or Horizontal "*Fire Separations"* shall comply with the requirements described in the O.B.C., 3.1.9.4.(1) though (8) and provide a firestop system that has been Tested and Listed to the test Standard CAN/ULC-S115-M with a pressure differential of 50 Pa. In addition, the manufacturer shall provide documentation confirming compliance to the required Standard.

.7 Above grade piping and fittings

.1 Pipe for SANITARY SYSTEMS NPS 1 1/2 and over, (inside the building):

.1 System XRF 15-50 DWV pipes and fittings certified to CAN/CSA-B181.2 and listed by ULC to Standard CAN/ULC-S102.2 M, having a maximum flame-spread rating not exceeding 25.

.2 Joints

.1 Piping NPS 1 1/2 to NPS 6, solvent weld for PVC to ASTM D2564-80, using CSA approved one-step cement.

.2 Piping over NPS 6 solvent weld for PVC using IPS Primer Type P-70 and IPS Cement Type 711, Heavy-Bodied.

.8 Solvent welded piping and fittings:

.1 Pipe for SANITARY SYSTEMS NPS 3 and over:

.1 IPEX SYSTEM BDS pipes and fittings certified to CAN/CSA-B182.1.

.2 Joints

.1 Piping NPS 1 1/2 to NPS 6, solvent weld for PVC to ASTM D2564-80, using CSA approved one-step cement.

.2 Piping over NPS 6 , solvent weld for PVC using IPS Primer Type P-70 and IPS Cement Type 711, Heavy-Bodied.

.9 Gasketted joint piping and fittings

.1 To CSA B182.2 and conform to ASTM D3034 (100mm - 375mm), ASTM F679 (450mm - 900mm), NQ 3624-130 and NQ 3624-135 standards.

.2 Pipe to be manufactured from ASTM D1784 12454-B, 12454-C, 13364-C or 12364-C compound. Minimum pipe stiffness (F/♠y) to be 320 kPa (46 psi) for DR35; 625 kPa (90 psi) for DR28 pipe as tested using methods of ASTM D2412.

.3 Pipe for SANITARY SYSTEMS NPS 4 to 36:

.1 Pipes and fittings certified to CAN/CSA-B182.2.

.4 Pipe for SANITARY SYSTEMS NPS 4 to 6:

.1 Pipes and fittings certified to CAN/CSA-B182.2.

.5 Fittings

.1 Injection-moulded gasketted PVC fittings to be certified to CSA B182.1 or CSA B182.2. Fabricated fittings to be certified to CSA B182.2 and conform to ASTM D3034 or ASTM F679.

.6 Joints

.1 Gasketted joints to meet the requirements of ASTM D3212 and CSA B182.2, with the additional requirement that joints be able to withstand 345 kPa (50 psi) hydrostatic pressure. Gasket material to conform to ASTM F477.

.7 Colour Coding

.1 Pipe to be colour coded as follows: green for DR35; white for DR28.

.8 NPS 4 to 6 piping, DR 28

.9 NPS 4 to 36 piping, DR 35

3.0 EXECUTION

3.1 INSTALLATION

.1 Install suspended piping to grade, parallel and close to walls and ceilings to conserve headroom and space.

.2 Pipe to be squarely cut, burrs and loose materials removed, and pipe end chamfered.

.3 Apply solvent to male end of joint only.

.4 Pipe-end to be inserted into the fitting hub and given a one-quarter turn during insertion, and held in position until the solvent cement adheres.

.5 Assembly of gasketted pipe and fittings to be done in accordance with the manufacturer's recommendations using only manufacturer's PVC pipe lubricant. Substitute lubricants must not to be used.

3.2 SOLVENT WELDING:

.1 It is the responsibility of the selected trade contractor to contact the manufacturer (IPEX Inc.) prior to installation and arrange a demonstration for proper solvent welding procedures as well as recommended solvent cement types.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 Section includes:

.1 The installation of drainage waste and vent piping – cast iron and copper.

1.2 RELATED SECTIONS

.1 Section 01 35 29.06 - Health and Safety Requirements.

.2 Section 01 74 21 - Construction/Demolition Waste Management and Disposal

.3 Section 23 05 05 - Installation of Pipework.

1.3 REFERENCES

.1 American Iron and Steel Institute (AISI)

.1 AISI 304, Stainless Steel.

.2 American Society for Testing and Materials (ASTM)

.1 ASTM B32, Specification for Solder Metal.
.2 ASTM B306, Specification for Copper Drainage Tube (DWV).
.3 ASTM C564, Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

.3 Canadian Standards Association (CSA International)

.1 CAN/CSA-B70, Cast Iron Soil Pipe, Fittings and Means of Joining.
.2 CAN/CSA- B125.3, Plumbing Fittings.
.3 CSA B67-1972(R1996), Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories

1.4 QUALITY ASSURANCE

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with *Section 01 35 29.06 – Health and Safety Requirements*.

1.5 DELIVERY STORAGE AND DISPOSAL

.1 Waste Management and Disposal:

.1 Separate and recycle waste materials in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.2 Collect and separate for disposal, paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

1.6 SUBMITTALS:

.1 Provide submittals in accordance with Section *01 33 00 - Submittal Procedures.*

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

PART 2 PRODUCTS

2.1 COPPER TUBE AND FITTINGS

.1 Above ground sanitary, storm and vent Type DWV to: ASTM B306.

.1 Fittings.

.1 Cast brass: to CAN/CSA-B125.

.2 Wrought copper: to CAN/CSA-B125.

.2 Solder: tin-lead, 50:50, type 50A or tin-antimony only 95:5, type TA to ASTM B32.

2.2 CAST IRON PIPING AND FITTINGS

.1 Buried sanitary, storm and vent minimum NPS2, to: CAN/CSA-B70, with one layer of protective coating of butimous.

.1 Joints.

.1 Mechanical joints.

.1 Neoprene or butyl rubber compression gaskets: to ASTM C564 or CAN/CSA-B70.

.2 Stainless steel clamps.

.2 Hub and spigot.

.1 Neoprene gasket : to CSA B70.

.2 Cold caulking compounds.

.2 Above ground sanitary, storm and vent: to CAN/CSA-B70.

.1 Joints.

.1 Mechanical joints.

.1 Neoprene or butyl rubber compression gaskets with stainless steel clamps.

2.3 STAINLESS STEEL PIPE AND FITTINGS

.1 Above ground and buried sanitary, storm and vent, NPS 2 to NPS 10, stainless steel, type AISI 304.

.1 Mechanical Joints:

.1 Push-fit socket joint with EPDM sealing ring.

PART 3 EXECUTION

3.1 INSTALLATION

.1 In accordance with Section 23 05 05 – Installation of Pipework and by certified journeyperson.

.2 Install in accordance with Canadian Plumbing Code and local authority having jurisdiction.

3.2 TESTING

.1 Pressure test buried systems before backfilling.

.2 Hydraulically test to verify grades and freedom from obstructions.

3.3 PERFORMANCE VERIFICATION

.1 Cleanouts:

.1 Ensure accessible and that access doors are correctly located.

.2 Open, cover with linseed oil and re-seal.

.3 Verify that cleanout rods can probe as far as the next cleanout, at least.

.2 Test to ensure traps are fully and permanently primed.

.3 Storm water drainage:

.1 Verify domes are secure.

.2 Ensure weirs are correctly sized and installed correctly.

.3 Verify provisions for movement of roof system.

.4 Ensure that fixtures are properly anchored, connected to system and effectively vented.

.5 Affix applicable label (storm, sanitary, vent, pump discharge, etc.) c/w directional arrows every floor or 4.5 m (whichever is less).

.6 Provide copies of test reports for Commissioning Manuals.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 Section includes:

.1 The installation of drainage waste and vent piping – plastic.

1.2 RELATED SECTIONS

.1 Section 01 35 29.06 - Health and Safety Requirements.

.2 Section 01 74 21 - Construction/Demolition Waste Management and Disposal

.3 Section 23 05 05 - Installation of Pipework.

1.3 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM D2235, Specification for Solvent Cement for Acrylonitrille-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.

.2 ASTM D2564, Specification for Solvent Cements for Poly(Vinyl-Chloride) (PVC) Plastic Piping Systems.

.2 Canadian Standards Association (CSA)

.1 CSA-B1800 Series, ABS Drain, Waste and Vent Pipe and Pipe Fittings.

.2 CSA-B181.2, PVC Drain, Waste and Vent Pipe and Pipe Fittings.

.3 CSA-B182.1, Plastic Drain and Sewer Pipe and Pipe Fittings.

.3 Underwriters Laboratory of Canada (ULC)

.1 CAN/ULC-S102.2 Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies.

1.4 DELIVERY STORAGE AND DISPOSAL

.1 Waste Management and Disposal:

.1 Separate and recycle waste materials in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.2 Collect and separate for disposal, paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

1.5 SUBMITTALS:

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for piping and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

PART 2 PRODUCTS

2.1 PIPING AND FITTINGS

.1 For buried DWV piping to:

.1 CSA-B181.1.

.2 CSA-B181.2.

.3 CSA-B182.1.

.2 For aboveground DWV piping for combustible construction to:

.1 CSA – B181.2

.3 For aboveground DWV piping for non-combustible construction:

.1 Flame spread rating less than 25 and smoke developed classification less than 50.

.2 CSA B181.2

2.2 JOINTS

.1 Solvent weld for PVC: to ASTM D2564.

.1 NPS 1 ½ to 6: one step or two step cement

.2 NPS 8 and above: two step cement.

.2 Solvent weld for ABS: to ASTM D2235.

PART 3 EXECUTION

3.1 INSTALLATION

.1 In accordance with Section 23 05 05 - Installation of Pipework and certified journeyperson.

.2 Install in accordance with Canadian Plumbing Code and local authority having jurisdiction.

3.2 TESTING

.1 Pressure test buried systems before backfilling in accordance with Canadian Plumbing Code.

.2 Hydraulically test to verify grades and freedom from obstructions.

3.3 PERFORMANCE VERIFICATION

.1 Cleanouts:

.1 Ensure accessible and that access doors are correctly located.

.2 Open, cover with linseed oil and re-seal.

.3 Verify cleanout rods can probe as far as the next cleanout, at least.

.2 Test to ensure traps are fully and permanently primed.

.3 Storm water drainage:

.1 Verify domes are secure.

.2 Ensure weirs are correctly sized and installed correctly.

.3 Verify provisions for movement of roof system.

.4 Ensure fixtures are properly anchored, connected to system and effectively vented.

.5 Affix applicable label (storm, sanitary, vent, pump discharge etc.) c/w directional arrows in accordance with Section 23 05 53.01 – Mechanical Identification.

.6 Provide copies of test reports for Commissioning Manuals.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 Use of HVAC systems during construction.

1.2 RELATED SECTIONS

.1 Section 01 51 00 - Temporary Utilities.

1.3 USE OF SYSTEMS

.1 Use of new and/or existing permanent heating and/or ventilating systems for supplying temporary heat or ventilation is permitted only under the following conditions: .

.1 Entire system is complete, pressure tested, cleaned, flushed out.

.2 Specified water treatment system has been commissioned, water treatment is being continuously monitored.

.3 Building has been closed in, areas to be heated/ventilated are clean and will not thereafter be subjected to dust-producing processes.

.4 There is no possibility of damage from any cause.

.5 Supply ventilation systems are protected by 60 % filters, which shall be inspected daily, changed every week or more frequently as required.

.6 Return systems have approved filters over all openings, inlets, outlets.

.7 All systems will be:

.1 operated as per manufacturer's recommendations or instructions.

.2 operated by Contractor.

.3 monitored continuously by Contractor.

.8 Warranties and guarantees are not thereby relaxed.

.9 Regular preventive and all other manufacturers recommended maintenance routines are performed by Contractor at his own expense and under supervision of Owner’s Representative.

.10 Refurbish entire system before static completion; clean internally and externally, restore to "as- new" condition, and replace filters in air systems.

.2 Filters specified in this section are over and above those specified in other sections of this project.

.3 Exhaust systems are not included in any approvals for temporary heating ventilation.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 74 21 – Construction/Demolition Waste Management and Disposal

.2 Section 23 05 05 - Installation of Pipework.

.3 Section 23 21 13.02 - Hydronic Systems: Steel

1.2 REFERENCES

.1 American National Standards Institute/American Society of Mechanical Engineers. (ANSI/ASME)

.1 ANSI/ASME B31.1, Power Piping.

.2 ANSI/ASME B31.3, Process Piping.

.3 ANSI/ASME B31.5 – Refrigeration Piping and Heat Transfer Components.

.4 ANSI/ASME B31.9 Building Services.

.5 ANSI/ASME Boiler and Pressure Vessel Code

.1 Section I: Power Boilers.

.2 Section V: Nondestructive Examination.

.3 Section IX: Welding and Brazing Qualifications.

.2 American National Standards Institute/American Water Works Association (ANSI/AWWA)

.1 ANSI/AWWA C206, Field Welding of Steel Water Pipe.

.3 American Welding Society (AWS)

.1 AWS C1.1, Recommended Practices for Resistance Welding.

.2 AWS Z49.1, Safety Welding, Cutting and Allied Process.

.3 AWS W1, Welding Inspection Handbook.

.4 Canadian General Standards Board

.1 CAN/CGSB-48.2, Spot Radiography of Welded Butt Joints in Ferrous Materials.

.5 Canadian Standards Association (CSA International)

.1 CSA W47.2, Certification of Companies for Fusion Welding of Aluminum.

.2 CSA W48 series-, Filler Metals and Allied Materials for Metal Arc Welding.

.3 CSA B51, Boiler, Pressure Vessel and Pressure Piping Code.

.4 CSA B52 Mechanical Refrigeration Code.

.5 CSA W117.2, Safety in Welding, Cutting and Allied Processes.

.6 CSA W178.1, Certification of Welding Inspection Organizations.

.7 CSA W178.2, Certification of Welding Inspectors.

.6 Provincial regulations: Boiler, Pressure Vessel and Compressed Gas Regulations.

1.3 QUALIFICATIONS

.1 Welders

.1 Welding qualifications in accordance with CSA B51

.2 Use qualified and licensed welders possessing certificate for each procedure performed from authority having jurisdiction.

.3 Furnish welder's qualifications to Owner’s Representative.

.4 Each welder to possess identification symbol issued by authority having jurisdiction.

.5 Certification of companies for fusion welding of aluminum in accordance with CSA W47.2.

.2 Inspectors

.1 Inspectors qualified to CSA W178.2.

1.4 QUALITY ASSURANCE

.1 Registration of welding procedures in accordance with CSA B51, CSA B52 and provincial regulations.

.2 Copy of welding procedures available for inspection.

.3 Safety in welding, cutting and allied processes in accordance with CSA-W117.2.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 21 – Construction / Demolition Waste Management and Disposal, and with the Waste Reduction Workplan.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal, paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility as approved by Owner's Representative.

PART 2 PRODUCTS

2.1 ELECTRODES

.1 Electrodes: in accordance with CSA W48 Series.

PART 3 EXECUTION

3.1 WORKMANSHIP

.1 Welding: in accordance with ANSI/ASME B31.1 B31.3, B 31.5, B31.9, ANSI/ASME Boiler and Pressure Vessel Code, Sections I and IX and ANSI/AWWA C206, using procedures conforming to AWS C1.1, and special procedures specified elsewhere in Mechanical Division and applicable requirements of provincial authority having jurisdiction.

3.2 INSTALLATION REQUIREMENTS

.1 Identify each weld with welder's identification symbol.

.2 Backing rings:

.1 Where used, fit to minimize gaps between ring and pipe bore.

.2 Do not install at orifice flanges.

.3 Fittings:

.1 NPS 2 and smaller: install welding type sockets.

.2 Branch connections: install welding tees or forged branch outlet fittings.

3.3 INSPECTION AND TESTS - GENERAL REQUIREMENTS

.1 Review weld quality requirements and defect limits of applicable codes and standards with Owner's Representative before work is started.

.2 Formulate "Inspection and Test Plan" in co-operation with Owner's Representative.

.3 Do not conceal welds until they have been inspected, tested and approved by inspector.

.4 Provide for inspector to visually inspect welds during early stages of welding procedures in accordance with Welding Inspection Handbook. Repair or replace defects as required by codes and as specified.

3.4 SPECIALIST EXAMINATIONS AND TESTS

.1 General

.1 Perform examinations and tests by specialist engaged by contractor, qualified in accordance with CSA W178.1 and CSA W178.2 and approved by Owner's Representative.

.2 To ANSI/ASME Boiler and Pressure Vessels Code, Section V, CSA B51 and requirements of authority having jurisdiction.

.3 Inspect and test welds in accordance with "Inspection and Test Plan" by non-destructive visual examination and magnetic particle (hereinafter referred to as "particle") tests and/or spot or full gamma ray radiographic (hereinafter referred to as "radiography") tests. As per applicable reference standard or as specified.

.2 Hydrostatically test welds to requirements of ANSI/ASME B31.1.

.3 Visual examinations: include entire circumference of weld externally and wherever possible internally.

.4 Failure of visual examinations:

.1 Upon failure of welds by visual examination, perform additional testing as directed by Owner's Representative of total of up to 10 % of welds, selected at random by Owner's Representative by radiographic tests.

.5 Full radiographic tests for piping systems.

.1 Spot radiography to CAN/CGSB-48.2.

.1 Conduct spot radiographic tests of up to 10% of welds, selected at random by Owner's Representative from welds which would be most difficult to repair in event of failure after system is operational.

.2 Radiographic film:

.1 Identify each radiographic film with date, location, name of welder, and submit to Owner's Representative. Replace film if rejected because of poor quality.

.3 Interpretation of radiographic films:

.1 By qualified radiographer.

.4 Failure of radiographic tests:

.1 Extend tests to welds by welder responsible when those welds fail tests.

.6 Magnetic particle tests for piping systems as indicated.

3.5 DEFECTS CAUSING REJECTION

.1 As described in ANSI/ASME B31.1 and ANSI/ASME Boiler and Pressure Vessels Code.

.2 In addition, chilled water systems below 1000 kPa:

.1 Undercutting greater than 0.8 mm adjacent to cover bead on outside of pipe.

.2 Undercutting greater than 0.8 mm adjacent to root bead on inside of pipe.

.3 Undercutting greater than 0.8 mm at combination of internal surface and external surface.

.4 Incomplete penetration and incomplete fusion greater than total length of 38 mm in 1500 mm length of weld depth of such defects being greater than 0.8 mm.

.5 Repair cracks and defects in excess of 0.8 mm in depth.

.6 Repair defects whose depth cannot be determined accurately on basis of visual examination or radiographic particle tests.

3.6 REPAIR OF WELDS WHICH FAILED TESTS

.1 Re-inspect and re-test repaired or re-worked welds at Contractor's expense.

END OF SECTION

1. GENERAL

1.1 Related Work

1. This Specification Section forms part of Contract Documents and is to be read, interpreted and coordinated with other parts.

2. PRODUCTS

2.1 General

1. Select thermometers and pressure gauges so that their operating range falls in middle half of scale range.

2.2 Thermometers - Piping

1. Acceptable Manufacturers:
    1. Trerice, Weiss, Winters.
2. Minimum Requirements:
    1. Thermometers to be in accordance with Canadian General Standards Board CGSB 14.4 - M88.
    2. Pipe mounted stem type - mercury actuated, adjustable angle type.
    3. Refer to flow schematics for location of pipe mounted thermometers and wells.
3. Case:
    1. Stem type – Stainless Steel. Case shall be provided with clear glass or heat resistant plastic window.
4. Scale:
    1. Stem type - 225 mm scale length.
    2. White background with temperature range in black.
    3. Dual Celsius and Fahrenheit scale.

2.3 Thermometers - Duct/Panel Mounted

1. Acceptable Manufacturers:
    1. Trerice, Weiss, , Winters.

2. Minimum Requirements:

    1. Thermometers to be in accordance with Canadian General Standards Board CGSB 14-GP-2a.

    2. Duct mounted dial type - solid liquid filled with remote capillary element.

    3. Panel mounted dial type (surface) type - vapour filled direct mounting.

    4. Panel mounted dial type (flush) type - remote liquid filled capillary element.

3. Case:

    1. Dial type - cast aluminum, black enamel steel or stainless steel with stainless steel or chrome-plated face ring.

4. Scale:

    1. Dial type - nominal 115 mm unless otherwise indicated.

    2. White background with temperature range in black.

    3. Dual Celsius and Fahrenheit scale.

2.4 Pressure Gauges - Piping

1. Acceptable Manufacturers:

    1. Trerice, Weiss, Winters (model 91T).

2. Minimum Requirements:

    1. Gauges to be in accordance with ANSI B40.1 Grade “A” level.

    2. 115 mm cast aluminum, black steel or stainless steel case, with stainless steel or chrome-plated face ring.

    3. White background with pressure range in black.

    4. Dual kPa and psig scale.

    5. Phosphor bronze bourdon tube, silber brazed tip and socket 6.0 mm NPT lower connection.

    6. Rotary type bushed movement, silicone dampened to prevent pointer oscillation.

    7. Gauges to be registered with Provincial Boiler and Pressure Vessel Safety Branches with

CRN number.

8. ULC listed for use on fire protection systems.

9. Accuracy shall be 1% off full scale over the middle half of the scale.

3. Accessories:

1. Install needle valve ahead of each gauge.

2. Install an anti-syphon loop (suitable for steam pressure) ahead of each gauge on steam systems.

2.5 Test Plugs for Pressure/Temperature

1. Provide 6.0 mm NPT solid brass test plug fitting complete with brass chain where indicated.

2. Test plugs shall be capable of receiving either pressure or temperature 3.2 mm OD Dual seal core shall be Nordel suitable for temperature of 177°C and shall be rated zero leakage from vacuum to 6,895 kPa.

3. Provide 1 master test kit containing 2 test pressure gauge of suitable range, 1 gauge adaptor, 3.2 mm OD probe and 2 stem pocket testing thermometers of suitable range.

4. Acceptable Products:

1. Sisco P/T Plugs.

2. Trerice

2.6 Test Thermometer.

2.7 Thermometer Wells.

1. For copper pipe use copper or bronze. For steel pipe use brass, separable socket, 3/4 NPT.

2. Thermowell to be registered with Provincial Boiler and Pressure Vessels Safety Branch with CRN number.

3. EXECUTION

3.1 General

1. Install thermometers and gauges to be easily read from floor or platform. If this cannot be accomplished, install remote reading thermometers and gauges.

2. Install engraved lamicoid nameplates as specified in Section 23 05 53 - Identification

(identifying medium).

3.2 Thermometers

1. Install in wells on piping.
2. Install separable well to minimize restriction to flow and, if necessary, install in section of oversized pipe.
3. Install wells where indicated for use with test thermometers.
4. Install in locations as indicated and on inlet and outlet of:
    1. Heat exchangers.
    2. Water heating coils.
    3. Water boilers.
5. Use extensions where thermometers are installed through insulation.

3.3 Pressure Gauges.

1. Install the following locations:
    1. Suction and discharge of pumps.
    2. Upstream and downstream of PRVs.
    3. Inlet and outlet of waterside of coils (excluding terminal unit coils) and heat exchangers
    4. In other locations indicated.
2. Use extensions where pressure gauges are installed through insulation.
3. Where single gauge is used to measure multiple points, provide needle valves to isolate each point, including pressure gauge.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)

.1 ANSI/ASME B1.20.1-[1983(R2006)] , Pipe Threads, General Purpose (Inch).

.2 ANSI/ASME B16.18-[2001] , Cast Copper Alloy Solder Joint Pressure Fittings.

.2 ASTM International (ASTM)

.1 ASTM A276-[08] , Standard Specification for Stainless Steel Bars and Shapes.

.2 ASTM B62-[02] , Standard Specification for Composition Bronze or Ounce Metal Castings.

.3 ASTM B283-[08a] , Standard Specification for Copper and Copper Alloy Die Forgings (Hot-Pressed).

.4 ASTM B505/B505M-[08a] , Standard Specification for Copper-Base Alloy Continuous Castings.

.3 Canada Green Building Council (CaGBC)

.1 LEED Canada-NC Version 1.0-[2004] , LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addendum [2007]).

.2 LEED Canada-CI Version 1.0-[2007] , LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.

.4 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS)

.1 MSS-SP-25-[1998] , Standard Marking System for Valves, Fittings, Flanges and Unions.

.2 MSS-SP-80-[2008] , Bronze Gate Globe, Angle and Check Valves.

.3 MSS-SP-110-[1996] , Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section [01 33 00- Submittal Procedures] .

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section [02 81 01- Hazardous Materials] .

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in [Province] [Territory] of Canada.

.2 Submit data for valves specified in this Section.

.4 Sustainable Design Submittals:

.1 LEED Canada-[CI Version 1.0] [NC Version 1.0] Submittals: in accordance with [Section 01 35 21- LEED Requirements] .

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section [01 78 00- Closeout Submittals] .

1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials/Spare Parts:

.1 Furnish following spare parts:

.1 Valve seats: one for every [10] valves each size, minimum [1] .

.2 Discs: one for every [10] valves, each size. Minimum [1] .

.3 Stem packing: one for every [10] valves, each size. Minimum [1] .

.4 Valve handles: [2] of each size.

.5 Gaskets for flanges: one for every [10] flanged joints.

.2 Tools:

.1 Furnish special tools for maintenance of systems and equipment.

.2 Include following:

.1 Lubricant gun for expansion joints.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section [with manufacturer's written instructions] [01 61 00- Common Product Requirements] .

.2 Delivery and Acceptance Requirements:

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: remove for reuse [and return] [by manufacturer] of [crates,] [packaging materials] [padding,] [pallets,] in accordance with Section [01 74 19-Waste Management and Disposal] .

Part 2 Products

2.1 MATERIALS

.1 Sustainable Requirements:

.2 Valves:

.1 Except for specialty valves, to be single manufacturer.

.2 Products to have CRN registration numbers.

.3 End Connections:

.1 Connection into adjacent piping/tubing:

.1 Steel pipe systems: screwed ends to ANSI/ASME B1.20.1.

.2 Copper tube systems: [grooved ends] [solder ends] to ANSI/ASME B16.18.

.4 Lockshield Keys:

.1 Where lockshield valves are specified, provide [10] keys of each size: malleable iron cadmium plated.

.5 Globe Valves:

.1 Requirements common to globe valves, unless specified otherwise:

.1 Standard specification: MSS SP-80.

.2 Bonnet: union with hexagonal shoulders.

.3 Connections: screwed with hexagonal shoulders.

.4 Pressure testing: to MSS SP-80. Tests to be hydrostatic.

.5 Stuffing box: threaded to bonnet with gland follower, packing nut, high grade non-asbestos packing.

.6 Handwheel: non-ferrous.

.7 Handwheel Nut: bronze to ASTM B62.

.2 NPS 2 and under, composition disc, Class 125:

.1 Body and bonnet: screwed bonnet.

.2 Disc and seat: renewable rotating [PTFE] disc [composition to suit service conditions] , regrindable bronze seat, loosely secured to bronze stem to ASTM B505.

.3 Operator: [handwheel] [lockshield] .

.3 NPS 2 and under, composition disc, Class 150:

.1 Body and bonnet: union bonnet.

.2 Disc and seat: renewable rotating [PTFE] disc in easily removable disc holder, regrindable bronze seat, loosely secured to bronze stem to ASTM B505.

.3 Operator: [handwheel] [lockshield] .

.4 NPS 2 and under, plug disc, Class 150, screwed ends:

.1 Body and bonnet: union bonnet.

.2 Disc and seat ring: tapered plug type with disc stem ring of AISI S420 stainless steel to ASTM A276, loosely secured to stem.

.3 Operator: [handwheel] .

.5 Angle valve, NPS 2 and under, composition disc, Class 150:

.1 Body and bonnet: union bonnet.

.2 Disc and seat: renewable rotating PTFE disc in slip-on easily removable disc holder having integral guides, regrindable bronze seat, loosely secured to stem.

.3 Operator: [lockshield] [handwheel] .

.6 Check Valves:

.1 Requirements common to check valves, unless specified otherwise:

.1 Standard specification: MSS SP-80.

.2 Connections: screwed with hexagonal shoulders.

.2 NPS 2 and under, swing type, bronze disc, Class 125:

.1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.

.2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.

.3 NPS 2 and under, swing type, bronze disc:

.1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.

.2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.

.4 NPS 2 and under, swing type, composition disc, Class 200:

.1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.

.2 Disc: renewable rotating disc of number [6] composition to suit service conditions, bronze two-piece hinge disc construction.

.5 NPS 2 and under, horizontal lift type, composition disc, Class 150:

.1 Body: with integral seat, union bonnet ring with hex shoulders, cap.

.2 Disc: renewable [PTFE] [no. 6 composition] rotating disc in disc holder having guides top and bottom, of bronze to ASTM B62.

.6 NPS 2 and under, vertical lift type, bronze disc, Class 125:

.1 Disc: rotating disc having guides top and bottom, disc guides, retaining rings.

.7 Silent Check Valves:

.1 NPS 2 and under:

.1 Body: cast high tensile bronze to ASTM B62 with integral seat.

.2 Pressure rating: [Class 125] .

.3 Connections: screwed ends to ANSI B1.20.1 and with hex. shoulders.

.4 Disc and seat: renewable rotating disc.

.5 Stainless steel spring, heavy duty.

.6 Seat: regrindable.

.8 Ball Valves:

.1 NPS 2 and under:

.1 Body and cap: cast high tensile bronze to ASTM B62.

.2 Pressure rating: [Class125] [4140-kPa CWP] [2760-kPa CWP] , 860 kPa steam.

.3 Connections: [screwed ends to ANSI B1.20.1 and with hexagonal shoulders] [solder ends to ANSI] .

.4 Stem: stainless steel & tamperproof ball drive.

.5 Stem packing nut: external to body.

.6 Ball and seat: replaceable stainless steel solid ball and Teflon seats.

.7 Stem seal: TFE with external packing nut.

.8 Operator: removable lever handle.

.9 Butterfly Valves:

.1 NPS 2 1/2 through NPS 6, [2068 kPa] with grooved ends.

.1 Body: cast bronze, with copper-tube dimensioned grooved ends.

.2 Disc: elastomer coated ductile iron with integrally cast stem.

.3 Operator: [lever] [handwheel] .

Part 3 Execution

3.1 INSTALLATION

.1 Install rising stem valves in upright position with stem above horizontal.

.2 Remove internal parts before soldering.

.3 Install valves with unions at each piece of equipment arranged to allow servicing, maintenance, and equipment removal.

3.2 CLEANING

.1 Clean in accordance with Section [01 74 00- Cleaning] .

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Waste Management: separate waste materials for [recycling] [reuse] in accordance with Section [01 74 19- Waste Management and Disposal] [01 35 21- LEED Requirements] .

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B16.1-[05] , Cast Iron Pipe Flanges and Flanged Fittings.

.2 ASTM International (ASTM).

.1 ASTM A49-[01(2006)] , Standard Specification for Heat-Treated Carbon Steel Joint Bars.

.2 ASTM A126-[04] , Standard Specification for Grey Iron Castings for Valves, Flanges, and Pipe Fittings.

.3 ASTM A536-[84(2004)e1] , Standard Specification for Ductile Iron Castings.

.4 ASTM B61-[08] , Standard Specification for Steam or Valve Bronze Castings.

.5 ASTM B62-[02] , Standard Specification for Composition Bronze or Ounce Metal Castings.

.6 ASTM B85/B85M-[08] , Standard Specification for Aluminum-Alloy Die Castings.

.7 ASTM B209-[07] , Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

.3 Canada Green Building Council (CaGBC)

.1 LEED Canada-NC Version 1.0-[2004] , LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addendum [2007]).

.2 LEED Canada-CI Version 1.0-[2007] , LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.

.4 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS)

.1 MSS SP-61-[03] , Pressure Testing of Steel Valves.

.2 MSS SP-70-[06] , Grey Iron Gate Valves, Flanged and Threaded Ends.

.3 MSS SP-71-[05] , Grey Iron Swing Check Valves, Flanged and Threaded Ends.

.4 MSS SP-82-[1992] , Valve Pressure Testing Methods.

.5 MSS SP-85-[2002] , Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section [01 33 00- Submittal Procedures] .

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheets for valves and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in [Territory] [Province] , Canada.

.4 Sustainable Design Submittals:

.1 LEED Submittals: in accordance with [Section 01 35 21- LEED Requirements] .

1.3 CLOSEOUT SUBMITTALS

.1 Submit maintenance data for incorporation into manual specified in Section [01 78 00- Closeout Submittals] .

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section [01 61 00- Common Product Requirements] [with manufacturer's written instructions] .

.2 Delivery and Acceptance Requirements:

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: remove for reuse [and return] [by manufacturer] of [padding] [pallets] [packaging materials] [crates] in accordance with Section [01 74 19- Waste Management and Disposal] .

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials/Spare Parts:

.2 Furnish following spare parts:

.1 Valve seats: one for every [10] valves each size, minimum [1] .

.2 Discs: one for every [10] valves, each size, minimum [1] .

.3 Stem packing: one for every [10] valves, each size, minimum [1] .

.4 Valve handles: [2] of each size.

.5 Gaskets for flanges: one for every [10] flanged joints.

.3 Tools:

.1 Furnish special tools for maintenance of systems and equipment.

.2 Include following:

.1 Lubricant gun for expansion joints.

Part 2 Products

2.1 MATERIAL

.1 Sustainable Requirements:

.2 Valves:

.1 Except for specialty valves, to be of single manufacturer.

.3 Standard specifications:

.1 Gate valves: MSS SP-70.

.2 Globe valves: MSS SP-85.

.3 Check valves: MSS SP-71.

.4 Requirements common to valves, unless specified otherwise:

.1 Body, bonnet: [ductile iron to ASTM A536 Grade 65-45-12] [cast iron to ASTM B209 Class B] .

.2 Connections: flanged ends [plain face] [grooved ends] [with 2 mm raised face with serrated finish] to ANSI B16.1.

.3 Inspection and pressure testing: to MSS SP-82.

.4 Bonnet gasket: non-asbestos.

.5 Stem: to have precision-machined Acme or 60 degrees V threads, top screwed for handwheel nut.

.6 Stuffing box: non-galling two-piece ball-jointed packing gland, gland bolts and nuts.

.7 Gland packing: non-asbestos.

.8 Handwheel: die-cast aluminum alloy to ASTM B85/B85M or malleable iron to ASTM A49. Nut of bronze to ASTM B62.

.9 Identification tag: with catalogue number, size, other pertinent data.

.5 All products to have CRN registration numbers.

2.2 GATE VALVES

.1 NPS 2 1/2 - 8, non rising stem, inside screw, [iron] [bronze] trim, solid wedge disc:

.1 Body and multiple-bolted bonnet: with [bosses in body and bonnet for taps and drains,] full length disc guides designed to ensure correct re-assembly, Class 125.

.2 Disc: solid offset taper wedge, bronze to ASTM B62.

.3 Seat rings: renewable bronze to ASTM B62, screwed into body.

.4 Stem: bronze to ASTM B62.

.5 Disc: solid offset taper wedge, cast iron to ASTM A126 Class B, secured to wrought steel stem.

.6 Seat: integral with body.

.7 Stem: wrought steel.

.8 Operator: [hydraulic:<empty/>] [motor:<empty/>] [manual gear:<empty/>] [handwheel] .

.9 Bypass: complete with union and NPS [gate] [globe] valve as Section [23 05 23.01- Valves - Bronze] , paragraph [_____]

.2 NPS 10 - 24, non rising stem, inside crew, [bronze] [iron] trim, solid wedge disc:

.1 Body and multiple-bolted bonnet: cast iron to ASTM A126 Class B for sizes up to NPS 14, Class C for sizes NPS 16 and over, with [bosses in body and bonnet for taps and drains,] full length disc guides designed to ensure correct re-assembly, body tie ribs between bonnet and end flanges.

.2 Pressure ratings: Class 125.

.3 Disc: solid offset taper wedge, with bronze rings to ASTM B62 rolled into cast iron disc, secured to stem.

.4 Seat rings: renewable bronze to ASTM B62 screwed into body.

.5 Stem: bronze to ASTM B62.

.6 Disc: solid offset taper wedge, cast iron secured to stem.

.7 Seat: integral with body up to NPS 14, renewable nodular iron on other sizes.

.8 Stem: wrought steel.

.9 Operator: [handwheel] [motor:<empty/>] [manual gear:<empty/>] [hydraulic:<empty/>] .

.10 Bypass: complete with union and NPS [gate] [globe] valve as Section [23 05 05- Installation of Pipework] , paragraph [_____]

.3 NPS 2 1/2-8, outside screw and yoke (OS&Y), [bronze] [iron] trim, solid wedge disc:

.1 Body and multiple-bolted bonnet: with [bosses in body and bonnet for taps and drains,] full length disc guides designed to ensure correct re-assembly, yoke, yoke hub, yoke sleeve and nut. Class 125.

.2 Disc: solid offset taper wedge, bronze to ASTM B62 up to NPS 3, cast iron with bronze disc rings on other sizes, secured to stem through integral forged T-head disc-stem connection.

.3 Seat rings: renewable bronze screwed into body.

.4 Stem: [manganese-bronze] [nickel-plated steel] .

.5 Disc: solid offset taper all-cast iron, secured to stem through integral forged T-head disc-stem connection.

.6 Seat rings: integral with body.

.7 Stem: nickel-plated steel.

.8 Pressure-lubricated operating mechanism.

.9 Operator: [handwheel] [motor:<empty/>] [hydraulic:<empty/>] [manual gear:<empty/>] .

.10 Bypass: complete with union and NPS [gate] [globe] valve as Section [23 05 05- Installation of Pipework] , paragraph [_____]

.4 NPS 10 - 24, outside screw and yoke (OS&Y), [iron] [bronze] trim, solid wedge disc:

.1 Body and multiple-bolted bonnet: NPS 10 - 14: cast iron to ASTM A126 Class B. With [bosses in body and bonnet for taps and drains,] full length disc guides designed to ensure correct re-assembly, body tie ribs between bonnet and end flanges, yoke, yoke hub, yoke sleeve and nut.

.2 Pressure ratings: Class 125.

.1 NPS 10-12: WP = 1.4 Mpa CWP.

.2 NPS 14-24: WP = 1.03 Mpa CWP.

.3 Disc: solid offset taper wedge, bronze disc rings to ASTM B62 rolled into cast iron disc, secured to stem through integral forged T-head disc-stem connection.

.4 Seat rings: renewable bronze to ASTM B62 screwed into body.

.5 Stem: [nickel-plated steel] [manganese-bronze] .

.6 Disc: solid offset taper all-cast iron, secured to stem through integral forged T-head disc-stem connection.

.7 Seat: integral with body up to NPS 14, renewable nodular iron on other sizes.

.8 Stem: nickel-plated steel.

.9 Pressure-lubricated operating mechanism.

.10 Operator: [motor:<empty/>] [handwheel] [manual gear:<empty/>] [hydraulic:<empty/>] .

.11 Bypass: complete with union and NPS [gate] [globe] valve as Section [23 05 23.01- Valves - Bronze] , paragraph [_____]

2.3 UNDERWRITERS APPROVED GATE VALVE

.1 NPS 2 1/2 - 14, OS&Y:

.1 Approvals: UL and FM approved for fire service.

.2 UL and FM Label: on valve yoke.

.3 Body, Bonnet: cast iron to ASTM A126 Class B. Wall thicknesses to [ANSI B16.1 and ULC C-262 (B)] [ductile iron to ASTM A536 Grade 65-45-12] .

.4 Bonnet bushing, yoke sleeve: bronze, to FM requirements.

.5 Packing gland: bronze.

.6 Stem: manganese bronze. Diameter to ULC C-262 (B). [Brass, ASTM B16] .

.7 Stuffing box dimensions, gland bolt diameter: to ULC C-262 (B).

.8 Bosses for bypass valve, drain: on NPS 4 and over.

.9 Disc: solid taper wedge. Up to NPS 3: bronze. NPS 4 and over: EPDM coated cast iron with bronze disc rings.

.10 Disc seat ring: self-aligning, Milwood undercut on NPS 3 - 12.

.11 Pressure rating:

.1 NPS 2-1/2 - 12: 1.7 Mpa CWP.

.2 NPS 14-1.2: 1.2 MPa CWP.

.12 Operator: handwheel.

.13 Bypass: complete with union and NPS [gate] [globe] valve as Section [23 05 23.01- Valves - Bronze] , paragraph [_____]

2.4 GLOBE VALVES

.1 NPS 2 1/2 - 10, OSY:

.1 Body: with multiple-bolted bonnet.

.2 WP: 860 kPa steam, 1.4 MPa CWP.

.3 Bonnet-yoke gasket: non-asbestos.

.4 Disc: bronze to ASTM B62, fully guided from bottom, securely yet freely connected to stem for swivel action and accurate engagement with disc.

.5 Seat ring: renewable, regrindable, screwed into body.

.6 Stem: bronze to ASTM B62.

.7 Operator: [manual gear:<empty/>] [handwheel] [hydraulic:<empty/>] [motor:<empty/>] .

.8 Bypass: complete with union and NPS [gate] [globe] valve as Section [23 05 23.01- Valves - Bronze] , paragraph [_____]

2.5 BYPASSES FOR GATE AND GLOBE VALVES

.1 Locations: on valves as indicated.

.2 Position of bypass valve on main valves: [_____]

.3 Size of bypass valve:

.1 Main valve up to NPS 8: NPS 3/4.

.2 Main valve NPS 10 and over: NPS 1.

.4 Type of bypass valves:

.1 On gate valve: globe, with [composition] [bronze] disc, [bronze] trim, to Section [23 05 23.01- Valves - Bronze] . Pressure rating to match main valve.

.2 On globe valve: globe, with [composition] [bronze] disc, [bronze] trim, to Section [23 05 23.01- Valves - Bronze] . Pressure rating to match main valve.

2.6 VALVE OPERATORS

.1 Install valve operators as follows:

.1 Handwheel: on valves except as specified.

.2 Handwheel with chain operators: on valves installed more than 2400 mm above floor in [mechanical equipment rooms] [boiler rooms] .

2.7 CHECK VALVES

.1 Swing check valves, Class 125:

.1 Body and bolted cover: with tapped and plugged opening on each side for hinge pin. Grooved or flanged ends: plain faced with smooth finish.

.1 Up to NPS 16: [ductile iron ASTM A536 Grade 65-45-12] [cast iron to ASTM A126 Class B] .

.2 NPS 18 and over: cast iron to ASTM A126 Class C.

.2 Ratings:

.1 NPS 2 1/2 - 12: 860 kPa steam; 1.4 MPa CWP.

.2 NPS 14 - 16: 860 kPa steam; 1.03 MPa CWP.

.3 NPS 18 and over: 1.03 MPa CWP.

.3 Disc: rotating for extended life.

.1 Up to NPS 6: [stainless steel type 316] [bronze to ASTM B62] .

.2 NPS 8 and over: bronze-faced cast iron.

.4 Seat rings: renewable bronze to ASTM B62 screwed into body.

.5 Hinge pin, bushings: [renewable bronze to ASTM B62] [stainless steel] .

.6 Disc: A126 Class B, secured to stem, rotating for extended life.

.7 Seat: cast iron, integral with body.

.8 Hinge pin: exelloy; bushings: malleable iron.

.9 Identification tag: fastened to cover.

.10 Hinge: [galvanized malleable iron] [stainless steel] .

.2 Swing check valves, NPS 2 1/2 - 8 Class 250:

.1 Body and bolted cover: cast iron to ASTM A126 Class B with tapped and plugged opening on each side for hinge pin.

.2 Flanged ends: 2 mm raised face with serrated finish.

.3 Rating: 250 psi steam; 500 psi CWP.

.4 Disc: rotating for extended life.

.1 Up to NPS 3: bronze to ASTM B61.

.2 NPS 4 - 8: iron faced with ASTM B61 bronze.

.5 Seat rings: renewable bronze to ASTM B61, screwed into body.

.6 Hinge pin, bushings: renewable, bronze to ASTM B61.

.7 Hinge: galvanized malleable iron.

.8 Identification tag: fastened to cover.

2.8 SILENT CHECK VALVES

.1 Construction:

.1 Body: [malleable] [ductile iron] with integral seat.

.2 Pressure rating: Class 125, WP = 860 kPa.

.3 Connections: grooved ends.

.4 Disc: [stainless steel] [bronze] renewable rotating disc.

.5 Seat: renewable, EPDM.

.6 Stainless steel spring, heavy duty.

Part 3 Execution

3.1 INSTALLATION

.1 Install rising stem valves in upright position with stem above horizontal.

3.2 CLEANING

.1 Clean in accordance with Section [01 74 00- Cleaning] .

.2 Clean installed products in accordance to manufacturer's recommendation.

.3 Waste Management: separate waste materials for [reuse] [recycling] in accordance with Section [01 35 21- LEED Requirements] [01 74 19- Waste Management and Disposal] .

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)

.1 ASME B16, Fittings and Valves Package.

.2 ASME B16.5-[2009] , Pipe Flanges and Flanged Fittings: NPS ½ through NPS 24 Metric/Inch Standard.

.3 ANSI/ASME B16.10-[2009] , Face-to-Face and End-to-End Dimensions Valves.

.4 ANSI/ASME B16.25-[2007] , Buttwelding Ends.

.5 ANSI/ASME B16.34-[2009] , Valves Flanged, Threaded and Welding End. Includes Supplement (2010).

.2 American Petroleum Institute (API)

.1 API STD 598-[2009] , Valve Inspection and Testing.

.3 ASTM International (ASTM)

.1 ASTM A49-[12] , Standard Specification for Heat-Treated Carbon Steel Joint Bars, Micro Alloyed Joint Bars, and Forged Carbon Steel Comprise Joint Bars.

.2 ASTM A182/A182M-[11a] , Standard Specification for Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valve Parts for High Temperature Service.

.3 ASTM A193/A193M-[12] , Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature or High Pressure Service and Other Special Purpose Applications.

.4 ASTM A194/A194M-[2011] , Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service, or Both.

.5 ASTM A216/A216M-[08] , Standard Specification for Steel Castings, Carbon Suitable for Fusion Welding for High-Temperature Service.

.6 ASTM B85/B85M-[10] , Standard Specification for Aluminum-Alloy Die Castings.

.4 Canada Green Building Council (CaGBC)

.1 LEED Canada-NC Version 1.0-[2004] , LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addendum [2007]).

.2 LEED Canada-CI Version 1.0-[2007] , LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.

.3 LEED Canada 2009 for Design and Construction-[2010] , LEED Canada 2009 for Design and Construction Leadership in Energy and Environmental Design Green Building Rating System Reference Guide.

.4 LEED Canada for Existing Buildings, Operations and Maintenance-[2009] , LEED Canada 2009 Leadership In Energy and Environmental Design Green Building Rating System Reference Guide.

.5 Efficiency Valuation Organization (EVO)

.1 International Performance Measurement and Verification Protocol (IPMVP)

.1 IPMVP [2007] Version.

.6 Green Seal Environmental Standards (GS)

.1 GS-11-[11] , Standard for Paints and Coatings.

.2 GS-36-[11] , Standard for Commercial Adhesives.

.7 Manufacturers Standardization Society of the Valve and Fittings Industry (MSS)

.1 MSS SP-25-[2008] , Standard Marking System for Valves, Fittings, Flanges and Unions.

.2 MSS SP-61-[2009] , Pressure Testing of Valves.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section [01 33 00- Submittal Procedures] .

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for [each valve] and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in [Province] [Territory] , Canada.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Sustainable Design Submittals:

.1 LEED Canada submittals: in accordance with [Section 01 35 21- LEED Requirements] .

.2 Building Energy and Water Consumption: [submit Measurement and Verification Plan following IPMVP] [for monitoring end-uses as follows] :

.1 Air and water economizer and heat recovery cycle.

.2 Building-related process energy systems and equipment.

.3 Indoor water risers and outdoor irrigation systems.

.3 Construction Waste Management:

.1 Submit project [Waste Reduction Workplan] [Waste Management Plan] highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that [75] [50] % of construction wastes were recycled or salvaged.

.4 Regional Materials: submit evidence that project incorporates required percentage [20] [10] % of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section [01 78 00- Closeout Submittals] .

.2 Operation and Maintenance Data: submit operation and maintenance data for [valves] for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section [with manufacturer's written instructions] [01 61 00- Common Product Requirements] .

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials [indoors] [off ground] [in dry location] and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect [valves] from [nicks, scratches, and blemishes] .

.3 Replace defective or damaged materials with new.

.4 Develop [Construction Waste Management Plan] [Waste Reduction Workplan] related to Work of this Section and in accordance with Section [01 35 21- LEED Requirements] .

.5 Packaging Waste Management: remove for reuse [by manufacturer] [and return] of [pallets,] [crates,] [packaging materials] [padding,] as specified in [Construction Waste Management Plan] [Waste Reduction Workplan] in accordance with Section [Section 01 35 21- LEED Requirements] [01 74 19- Waste Management and Disposal] .

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit in accordance with Section [01 78 00- Closeout Submittals] .

.2 Extra Stock Materials:

.3 Furnish following spare parts:

.1 Valve seats: one for every [10] valves each size, minimum [1] .

.2 Discs: one for every [10] valves, each size, minimum [1] .

.3 Stem packing: one for every [10] valves, each size. Minimum [1] .

.4 Valve handles: [2] of each size.

.5 Gaskets for flanges: one for every [10] flanged joints.

Part 2 Products

2.1 MATERIAL

.1 Valves:

.1 To be of single manufacturer.

.2 Test valves individually.

.2 Requirements common to valves, unless specified otherwise:

.1 Pressure-temperature ratings: to ANSI B16.34.

.2 Inspections and tests: to API 598.

.3 Pressure testing: to MSS SP-61.

.4 Flanged valves:

.1 Face-to-face dimensions: to ANSI B16.10.

.2 Flange dimensions: to ANSI B16.5 with 1.6 mm raised face.

.5 Butt-weld valves:

.1 End-to-end dimensions: to ANSI B16.10.

.2 End dimensions: to ANSI B16.25 bored for [standard pipe schedule] .

.6 Handwheel: non-heating type with raised rim of die-cast aluminum alloy to ASTM B85 or malleable iron to ASTM A49.

.7 Markings: to MSS SP-25.

.8 Identification:

.1 Plate showing catalogue number, size, material of body disc, stem seat, fluid, pressure-temperature rating.

.2 Body markings: manufacturer, size, primary service rating, material symbol.

.9 CRN registration number required for all products.

2.2 GLOBE VALVES

.1 NPS 2 1/2 - 12, rising stem, OS&Y, [butt-weld] [flanged] ends, Class [150] [300] :

.1 Body and multiple-bolted integral yoke and bonnet: cast steel to ASTM A216/A216M WCB.

.2 Body/bonnet joint: [male-female] [flat] face with corrugated metallic gasket.

.3 Bonnet studs: to ASTM A193/A193M Type B7.

.4 Bonnet nuts: to ASTM A194/A194M Type 2H.

.5 Stuffing box: including non-galling two-piece ball-jointed packing gland, with swing-type eye bolts and nuts.

.6 Gland packing: containing corrosion inhibitor to prevent stem pitting.

.7 Yoke bushing: Ni-Resist, minimum melting point above 954 degrees C.

.8 Hydraulic grease fitting: for lubrication of yoke sleeve bearing surfaces.

.9 Disc: [ball type with 35 degrees taper seat] [plug type with 15 degrees taper seat and bottom guide] .

.10 Seat rings: with 1.6 mm thick cobalt-chromium-tungsten alloy facings with minimum hardness of 375 HB (cold), slipped in, seal welded, ground to match disc.

.11 Stem: heat treated corrosion and heat resistant 13% chromium steel with bonnet bushing, long engagement with yoke bushing for accurate seating, accurately-cut precision-machined Acme or 60 degrees V threads, top screwed for handwheel nut.

.12 Operator: see elsewhere in this Section.

2.3 VALVE OPERATORS

.1 Handwheel: on all valves.

.2 Handwheel with chain operators: on valves installed more than 2400 mm above floor in [boiler rooms] [mechanical equipment rooms] .

.3 Motors:

.1 Application: [full open and full close applications] .

.2 [Position and precision control] .

.4 Hydraulic operators:

.1 Application: [conveyor and feeder drives] .

.2 [Mixer and agitator drives] .

.5 Pneumatic operators:

.1 Application: [media with high dirt content, media with high viscosity, high ambient temperatures, large flow quantities, damp environments and where there is a risk of explosion] .

2.4 BYPASSES FOR GATE AND GLOBE VALVES

.1 Locations: on valves as indicated.

.2 Position of bypass valve on main valves: [_____]

.3 Size of bypass valve:

.1 Main valve up to NPS 8: NPS 3/4.

.2 Main valve NPS 10 and over: NPS 1.

.4 Type of bypass valves:

.1 On gate valve: globe, with [bronze] [composition] disc, [bronze] trim, to Section [23 05 23.01- Valves - Bronze] .

.2 On globe valve: globe, with [bronze] [composition] disc, [bronze] trim, to Section [23 05 23.01- Valves - Bronze] .

2.5 CHECK VALVES

.1 NPS 2 1/2 and over, [flanged] [butt-weld] ends, Class[300] [150] : swing check.

.1 Body and multiple-bolted cap: cast steel to ASTM A216/A216M WCB.

.2 Cap studs: to ASTM A193/A193M Type B7.

.3 Cap nuts: to ASTM A194/A194M Type 2H.

.4 Body/cap joint: male-female face with corrugated metallic gasket.

.5 Disc: heat treated corrosion and heat resistant 13% chromium steel.

.6 Seat rings: heat treated corrosion and heat resistant 13% chromium steel, slipped in, seal welded, ground to match disc.

.7 Hinge: [ASTM A182/A182M] .

.8 Hinge pin: [ASTM A182/A182M] .

.9 Hinge pin plugs: [ASTM A182/A182M] .

2.6 SILENT CHECK VALVES

.1 Construction:

.1 Body: cast steel to [_____]

.2 Pressure rating: Class [125] , [250] .

.3 Connections: [flanged] [wafer] ends.

.4 Double bronze disc with SS seat and stem. Renewable disc, seat, stem and spring. Spring rating must match system design for silent operation and installation.

.5 Stainless steel spring, heavy duty.

.6 Seat: regrindable.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of [Departmental Representative] [DCC Representative] [Consultant] .

.2 Inform [DCC Representative] [Consultant] [Departmental Representative] of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied [and after receipt of written approval to proceed from [DCC Representative] [Departmental Representative] [Consultant]] .

3.2 INSTALLATION

.1 Install in accordance with manufacturer's recommendations in upright position with stem above horizontal.

3.3 COMMISSIONING

.1 As part of commissioning activities, develop schedule of valves and record thereon identifier, location, service, purchase order number and date, manufacturer, identification data specified above.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section [01 74 00- Cleaning] .

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section [01 74 00- Cleaning] .

.3 Waste Management: separate waste materials for [recycling] [reuse] in accordance with Section [01 74 19- Waste Management and Disposal] [01 35 21- LEED Requirements] .

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by cast steel valve installation.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)

.1 ASME B1.20.1-[1983(R2006)] , Pipe Threads, General Purpose (Inch).

.2 ASME B16.1-[05] , Grey Iron Pipe Flanges and Flanged Fittings: Classes 25,125 and 250.

.3 ANSI/ASME B16.5-[03] , Pipe Flanges and Flanged Fittings: NPS ½ through 24.

.4 ANSI/ASME B16.11-[05] , Forged Fittings, Socket-Welding and Threaded.

.5 ANSI/ASME B16.25-[07] , Buttwelding Ends.

.6 ANSI/ASME B16.34-[04] , Valves - Flanged, Threaded and Welding Ends.

.2 American Petroleum Institute (API)

.1 API Std. 609-[04] , Butterfly Valves: Double Flanged, Lug- and Wafer-Type.

.3 ASTM International (ASTM).

.1 ASTM A126-[04)] , Standard Specification for Grey Iron Castings for Valves, Flanges, and Pipe Fittings.

.2 ASTM A536-[84(2004)e1] , Standard Specification for Ductile Iron Castings.

.3 ASTM B62-[02] , Standard Specification for Composition Bronze or Ounce Metal Castings.

.4 ASTM B209M-[07] , Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric] .

.4 Canada Green Building Council (CaGBC)

.1 LEED Canada-NC Version 1.0-[2004] , LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addendum [2007]).

.2 LEED Canada-CI Version 1.0-[2007] , LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.

.5 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS)

.1 MSS SP-67-[02a] , Butterfly Valves.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section [01 33 00- Submittal Procedures] .

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheets for valves and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit data for valves specified in this section.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in [Province] [Territory] , Canada.

1.3 CLOSEOUT SUBMITTALS

.1 Submit maintenance data for incorporation into manual specified in Section [01 78 00- Closeout Submittals] .

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section [with manufacturer's written instructions] [01 61 00- Common Product Requirements] .

.2 Delivery and Acceptance Requirements:

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: remove for reuse [and return] [by manufacturer] of [pallets] [crates] [packaging materials] [padding] in accordance with Section [01 74 19- Waste Management and Disposal] .

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials/Spare Parts:

.2 Furnish following spare parts:

.1 Valve seats: one for every [10] valves each size, minimum [1] .

.2 Discs: one for every [10] valves, each size, minimum [1] .

.3 Stem packing: one for every [10] valves, each size, minimum [1] .

.4 Valve handles: [2] of each size.

.5 Gaskets for flanges: one for every [10] flanged joints.

.3 Tools:

.1 Furnish special tools for maintenance of systems and equipment.

.2 Include following:

.1 Lubricant gun for expansion joints.

Part 2 Products

2.1 MATERIAL

.1 Sustainable Requirements:

2.2 BUTTERFLY VALVES - RESILIENT SEAT - 200 PSIG

.1 Except to specialty valves, to be of single manufacturer.

.2 To be suitable for dead-end service.

.3 CRN registration number required for products.

.4 Sizes:

.1 [Lug] [Wafer] type: NPS 2 to 30.

.2 Grooved end type: NPS 2 to 12.

.5 Pressure rating for tight shut-off at temperatures up to maximum for seat material.

.1 NPS 2 - 12: [200] psig.

.2 NPS 14 - 48: [200] psig.

.6 Minimum seat temperature ratings to [135] [121] degrees C.

.7 Application: on-off operation.

.8 [Grooved ends] [Full lug body (threaded)] .

.9 Operators:

.1 NPS 2 - 6: handles capable of locking in any of ten (10) positions - 0 degrees to 90 degrees. Handle and release trigger - ductile iron. Return spring and hinge pin: carbon steel. Latch plate and mounting hardware: cadmium plated carbon steel. Standard coating: black laquer.

.2 NPS 8 - 30: [manual enclosed gear operator] [[pneumatic] [electric] actuators] as specified elsewhere in this section.

.10 Designed to comply with MSS SP-67 and API 609.

.11 Compatible with ANSI Class 125/Class 150 flanges.

.12 Construction:

.1 Body [ss] [ductile iron] [aluminum bronze] .

.2 Disc: [coated ductile iron] [aluminum bronze] [316 SS] [plated ductile iron] .

.3 Seat: [EPT] [EPDM] [Buna-N] [Viton] .

.4 Shaft: [316] [416] stainless steel.

.5 Taper pin: [Monel] [316 SS] .

.6 Key: [stainless] [carbon steel] .

.7 O-Ring:[Fluoroelastomer] [EPDM] [Buna-N] .

.8 Bushings: [Teflon] [fibreglass with Teflon lining] [luberized bronze] .

2.3 BUTTERFLY VALVES - RESILIENT SEAT - 285 PSIG

.1 Sizes:

.1 Lug type: NPS 2 to 48.

.2 Grooved end type: NPS 2 to 12.

.2 Pressure rating: 285 psig at [121] [135] degrees C.

.3 Lug body: 150 ANSI bolt pattern.

.4 [Grooved ends] [Full lug body (threaded)] ..

.5 Application: for on-off service.

.6 Operators:

.1 NPS 2 - 6: handles capable of locking in any of ten (10) positions - 0 degrees to 90 degrees. Handle and release trigger - ductile iron. Return spring and hinge pin: carbon steel. Latch plate and mounting hardware: cadmium plated carbon steel.

.2 NPS 8 - 24: [manual enclosed gear operator] [[electric] [pneumatic] actuators] .

.3 Install parallel or perpendicular to pipeline.

.7 Designed to comply with MSS SP-67 and API Std. 609.

.8 Compatible with ANSI B16.1 Class 125 (iron) and ANSI B16.5 Class 150 (steel) flanges.

.9 Construction:

.1 Body: ductile iron.

.2 Disc: [316 SS] [aluminum bronze] [coated ductile iron] .

.3 Seat: [Viton] [EPDM] [Buna-N] [EPT] .

.4 Refer to manufacturer's literature for additional materials.

.5 Shaft: [NPS 2 - 12: 416 stainless steel] [316 stainless steel] [NPS 14 - 48,] .

.6 Taper pin: [316 SS] [Monel] .

.7 Blowout proof stem.

.8 O-Ring: [EPDM] [Fluoroelastomer] [Buna-N] .

.9 Bushings: Teflon.

.10 Disc shall not be pinned to shaft.

.11 Bubble tight shutoff with downstream flanges removed, class 6 shutoff.

2.4 MOUNTING FLANGES

.1 Class 125 cast iron to ANSI B16.1 or Class 150 steel to B16.5 pipe flanges.

2.5 ELECTRIC ACTUATORS

.1 Operation: designed to provide precise quarter turn electric operation.

.1 Torque range: up to 1.130 N-m and speed ranges from 10 seconds to 30 seconds to move from fully open to fully closed.

.2 Gear train within actuator to provide smooth continuous rotary power stroke for accurate automatic valve positioning. Factory-set, field adjustable cam-actuated travel limit switches to provide precise control of shaft rotation.

.2 Construction:

.1 Castings: heavy duty industrial grade for rugged use.

.2 Actuators: continuous duty with high efficiency single phase reversing capacitor motor with thermal overload protection.

.3 Gears and pinions constructed from hardened steel.

.4 Gear train to be permanently lubricated.

.5 Mechanical brake to ensure that gear is locked in precise position.

.3 Electrical:

.1 Standard voltage: [120 VAC. 60 Hz] .

.2 Control options: [0-10 V DC] [4-20 Ma DC] .

.3 CSA approved.

.4 Electrical rating: NEMA IV.

Part 3 Execution

3.1 PREPARATION

.1 Valve and mating flange preparation.

.1 Inspect adjacent pipeline, remove rust, scale, welding slag, other foreign material.

.2 Ensure that valve seats and pipe flange faces are free of dirt or surface irregularities which may disrupt flange seating and cause external leakage.

.3 Install butterfly valves with disc in almost closed position.

.4 Inspect valve disc seating surfaces and waterway and eliminate dirt or foreign material.

3.2 INSTALLATION OF VALVES

.1 Install in accordance with manufacturer's instructions.

.2 Do not use gaskets between pipe flanges and valves unless instructed otherwise by valve manufacturer.

.3 Verify suitability of valve for application by inspection of identification tag.

.4 Mount actuator on to valve prior to installation.

.5 Handle valve with care so as to prevent damage to disc and seat faces.

.6 Valves in horizontal pipe lines should be installed with stem in horizontal position to minimize liner and seal wear.

.7 Ensure that valves are centered between bolts before bolts are tightened and then opened and closed to ensure unobstructed disc movement. If interference occurs due, for example to pipe wall thickness, taper bore adjacent piping to remove interference.

3.3 ACTUATOR INSTALLATION

.1 Air hoses or electrical connections to be made by actuator manufacturer.

.2 Cycle valve operation from fully closed to fully open then back to fully closed.

.3 At same time, check travel stop settings for proper disc alignment.

3.4 CLEANING

.1 Clean in accordance with Section [01 74 00- Cleaning] .

.2 Clean installed products in accordance to manufacturer's recommendation.

.3 Waste Management: separate waste materials for [recycling] [reuse] in accordance with Section [01 74 19- Waste Management and Disposal] [01 35 21- LEED Requirements] .

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 Section includes:

.1 Concrete housekeeping pads, hangers and supports for mechanical piping, ducting and equipment.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal

.3 Section 03 30 00 - Cast-in-Place Concrete.

.4 Section 05 12 23 - Structural Steel for Buildings.

.5 Section 05 50 00 - Metal Fabrications.

1.3 REFERENCES

.1 American National Standards Institute/ American Society of Mechanical Engineers (ANSI/ASME)

.1 ANSI/ASME B31.1, Power Piping, (SI Edition).

.2 American Society for Testing and Materials (ASTM)

.1 ASTM A125, Specification for Steel Springs, Helical, Heat-Treated.

.2 ASTM A307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.3 ASTM A563, Specification for Carbon and Alloy Steel Nuts.

.3 Factory Mutual (FM)

.4 Health Canada / Workplace Hazardous Materials Information System (WHMIS).

.1 Materials Safety Data Sheets (MSDS).

.5 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)

.1 MSS SP-58, Pipe Hangers and Supports - Materials, Design and Manufacture.

.2 ANSI/MSS SP-69, Pipe Hangers and Supports - Selection and Application.

.3 MSS SP-89, Pipe Hangers and Supports - Fabrication and Installation Practices.

.6 Underwriter's Laboratories of Canada (ULC)

1.4 SYSTEM DESCRIPTION

.1 Design Requirements

.1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.

.2 Base maximum load ratings on allowable stresses prescribed by MSS SP58 or ASME B31.1.

.3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.

.4 Design hangers and supports to support systems under all conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.

.5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment to be in accordance with MSS SP58.

.2 Performance Requirements

.1 Design supports, platforms, catwalks, hangers, to withstand seismic events for location as per the National Building Code

1.5 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop drawings: submit drawings stamped and signed for approval by Owner’s Representative.

.3 Submit shop drawings and product data for following items:

.1 Bases, hangers and supports.

.2 Connections to equipment and structure.

.3 Structural assemblies.

.4 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.1 Owner’s Representative will make available 1 copy of systems supplier's installation instructions.

.5 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals

1.6 QUALITY ASSURANCE

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 PRODUCTS

2.1 GENERAL

.1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS SP-58 and SP-89.

.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.2 PIPE HANGERS

.1 Finishes:

.1 Pipe hangers and supports: galvanized painted with zinc-rich paint after manufacture.

.2 Use electro-plating galvanizing process or hot dipped galvanizing process.

.3 Ensure steel hangers in contact with copper piping are copper plated or epoxy coated.

.2 Upper attachment structural: Suspension from lower flange of I-Beam.

.1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.

.1 Rod: 9 mm UL listed, 13 mm FM approved.

.2 Cold piping NPS 2 1/2 or greater, hot piping: Malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed, FM approved where required to MSS-SP58 and MSS-SP69.

.3 Upper attachment structural: Suspension from upper flange of I-Beam.

.1 Cold piping NPS 2 maximum: Ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed FM approved where required to MSS SP69.

.2 Cold piping NPS 2 1/2 or greater, all hot piping: Malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut UL listed, FM approved where required.

.4 Upper attachment to concrete.

.1 Ceiling: Carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.

.2 Concrete inserts: wedge shaped body with knockout protector plate UL listed FM approved where required to MSS SP-69.

.5 Shop and field-fabricated assemblies.

.1 Trapeze hanger assemblies: MSS SP-89.

.2 Steel brackets: MSS SP-89.

.3 Sway braces for seismic restraint systems: to MSS SP-89.

.6 Hanger rods: threaded rod material to MSS SP-58.

.1 Ensure that hanger rods are subject to tensile loading only.

.2 Provide linkages where lateral or axial movement of pipework is anticipated.

.3 Do not use 22 mm or 28 mm rod.

.7 Pipe attachments: material to MSS SP-58.

.1 Attachments for steel piping: carbon steel galvanized.

.2 Attachments for copper piping: copper plated black steel.

.3 Use insulation saddles for hot pipework.

.4 Oversize pipe hangers and supports for insulated pipes.

.8 Adjustable clevis: material to MSS SP-69, UL listed FM approved, where required clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.

.1 Ensure "U" has hole in bottom for rivetting to insulation shields.

.9 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP-69.

.10 U-bolts: carbon steel to MSS SP-69 with 2 nuts at each end to ASTM A563.

.1 Finishes for steel pipework: galvanized.

.2 Finishes for copper, glass, brass or aluminum pipework: black with formed portion plastic coated or epoxy coated.

.11 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP-69.

2.3 RISER CLAMPS

.1 Steel or cast iron pipe: galvanized black carbon steel to MSS SP-58, type 42, UL listed FM approved where required.

.2 Copper pipe: carbon steel copper plated to MSS SP-58, type 42.

.3 Bolts: to ASTM A307.

.4 Nuts: to ASTM A563.

2.4 INSULATION PROTECTION SHIELDS

.1 Insulated cold piping:

.1 64 kg/m^3 density insulation plus insulation protection shield to: MSS SP-69, galvanized sheet carbon steel. Length designed for maximum 3 m span.

.2 Insulated hot piping:

.1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP-69.

2.5 EQUIPMENT SUPPORTS

.1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Section 05 12 23 - Structural Steel for Buildings. Submit calculations with shop drawings.

2.6 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

.1 Provide templates to ensure accurate location of anchor bolts.

2.7 PLATFORMS AND CATWALKS

.1 To Section 05 50 00 - Metal Fabrication.

2.8 HOUSE-KEEPING PADS

.1 For base-mounted equipment: Concrete, at least 100 mm high, 50 mm larger all around than equipment, and with chamfered edges.

.2 Concrete: to Section 03 30 00 - Cast-in-place Concrete by Division 3.

2.9 OTHER EQUIPMENT SUPPORTS

.1 From structural grade steel meeting requirements of Section 05 12 23 - Structural Steel for Buildings.

.2 Submit structural calculations with shop drawings.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install in accordance with:

.1 Manufacturer's instructions and recommendations.

.2 Vibration Control Devices:

.1 Install on piping systems at pumps, boilers, chillers, cooling towers, elsewhere as indicated.

.3 Clamps on riser piping:

.1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.

.2 Bolt-tightening torques to be to industry standards.

.3 Steel pipes: Install below coupling or shear lugs welded to pipe.

.4 Cast iron pipes: Install below joint.

.4 Clevis plates:

.1 Attach to concrete with 4 minimum concrete inserts, one at each corner.

.5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

.6 Use approved constant support type hangers where:

.1 vertical movement of pipework is 13 mm or more,

.2 transfer of load to adjacent hangers or connected equipment is not permitted.

.7 Use variable support spring hangers where:

.1 transfer of load to adjacent piping or to connected equipment is not critical.

.2 variation in supporting effect does not exceed 25 % of total load.

3.3 HANGER SPACING

.1 Plumbing piping: most stringent requirements of Canadian Plumbing Code

.2 Fire protection: to applicable fire code.

.3 Gas and fuel oil piping: up to NPS 1/2: every 1.8 m.

.4 Copper piping: up to NPS 1/2: every 1.5 m.

.5 Hydronic, steam, condensate, rigid, and flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.

Maximum Pipe Size: NPS	Maximum Spacing: Steel	Maximum Spacing: Copper
up to 1-1/4	2.1 m	1.8 m
1-1/2	2.7 m	2.4 m
2	3.0 m	2.7 m
2-1/2	3.6 m	3.0 m
3	3.6 m	3.0 m
3-1/2	3.9 m	3.3 m
4	4.2 m	3.6 m
5	4.8 m	
6	5.1 m	
8	5.7 m	
10	6.6 m	
12	6.9 m	

.6 Within 300 mm of each elbow.

.7 Pipework greater than NPS 12: to MSS SP69.

3.4 HANGER INSTALLATION

.1 Install hanger so that rod is vertical under operating conditions.

.2 Adjust hangers to equalize load.

.3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members, comprised of angel iron or c-channel.

3.5 HORIZONTAL MOVEMENT

.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.

.2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 FINAL ADJUSTMENT

.1 Adjust hangers and supports:

.1 Ensure that rod is vertical under operating conditions.

.2 Equalize loads.

.2 Adjustable clevis:

.1 Tighten hanger load nut securely to ensure proper hanger performance.

.2 Tighten upper nut after adjustment.

.3 C-clamps:

.1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

.4 Beam clamps:

.1 Hammer jaw firmly against underside of beam.

END OF SECTION

1. GENERAL

1.1 Related Work

1. This Specification Section forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

2. References: American National Institute (ANSI) – ASME A13.1 (Rev. 1985) Scheme for the Identification of Piping Systems.

1.2 References

1. Canadian General Standards Board (CGSB).
    1. CAN/CGSB-1.60- latest edition, Interior Alkyd Gloss Enamel.
    2. CAN/CGSB-24.3- latest edition, Identification of Piping Systems.

1.3 Product Date

1. Submit product data in accordance with Section 01340 - Shop Drawings, Product Data, Samples and Mock-ups.

2. Product data to include paint colour chips, all other products specified in this section.

1.4 SAMPLES

.1 Submit samples in accordance with Section 01340 - Shop Drawings, Product Data, Samples and Mock-ups.

.2 Samples to include nameplates, labels, tags, lists of proposed legends.

1.5 Equipment Identification

1. Manufacturer's Nameplates.

    1. Each piece of manufactured equipment shall have metal nameplate, with raised or recessed letters. Mechanically fasten plate to equipment.

    2. Manufacturer's nameplates shall indicate Manufacturer's name, equipment model, size, serial number and electrical characteristics and pertinent information for any other service connections.

    3. Include Underwriters' Laboratories Canada (ULC) or Canadian Standards Association (CSA) registration logos and those of other agencies, as required by respective agencies.

4. Nameplates shall be located so they are easily read. Do not insulate or paint over name plates.

2. System Nameplates

1. Each piece of equipment shall be identified with its equipment schedule identification, e.g. supply fan SF- 1, cooling coil CC-1, pump P-1.

2. Identification letters shall be 50 mm high black letters on white background, sized to suit label or provide laminated plastic plates with black face and white centre of minimum size 90 mm x 38 mmx 2.5 mm engraved with 6.0 mm high lettering. Use 25 mm high lettering for major equipment.

3. Apply nameplates securely in conspicuous places, on cool surfaces.

4. Identify systems, and areas or zones of building being serviced.

1.6 Piping Identification

1. Piping Identification

1. Each piping system shall be colour coded for identification and labelled with system identification code letters, including temperature and pressure, if applicable, and directional flow arrow in accordance with Pipe Identification Colour Schedule.

2. Identifying piping (pipe markers and direction arrows) at the following locations:

1. Adjacent to major valves and where valves are in series at no more than 2.0 m intervals.

2. At least once in each room and 15 m maximum spacing in open areas.

3. Gas piping to be identified at 2.0 m intervals in ceiling plenums.

4. On both sides where piping passes through walls, partitions and floors.

5. Adjacent to major changes in direction.

6. At point of entry and leaving each pipe chase and/or confined space and piping accessible at each access opening.

7. At beginning and end points of each run and at each piece of equipment in each run.

3. Identification labels may be stenciled. Identification arrows, labels and letters may be vinyl cloth (Brady B500) or vinyl film (Brady B946), with adhesive compatible with surface temperature.

4. Identification colour bands for primary and secondary colours to indicate the type and degree of hazard shall be applied to overlap a minimum of 150 mm. Ends to be stapled. Bands shall be Brady B550 vinyl cloth tape or Brady B946 vinyl tape, with adhesive compatible with surface temperature.

2. Valve Tags

1. Provide valve identification tags and secure them using non-ferrous chain, braided band or plastic band (suitable for temperature). Tags may be of brass, aluminum, metal photo, lamicoid or fiberglass, stamped or engraved, of 25 mm minimum diameter.

2. Valves to be tagged include:

    1. Valves on main piping circuits.

    2. Valves on major branch lines.

    3. Valves on minor branch lines in horizontal service spaces, vertical service spaces and mechanical equipment rooms.

    4. DO NOT TAG valves on control valve stations, steam trap stations, fixture stops, or system drain valves.

    5. Drain valves and hose bibs on systems containing glycol.

    6. Control valves

3. Schedule valve numbers using sequential numbering system indicating location, service and the normal position (open or closed). Numbers shall be prefixed by letter “P” or letter “H” indicating valve is on plumbing or heating service.

1.7 Ductwork Identification

1. Identify plenum access doors with accessed items, e.g. Filter F-1, Supply Fan SF-1, Cooling Coil CC-1.

2. Stencil on plenum doors, downstream from air filter bank, “Do not open when fan operating.”

3. Identify ductwork in mechanical equipment rooms to denote system and/or zone served and air flow direction arrow.

4. Identify automatic control dampers concealed in ductwork. Identify “open” and “closed” position of operator arm on outside of duct or duct insulation.

5. Identify hazardous exhaust ducts, e.g. fume hood, radioactive exhaust at not greater than 3.0 m and at least once in each partitioned space. Radioisotope exhaust ducts shall be marked with radiation-warning symbol.

6. Identification letters shall be 50 mm high black letters on white background. Flow arrows shall be 50 mm wide by 150 mm long black arrows on white background. Stencil over final finish only.

1.8 Ceiling Access Identification

1. Secure 6.0 mm self adhesive coloured dots (Brady Quik Dots or Avery Data Dots) to ceiling to identify location of access to equipment concealed above ceiling, according to the following schedule:

	Colour
Concealed equipment and cleaning access	Yellow
Control Equipment, including control valves, dampers and sensors	Black
Fire and smoke dampers	Red
Fire protection, including sprinkler equipment and drains	Red
Heating/Chilled water, DCW, DHW isolation valves	Green
Pipe mounted equipment, other than fire, smoke and sprinkler equipment	Green

2. When T-bar ceilings are installed, adhere coloured dots to T-bar framing, adjacent to panel to be removed.

1.9 Duct Access Identification

1. Secure 50 mm high, Gothic style self-adhesive stick-on letters, (Letrasign or Brady Quick Align) on duct access panels to identify their usage, according to the following schedule:

	Colour	**Letters**
Cleaning and service access	black	C.A.
Controls, including sensors	black	C
Dampers (backdraft, balance and control)	black	D
Fire dampers	red	F.D.
Smoke dampers and detectors	red	S.D.

1.10 Tagging Identification

1. Secure engraved laminated plastic identification tags (black face and white centre) on the following items:

    1. Temperature control instruments, gauges and panels, coordinated with control diagrams identification.

2. Electrical switchgear supplied under the Mechanical Division 21, 22, 23 and 25.

3. Refer also to Controls Sections.

1.11 Identification Schedules

1. Submit schedules of the following for review prior to framing:

    1. Pipe Identification Colours.

    2. Valves.

    3. Ceiling Access Identification Colours.

    4. Duct Access Identification Colours.

2. Schedules will be required in each major mechanical room and at least one schedule will be required on each floor having minor mechanical room. Frame schedules under glass in matching frames and hang where directed.

    1. Include one copy of schedules in each operating maintenance manual.

1.12 Pipe Identification Colour Schedule

Service	Identification Letter Colour	Primary Colour	Secondary Colour
Cold Water Service	C.W.	Green	-
Domestic Cold Water	D.C.W.	Light Blue	-
Domestic H.W. Recirc.	D.H.W.R.	Yellow	Black
Domestic H.W. Supply	D.H.W.S.	Yellow	Black
Exhaust Piping	-	Yellow	Black
Hot Water Return	H.W.R.	Yellow	Black
Hot Water Supply	H.W.S.	Yellow	Black
Natural Gas	Gas	Yellow	Orange
Fire Sprinkler lines	SPR	Red	White

Sanitary Drain	SAN	None	None (-)
Storm Drain	Storm	None	(-)

1.13 Pipe Identification Banding Colours

1. Letters:
    1. 12 mm high - 1-1/4 NPS pipe and smaller.
    2. 25 mm high - 1-1/2 NPS up to 2-1/2 NPS pipe.
    3. 50 mm high - 3 NPS and larger pipe.
2. Bands:
    1. 38 mm wide, except arrow bands 50 mm wide.
3. Colours:
    1. Horizontally hatched - primary colour.
    2. Vertically hatched - secondary colour.
    3. Black letters and arrows on yellow primary colour.
    4. Background, white letters and arrows or red, blue or green backgrounds.

1.14 Buried Piping Identification/Markers

1. Metallic Pipe: Provide continuously printed 100 mm wide, 4 Mil thick blaze orange plastic tape with printing indicating type of service of buried pipe. Place tape at ±300 mm above buried pipe in backfill lifts.
2. Non-Metallic Piping: Provide detectable multi-ply tape consisting of aluminum foil core between two layers of 100 mm wide x 4 Mil blaze orange plastic tape with printing indicating type of service of buried pipe. Place tape at ±±300 mm above buried pipe in backfill lifts.
3. Where multiple small pipes are buried in a common trench and does not exceed an overall width of 450 mm, install a single tape line marker.

END OF SECTION

1. GENERAL

1.1 Related Work

1. This Specification Section forms part of Contract Documents and is to be read, interpreted and coordinated with other parts.

1.2 Work Included

1. Adjust and balance hydronic systems.
2. Adjust and balance domestic cold water systems.
3. Adjust and balance air systems.
4. Perform acoustic measurements.
5. Confirm operation of Fire Protection and Smoke Control Systems.

1.3 Intent: Perform work as an integral part of contract.

1.4 Quality Assurance

1. Acceptable TAB firms shall be credentialed by international organizations such as AABC (Associated Air Balance Council) and the NEBB (National Environmental Balancing Bureau). Exceptions to credentialed TAB firms would require submittal to the Consultant for review and approval.
2. Procedures shall be in accordance with current edition of AABC's National Standards for Field Measurement and Instrumentation, Total System Balance or NEBB's Procedural Standards for TAB Environmental Systems.
3. Each Balancing TAB Sub-Trade (other than those with proper acceptance) intending to bid for work shall submit the following information not less than seven days before close of Sub-Trade tenders. ANY FIRM THAT DOES NOT COMPLY WILL NOT BE ACCEPTED BY CONSULTANT.
    1. List previous projects of similar scope with dates projects were executed.
    2. Outline depth of firm including principals, years of operation, address and phone number.
    3. List instruments and procedures that will be used on project.
    4. List name of job site supervisor and provide resume of his/her specific work experience.
    5. Provide sample of balance report on project of similar scope.

1.5 Submittals

1. Submit name of proposed TAB firm for approval within seven days of contract award.

2. Include qualifications, including name and qualification of individual certifying reports. Failure to submit name of TB firm within required time period shall be cause for Consultant to select an alternative firm to carry out work at no change in contract price.

3. Within 14 days of request, TAB schedules and agenda shall be submitted for approval. TAB work shall not commence until approved.

1.6 Procedures

1. General: Before TAB, review with Consultant methods and instruments to be used. Include descriptive data, procedure data and sample forms.

2. Descriptive Data: Review design concepts and general function of each system including associated equipment and operation cycles including BAS Systems sequence of operations. Confirm listing of flow and terminal measurements to be performed and selection points for proposed sound measurements.

3. Procedure Data: Outline procedures for taking test measurements to establish compliance with requirements. Specify type of instrument to be used, method of instrument application (by sketch) and correction factors.

4. Data sheets required as a minimum are as follows:

    1. Air System Schematic Diagram
    2. Air Moving Equipment Test Sheet.
    3. Exhaust Fan Test Sheet.
    4. Air Distribution / Outlets Test Sheet
    5. Air Distribution Duct Traverse Test Sheet
    6. Air Moving Equipment Static Pressure Profile Test Sheet
    7. Hydronic System Schematic Diagram
    8. Circulation Water Pump Data Sheet.
    9. Hydronic Distribution / Terminal Test Sheet
    10. Covering comments sheet detailing systems balanced setpoints.

    Note: All test sheets shall include a Colum detailing achieved results as a % of design.

1.7 Cooperation

1. TAB firm shall check and report defects or deficiencies that may affect balancing.

2. Mechanical Contractor shall cooperate with balancing firm to:

    1. Provide sufficient time before final completion date so that TAB can be accomplished.

2. Provide labour and tools to make corrections without delay.
3. Place heating ventilating and air conditioning systems and equipment into full operation and continue operation.
4. Advise TAB firm of changes made to system during construction.
5. Install required test holes complete with removable and replaceable plugs.
6. Make necessary revisions to controls, dampers, fan and pump drives and consult with equipment Manufacturers as required to achieve specified systems performance.
7. Supply and install dampers as shown and where required to obtain final system balance.
8. Provide ladders scaffolds, tools and labour to assist work of balancing firm, including removing ceiling tiles and guards and adjusting pulleys and belts, replace when finished.
9. Control and/or equipment Manufacturer shall work with balancing firm when setting damper linkages and minimum outside air dampers. They shall be available for readjusting of dampers of controls improperly calibrated.
10. Set pressure regulating valves to operating and code conditions.
11. Check and set relief and safety valves to code requirements.
12. Clean strainers. Provide clean air filter immediately before air balancing.
13. Open fire dampers.
14. Change variable pitch pulley supplied on 11 KW motors and larger to fixed pulleys after air balance. Provide pulleys.
15. Provide drive changes required to suit final balance.

1.8 Tests

1. Give written 24 hour notice of date for tests.
2. Do not externally insulate or conceal work until tested and approved. Follow construction schedule and arrange for tests.
3. Conduct tests in presence of Consultant. Arrange for Owner's Representative to be present.
4. Bear costs including retesting and making good.
5. Refer to Piping Sections for specific test requirements.
6. Prior to tests, isolate equipment or other parts which are not designed to withstand test pressures.

2. PRODUCTS

2.1 Instruments

1. Instruments for TAB of air and hydronic systems shall have been calibrated within six months and verified for accuracy before start of work.

2. Submit list of equipment to be used for balancing and calibration certificates for each instrument listed.

3. EXECUTION

3.1 General Procedures

1. TAB to maximum flow deviation from specified values of 10% at terminal devices and
   -0% +5% at equipment or mean sound level deviation of 20 db. Provide air balancing volumes and settings for all air supply, exhaust, and return air ducts and terminals regardless of whether a special air volume tag has been noted on the drawing.

2. Permanently mark setting on valves, splitters, dampers and other adjustment devices.

3. Take measurements to verify system TAB has not been disrupted or such disruption has been rectified.

4. At final field review, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by Owner.

5. At completion, allow minimum two days for Consultant to witness test procedures and conduct tests for each system.

6. When building is occupied before completion, continue execution of work outside occupied hours.

3.2 Site Visits

1. Schedule total of four (4) site visits to correspond with site meetings held by Contractor. After each visit, submit written report to Contractor and Consultant. Site visits shall commence after start of air distribution work and be spread over remaining construction period to start of balancing.

2. Review of installation shall be made at scheduled visit and any additional dampers or valves required for proper balance shall be reviewed with Consultant and Contractors.

3. Allow for two (2) visits to site to adjust systems for seasonal changes during warranty.

3.3 Acceptance

1. Mechanical systems shall not be considered ready for final field review until TAB results are acceptable to Consultant.

2. If found that specified flows cannot be achieved on portions of system, actual conditions shall

be reported to Consultant for consideration of correctible action before continuing TAB procedure.

3. If measured flow at final field review shows deviation of 10% at terminal devices, 5% at equipment or more or mean sound level deviation of 10 db or more from certified report listing, by more than 10% of selected areas, report shall be rejected.

4. If report rejected, systems shall be re-balanced and certified report submitted at no extra cost.

3.4 TAB Report

1. Submit draft copies of reports before final acceptance of project. Provide three (3) copies of final report for inclusion in Operating and Maintenance Manuals.

2. Submit with report, fan and pump curves with operating conditions plotted.

3. Report shall be indexed as follows:

Section 1 Instrumentation and Measurement Procedures.

Section 2 System Data (Designed, Installed and Recorded), test sheet to be systems sequential.

Each system should including the following test sheets:

1. System Schematic.
2. Maintain equipment test sheets.
3. System distribution (inlet / outlets / valves) test sheets.
4. Profile pressure test sheets.
5. Comments sheet noting system setpoints.

3.5 Air System Procedures

1. Execute air systems balancing for each air system in accordance with AABC and NEBB specifications and as describer herein.

2. Make tests with supply, return and exhaust systems operating and doors and windows closed or in normal operation condition.

3. Test and adjust blower r/min to design requirements.

4. Test and record motor full load amps.

5. Make air quantity measurements in supply and return ducts at each major air handling or rooftop system by pilot tube traverse of entire cross-sectional area. Take minimum of 16 readings on each air handler.

6. Test and record required and measured system static pressures, filter differential, coil

differential and fan total static pressure.

7. Test and adjust systems for design recirculated airflows rates.

8. Test and adjust systems for design outdoor air quantities.

9. Test and record entering air temperatures (DB heating)(DB/WB cooling).

10. Test and record leaving air temperatures (DB heating)(DB/WB cooling).

11. Adjust main supply and return ducts to design flow rates.

12. Adjust zones to design, supply and return flow rates.

13. Test and adjust each diffuser, grille and register to within 10% of design requirements.

14. Identify each diffuser, grille and register as to location and area.

15. Identify and list size, type and Manufacturer of diffusers, grilles, registers and testing equipment. Use Manufacturer's rating on equipment to make required calculations.

16. Control and/or equipment Manufacturer shall set adjustments of automatically operated dampers to operate as indicated in cooperation with balancing firm.

17. Adjust diffusers, grilles and registers to minimize drafts.

18. Provide fire damper drop tests, in association with the Sheet Metal Contractor in accordance with Section 23 33 00.

19. Use volume control devices to regulate air quantities only to extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

20. Vary total system airflow rates by adjustments of fan speeds. Vary branch air quantities by damper regulation.

21. Provide system schematic with required and actual air flow rates at each outlet or inlet. Schematic shall include all fire dampers shown on drawings.

22. Record installed fan drive assemblies, fan sheaves, motor sheaves and belts.

23. Record each installed motor Manufacturer.

24. Final balanced condition of each area shall include testing and adjusting of pressure conditions. Test and record building pressurization levels in variable volume systems throughout full range of fan delivery rates, under both heating and cooling conditions. Test pressure conditions at ground, intermediate and upper levels. Check front doors, exits and elevator shafts for airflow so that exterior conditions do not cause excessive or abnormal

pressure conditions. Document abnormal building leakage conditions noted.

25. Complete TAB to achieve positive building pressure unless otherwise instructed. Positive pressure relative to outside pressure of 10 Pa minimum and 18 Pa maximum shall be achieved, measured with negligible outside wind velocity.

3.6 Hydronic System Procedures

1. Preparation of System - Phase I: Hydronic system shall be prepared for TAB by Mechanical Contractor in the following manner:

    1. Open valves, close bypass valves.
    2. Determine water in system has been treated and is clean.
    3. Check pump rotation.
    4. Confirm expansion tanks are not air bound and system is full of water.
    5. Confirm air vents at high points are installed properly and are operating freely and air is removed from circulation system.
    6. Set temperature controls for full flow.
    7. Check operation of automatic bypass valves.
    8. Check and set operating temperature of equipment to design requirements.

2. TAB Procedure - Phase II:

    1. Set pumps to proper flow rate.
    2. Proportionally balance flow of water through equipment.
    3. Record leaving water temperatures and return water temperatures and pressure drops through equipment. Reset to design temperatures.
    4. Record water temperature at inlet side of terminals. Note rise or drop of temperatures from source.
    5. Proportionally balance each terminal or in the absence of flow measuring commissioning valves balance each terminal based on temperature differential, including a check and combination that all auto-flow vavles are correctly installed, and are set at the correct flow.
    6. Upon completion of flow readings and adjustments, mark settings and record data.
    7. Coordinate shaving of pump impeller to pump operating condition on pumps larger than 1.5 KW.

3. TAB Procedure - Phase III:

    1. After adjustments to terminals, recheck settings at pumps. Readjust if required.
    2. Read pressure drop through each terminal and set flow rate on call for full flow. Set pressure drop across bypass valve to match terminal full flow pressure drop.

3.7 TAB Data

1. TAB and equipment data shall be listed in SI Metric Units.

2. Air Handling Equipment

   Installation Data:

   Arrangement, discharge

   and class.
   Motor type, KW, r/min, voltage, phase cycles and full load amps.

   Location and local identification.

3. Air Handling Equipment

   Design Data: Airflow

   rate (L/s).
   Static pressure (Pa).
   Motor KW, r/min
   and amps. Outside
   airflow rate (L/s).
   Fan
   r/mi
   n.
   Fan
   KW.
   Entering and leaving air dry and wet bulb temperatures (°C).

4. Air Handling Equipment

   Recorded Data Airflow

   rate (L/s).
   Static
   pressure (Pa).
   Fan r/min.
   Motor operating amps.
   Entering and leaving air dry and wet bulb temperatures (°C).

5. Duct Air Quantities - Mains, Branches, Outside Air and Exhausts (Minimum

   and Maximum) Duct sizes (at traverse normally) (mm).
   Number of pressure readings.
   Sum of velocity
   measurements.
   Average velocity

(m/s).
Duct recorded airflow
rate (L/s). Duct design
airflow rate (L/s).

6. Air Inlets and Outlets:

   Outlet identification, location and
   designation. Application factors.
   Design and recorded airflow rates (L/s).

7. Building Pressurization Data

   Outside air
   temperatures (°C).
   Outside wind velocity
   (m/s).
   Building pressures plotted with respect to
   systems (Pa). Supply air, return air and
   exhaust airflow rates (L/s).
   Locations of pressure measuring points, inside and outside building.

8. Pump Design Data

   Water flow
   rate (L/s).
   Pressure
   (kPa).
   Pump Motor
   r/min. Pump
   Motor KW

9. Pump Installation Data

   Size.
   Drive type.
   Motor type, KW, r/min, voltage phase, cycles and full load motor amps.

10. Pump Recorded Data

    Discharge and suction pressures (full flow and no flow)
    (kPa). Pressure and total dynamic head (kPa).
    Water flow rate (from pump curves if metering not
    provided) (L/s). Motor amps.

11. Expansion Tank Installation Data

Manufacturer, size and capacity (mm and L). Pressure reducing valve setting (kPa).
Pressure relief valve setting (kPa).

12. Heating Equipment Design Data

Heat transfer rate (kw). Water flow rate (L/s).
Entering and leaving water temperatures (°C). Water pressure drop (kPa).

13. Heating Equipment Recorded Data

Element type and identification (location and designation). Entering and leaving water temperatures (°C).
Water pressure drop (kPa). Water flow rate (L/s).

14. Air Heating and Cooling Equipment

Design Data Heat transfer rate

(kw).
Water flow rate (L/s).
Airflow rate (L/s).
Water pressure drop across coil (kPa). Air static pressure drop (Pa).
Entering and leaving water temperatures (°C).
Entering and leaving air dry and wet bulb temperatures (°C).

15. Air Heating and Cooling Equipment Recorded Data

Element type and identification (location and designation). Entering and leaving air dry and wet bulb temperatures (°C). Entering and leaving water temperatures (°C).
Water pressure drop across coil (kPa).
Water pressure drop across bypass valve (kPa). Air static pressure drop (Pa).

Water flow
rate (L/s).
Airflow rate
(L/s).
Adjusted temperature rise or drop (°C).

3.8 Fire Protection and Smoke Control

1. Mechanical Contractor shall test systems in conjunction with Electrical Contractor to ensure proper sequencing and monitoring of mechanical equipment and devices as indicated on drawings five days before application for Occupancy Permit. Make corrections to systems as required and retest deficient items. Provide written verification to Consultant that Fire Protection and Smoke Control Systems are operating with indication/control on Fire Alarm Panel.

2. Testing shall include but not be limited to the following:

    1. Automatic shut-down of air systems connected to fire alarm panel and restarting of systems when panel returned to normal operation.

3. Mechanical Contractor shall be represented during final testing with Authorities having jurisdiction

END OF SECTION

1.0 GENERAL

1.1 Read Basic Mechanical Requirements 21 05 00 -GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS

1.2 Carry out site visits during latter stages of construction to ensure that arrangements for TAB are incorporated. Confirm proper placement of thermometer wells, pressure gauge cocks, balancing valves and access doors.

1.3 Submit TAB schedule, with descriptive data outlining procedures and sample forms showing method of data presentation, a minimum of three weeks before start of TAB work on site.

1.4 Systems equipment and related controls requiring TAB:

.1 Heating equipment and piping systems.
.2 Domestic water equipment and cold, hot and recirculation hot water piping systems.

1.5 Start TAB when building work is advanced to include:

.1 Normal operations of mechanical systems.

1.6 Accuracy.

.1 Continue TAB until operating values within plus or minus 5% of design values is achieved.
.2 Measurements to be accurate to within plus or minus 2% of actual values.

2.0 PRODUCTS

Not applicable

3.0 EXECUTION

1.1 Parameters
.1 Listed below is an outline of the information to be established in the TAB process:
.2 Measurements required are:
.1 Flow.
.2 Pressure.
.3 Temperature.
.4 Specific gravity.
.5 RPM.
.6 Electrical power.

1. Voltage.
2. Current draw.

.3 Measurement are required at and around equipment to establish fluid side performance of:
1. All boilers and fluid coolers.
2. Pumps.
3. PRVs and CBVs
4. Makeup (water) systems.

1.2 Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

1.3 Effect system balancing with automatic control valves open to heat transfer elements and bypasses closed.

1.4 Adjust water distribution systems by means of balancing valves, balancing cocks and fittings. Do not use shut-off valves for balancing. Mechanical Contractor must provide balancing valves for balancing water flow to all terminal units and coils.

1.5 Where available pump capacity is less than total flow requirements of individual system parts, full flow in any part may be simulated by temporary restriction of flow to other parts.

1.6 Setting Valves

.1 Lock and permanently mark settings of balancing valves and dampers adjusted in TAB procedures.

3.7 Report Presentation &

Verification Report

format:

.1 Arrangement to incorporate approved standard forms, with values expressed in SI and Imperial units.
.2 Include "as-built" system schematics showing flow quantities and measurement points. Use as-built drawings and ventilating line diagrams for references.
.3 Submit 3 copies of TAB reports, with index tabs, in 3 ring binders, for verification.

Completion:

.1 TAB to continue until final reports are approved.

END OF SECTION

1. GENERAL

1.1 Related Work

1. This Specification Section forms part of contract Documents and is to be read, interpreted and coordinated with other parts.

1.2 Quality Assurance

1. Catalogued or published ratings shall be obtained from tests carried out by Manufacturer or from independent testing agency signifying adherence to codes and standards.

2. Flame and smoke spread ratings less than 25/50 tested in accordance with CAN/ULC-S102-07 "Test for Surface Burning Characteristics of Building Materials".

2. PRODUCTS

2.1 Backdraft Dampers - Light Duty

1. Minimum Requirements:

    1. 1.61 mm thick galvanized steel or 1.29 mm aluminum channel frame.
    2. 0.51 mm thick embossed aluminum blades.
    3. Full blade length shafts, brass bearings.
    4. Felt or neoprene anti-chatter blade strips.
    5. Maximum blade height per section, 600 mm, use multiples for larger dimensions.
    6. Maximum blade length of 450 mm, use multiples for larger dimensions.
    7. Manufacturer's label.
    8. Where balanced backdraft damper (BBD) is indicated, damper shall incorporate adjustable counter balance weight and lever.
    9. Maximum pressure drop across damper at 4.06 m/s shall be 35 Pa.

2. Standard of Acceptance: EH Price CBD, Nailor, Ruskin, Westvent.

2.2 Backdraft Dampers - Medium Duty

1. Minimum Requirements:

    1. 1.61 mm galvanized steel or 1.29 mm aluminum channel frame.
    2. 1.63 mm aluminum blades, complete with stiffening ribs/bends.
    3. Full blade length shafts, brass ball or nylon bearings.
    4. Felt or neoprene anti-chatter blade strips.
    5. Blade connecting linkage with eyelet and pin bearings.

6. Maximum blade length of 762 mm, use multiples for larger dimensions.
7. Manufacturer's label.
8. Where balanced backdraft damper (BBD) is indicated, damper shall incorporate adjustable counter balance weight and lever.
9. Maximum pressure drop across damper at 4.06 m/s shall be 45 Pa.

2. Standard of Acceptance: Airolite 625, Penn CBD-6.

2.3 Balancing Dampers

1. Construction in accordance with SMACNA Duct Standards.

2. Minimum Requirements:

    1. Rectangular ducts:
        1. Up to 300 mm deep - single blade (butterfly type).
        2. 325 mm to 400 mm deep - two opposed blades, mechanically interlocked with pivots at quarter points.
        3. 430 mm deep and over - multiple opposed blades, mechanically interlocked with blades not greater than 200 mm deep and pivots equally spaced.
    2. Round Ducts:
        1. Single Blade (butterfly type).
    3. Material:
        1. Minimum 1.61 mm thick galvanized steel blades on butterfly dampers.
        2. Minimum 1.61 mm thick galvanized steel blades on multi-blade dampers with rigidly constructed galvanized steel frame (no frame required on single blade dampers).
        3. Minimum 1.27 mm thick stainless steel blades for fume exhaust ducts.
    4. Bearings:
        1. End bearings on low pressure single blade dampers above 300 mm diameter.
        2. Bearings on multiple blade dampers shall be bronze iolite type.
    5. Operating Mechanism:
        1. Lockable quadrant type with end bearing on accessible rectangular ducts up to 400 mm deep and on accessible round ducts.
        2. Wide pitch screw mechanism type with crank operator on accessible rectangular ducts 430 mm and over in depth and on inaccessible rectangular and round ducts.
        3. Override limiting stops.
        4. No blade movement in set position.
    6. Concealed Regulators:
        1. For drywall ceilings with no access panels, provide concealed balancing damper regulators embedded in finished ceiling, mounted behind grilles, on or inside plenum

slot diffusers and various other types of diffusers. Concealed damper regulator to be connected to balancing damper by means of flexible Bowden cable and installed flush with ceiling. Cover plate held in place with 2 screws and easily removed for damper adjustment. Concealed damper regulator similar to Young Regulator Co. Model No. 270-301. Provide necessary hardware, including Young Regulator balance damper model 5020- CC, Bowden cable and Young Regulator Model 030-12 wrench.

2. Drawing designation: D (CR).

2.4 Duct and Plenum Access

1. Dimensions:

    1. Doors:
        1. 500 mm wide x 1,350 mm high.
        2. Head of door 1,780 mm above floor.
    2. Panels:
        1. 380 mm x 500 mm.
        2. Where far corners of the duct are closer than 500 mm and equipment within duct is closer than 300 mm size may be reduced to 400 mm x 300 mm or 450 mm x 250 mm elliptical.
        3. Where space will not permit above dimensions they should be matched as closely as possible and additional access provided as required.

2. Products:

    1. Doors - construct in accordance with SMACNA Duct Standards Figure 6-12 except for latch type. 38 mm thick insulation.
    2. Panels - Nailor Hart, Ventlok, 25 mm thick insulation.
    3. Gaskets - neoprene or foam rubber.

3. Hardware:

    1. Panels up to 400 mm x 300 mm - 2 sash locks.
    2. Panels - 380 mm x 500 mm - 4 sash locks.
    3. Doors - piano hinge and Ventlok 310 latches complete with front and inside handles and front door pull.

2.5 Duct Connectors - Vibration Isolation

1. Provide flexible duct connections to provide vibration isolation at duct and plenum connections to fan and air handling units. See Figure 2-19 SMACNA Duct Standards.

2. Minimum Requirements:

1. Pre-assembled 75 mm minimum long flexible connection with 75 mm long 0.70 mm galvanized steel duct connectors on each side of flexible connection. Flexible connector - fibre glass fabric with elastomer coating.

3. Centrifugal fans with 914 mm diameter and larger fan wheels, use 150 mm long flexible connection.

4. Do not install connectors on perchloric acid fume exhaust systems.

5. Standard of Acceptance: Duro Dyne “Durolon,” Dynair “Hypalon,” Ventfabrics “Ventlon.”

2.6 Ductwork - Flexible – Plain

1. Provide factory fabricated plain, flexible air ductwork for the following applications:

    1. Connections to air terminals.
    2. Connections to downstream side of mixing boxes/air valves.
    3. Connections to round fire dampers (up to 300 mm diameter).

2. Minimum Requirements:

    1. Non-corrosive spirals wire reinforcing flexible vinyl coated fibreglass cloth membrane.
    2. Suitable for up to 2,500 kPa positive static pressure and 250 Pa negative static pressure.
    3. UL or ULC labelled, Class 1, duct connector.
    4. Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.

3. Standard of Acceptance: Flexmaster FAB4, Thermaflex SLP10, ATCO UPC#017 Class ‘O’.

2.7 Ductwork - Flexible - Insulated

1. Provide factory fabricated insulated flexible ductwork for the following application:

    1. Connections to downstream side of variable volume and consistent volume mixing boxes, where indicated.
    2. Connections to air terminals where indicated.

2. Minimum Requirements:

    1. Flexible vinyl coated steel helix bonded to inner duct liner. Fibrous glass thermal insulation.
    2. Outer jacket of metalized fire-resistant vapour barrier.
    3. Suitable for up to 500 Pa positive static pressure and/or 250 Pa negative static pressure.
    4. UL or ULC labelled, Class 1, duct connector.
    5. Acoustically rated.

3. Standard of Acceptance: Gladd-Flex ABL-181, Thermaflex M-KE, Wiremold WK, ATCO UPC#070.

2.8 Ductwork and Plenum Sealers

1. Provide duct sealing compounds for use in fabrication of ductwork and plenum joints.

2. Low Pressure Systems - SMACNA Seal Classification B. Medium and High Pressure Systems - SMACNA Seal Classification A.

3. Standard of Acceptance:

    1. Foster 32-14, Hardcast Versa Grip, Hardcast Foil Grip 1402, Robson's Duct Seal-WB, United Duct Sealer, Trans Continental Multi-Purpose.

4. Where accessible, apply sealer to inside of joints on ducts and plenums under positive pressure - e.g. discharge side of fans.

5. Apply sealer to outside of joints on ducts and plenums under negative pressure - e.g. suction side of fans.

2.9 Fire Dampers

1. Minimum Requirements:

    1. Fire dampers shall be ULC or Warnock Hersey tested and shall bear testing agency's label.
    2. Fire dampers shall meet requirements of National Building Code and authorities having jurisdiction.
    3. Fire dampers shall be "dynamic," rated to close under airflow, where the air system runs during a fire alarm condition.
    4. Fire dampers may be static type in applications where there is no airflow/air system is off in a fire alarm

       condition.
    5. Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire separation.
    6. Fusible link actuated, weighted to close and lock in closed position when released or having negator- spring-closing operator for multi-leaf type in horizontal position with vertical airflow.
    7. Fire dampers in low-pressure ductwork may be multi blade or curtain type.
    8. Fire dampers in medium and high pressure ductwork shall be curtain type.
    9. Curtain fire dampers shall be blades retained in recess so free area of connecting ductwork is not reduced.
    10. Fusible links: ULC approved with melting point of 74°C on supply, return and exhaust air systems. Use fusible links with melting point of 141°C on return and exhaust air systems if used for smoke venting.

11. Standard of Acceptance:
    1. Type B or C.

2.10 Fire Dampers - Ceiling

1. Minimum Requirements:
    1. ULC tested and labelled.
    2. Spring loaded heat retardant blanket or insulated damper blades.
    3. 74°C fusible links.
    4. Where diffuser/grille neck is smaller than diffuser/grille face area, provide UL listed CK 2000 thermal blanket over ceiling plenum side of exposed diffuser/grille.
    5. Install above each diffuser/grill mounted in fire rated ceiling.
    6. Provide transition plates (round to rectangular).
2. Standard of Acceptance: Price, Ruskin CFSR, Nailor Hart.

2.11 Fire Dampers - Combination Register Damper

1. Minimum Requirements:
    1. Warnock- Hersey tested and labelled.
    2. Combined opposed blade damper with spring tensioned fusible link.
    3. Fasten to 3.51 mm thick steel sleeve, welded with integral flange on register side.
2. Standard of Acceptance: EH Price VCS-4, Tuttle & Bailey 90A.
3. Airflow probe (Duct or Fan Inlet)
    1. Aluminum construction.
    2. Multiple traverse probes.
    3. Traverse probe to contain multiple total and static pressure sensors located along exterior surface of probe and internally connected to respective averaging manifolds.
    4. Threaded end support rod and mounting plate with gasket and signal fittings.
    5. Fan inlet probes (two per inlet) with dual end support swivel brackets suitable for mounting in fan inlet bell.
    6. Capable of producing an output signal linear and scaled to air volume (4-20 mADC, 0-10 VDC, 0-5VDC).
    7. Capable of local digital display of continuous indication of air volume.
    8. Standard of Acceptance:
        1. Air monitor VOLU-probe/7200AZ (Duct).
        2. Air monitor VOLU-probe/7200AZ (Fan Inlet).

2.12 Instrument Test Ports

1. Application:
    1. Provide instrument test ports in each plenum access door (unless more than one door serves a plenum compartment).
    2. Locate ports to permit easy reading of instruments.
2. Minimum Requirements:
    1. 1.61 mm thick steel zinc plated after manufacture.
    2. Cam lock handles with neoprene expansion plug and handle chain.
    3. 25 mm minimum inside diameter. Length to suit insulation thickness.
    4. Neoprene mounting gasket.
3. Standard of Acceptance: Duro Dyne IP1 or IP2.

3. EXECUTION

3.1 Balancing Dampers

1. Provide balancing dampers at points on low pressure supply, return and exhaust systems where branches are taken from larger duct as required for proper air balancing, complete with 25 mm high stand-off bridges for operators to allow full, continuous duct insulation.
2. Provide balancing dampers at each run out to grille or diffuser.
3. Identify airflow direction and blade rotation and open and closed position
4. On round ductwork larger than 300 mm diameter and externally insulated rectangular ductwork, provide sheet metal bridge to raise quadrant type operator above insulation thickness (coordinate with Section 23 07 13). Provide open end bearing where bridges are used. Bridges on uninsulated round ducts shall be at least 25 mm high.
5. Where quadrant type operators are used, lever shall be arranged parallel with damper blade, complete with 25 mm high stand-off bridge for operators to allow continuous duct insulation to be applied on the duct.

3.2 Backdraft Dampers

1. Install backdraft dampers on exhaust and relief openings through building walls and roof on exhaust fans where control dampers are not called for or indicated.

3.3 Control Dampers - Automatic

1. Packaged equipment specified to be complete with control dampers, shall include control

dampers as normally supplied by equipment Manufacturer unless otherwise noted.

2. Other automatic control dampers are specified in Controls Sections.

3. Under this section be responsible for receipt, handling, storage and installation of control dampers supplied under Control or other Sections.

4. Indicated size of control dampers is dimension outside frame. Oversize ductwork to include depth of damper frame if pressure drop across damper exceeds 25 Pa.

5. Control damper frames shall be fitted tightly into ductwork and sealed airtight.

6. Check that dampers are installed square and true. Ensure damper end linkages are easily accessible. Provide saw-cuts with black paint in the exposed ends of all damper shafts, aligned with damper blade for visual indication of damper blade position.

7. Do not install control dampers in thickness of wall unless otherwise indicated.

3.4 Duct and Plenum Access

1. Locations: Provide access doors and panels as follows:
    1. Doors: where indicated on drawings.
    2. Panels:
        1. Every 12 m on ductwork.
        2. Base of each duct riser.
        3. Both side of equipment blocking duct e.g.
            1. Air flow measuring stations.
            2. Coils.
        4. At or to one side of other equipment in duct, e.g.
            1. Backdraft dampers (counter weight side).
            2. Balance dampers serving multiple outlets/inlets.
            3. Bearings (fans/motors).
            4. Control dampers.
            5. Control sensors.
            6. Fire dampers (rectangular ducts and round ducts 325 mm diameter and larger - latch side).
            7. Heat detectors (upstream from device)
            8. Smoke dampers (operator side).
            9. Smoke detectors (upstream from device).
        5. Panels need not be provided where access in available through door or register mounted to side of duct.
    3. Patches:

1. Where required for cleaning and where access panels are not specified e.g. on both sides of turning vanes.

4. Flexible duct - on round duct and round fire dampers up to 300 mm diameter.

2. Seal Frames airtight.

3. Install to not interfere with airflow.

4. Install to provide access for service and cleaning.

5. Do not use sheet metal screws for attaching access panels to ductwork.

6. Round ducts 325 mm diameter and larger shall include a short collar for installation of access panels.
7. Small rectangular ducts shall be transitioned to minimum dimension across duct of 325 mm for installation of access panels.

3.5 Duct Connectors - Vibration Isolation

1. Ensure flexible duct connectors do not reduce duct free area on suction side of fans.

3.6 Ductwork - Flexible

1. Installed lengths shall be limited to 6 times duct diameter but not longer than 1.2 m.

2. Connect to ductwork and diffusers with stainless steel worm drive clamps or Panduit adjustable clamps or Thermaflex duct strap applied over two wraps of duct tape. Use stainless steel clamps on connections to fire dampers.

3. Minimum centreline radius of flexible ductwork bend shall be 1.5 time duct diameter, alternatively, sheet metal elbow may be used at branch takeoffs and boot diffuser connections.

4. Support with 25 mm x 0.85 mm galvanized steel straps at a maximum of 600 mm. Straps shall completely encircle duct.

5. Support clear of ceiling assembly, light fixtures and hot surfaces.

3.7 Fire Dampers

1. Install in accordance with the SMACNA Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems
- Fourth Edition 1992. Demonstrate fire damper drop tests **[ALL / 50% / 25% / 10%]** of fire dampers installed in this project.

2. Fire damper sleeves must not extend more than 75 mm from wall on each side.

3. Fire dampers shall be installed within wall thickness of fire separation.

4. Wall openings sized to allow sleeve/damper expansion.

5. Arrange dampers so linkages and locking catches are accessible from access side of fire damper.

6. Install to close in direction of normal airflow.

7. Size so free area of duct is maintained through assembly. All fire dampers shall be Type B – blades out of airstream, unless specifically noted otherwise or as required for specific installation.

8. Install in galvanized steel sleeve, retained in place with retaining angles on four sides at each face of wall.

9. Connect ductwork to damper sleeves using break-away duct joints on faces.

3.8 Flow Measure Devices - Air

1. Install in accordance with Manufacturers recommendations. Minimum distance from air turbulence - producing fittings, transitions etc shall be maintained.

2. Mount air volume gauges at height for easy visual inspection and install interconnection piping.

END OF SECTION

1. GENERAL

1.1 Related Work

1. This Specification Section forms part of Contract Documents and is to be read, interpreted and coordinated with other parts.

1.2 General

1. Provide external thermal insulation for plenums and ductwork where specified.
2. Provide internal acoustical insulation for plenums and ductwork where specified.
3. Journeyman insulation applicators shall perform work.
4. Be responsible for ensuring sufficient space is provided for proper installation of insulation materials.
5. All insulation shall be in accordance with latest edition of the "Master Insulators Association of Ontario Standards Manual" as reference standard.
6. Install insulation and related materials and accessories in accordance with the Manufacturer's recommended installation instructions.

1.3 Regulatory Requirements

1. Flame spread ratings and smoke developed classifications shall be as required by applicable code and NFPA 90A. Flame spread rating throughout material shall not exceed 25 and smoke developed shall not exceed 50. Materials shall not flame, smoulder, smoke, or glow at temperatures they are exposed to in service.
2. Minimum insulation thickness and insulating values shall be in accordance with ASHRAE Std 90.1 0 Latest Edition. or as per the schedule in this Specification, whichever is more stringent.
3. Fibreglass duct wrap shall comply with:
    1. CAN 4-S102.
    2. CAN/CGSB-51.5M; Type II (FSK Facing).
    3. CAN/CBSB-51.11-92.
    4. CCG Low FS Laminate Cert. #GI-141.
    5. ULC Listed.

6. ASTM C 553; Type I, II III
7. ASTM C 795.
8. ASTM C 1136; Type II (FSK and PSK facings only)
9. ASTM C 1290; Specification for flexible fibrous glass blanket/HVAC ducts.
10. ASTM E-84 Surface Burning Characteristics, 25/50 Flame/Smoke.
11. CAN/ULC-S102-07 “Test for Surface Burning Characteristics of Building Materials”.

4. Fibreglass insulation board shall comply with:
    1. CAN-4-S102.
    2. CBSB 51-GP-10M
    3. CGSB 51-GP-52M (facings).
    4. ASTM C 612.
    5. ASTM C 795.
    6. ASTM E-84 Surface Burning Characteristics, 25/50 Flame/Smoke.
5. Duct liner (internal lining) shall comply with:
    1. CAN 4-S102.
    2. CAN/CGSB 51.11-92.
    3. ULC listed.
    4. ASTM C 1071; Type I.
    5. NFPA 90A and 90B.
    6. Microbial Growth; ASTM C 1338, G21, G22.
6. Qualifications and Samples
    1. Submit Manufacturer documentation (and samples when requested) for materials, applications and finishing methods to establish they satisfy specification and meet applicable code requirements, before commencing work.
7. Definitions

1. "Concealed" means insulated mechanical services in furred spaces, shafts and hung ceilings.

2. "Exposed" will mean not concealed.

2. PRODUCTS

2.1 External Flexible Insulation

1. External flexible glass fibre insulation with integral vapour barrier.

    1. Minimum density – 1.0 lb/ft^3

    2. Thermal conductivity at 24° C - 0.042 W/m/°C.

    3. Acceptable Manufacturers:

        1. Certainteed STD Ductwrap #75 FSK, Manson Alley-Wrap FSK, Owens Corning all service faced duct wrap, Knauf FSK Ductwrap, Schuller Micro Lite FSK.

2.2 Duct Liner

1. Rigid Duct Liner.

    1. Yellow or light coloured internal rigid glass fibre acoustical insulation with black sealer coating on one face.

    2. Minimum sound absorption (NRC) of 0.60 as tested per ASTM C423 using Type "A" mounting.

    3. Thermal conductivity at 24° C - 0.035 W/m/°C.

    4. Acceptable Manufacturers:

        1. Certainteed Toughgard 300#, Manson Akousti-Liner R, Knauf Rigid Plenum Liner, Schuller Permacoat R300, Owens Corning Rigid Coated Duct Liner.

2.3 Accessories

1. Insulation Adhesive

    1. Bakelite 230-39, Childers CP-82, CP-56W, Epolux Cadoprene 400, Foster 85-20, Polymer Glasstack #25, Robson Ticki-Tuff.

2. Vapour Barrier Tape.

    1. Finishing tape to meet flame spread rating and smoke developed classification

requirements of applicable code and compatible with facing material.

2. Scrim foil self-adhesive tape.

3. Vapour Barrier Adhesive.

    1. Bakelite 230-21, Childers CP-82, Epolux Cadoprene 400, Foster 85-20, 3M 4230.

4. Insulation Coating

    1. Bakelite 120-09, Childers CP-50, Epolux Cadalag 336, Foster 30-36, Robson White Lag.

5. Weather Coating - vapour barrier.

    1. Bakelite 110-14, Childers CHIL-PRUF CP22/23/24, Foster 60-25, Insul-Mastic 15187.

6. Reinforcing Membrane.

    1. Glass reinforcing membrane as commercially available.

7. Seal Coating

    1. Bakelite 120-09, Childers CP-50, Epolux Cadalag 336, Foster 30-36, Robson White Lag.

8. Fabric Adhesive.

    1. Bakelite 120-18, Childers CP-52, Epolux Cadalag 336, Foster 30-36.

9. Fabric Coating.

    1. Bakelite 120-09, Childers CP-50, Epolux Cadalag 336, Foster 30-36.

2.4 Duct Insulation Schedule and Thickness

1. External Flexible Insulation with vapour barrier. (Exposed within room which is being served by exposed ducts, do not require external insulation).

Service	Thickness
Cooling and heating supply ducts - where temperature difference between space where duct is located and design air temperature in duct is less than or equal to 22.2°C.	25 mm
All cooling and heating supply ducts - where the temperature difference between the space within which the duct is located and the design air temperature in the duct is greater than 22.2°C.	50 mm

Outdoor air ductwork and plenums (from intake to mixing plenum).	50 mm
Combustion intake/relief air.	50 mm
Exhaust air discharge through roof (including sides and bottom of plenum).	50 mm
Exhaust air ductwork outside the building.	25 mm
All exhaust air ductwork from the outside wall or roof to 1.5 m inside building.	38 mm

2. Internal Flexible Duct Liner

Service	Thickness
All ductwork where indicated by single hatching.	25 mm
All supply ductwork in the mechanical room (From AHU discharge to duct shaft, or to 3M beyond fan/mechanical room).	50 mm

3. Internal Rigid Duct Liner

Service	Thickness
Built-up site fabricated air handling unit(s). Line sheet metal walls and tops from inlet dampers to discharge dampers. Do not line transverse walls containing coils, filters or fan discharge.	50 mm
Built-up site fabricated heat recovery exhaust unit(s). Line sheet metal walls and tops.	50 mm
Cold and hot supply air plenums. Line walls, tops and bottoms from discharge dampers to supply duct connections.	50 mm
All outdoor air plenums. Line sheet metal walls and top.	50 mm

3. EXECUTION

3.1 Application

1. Apply external insulation to ductwork only after tests have been made and systems accepted.

2. Apply insulation and insulation finish so finished product is uniform, smooth in finish, with longitudinal seams concealed from view. Apply ductwork insulation materials, accessories and finishes in accordance with Manufacturer's recommendations.

3. Insulation and vapour barrier shall be continuous through non-rated separations.

4. Grease and fire rated flexible duct insulation shall be applied and installed in accordance with the Manufacturer's instructions.

3.2 Insulation Termination

1. Terminate insulation short of control, smoke and fire dampers so as not to interfere with operation.

3.3 Insulation for Cooling Coil Headers and Return Bends

1. Pack flexible glass fibre insulation around headers and return bends on all cooling coils in built up air handling units and at re-cool coils in terminal ductwork systems to control condensation

3.4 External Flexible Insulation with Vapour Barrier

1. Adhere insulation with insulation adhesive applied in 150 mm wide strip on 300 mm centres.

2. On rectangular duct work and plenums, over 600 mm in width, spotweld pins 6.0 mm longer than insulation thickness, one per square foot of duct minimum. If pins are installed in field, capacitor gun shall be used. Impale insulation over pins, and hold in place using metal or nylon clips (washers). Alternatively, use assembly consisting of welded pin with integral head washer welded in place over insulation (Clinched pins not acceptable).

3. Adhere foil faced vapour barrier tape over butt joints, raw edges, holding washers and other points of penetration of vapour barrier jacket on exposed hot and cold ducts and concealed cold ducts. Provide 16 ga wire wrap on 600 mm centers as additional exterior insulation reinforcing, to snug-tight so insulation is not crushed/compressed.

3.5 Internal Flexible Duct Liner Application

1. Adhere insulation with insulation adhesive applied to whole of metal surface, with the coating side of insulation exposed to airstream.

2. Ducts 600 mm in width and less require no further adhesion.

3. Duct sides and plenum panels greater than 600 mm in width shall have metal clips or nylon pins adhered to metal surface at 300 mm to supplement adhesive. (Welding pins may be used provided capacitor type gun is used.) Impale insulation or pins or clips with coated side of insulation exposed to airstream and secured with holding washers. Cover holding washers with reinforcing membrane and insulation coating/sealer.

4. Seal transverse joints, raw edges, and other points of penetration of coating with reinforcing membrane and insulation coating/sealer.

5. Seal longitudinal joints with insulation coating sealer.

6. No raw edges of internal insulation material shall be exposed to moving airstream. Provide 26 ga sheet metal hosing at all leading edges of exposed lining, to overlap insulation by at least 25 mm downstream.

7. Duct size indicated is inside dimension of the insulation. Metal duct sizes shall be increased to allow for internal acoustic insulation thickness.

3.6 Ductwork Insulation Finished

1. "Concealed" ductwork insulation, in horizontal and vertical service spaces, will require no further finish.

2. "Exposed" ductwork insulation, in unfinished floor space will have no further finish.

3. "Exposed" duct insulation in warehouse type spaces shall be painted with one sealer coat of insulation coating.

4. "Exposed" ductwork insulation in finished floor spaces, fan rooms, and boiler room shall be finished with two coats of white, foil-finishing, insulation coating.

END OF SECTION

1. GENERAL

1.1 Related Work

1. This Specification Section forms part of Contract Documents and is to be read, interpreted and coordinated with other parts.

1.2 General

1. Provide thermal insulation on piping, valves, fittings and radiant ceiling panels, as called for and as scheduled. Note items listed that do not require insulation.

2. Journeyman insulation applicators shall perform work.

3. Be responsible for ensuring sufficient space is provided to allow proper installation of insulation materials.

4. All insulation installations shall be in accordance with latest edition of the **"Master Insulators Association of Ontario"** as a reference standard.

5. Install insulation and related materials and accessories in accordance with the Manufacturer's and suppliers recommended installation instructions.

1.3 Regulatory Requirements

1. Flame spread ratings and smoke developed classifications shall be as required by **Ontario Building Code** and NFPA 90A. Generally, the flame spread rating throughout the material shall not exceed 25 and the smoke developed classification shall not exceed 50. Materials shall not flame, smoulder, glow, or smoke at temperature they are exposed to at service.

2. Minimum insulation thickness and insulating values shall be in accordance with ASHRAE Std.90.1 Latest Edition, or as listed in the schedule in this section, whichever is more stringent.

3. Fibreglass pipe insulation shall comply with:

    1. CAN/ULC S102-M88.
    2. CCG F1-304 (plain only).
    3. CBSB 51-GP-9M.
    4. CGSB 51-GP52M (jacket).
    5. ASTM C 547, Type I, Type IV.
    6. STM C 585 – Standard for inner and outer diameters.
    7. ASTM C 795 – Insulation in contact with austenitic stainless steel.
    8. ASTM C 1136 (jackets; Type I, II, III, IV.
    9. ASTM E-84, Surface Burning Characteristics, 25/50 Flame/Smoke.

10. CAN/ULS-S102-07 – "Test for Surface Burning Characteristics of Building Materials".

4. PVC Fittings and Jacketing shall

comply with: 1. CAN/CGSB –

51.53-95

2. ASTM E-84 Surface Burning Characteristics, 25/50 Flame/Smoke.

1.4 Qualifications and Samples

1. Submit Manufacturer's documentation (and samples when requested) for materials, applications and finishing methods to establish they satisfy this specification and meet applicable code requirements, before commencing work.

2. Submit, for approval, samples of each type of firestopping, smoke seal and accessory.

1.5 Definitions

1. "CONCEALED" means insulated mechanical services in trenches, chases, furred spaces, shafts and hung ceilings.

2. "EXPOSED" will mean not concealed.

1.6 Connections to Existing Piping

1. Make good existing insulation disturbed or removed to facilitate alterations and additions to existing piping.

1.7 Heat Traced Piping

1. Piping subject to freezing is specified to be heat traced. Insulation shall cover heat tracing.

2. PRODUCTS

2.1 Pre-formed Pipe Covering

1. Mineral Fibre - Low and Medium Temperature:

    1. With integral vapour barrier jacked and longitudinal lap.
    2. Thermal conductivity at 24° C - 0.033 W/m/°C.
    3. Acceptable Products:
        1. Manson Alley K, Owens Corning SSL-11, Knauf 850 580 ASJ/SSL, Johns Manville Micro-Lok AP-T Plus, Owens Corning 1200 ASJ/SSL.

2. Calcium Silicate - High Temperature:

1. Without integral jacket.
2. Thermal Conductivity at 93°C - 0.059 W/m/°C.
3. Acceptable Products:
    1. Manson Cal Silite, Johns Manville Thermo-12.

3. Perlite Insulation - High Temperature:

    1. Without integral jacket.
    2. Thermal Conductivity at 90°C - 0.071 W/m/°C.
    3. Acceptable Products
        1. Knauf Temperlite 1200

4. Mineral Fibre - High Temperature:

    1. With integral vapour barrier jacket and longitudinal lap.
    2. Thermal conductivity at 93° C - 0.040 W/m/°C.
    3. Acceptable Products:
        1. Manson Alley Kapt, Johns Manville Micro-Lok AP-T Plus, Owens Corning 1200 ASJ/SSL, Roxul ASJ/SL, ESLIN (Energy Savings Layered Insulation) by Visionary Industrial Insulation.

5. Flexible Foamed Elastomeric:

    1. Thermal conductivity at 24° C - 0.040 W/m/°C.
    2. Acceptable Products:
        1. AP Armaflex, Rubatex R-180-FS.

6. Flexible Closed Cell:

    1. Thermal conductivity at 24° C - 0.036 W/m/°C.
    2. Acceptable Products:
        1. Bondtex Polyethylene, Therma-Cel.

7. Phenolic closed cell - rigid:

    1. With integral vapour barrier jacket and longitudinal lap.
    2. Thermal conductivity at 24° C - 0.019 W/m/°C.
    3. Acceptable Products:
        1. Kingspan Koolphenk.

2.2 Fire Stopping and Smoke Seal Materials

1. References:

    1. CAN4-S115-M, Standard Method of Fire Tests of Firestop Systems.
    2. ASTM E814 Standard Method of Fire Tests and Through-Penetration Firestops.
    3. 1997 Certifications Listings Intertek Testing Services NA Ltd. (Warnock Hersey).
    4. Underwriters Laboratories of Canada. Listing of Equipment and Materials Vol. # Fire Resistance Ratings - Revision 4/95.

2. Work Included:

    1. Furnish labour, material, equipment and services necessary to provide firestopping and smoke seals around mechanical service piping and duct penetrations through fire rated wall and floor assemblies, as specified.

3. Quality Assurance:

    1. Work of this section shall be carried out by approved specialist firm employing skilled tradesmen experienced in firestopping and smoke seal application and approved, licensed and supervised by Manufacturer of fire stopping materials.
    2. Work to be of highest quality according to best trade practice and in accordance with Manufacturer's printer specifications.

4. Submittals:

    1. Submit shop drawings to show proposed material, reinforcement, anchorage, fastenings and methods of installation.
    2. Submit Manufacturers' product design data for materials and prefabricated devices. Include assembly/location design system number reference with copies of test information. Construction details should accurately reflect actual job conditions.
    3. For building assemblies which do not correspond to previously tested and rated assemblies, submit proposals based on related designs using accepted fireproofing design criteria.

5. Materials

    1. Asbestos-free materials and systems capable of maintaining effective barrier against flame, smoke and gases in compliance with requirements of ULC CAN4-S115 and not to exceed opening sizes for which they are intended.
    2. Service penetration assemblies and design numbers: Certified by ULC in accordance with CAN4-S115 and listed in ULC Guide No. 40 U19. 1997 Certification Listings Intertek Testing Services NA Ltd. (Warnock Hersey).

3. Service penetration firestop components: Certified by ULC in accordance with CAN4-S115 and listed in ULC Guide No. 40 U19.13 and ULC Guide No. 40 U19.15 under the Label Service of ULC or equivalent approved tests Warnock Hersey.
4. Fire resistance rating of installed fire stopping assembly shall be not less than fire resistance rating of surrounding floor and wall assembly.
5. Acceptable Products:
    1. DOW FS 2000/2001, Tremco Fyre-Sil, #M 1000 silicone, 3M CP25WB, Firestop Systems 4800DW, Nuco Self Seal Fire Stops.

2.3 Accessories

1. Insulation Fastenings:
    1. 1.61 mm galvanized wire or 1.6 mm thick copper wire as commercially available.
2. Jacket Fastenings:
    1. Thermocanvas and All Service:
        1. Staples (flare type), compatible jacket finishing tape, contact adhesives recommended by the jacket manufacture.
    2. Metal Jackets
        1. Sheet metal screws, pop rivets, bands.
    3. PVC Jacket and Fitting Covers:
        1. PVC self-adhesive tape, plastic pop rivets, bonding cement.
3. Adhesives:
    1. Flexible elastomeric and flexible closed cell insulation adhesive:
        1. Armstrong 520, Terma-Cel 1590, Rubatex R-373, Zipcoat 8A.
    2. Vapour barrier jacket adhesive:
        1. Bakelite 230-39, Childers CP-82, Epolux Cadoprene 400, Foster 85-20.
    3. Fabric adhesive, to insulation pipe covering:
        1. Bakelite 120-18, Childers CP-52, Epolux Cadalag 336, Foster 30-36, Robson White Lad.
4. Coatings:
    1. Vapour barrier coating on reinforcing membrane or on insulating cement:
        1. Bakelite 120-09, Childers CP-50, Epolux Cadalag 336, Foster 30-36.
        2. Childers CP-30 (refrigeration suction lines only).
    2. Flexible elastomeric and flexible closed cell insulation finish coating:
        1. Armstrong, Bakelite 120-13, Rubatex, Zipcoat.

5. Finish Jackets:
    1. Thermocanvas Jacket:
        1. Fattal's Thermocanvas, Robson Flamex FR Canvas or Tai-Can Canvas.
    2. All Service Jacket (with 0.3 mm minimum thick foil):
        1. Fattal's Fat-Lock ASJ, Fibreglass ASJ, Knauf ASJ, Kingspan ASJ, Manson SPT, Johns Manville AP-T Plus, Owens Corning ASJ, Roxul ASJ.
    3. PVC Finishing Jacket (minimum 0.3 mm thick):
        1. Proto PVC, Speedline PVC, Zeston PVC.
    4. Aluminum Jacket:
        1. 0.64 mm thick corrugated or smooth aluminum jacketing with longitudinal slip joints and 0.3 mm end laps with factory applied protective liner on interior surface.
            1. Childers, Alco Thermoclad 1 or other as commercially available.
6. Reinforcing Membrane:
    1. Glass reinforcing membrane as commercially available.
7. Insulating Cement:
    1. Fibrex Superkote, Partek No. 1, Ryder Thermokote MW high temperature.
8. Finishing Cement:
    1. Ryder Thermokote 1 FW.
9. Flexible Insulation:
    1. Manson Alley-Wrap, Owens Corning AF 300 Series, Knauf Plain Wrap, Johns Manville Microlite, Roxul Wrap (RW).
10. Pre-formed Fitting Covers:
    1. Aluminum Fitting Covers:
        1. 0.64 mm thick, die shaped components with factory applied protective liner on interior surface.
            1. Childers Ell-Jacs, Perma-Ells or Shield-Ells or other as commercially available.
    2. PVC Fitting Covers:
        1. 0.50 mm thick pre-moulded one-piece covers.
            1. Certainteed Snapform, Childers, Proto PVC, Speedline PVC, Zeston PVC, Fattal PVC.

11. Pre-formed Insulation fittings:

    1. Shur-Fit, Moulded Acoustic Production or from insulation fabricators.

2.4 Scope of Insulation

1. Heating Piping, Fittings and Valves:

    1. Insulate the following systems, unless otherwise noted:
        1. Hot water heating supply and return piping.
    2. DO NOT insulate the following, unless otherwise noted:
        1. Piping located within perimeter heating enclosures.
        2. Relief piping.
        3. Drain lines.
        4. Small branch risers to terminal heating elements just above floor level, from 150 mm below floor slab up to heating element.
        5. Flexible interconnections between ceiling radiant heating panels.
        6. Condenser water piping inside building.
        7. HDPE plastic geo-exchange piping inside the building.
    3. Insulate the following valves and fittings if pipe is insulated using pre-formed fitting insulation sections:
        1. Elbows, tees, reducers.
        2. Flanges.
        3. Strainers.
    4. The following hot pipe fittings that operate at greater than 60°C shall be coated with Thermalite - SG as per Manufacturer's specification to prevent skin burns:
        1. Drip legs.
        2. Flexible connections.
        3. Expansion Joints.
        4. Check valve covers.

2. Plumbing pipes, fire protection pipes, fittings, valves:

    1. Insulate the following systems, unless otherwise noted:
        1. Domestic cold water system including meter body.
        2. All drains, lines, stacks, fire standpipes and sprinkler mains in unheated areas (insulation shall cover heat tracing cables).
        3. Water valves, flanges, PRVs strainers, check valves.

4. Interior irrigation/hose bibb supply piping.

2. DO NOT insulate the following, unless otherwise noted:
   1. Piping used exclusively for fire protection (unless in unheated spaces).
   2. Soil stacks, vents, etc.
   3. All special service piping, e.g. gas, compressed air, etc.
   4. Unions.
   5. Flexible connections or expansion joints (unless noted on drawings).
   6. Check valve covers.
   7. Strainer leg and basket covers.
   8. Flexible fixture connections.

3. Pipe penetrations through walls and floors:

   1. Material for stuffing, sealing and caulking of pipe penetrations shall be supplied and installed under this section.

2.5 Pipe Insulation Schedule and Thickness Table - mm

		NOMINAL PIPE SIZE (NPS)				
Service	**Design Operating Temperature**	**Runouts 2 and less**	**1 and less**	**1-1/4 to 2**	**2-1/2 to 4**	**5 and large**
Hot Water/Glycol Heating	50°C-96°C	25 mm	25 mm	50 mm	50 mm	50 mm
Hot Water/Glycol Heating	96°C-120°C	25 mm	38 mm	50 mm	50 mm	50 mm
Domestic Cold Water	32.2°C	25 mm	25 mm	25 mm	25 mm	25 mm

Note 1: Runouts to individual terminal units not to exceed 3.6 m in length.
Note 2: All piping forming part of the HVAC system and located outside the building envelope shall be insulated for the level specified in the Table for steam piping at pressures 334 kPa and greater.

3. EXECUTION

3.1 Application

1. Apply insulation to piping only after tests have been made and systems accepted.

2. Apply insulation and insulation finish so finished product is smooth in finish, with the longitudinal seams concealed from view. Apply piping insulation materials, accessories and finishes in accordance with Manufacturer's recommendations. Pre-formed pipe fitting insulation sections shall be used on all elbows, tees, and pipe joint/flange fittings.

3. On piping NPS 2-12 and larger with insulation and vapour barrier, install high density insulation above hanger shield. Insert to be slightly longer than length of shield. Maintain integrity of vapour barrier over full length of pipe without interruption at sleeves, fittings and supports.

4. Insulation and vapour barrier shall be continuous through non-rated separations.

5. Provide sealed bevelled cut-outs at all bal valve handles to allow free movement of handle without tearing insulation.

3.2 Insulation Termination Points

1. Terminate insulation 75 mm back from all uninsulated fittings to provide working clearance and terminate insulation at 90° and finish with reinforced scrim cloth vapour barrier mastic system. Cover onto pipe and over the insulation vapour barrier. On concealed hot services terminate insulation 75 mm back from uninsulated fittings, cut off at 90° and apply reinforce scrim cloth and breather mastic systems.

2. Cut back insulation at 45° and finish with silicone caulking sealant around base of thermometer wells, pressure gauges, flow switches and pressure and control sensors.

3.3 Vertical Risers

1. On vertical pipe over 75 mm provide insulation supports welded or bolted to pipe, directly above lowest pipe fitting. Thereafter, locate on 4.5 m centres.

3.4 Hot Application 26.7°C and Over

1. Piping:

    1. Install medium temperature pipe insulation with integral jacket to pipe and hold in place by stapling flap, with spreading staples at 75 mm centres. Pipe insulation with integral self-sealing jacket will not require additional fastening.

    2. Install strips of vapour barrier jacket over butt joints and secure with spreading staples.

2. Fittings:

    1. Insulate fittings, to thickness of adjacent pipe insulation, with sections of pipe insulation mitred to fit tightly, or with pre-formed insulation fittings (Shur-Fit) or from insulation fabricator.

3. Valves, Strainers:

    1. Insulate valve bodies and strainers with fitted pipe insulation, or mitred blocks to

thickness of adjacent pipe insulation or insulate with pre-formed insulation fittings (Shur-Fit) or from insulation fabricator. Drains, blow-off plugs and caps shall be left uncovered.

4. Flanges and Victaulic Fittings:

    1. Insulate flanges with oversized pipe insulation or mitred blocks to thickness of adjacent pipe insulation. Insulation to overlap adjoining insulation at least 75 mm.

3.5 Cold Application 10°C and Less

1. Piping:

    1. Install low/medium temperature pipe insulation with integral vapour barrier jacket to pipe and hold in place by securing jacket flap. Seal flaps with vapour barrier adhesive. Pipe insulation with integral self- sealing vapour barrier jacket does not require additional fastening.
    2. Install strips of vapour barrier jacket over butt joints with vapour barrier adhesive. Over wrap butt strips by 50 % for insulation OD 300 mm and above apply strip on 250 mm centres for additional securement.

2. Fittings:

    1. Insulate fittings to thickness of adjacent pipe insulation with section of pipe insulation mitred to fit tightly, or pre-formed insulation fittings (Shur-Fit), apply reinforcing membrane embedded barrier coating and apply finish vapour barrier coating.
    2. Alternatively insulate fittings with tightly placed flexible insulation and apply pre-moulded 20/50 rated PVC fitting covers. Apply vapour-barrier adhesive and tape on joints and overlaps.

3. Valves, Strainers:

    1. Insulate valve bodies, bonnets and strainers with fitted pipe insulation, or mitred blocks to thickness of adjacent pipe insulation, apply reinforcing membrane embedded in barrier coating. Alternately, insulate with pre-formed insulation fittings (Shur-fit) covered with reinforcing membrane, stapled in place and covered with barrier coating. Drains, blow-off plugs and caps shall be left uncovered.

4. Unions, Flange and Victaulic Fittings:

    1. Insulate cold unions and flanges with oversized pipe insulation or mitred blocks to thickness of adjacent pipe covering, apply reinforcing membrane embedded in barrier coating and final coating of vapour barrier mastic.

3.6 Anti-Sweat Coating

1. Coat with anti-sweat coating - "No Sweat" by Robson Thermal Mfg. Ltd. or approved alternate, the following uninsulated cold surfaces:

    1. Connect surfaces of thermometers, pressure gauges, flow switches, controllers, etc.

2. The coating thickness shall be recommended by coating Manufacturer for system operation conditions.

3.7 Pipe Insulation Finishes

1. "Concealed" insulation in horizontal and vertical service spaces will require no further finish.

2. "Concealed" pipe insulation in damp locations, e.g. pipe trenches, shall have vapour barrier jacket, vapour sealed.

3. "Exposed" flexible insulation shall be painted with heavy brush coating of foam plastic white insulation coating.

4. "Exposed" insulation inside building shall be finished as follows:

    1. Premium Finish (PVC Covers):
        1. Over factory applied integral all-service type jacket on pipe insulation, apply PVC jacket.
        2. Over insulated fittings apply PVC fitting covers. Over insulated valve bodies, valves bonnets, strainers and flanges apply purchased PVC covers or field fabricate from PVC sheeting secured with solvent bonding cement.
        3. Premium Finish with Canvas Wrap: Finish fabric with one coat of fabric coating.

5. "Exposed" outdoor insulation shall be finished as follows:

    1. Insulation shall have vapour barrier jacket.
    2. Over pipe insulation jacket apply aluminum weather protecting jacket. The longitudinal seam shall be located to shed water. Secure the jacket using necessary metal banding on approximately 250 mm centres and at the overlaps. Screws are not permitted on cold operating systems.
    3. Over insulated fittings, valve bodies, valve bonnets, strainers and flanges, apply metal jacket or pre- formed metal fittings to provide complete jacket system. Secure with necessary fastenings.
    4. Seal outdoor jacketing watertight.

3.8 Fire Stopping and Smoke Seals

1. Install fire stopping and smoke seal material and components in accordance with ULC certification and Manufacturer's instruction.

2. Maintain insulation around pipes penetrating fire separation only as permitted by Firestop

Assembly Listing.

3.9 Insulation Packing of Pipe Sleeves

1. Tightly pack space between pipe sleeves and pipe or between pipe sleeve and pipe insulation with mineral wool insulation - Thermal Ceramics “Cerafibre” or Carborundum “Fibrefrax” to full depth of sleeve to prevent transmission of sound and/or passage of smoke.

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 91 13 – General Commissioning (Cx) Requirements: supplemented as specified herein.

.2 Section 22 42 01 – Plumbing Specialities and Accessories.

.3 Section 23 05 93 – Testing, Adjusting and Balancing for HVAC.

.4 Section 23 08 02 – Cleaning and Start-up of Mechanical Piping Systems.

.5 Section 23 11 13 – Facility Fuel-Oil Piping.

.6 Section 22 11 18 – Domestic Water Piping Copper.

.7 Section 23 21 13.02 – Hydronic Systems: Steel.

.8 Section 23 23 00 – Copper Tubing and Fittings Refrigerant.

1.2 REFERENCES

.1 ASTM E202, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.

1.3 CLEANING AND START-UP OF MECHANICAL PIPING SYSTEMS

.1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

1.4 HYDRONIC SYSTEMS - PERFORMANCE VERIFICATION (PV)

.1 Perform hydronic systems performance verification after cleaning is completed and system is in full operation.

.2 When systems are operational, perform following tests:

.1 Conduct full scale tests at maximum design flow rates, temperatures and pressures for continuous consecutive period of two (2) working days to demonstrate compliance with design criteria.

.2 Verify performance of hydronic system circulating pumps as specified in relevant technical sections, recording system pressures, temperatures, fluctuations by simulating maximum design conditions and varying.

.1 Pump operation.

.2 Boiler and/or chiller operation.

.3 Pressure bypass open/closed.

.4 Control pressure failure.

.5 Maximum heating demand.

.6 Maximum cooling demand.

.7 Boiler and/or chiller failure.

.8 Cooling tower (and/or industrial fluid cooler) fan failure.

.9 Outdoor reset. Re-check heat exchanger output supply temperature at 100% and 50% reset, maximum water temperature.

1.5 HYDRONIC SYSTEM CAPACITY TEST

.1 Timing: After:

.1 TAB has been completed

.2 Verification of operating, limit, safety controls.

.3 Verification of primary and secondary pump flow rates.

.4 Verification of accuracy of temperature and pressure sensors and gauges.

.2 Calculate system capacity at test conditions.

.3 Using manufacturer's published data and calculated capacity at test conditions, extrapolate system capacity at design conditions.

.4 When capacity test is completed, return controls and equipment status to normal operating conditions.

.5 Submit sample of system water to approved testing agency to determine if chemical treatment is correct. Include cost.

.6 Heating system capacity test:

.1 Perform capacity test when ambient temperature is within 10% of design conditions. Simulate design conditions by:

.1 Increasing OA flow rates through heating coils (in this case, monitor heating coil discharge temperatures at all times to ensure that coils are not subjected to freezing conditions) or

.2 Reducing space temperature by turning off heating system for sufficient period of time before starting testing.

.2 Test procedures:

.1 Open fully heat exchanger, heating coil and radiation control valves.

.2 With boilers on full firing and hot water heating supply temperature stabilized, record flow rates and supply and return temperatures simultaneously.

.3 Conduct flue gas analysis test on boilers at full load and at low fire conditions.

1.6 POTABLE WATER SYSTEMS

.1 When cleaning is completed and system filled:

.1 Verify performance of equipment and systems as specified elsewhere in mechanical Division.

.2 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor. Repeat for each outlet and flush valve.

.3 Confirm water quality consistent with supply standards, verifying that no residuals remain as a result of flushing and/or cleaning.

1.7 SANITARY DRAINAGE SYSTEMS

.1 Buried systems: Perform tests prior to back-filling. Perform hydraulic tests to verify grades and freedom from obstructions.

.2 Ensure that traps are fully and permanently primed.

.3 Ensure that fixtures are properly anchored, connected to system.

.4 Operate flush valves, tank and operate each fixture to verify drainage and no leakage.

.5 Cleanouts: Refer to Section 22 42 01 - Plumbing Specialities and Accessories.

.6 Roof drains:

.1 Refer to Section 22 42 01 - Plumbing Specialities and Accessories.

.2 Remove caps as required.

1.8 REPORTS

.1 In accordance with Section 01 91 13 – General Commissioning (Cx) Requirements: supplemented as specified herein.

1.9 TRAINING

.1 In accordance with Section 01 91 13 – General Commissioning (Cx) Requirements: supplemented as specified in relevant specification sections

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Procedures and cleaning solutions for cleaning mechanical piping systems.

1.2 RELATED SECTIONS

.1 Section 01 74 21 – Construction/Demolition Waste Management and Disposal

.2 Section 23 05 93 - Testing, Adjusting and Balancing of HVAC

.3 Section 23 25 00 - HVAC Water Treatment Systems.

1.3 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM E202 – Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.

.2 Health Canada / Workplace Hazardous Materials Information System (WHMIS).

.1 Material Safety Data Sheets (MSDS).

1.4 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 – Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.2 Quality assurance submittals: submit following in accordance with Section 01 33 00 – Submittal Procedures.

.1 Instructions: submit manufacturer's installation instructions.

.1 Owner's Representative will make available one (1) copy of systems supplier installation instructions.

1.5 QUALITY ASSURANCE

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section - Health and Safety Requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading.

.1 Deliver, store and handle in accordance with manufacturer's written instructions and Section – Common Product Requirements.

.2 Waste Management and Disposal:

.1 Construction / Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction / Demolition Waste Management and Disposal.

PART 2 PRODUCTS

2.1 CLEANING SOLUTIONS

.1 Low foaming detergent at all temperatures

.2 No pH neutralization required

.3 Designed for use on most metals including aluminium

.4 Bio-degradable

.5 Phosphate Free

.6 Nitrite Free

2.2 SUSTAINABLE REQUIREMENTS

.1 ENVIRONMENTAL: Choose products and materials with recycled content or resource efficient characteristics whenever possible. Use least toxic sealants, adhesives, sealers and finishes necessary to comply with the requirements of the project

PART 3 EXECUTION

3.1 CLEANING HYDRONIC AND STEAM SYSTEMS

.1 Timing

.1 Systems to be operational, hydrostatically tested and with safety devices functional, before cleaning is carried out.

.2 Cleaning Agency:

.1 Retain qualified water treatment specialist to perform system cleaning.

.3 Install instrumentation such as flow meters, orifice plates, pitot tubes, flow metering valves only after cleaning is certified as complete by water treatment specialist.

.4 Cleaning procedures:

.1 Provide detailed report outlining proposed cleaning procedures at least 4 weeks prior to proposed starting date. Report to include:

.1 Cleaning procedures, flow rates, elapsed time.

.2 Chemicals and concentrations to be used.

.3 Inhibitors and concentrations.

.4 Specific requirements for completion of work.

.5 Special precautions for protecting piping system materials and components.

.6 Complete analysis of water to be used to ensure water will not damage systems or equipment.

.5 Conditions at time of cleaning of systems

.1 Systems to be free from construction debris, dirt and other foreign material.

.2 Control valves to be operational, fully open to ensure that terminal units can be cleaned properly.

.3 Strainers to be clean prior to initial fill.

.4 Install temporary filters on pumps not equipped with permanent filters.

.5 Install pressure gauges on strainers to detect plugging.

.6 Report on Completion of Cleaning

.1 When cleaning is completed, submit report, complete with certificate of compliance with specifications of cleaning component supplier.

.7 Hydronic Systems:

.1 Flush system thoroughly with water, back flush pump, strainers, blow down drain valves and risers to remove all loose debris. Remove accumulated sludge in boilers if necessary.

.2 Then add 2% solution of low foaming detergent to the system through a by-pass feeder or another feeding device.

.3 Circulate for 36 hours at 82° C. For chilled systems, circulate at least 48 hours at ambient temperature.

.4 During recirculation, back flush strainers, drain valves and risers at their lowest point once every 8 hours.

.5 Drain cleaning water completely.

.6 Then fill and drain system several times. Circulate 30 minutes every time the system is refilled.

.7 Bleed system at several points until water is clear and non-foaming. Clean pump strainers.

.8 Draw a water sample from the system and send it to out laboratory for analysis.

.9 If the laboratory report is satisfactory, the system must then be treated with the appropriate formula.

.8 Glycol Systems:

.1 In addition to procedures specified above perform procedures specified herein.

.2 Test to prove concentration will prevent freezing to minus 40°C. Test inhibitor strength and include in procedural report. Refer to ASTM E202.

.9 Steam Systems: In addition to general requirements as specified above, perform following:

.1 Remove internal components of steam traps until flushing and warm-up have been completed.

.2 Open drip points to atmosphere. If needed for protection of personnel or environment, install flexible hose and direct discharge to safe location.

.3 Starting at drip point closest to source, verify removal of condensate, then re-install steam trap internal parts. Repeat sequence down the line.

.4 Water hammer: Determine source and eliminate cause.

.10 Steam boilers:

.1 Isolate boilers from piping system.

.2 Fill to normal operating level. Add cleaner. Fire to 50% of design operating steam pressure. Maintain for 24 h, during which blow down boiler every 4 h including water columns, controls, skimmer lines and valves, test cocks, blowdown valves. Add water to return to operating level.

.3 Allow boiler to cool, then drain, flush and inspect.

.4 Reconnect to piping system.

.5 Refill boiler with clean softened water and immediately add chemical inhibitors.

.6 Apply heat slowly and raise to normal design operating steam pressure. Maintain for 4 h.

.7 Discharge condensate from steam system to sewer for 96 h after initial operation. During this period continue chemical treatment of boilers with inhibitors to ensure complete removal of oils, grease and millscale from steam and condensate return piping steam.

.8 Drain steam condensate until it is clean and free from suspended matter. Ensure proper operation of steam traps.

.9 Allow boiler to cool, drain, open inspection ports and wash out with clean water.

.10 If boiler is not to be used immediately, refill with softened water, add sodium sulphite, bring up to pressure. Test for residual sulphite.

.11 After cleaning is completed and system is filled, perform relevant start-up procedures as specified for hydronic systems:

3.2 START-UP OF HYDRONIC SYSTEMS

.1 After cleaning is completed and system is filled:

.1 Establish circulation and expansion tank level, set pressure controls.

.2 Ensure air is removed.

.3 Check pumps to be free from air, debris, possibility of cavitation when system is at design temperature.

.4 Dismantle system pumps used for cleaning, inspect, replace worn parts, install new gaskets and new set of seals.

.5 Clean out strainers repeatedly until system is clean.

.6 Commission water treatment systems as specified in Section 23 25 00 - HVAC Water Treatment Systems.

.7 Check water level in expansion tank with cold water with circulating pumps OFF and again with pumps ON.

.8 Repeat with water at design temperature.

.9 Check pressurization to ensure proper operation and to prevent water hammer, flashing, cavitation. Eliminate water hammer and other noises.

.10 Bring system up to design temperature and pressure slowly over a 48 hour period.

.11 Perform TAB as specified in Section 23 05 93 - Testing, Adjusting and Balancing (TAB).

.12 Adjust pipe supports, hangers, springs as necessary.

.13 Monitor pipe movement, performance of expansion joints, loops, guides, anchors.

.14 If sliding type expansion joints bind or if bellows type expansion joints flex incorrectly, shut down system, re-align, repeat start-up procedures.

.15 Re-tighten bolts, etc. using torque wrench, to compensate for heat-caused relaxation. Repeat several times during commissioning.

.16 Check operation of drain valves.

.17 Adjust valve stem packings as systems settle down.

.18 Fully open all balancing valves (except those that are factory-set).

.19 Check operation of over-temperature protection devices on circulating pumps.

.20 Adjust alignment of piping at pumps to ensure flexibility, adequacy of pipe movement, absence of noise or vibration transmission.

3.3 CLEANING

.1 Provide in accordance with Section 01 74 11 – Cleaning.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 Section Includes

.1 Materials and installation for piping, valves and fittings for gas fired equipment.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.3 Section 01 78 00 - Closeout Submittals.

.4 Section 01 91 13 – General Commissioning (Cx) Requirements.

.5 Section 23 05 05 – Installation of Pipework.

.6 Section 23 08 01 – Performance Verification Mechanical Piping Systems

.7 Section 23 08 02 – Cleaning and Start-up of Mechanical Piping Systems.

1.3 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B16.5, Pipe Flanges and Flanged Fittings

.2 ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings

.3 ASME B16.22, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings

.4 ASME B18.2.1, Square and Hex Bolts and Screws Inch Series.

.2 American Society for Testing and Materials International (ASTM)

.1 ASTM A 47/A47M, Standard Specification for Ferritic Malleable Iron Castings.

.2 ASTM A 53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.

.3 ASTM B 75M, Standard Specification for Seamless Copper Tube (Metric).

.4 ASTM B 837, Standard Specification for Seamless Copper Tube for Natural Gas and Liquefied Petroleum (LP) Gas Fuel Distribution Systems.

.3 Canadian Standards Association (CSA International).

.1 CSA W47.1, Certification of Companies for Fusion Welding of Steel.

.4 Canadian Standards Association (CSA) / Canadian Gas Association (CGA)

.1 CAN/CSA B149.1HB, Natural Gas and Propane Installation Code Handbook.

.2 CAN/CSA B149.2, Propane Storage and Handling Code.

.5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS)

1.4 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet for piping, fitting and equipment.

.2 Indicate on manufacturer's catalogue literature following: valves.

.3 Submit WHMIS MSDS in accordance with Section 02 62 00.01 – Hazardous Materials. Indicate VOC's for adhesive and solvents during application and curing.

.4 Test Reports: Submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

.5 Certificates: Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.6 Instructions: Submit manufacturer's installation instructions.

.7 Closeout Submittals: Submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.

1.5 QUALITY ASSURANCE

.1 Pre-Installation Meeting:

.1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations.

.1 Verify Project requirements.

.2 Review Installation and substrate conditions.

.3 Co-ordination with other building subtrades.

.4 Review manufacturer's installation instructions and warranty requirements.

.2 Do construction occupational health and safety in accordance with Section 01 35 29.06 – Health and Safety Requirements.

.3 Trades people to have journeyperson qualifications.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction /Demolition Waste Management and Disposal.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal, paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan (WMP).

.4 Separate for reuse and recycling and place in designated containers, steel, metal , plastic waste in accordance with WMP.

.5 Divert unused metal materials from landfill to metal recycling facility as approved by Owner's Representative.

PART 2 PRODUCTS

2.1 PIPE

.1 Steel pipe: to ASTM A 53/A53M, Schedule 40, seamless as follows:

.1 NPS ½ to 2, screwed.

.2 NPS2 ½ and over, plain end.

2.2 JOINTING MATERIAL

.1 Screwed fittings: pulverized lead paste

.2 Welded fittings: to CSA W47.1.

.3 Flange gaskets: non-metallic flat.

2.3 FITTINGS

.1 Steel pipe fittings, screwed:

.1 Malleable iron: screwed to ANSI B16.3, Class 150 for service pressures up to and including 861 kPa.

.2 Unions: malleable iron, brass to iron, ground seat, to ASTM A47M.

.3 Nipples: schedule 40, to ASTM A53.

2.4 MANUAL SHUT-OFF VALVES

.1 NPS 4 and under, full port, forged brass ball valve for two piece body construction complete with the following:

.1 Blowout-proof stem.

.2 Adjustable packing gland.

.3 Chrome-plated ball.

.4 Class 150 WSP, 600 WOG.

.5 CGA 3.16 approved.

.6 Provide complete with CRN.

.7 Lever handle.

.8 ANSI B1.20.1 NPT end connections

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions and datasheet.

3.2 PIPING

.1 Install piping in accordance Section 23 05 05 – Installation of Pipework, applicable Provincial Codes, CAN/CSA-B149.1, supplemented as specified.

.2 Slope piping down in direction to flow to low points.

.3 Install drip points:

.1 At low points in piping system and where indicated.

.2 Provide complete with blowdown valve i.e. manual shut-off valve as specified above.

.3 Minimum 75 mm in length from tee connection in riser to top of valve. Size to be minimum NPS ¾. Provide complete with threaded end cap.

.4 Use eccentric reducers at pipe size change installed to provide positive drainage.

.5 Provide clearance for access and for maintenance.

.6 Ream pipes, clean scale and dirt, inside and out.

.7 Install piping to minimize pipe dismantling for equipment removal.

.8 Field ending of piping to be prohibited.

.9 Nesting of bushings to be prohibited. Utilize properly sized reducing fittings.

.10 Do not utilize propane piping as an electrical ground.

3.3 VALVES

.1 Install valves with stems upright or horizontal unless approved otherwise by Owner's Representative.

.2 Install valves as indicated.

3.4 FIELD QUALITY CONTROL

.1 Site Tests/Inspection:

.1 Test system in accordance with CAN/CSA B149.1 and CAN/CSAB149.2 and requirements of authorities having jurisdiction.

.2 Manufacturer's Field Services:

.1 Have manufacturer of products supplied under this Section review work involved in handling, installation/application, protection and cleaning of its products, and submit written reports, in acceptable format, to verify compliance of work with contract.

.2 Provide manufacturer's field services, consisting of product use recommendations and periodic site visits for inspection of product installation, in accordance with manufacturer's instructions.

.3 Schedule site visits to review work at stages listed:

.1 After delivery and storage of products, and when preparatory work on which work of this Section depends is complete, but before installation begins.

.2 Twice during progress of work at 25% and 60% complete.

.3 Upon completion of work, after cleaning is carried out.

.3 Obtain reports within three (3) working days of review and submit immediately to Owner's Representative

.4 Performance Verification:

.1 Refer to Section 23 08 01 – Performance Verification of Mechanical Piping Systems.

.5 PV procedures:

.1 Test performance of components.

3.5 ADJUSTING

.1 Purging: purge after pressure test in accordance with CAN/CSA B149.1 and CAN/CSA B149.2.

.2 Pre-Start-Up Inspections:

.1 Check vents from regulators, control valves, terminate outside building in approved location, protected against blockage, damage.

.2 Check gas trains, entire installation is approved by authority having jurisdiction.

3.6 CLEANING

.1 Cleaning: in accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems, CAN/CSA B149.1, CAN/CSA B149.2, supplemented as specified.

.2 Perform cleaning operations as specified in Section 01 74 11 – Cleaning, and in accordance with manufacturer's recommendations.

.3 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.7 PURGING

.1 Purge after pressure test in accordance with CSA-B149.1.

3.8 IDENTIFICATION

.1 Identify new propane piping systems in accordance with requirements for CSA-B149.1.

.2 Above ground propane piping to be primed and painted yellow along its entire length. All below ground propane piping to be covered with plastic yellow identification marker tape suitable for direct burial.

.3 Supply and install “Propane Gas” pipe identification markers along length of propane piping installation in accordance with CSA-B149.1 and Section 23 05 53 01 – Mechanical Identification. Maximum spacing along straight length of pipe to be 6 m.

.4 Maintain minimum depth of burial of underground propane piping of 600 mm, unless otherwise noted.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL SYSTEMS DESCRIPTIONS

1.1.1. Provide a complete and operational HVAC and water system, designed to achieve desired space environment criteria. This section covers the following:

1.1.1.1. Hydronic distribution systems.

1.1.1.2. Pumps

1.2. REFERENCES

1.2.1. Air Conditioning and Refrigeration Institute (ARI)

1.2.2. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

1.2.3. ASHRAE 90.1-10, Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings.

1.2.4. American Society for Testing and Materials (ASTM)

1.2.5. ASTM A53/A53M-07, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

1.2.6. National Fire Protection Association (NFPA)

1.2.7. NFPA 90A-02, Standard for the Installation of Air Conditioning and Ventilating Systems.

1.2.8. NFPA 96-08, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

1.2.9. National Electrical Manufacturers Association (NEMA)

1.2.10. NEMA MG 1-06 (R2007), Motors and Generators.

1.2.11. Underwriters Laboratories Inc. (UL)

1.3. DESIGN AND PERFORMANCE REQUIREMENTS

1.3.1. General

1.3.1.1. Design an construct hydronic distribution system in accordance with ASHRAE guidelines and good engineering practice

1.3.1.2. Fluid Distribution Systems

1.3.1.2.1. Systems pipe shall be designed to ASTM A53/A53M.

1.3.1.2.2. Allow for system thermal expansion, to prevent structural failure or fluid leakage. Calculate location of anchors, guides and supports/hangers to minimize pipe flexing.

1.3.1.3. The arrangement of hydronic heating piping shall provide for logical isolation of systems. The location of isolation valves shall be well marked, and access shall be without removal of other equipment.

1.3.1.4. Provide isolation valves to ensure each floor or part of the floor can be isolated from the rest of the system.

1.3.2. Pumps:

1.3.2.1. Pumps shall be selected for optimum efficiency over the design operating pressure range.

1.3.2.2. Provide system distribution pumps to pump chilled water, hot water, etc from source supply pipe through distribution system and back to source return pipe as required.

1.3.2.3. Provide redundancy to meet operational requirements consistent with the redundancy requirements of the heating and cooling plant. Redundancy shall be provided for all heating pumps to allow heating systems to perform their intended function with one pump out of service (n+1).

1.3.2.4. The distribution systems shall be arranged for variable flow through the loads (coils, heat exchangers, terminal units). Pumps shall be fully modulating variable speed where the motors are above 2.0 kW, however this does not limit variable speed operation on smaller pumps.

1.3.3. Additional Document Requirement

1.3.3.1. Submit detailed construction drawings showing system schematics, floor plans and details.

1.3.3.2. Risers shall be numbered sequentially on the drawings and schematics. Indicate all terminal connections with flows.

1.3.4. Products

1.3.4.1. Pumps

1.3.4.1.1. Central pumps shall be in line.

1.3.4.1.2. Pumps 5 HP and larger shall be split coupler type with spacer coupling

1.3.4.1.3. Provide inline pumps from following approved

manufacturers: 1.3.4.1.3.1. Armstrong series 4300/4380

1.3.4.1.3.2. ITT Series 80

1.3.4.1.3.3. Grundfos

1.3.4.1.3.4. Taco

1.3.4.2. Pipe- Steel For 1-1/4" & Smaller Screwed Fittings

1.3.4.2.1. Provide piping materials and select pipe size recommended by ASHRAE for associated medium and to suit design conditions.

1.3.4.2.2. Type "L" hard drawn copper tubing conforming to ASTM B88. Type "L" soft annealed copper tubing may be used within convector enclosures.

1.3.4.2.3. Type "K" soft annealed copper tubing conforming to ASTM

B88 with no joints permitted below the floor for below grade applications. Use approved tube bender for tube bending.

1.3.4.2.4. Schedule 40, continuous weld or electric resistance welded black carbon steel conforming to ASTM A53 Grade B, with bevelled ends.

1.3.4.2.5. Schedule 40 seamless or electric resistance welded black carbon steel pipe conforming to ASTM A53 Grade B with grooved ends conforming to CSA B242 M

1.3.4.2.6. Use of copper pipe type M shall not be used.

1.3.4.3. Grooved connection shall be from same manufacturer and shall only be used in accessible areas. For pipes 1-1/2" & larger, only use Victualic fittings.

1.3.4.4. Valves General

1.3.4.4.1. Select valve types for the intended services, to ASHRAE guidelines and following:

1.3.4.4.2. Provide bronze valves with bodies made of bronze conforming to ASTM B62.

1.3.4.4.3. Use gate and globe valves of a design which permits valve to be re packed under pressure when fully open.

1.3.4.4.4. Provide valves with manufacturer's name or trade mark, figure number and pressure rating cast or stamped on valve body.

1.3.4.4.5. Provide globe, angle and check valves with composition discs with manufacturer's recommended disc for type of service on which it is to be used, unless otherwise specified.

1.3.4.4.6. Install balancing valves for all terminal units, coils and main branch piping.

1.3.4.4.7. All valves shall have appropriate CRN numbers.

1.3.4.4.8. Use ball valve for isolation of equipment up to and including NPS 2. In all other locations use butterfly valves for NPS 2 1/2 and over.

1.3.4.5. Globe Valves

1.3.4.5.1. Provide globe valves for control valve-bypass.

1.3.4.5.2. NPS 2 and Under Screwed: To MSS SP 80, Class 150, 1 mPa, bronze body, replaceable composition disc, union bonnet.

1.3.4.5.3. NPS 2 1/2 and Over Flanged: To MSS SP 85, Class 125, 860 kPa, bronze mounted, flat faced flange, cast iron body, OS&Y, bolted bonnet, renewable and regrindable bronze seat ring.

1.3.4.6. Butterfly valves

1.3.4.6.1. Centerline Butterfly Valves

1.3.4.6.1.1. Utilize for all on/off applications with operating pressures 200 psi and less 1.3.4.6.1.2. NPS 2 1/2 and Over Full Lug Body (200 psig):

1.3.4.6.1.3. To MSS SP 67, 200 psig, 1380 kPa WOG water, cast iron body with epoxy coated cast iron or bronze disc (nickel coated discs are not acceptable), 416 stainless steel stem, replaceable EPDM liner, with notched top plate and lever lock handle for valve sizes NPS 4 and smaller, and worm gear operator with hand wheel for valves NPS 6 and larger. For glycol service utilize stainless steel trim. Lugs shall be tapped. Shutoff up to 200 psi (1720 kPa) rating if downstream equipment is removed.

1.3.4.6.2. NPS 2 1/2 and Over Grooved End Pipe:

1.3.4.6.3. Utilize for all on/off applications up to 200 psi operating pressure 1.3.4.6.3.1. Grooved end butterfly valves shall have dual seal disc providing bubble tight service up to 300 psi. Ductile iron body conforming to ASTM A 536, Grade E EPDM disc coating. Glycol service EPDM disc coating with stainless steel trim.

1.3.4.7. Ball valves

1.3.4.7.1. NPS 2 and Under Branch Isolators Screwed:

1.3.4.7.2. Rated for 600 WOG, bronze body, bronze ball, with Teflon seal.

1.3.4.7.3. Ball valves shall have full port opening.

1.3.4.7.4. All ball valves shall be provided with lockable handles where specified.

1.3.4.7.5. Soldered ends are only acceptable for valves that are NPS 3/4 installed in copper piping

1.3.5. Installation and Testing

1.3.5.1. General

1.3.5.1.1. Install according to piping layout. Pipe drains and blow off nearest drain.

1.3.5.1.2. Flush and pressure test system.

1.3.5.1.3. Check that all openings for appurtenances and equipment operating weight, conform to shop drawings.

1.3.5.1.4. Install various HVAC distribution piping along similar routing where possible, to share pipe support structures. Locate pipe labels in similar locations.

1.3.5.1.5. Install piping to conserve space in buildings and to keep furring to a minimum.

1.3.5.1.6. Unless otherwise indicated, connect to equipment in accordance with manufacturer's instructions.

1.3.5.1.7. Install concealed pipes close to the building structure to keep furring space to minimum. Install to conserve headroom and space. Run exposed piping parallel to walls. Group piping wherever practical.

1.3.5.1.8. Slope piping up in the direction of flow.

1.3.5.1.9. Use eccentric reducers at pipe size change, installed to provide positive drainage or positive venting.

1.3.5.1.10. Provide clearance for installation of insulation and access for maintenance of equipment, valves and fittings.

1.3.5.1.11. Ream pipes clean of scale and dirt, inside and outside, before and after assembly.

1.3.5.1.12. Do not use compression fittings

1.3.5.1.13. Provide drain connections at the bottom of the risers.

1.3.5.2. Strainers

1.3.5.2.1. Install in horizontal or down flow lines.

1.3.5.2.2. Ensure clearance for removal of basket.

1.3.5.2.3. Install ahead of each pump, automatic control valve (except at radiation) and as required.

1.3.5.3. High Capacity Air Vents

1.3.5.3.1. Install at expansion tank connection c.

1.3.5.3.2. Install ball valve upstream of air vent.

1.3.5.3.3. Pipe overflow to nearest drain for water systems and back to glycol fill tank for glycol systems.

1.3.5.4. Air Vents

1.3.5.4.1. Install at high points of systems.

1.3.5.4.2. Pipe overflow to nearest drain.

1.3.5.4.3. On large-capacity air vent, install ball valve upstream of air vent.

1.3.5.5 Automatic Air Vent

1.3.5.5.2. Industrial float vent: cast iron body and NPS 15mm (1/2”) connection and rated at 860 KPA (125 Psi) working pressure

1.3.5.5.3. Float: solid material suitable for 115°C (240°F) working temperature.

1.3.5.5.4. Plastic vents are not acceptable.

1.3.5.5.5. Acceptable manufacturer:

- Maid-O-Mist No.67
- Spirax Sarco

1.3.5.5. Air Separators

1.3.5.5.1. Install downstream of the main pump.

1.3.5.6. Pressure Safety Relief Valves

1.3.5.6.1. Provide for hydronic system as per Code.

1.3.5.6.2. Pipe outlet to nearest drain.

1.3.5.7. Suction Diffusers

1.3.5.7.1. Install on inlet to pumps and to manufacturer's instructions.

1.3.5.7.2. Inspect the strainer prior to the start-up of the pump and shall remove the fine mesh stainless steel strainer after a short running period.

1.3.5.8. Venturi Check Valves

1.3.5.8.1. Install the venturi check valves downstream of the pumps as per manufacturers' instructions. Provide a minimum of 600 mm straight run prior to the check valve.

1.3.6. Chain wheel operators

1.3.6.1. Install chain wheel operators where indicated on the drawings in chilled water, condenser water, heating water and glycol lines that are more than 150 mm in size.

1.3.6.2. Provide chain wheel and operating chain for valves installed more than normal operating height or distance from floor, regardless of the type of valve.

1.3.6.3. Chain shall be of sufficient length to extend within 2150 mm of operating platform or floor for free hanging chains or to within 1500 mm of the floor in locations where chain can be secured to wall or column. Provide wall hook as required for securing chain to wall or column.

1.3.6.4. Chain wheels shall be of size recommended by the valve manufacturer for proper operation of the valve. Chain wheels shall be complete with guide. Chain shall be rust proof.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION

1. GENERAL

1.1 Related Work

1. This Specification Section forms part of Contract Documents and is to be read, interpreted and coordinated with other parts.

2. Refer to Section 23 05 49 for required seismic restraint of piping.

1.2 Reference Standards

1. Do piping system work in accordance with ASME/ANSI B31.9 code and CSA B51.

2. Grooved joint piping components shall conform to CSA B242 code.

1.3 Regulatory Requirements

1. Components, products and fabrication techniques shall be provided in compliance with **[Regulations and Requirements of Province of Ontario Technical Standards & Safety Authority (TSSA)].**

2. Installation, repair or alternations to pressure piping systems shall be performed by licensed Contractors Welders, certified for work in accordance with **[Regulations and Requirements of Province of Ontario Technical Standards & Safety Authority (TSSA)].**

3. Field welding to be in accordance with procedures of CSA-W117.2 and current edition of ASME/ANSI B31.1 or B31.9 Code.

1.4 System Pressure Ratings

1. Pipe Fittings:

    1. Piping system 860 kPa or less operating pressure – 860 kPa rating.

    2. Piping systems 870 kPa to 1,725 kPa operating pressure – 1730 1,725 kPa rating.

2. Valves:

    1. Suitable for maximum system operating temperature and pressure.

1.5 Shop Drawings

1. Submit detailed shop drawings of valves in accordance with Section 23 05 00. Shop drawings shall indicate make, model, location, type, size and pressure rating and Provincial CRN number.

2. Grooved joint couplings and fittings shall be shown on drawing and product submittals, and shall be specifically identified with the applicable style or series designation.

2. PRODUCTS

2.1 General

1. Products shall be registered with regulatory authority in accordance with CSA B51.

2.2 Pipe

1. Steel Pipe:
    1. To NPS 10, Schedule 40 to ASTM A53 Grade B or NPS 3/4 to NPS 2 to ASTM A795, Schedule 5, suitable for Pressfit.
    2. To NPS 12 and over, 9.5 mm wall thickness to ASTM A53 Grade B.
    3. For the following system:
        1. Hot water heating.
        2. Chemical feed.
        3. Relief valve vents.
2. Stainless Steel Pipe: To NPS 2, Schedule 10S to ASTM A312, Type 304/304L, suitable for and approved for use with Vic-Press 304™.
3. Copper Pipe: to ASTM B88M-86, Type K, or L hard drawn copper tubing.
    1. Type L, hard drawn:
        1. Pressure drains (to NPS 2).
    2. Type L hard drawn may be used as an alternative to steel piping for the following systems:
        1. Hot water heating, upto ½" is to be screwed and 1-1/2" and over is to be Victualic
    3. Type K, hard drawn:
        1. Air vent overflow

2.3 Pipe Joints – Steel Piping

1. NPS 2 and under: screwed fittings, except where otherwise noted, with Teflon tape

and RectorSeal Teflon paste or pipe dope, Pressfit in applicable applications.

2. NPS 2-1/2 and over: welding fittings and flanges to CSA W47.1.

3. Flanges: raised face, steel weld neck, lap or back-welded slip on type. Use flat face for attachment to case iron valves.

4. Victaulic Pressfit fittings with grade "E" EPDM O-rings may be used on hot water heating up to 110°C working temperature, and 200 psig working pressure glycol heating, glycol heat recovery, chilled water, heat pump water, condenser water-closed circuit systems.

5. Victaulic couplings or SHURJOINT brand to CSA B242-M1980 may be used on hot water heating, chilled water, condenser water, glycol heat recovery and heat pump water systems. Use lubricant supplied by Manufacturer and coat gasket. Grade "EHP" gasket for temperature range -34°C to 120°C or "EPDM" gasket for temperature range -34°C to 110°C. Couplings shall consist of two ductile iron housing segments conforming to ASTM A536 Grade 65-45-12.

    1. Rigid Type to NPS 12: 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. NPS 2 through NPS 8: Installation-Ready, for direct stab installation without field disassembly, with grade EHP gasket rated to 120°C. Victaulic Style 107H.

        2. Victaulic Zero-Flex Style 07.

    2. Flexible Type: For use in locations where vibration attenuation and stress relief are required. Three flexible couplings may be used in lieu of flexible connector provided it meets vibration isolation requirements. The couplings shall be placed in close proximity to the source of the vibration. Victaulic Style 77 or Installation-Ready Style 177.

    3. NPS 14 and Larger: 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.

    4. Flange Adapter: Flat face, ductile iron housings with elastomer pressure responsive gasket, for direct connection to ANSI Class 125 or 150 flanged components. Victaulic Style 741 / W741.

1. For connections to Class 300 flanged components in sizes through NPS 12, Victaulic Style 743.

6. Flange Bolts and Nuts, carbon steel: to ANSI B18.2.1 and ANSI B18.2.2.

7. Flange gaskets:

    1. Up to 860 kPa system pressure – non-asbestos gaskets for mating surfaces.

    2. Over 860 kPa system pressure – stainless steel spiral wound non-asbestos gaskets.

2.4 Pipe Fittings – Steel Pipe

1. Pipe fittings, screwed, flanged or welded:

    1. Cast-iron pipe flanges: Class 125 to ANSI B16.1.

    2. Cast-iron screwed fittings: Class 125 to ANSI B16.3.

    3. Steel pipe flanges and flanged fittings: to ANSI B16.5.

    4. Steel butt-welding fittings: to ANSI B16.9a.

    5. Unions, malleable iron ground joint type: Class 150 to ANSI B16.3

2. Fittings for roll grooved piping: Ductile iron to ASTM A536; wrought steel to ASTM A234 Grade WPB; or factory fabricated from steel pipe conforming to ASTM A53.

    1. All grooved joint couplings, fittings, valves, and specialties shall be Victaulic.

    2. Grooving tools shall be of the same Manufacturer as the grooved components.

    3. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

2.5 Pipe Joints – Stainless Steel Pipe

1. Victaulic Vic-Press 304™ fittings with HNBR O-rings may be used on hot water heating up to 98°C working temperature, domestic water, glycol heating, glycol heat recovery, chilled water, heat pump water, condenser water-closed circuit systems. Vic-Press system shall be rated to 3,450 kPa.

2.6 Pipe Joints – Copper Pipe

1. All sizes soldered or brazed as specified in Part 3 Execution of this Section.

2. NPS 2 to NPS 8 – Victaulic Style 607 installation-ready rigid copper couplings with offsetting angle-pattern bolt pads and grade "EHP" gasket for temperature range -34°C to 120°C may be used on hot water heating, heat pump, chilled water, and condenser water systems.

    1. Couplings shall be manufactured to copper-tube dimensions. (Flaring of tube or fitting ends to accommodate alternate sized couplings is not permitted.)

2.7 Pipe Fittings – Copper Pipe

1. Cast bronze: to ANSI B16.18.
2. Wrought copper bronze: to ANSI B16.22.
3. Roll grooved (non-flared) fittings by Victaulic.

2.8 Flanges – Copper Pipe

1. Brass or bronze: to ANSI B16.15.
2. Cast-iron: to ANSI B16.4.
3. Victaulic Style 641 Flange Adapter.

3. EXECUTION

3.1 Piping

1. Ream pipe ends. Clean scale and dirt, inside and outside before and after assembly. Remove welding slag or other foreign material from piping.
2. During construction, protect openings in piping and equipment, by capping or plugging to prevent entry of dirt.
3. Screw, weld or groove (unless otherwise specified) piping systems up to NPS 2.
4. Weld or groove (unless otherwise specified) all piping systems NPS 2-1/2 and over.
5. Install piping to conserve headroom and space. Run exposed piping parallel to walls. Group piping wherever practical.
6. Avoid piping in exterior walls unless otherwise directed. If required, install this piping protected from outside by building insulation and vapour barrier.
7. Maintain minimum of 25 mm space between adjacent flanges or pipe insulation,

whichever has larger diameter.

8. Provide clearance for installation of insulation and access for maintenance of equipment, valves and fittings.

9. Saddle type branch fittings may be used on mains, if branch line is half size or smaller than main. Hole saw or drill and ream main to maintain full inside diameter of branch line prior to welding saddle. Use correct hole saw size for Victaulic 920 Mechanical tees.

10. If welding, use long radius elbows.

11. Install thermometer wells and immersion sensor wells specified under Controls Section. Where wells restrict flow in small diameter pipes (NPS 1-1/2 and smaller) install section of oversized pipe at least NPS 2.

12. Remake leaking joints using new materials, do not caulk or cement leaking threaded joints.

13. Use eccentric reducers at pipe size changes, flush on top side, to permit positive venting and drainage.

14. Do not use thread protection couplings, close nipples, running nipples or street elbows.

15. Install di-electric type unions or flanges or Victaulic Style 47 Clearflow Di-electric Waterways to "OPEN" type systems, where copper piping connects to steel. E.g. Domestic hot water tanks.

16. Avoid locating water and drain piping over electrical equipment. Where unavoidable, provide galvanized drip pans under such pipe and weld piping and fittings. Provide drain and piping from drip pans to floor drain.

17. Bull head tees shall not be used for converging flows.

3.2 Pipe Grading

1. Grade piping to provide positive drainage and venting. Slope as follows:

    1. Supply mains and branches – up in direction of flow, minimum 1:480 [25 mm in 12 m].

    2. Return mains and branches – down in direction of flow, minimum 1:480 [25 mm in 12 m].

    3. Reverse return supply and return mains – up in direction of flow, minimum 1:480 [25 mm in 12 m].

    4. Grade horizontal drainage and vent piping down in direction of flow, 2% minimum.

5. On closed system, equip low points with 19 mm drain valves. Provide at high points on lines and equipment connections, collecting chambers and high capacity float operated air vents.

3.3 Grooved Joint Piping Systems:

1. Grooved joints shall be installed in accordance with Manufacturer's latest published installation instructions.

2. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove.

3. Gaskets shall be elastomer grade suitable for intended service, and be molded and produced by coupling Manufacturer.

4. Grooved coupling Manufacturer's factory trained Representative shall provide on-site training for Contractor's field personnel in use of grooving tools and installation of grooved joint products.

5. Representative shall periodically visit jobsite and review Contractor is following best recommended practices in grooved product installation. (Distributor's Representative is not considered qualified to conduct training or jobsite visit(s).)

3.4 Soldering and Brazing

1. Pressure fluid systems – with chemical treatment (heating, chilled and condenser water) BRAZE with silver base brazing alloy, 538°C melting point.

2. Pressure fluid systems – without chemical treatment, (heat recovery, domestic water) SOLDER with 95/5 tin- antimony.

3. Non-pressure systems, (drains) SOLDER with 50/50 tin lead.

4. Piping connections to radiant ceiling panels, SOLDER with 95/5 tin-antimony.

3.5 Drain Connections

1. Pipe discharge from liquid relief valves, liquid safety valves, high capacity air vents, steam drip pan elbows, equipment blowdown, water columns, overflows and piping system drains to nearest building drain. Install brass, bronze or copper receiving funnel on drain where shown.

2. Drains for drain pans shall be DWV copper ASTM B306 32 mm minimum size.

3. Drain and vent piping shall be of same material as piping system connected, except where otherwise specified.

4. Where item being drained is under pressure, provide deep seal trap.

3.6 Expansion of Piping

1. Install piping systems with due regard and provision for expansion, avoiding strain or damage to equipment and building. Provide adequate expansion and contraction for piping running across building expansion joints.

2. Only major expansion configuration and fittings have been indicated on drawings. Provide required additional compensators, loops and swing connections.

3. Where expansion loops are required, use Victaulic Style 177 and 77 couplings on the loops in accordance with Victaulic instructions and as approved by the Engineer is acceptable.

4. Provide anchors, where shown. Anchors shall be fabricated from mild steel plate and structural steel angle and channel sections, in accordance with ANSI B3.31.

5. Expansion loops shall be welded construction with long radius elbows.

6. Install expansion loops, cold sprung 50% of calculated expansion.

7. Install at least three elbows in branch connections. Where space does not permit, install braided flexible pipe connectors in accordance with Manufacturer's recommendations. Three elbow branch connections shall have sufficient developed length to ensure excessive stresses are not generated in piping and in no case less than 914 mm.

3.7 Valves

1. Install valves with stems upright or angled 45º above horizontal unless approved otherwise.

2. Install control valves with stems upright unless approved otherwise and with adequate clearance for removal of actuators.

3. Use gate valves or ball valves NPS 2 and under to shut-off branch takeoffs and to isolate equipment.

4. Butterfly valves may be used as alternative to gate valves on glycol heating, hot water heating, chilled water, condenser water, heat pump and glycol heat recovery systems.

5. Use globe valves to control flow in circuits except where balancing cocks are specifically specified.

6. Use plug type globe valves in control valve bypass connections.

7. Use plug cocks for balance valves in water return branch mains and branch connections to return mains and for shut-off and balancing on glycol circuits.

8. Install balance fittings or valves in return piping connections to each terminal heating and cooling unit, e.g. Radiators, unit heaters, fan coil units, heating and cooling coils.

9. Install radiator valves in supply connections to each convection heating element.

10. Provide isolation valves in systems such that floor by floor for horizontal systems, risers in vertical system and zone areas on large horizontal system can be isolated.

11. Provide valves upstream of meters, gauges, automatic air vents, Flowtrex/Triple duty valves, etc. for isolation purposes.

12. Use swing check valves, in horizontal and vertical upflow pipes and on discharge of pumps. Spring loaded water check valves shall be located 8 pipe diameters downstream of pumps or elbows.

13. Use silent check valves where specifically shown in vertical pipes with downward flow.

3.8 Drain Valves and Hose Bibbs

1. Install drain valves and hose bibbs at each low point in piping system and at specific drain locations indicated on drawings.

2. Install NPS 3/4 hose bibbs at downfed terminal heating and/or cooling units.

3. Install NPS 1-1/2 or NPS 3/4 on line sizes less than NPS 1-1/2 drain valves/hose bibbs at low points in piping systems to facilitate draining.

4. Install drain valves in lieu of hose bibbs for systems operating at over 93°C.

5. Install hose end adaptor on discharge side of each drain valve or pipe to drain, where indicated.

6. Use NPS 1-1/2 fire hose and connect to discharge side of drain valves to flush piping system during pipe cleaning process.

7. Install caps, with chains, on hose end adaptors, in public areas.

3.9 Piping Tests

1. Notify Consultant and Inspection Authority Having Jurisdiction, 48 hours in advance of intended test dates.

2. Before testing piping, isolate equipment, which cannot withstand test pressure.

3. Do not insulate, backfill or conceal until tests have been completed and approved by inspection authorities.

4. Examine systems under test for leaks.

5. Joints shall remain dry during test. General sweating around weld shall be reason for rejection.

6. Remake leaking connections and joints.

7. Tests shall be limited to new piping only.

8. New connections to existing piping shall be warranted.

9. Do not backfill any underground piping until it has been surveyed and documented by the Owner.

10. Initial Hydrostatic test:

    1. 150% of working pressure, but not less than 860 kPa for 1 working day.

11. Final Hydrostatic test:

    1. 150% of working pressure, after piping connections to equipment are complete, maintain until entire piping system has been inspected.

3.10 Flushing and Cleaning

1. Flushing and cleaning shall commence after piping tests are completed.

2. Install temporary bypass connections around heat pump units before commencing chemical cleaning.

3. Chemically clean the following piping systems as recommended by approved professional chemical cleaning and treatment agency who shall supervise work:

    1. Heating hot water system(s).

4. Flush out traces of chemical with clean water after chemical cleaning is complete.

5. Install final connections to heat pump units after flushing is complete.

6. Remove, clean and reinstall strainer baskets.

7. Submit report signed by principal of Agency, which certifies cleaning has been satisfactorily completed.

3.11 Chemical Treatment

1. Chemically treat water systems in accordance with Section 23 25 00.

3.12 Testing and Balancing

1. Balance piping systems in accordance with requirements of section 230593.

END OF SECTION

1. GENERAL

1.1 Related Work

1. This Specification Section forms part of Contract Documents and is to be read, interpreted and coordinated with other parts.

1.2 Reference Standards

1. Provision of specialty components shall be in accordance with ANSI/ASME B31 Codes for Building Services Piping.

1.3 Regulatory Requirements

1. Water specialty components shall be provided in compliance with Regulations and Requirements of Province of Ontario Technical Standards & Safety Authority (TSSA).

1.4 System Pressure Ratings

1. Piping systems 860 kPa or less operating pressure - 860 kPa rating.
2. Piping systems 870 kPa to 1,725 kPa operating pressure – 1,725 kPa rating.

2. PRODUCTS

2.1 Air Vents Automatic – High Capacity Type

1. Non-Serviceable Type:
    1. Casing and internal parts suitable for system operating pressure and temperature.
    2. Metal construction with outlet threaded to accept vent tubing connection.
    3. Automatic float type.
    4. Shraeder type venting valve.
    5. Acceptable Products:
        1. 345 kPa maximum operating pressure – Armstrong AW, Dole 75, Maid-O-Mist 6, Taco 426, Watson McDaniel AE 1800.
        2. 517 kPa maximum operating pressure – Armstrong AW, Dole 75, Maid-O-Mist 6, Taco 426, Watson McDaniel AE 1800.
        3. 1,034 kPa maximum operating pressure – Armstrong AW, Maid-O-Mist 6, Taco

426, Watson McDaniel AE 1800.

2.2 Air Vents Manual – High Capacity

1. Globe Type
    1. Bronze Body, union bonnet, screwed, 450 Brinell hardened stainless steel trim and plug type disc.
2. Acceptable Products:
    1. Class 860 kPa – Crane 14-1/2 LP, Jenkins 2032, Lunkenheimer 73-PS, Toyo 214.
    2. Class 1,380 kPa – Crane 212P, Jenkins 2050, Lunkenheimer 73-PS, Toyo 214.

2.3 Air Vents Manual – Radiator Type

1. Needle Type
    1. Bronze or steel body, screwed, needle valve.
    2. Manual key operator.
    3. 860 kPa maximum operating pressure and 120°C maximum operating temperature.
    4. Acceptable Products: Maid-O-Mist 816.
2. Hydroscopic Type
    1. Bronze or steel body, screwed hydroscopic discs.
    2. Manual screwdriver or key operator.
    3. Aceptable Products:
        1. 345 kPa maximum operating pressure – Dunham Bush V19B, Maid-O-Mist 72, Taco 417.
        2. 517 kPa maximum operating pressure –Maid-O-Mist 72, Taco 417.

2.4 Air Separators

1. Provide centrifugal, type with 860 kPa WSP steel tank, galvanized steel 6.0 mm perforated

strainer, perforated stainless steel air collector tube and drain connection.

2.5 Air Scoop

2.6 Expansion Tanks – Diaphragm Type

1. Expansion tanks with working pressure to 207 kPa and less than 600 mm in diameter.
    1. Steel construction with sealed-in elastomer diaphragm suitable for up to 116°C.
    2. Welding performed by certified, qualified welders.
    3. Factory tested hydraulically to 517 kPa.
    4. Identification plate showing:
        1. Manufacturer's name.
        2. Expansion tank operating pressure, 207 kPa.
        3. Hydraulic test pressure 517 kPa.
        4. Date of manufacture.
        5. Pre-charge via air charging valve to 83 kPa.
        6. Saddles for horizontal installation or base mount for vertical installation.

2.7 Pressure Reducing Station – Cold Water

1. Screwed, bronze or cast-iron body, suitable to 1,380 kPa, composition seat.
2. Each reducing station to include:
    1. Gate valve, strainer, union, pressure reducing valve, union gate valve.
    2. Bypass with globe valve.
    3. 19 mm relief valve.
3. Acceptable Products: Cashco, Watts.

2.8 Pressure Relief Valves – Water

1. Screwed, bronze body or cast-iron body with expanded outlet.

2. ASME rated.

3. Acceptable Products:

    1. Bronze body: Watts 174A, NPS 3/4 to NPS 2.

    2. Iron body: Watts 740, NPS 3/4 x 1 to NPS 2 x 2-1/2.

2.9 Pressure Relief Valves – Pump Bypass

1. Hydraulically operated, single seated globe valve, controlled by a direct acting spring valve and diaphragm pilot valve.

2. Main and Pilot Valve - cast-iron body, stainless steel seat and reinforced synthetic rubber diaphragm.

3. Suitable for system operating temperature and pressure.

4. Connections:

    1. NPS 2 and under, screwed.

    2. NPS 2-1/2 and over, flanged.

5. Refer to drawings and/or schedules for flow rates (min., normal, max.) and relief pressure range or setpoint.

6. Acceptable Products: Singer Model 106-RPS.

2.10 Pressure Relief Valves - Pump Bypass

1. Differential pressure overflow valve to control pump pressure.

2. Screwed, bronze body with stainless steel spring.

3. Acceptable Products: Braukmann DU 146.

2.11 Strainers

1. NPS 2 and under: bronze body, screwed connections.

2. NPS 2-1/2 and over: cast-iron body, flanged connections.

3. NPS 2 and over: Y or T type strainer with grooved ends with ductile iron body or factory fabricated steel body.

4. Suitable for maximum system operating pressure. Where system pressure exceeds 860 kPa, use 1,725 kPa strainer bodies.

5. Basket Screen:

    1. Bronze, stainless steel or monel perforated screen.

    2. 35 holes/cm², 1.2 mm diameter perforations, 36% open area.

6. Acceptable Products: Armstrong, Muesco, Spirax/Sarco, Toyo, Victaulic Series 730, 732 or W730 for all grooved end strainers.

3. EXECUTION

3.1 Air Vents – Automatic – High Capacity Type

1. Install automatic high capacity air vents at each high point in piping system and where indicated on drawings.

2. Install on tees and not on horizontal pipe runs or elbows.

3. Install 12 mm minimum isolating gate valve ahead of each air vent, unless air vent has integral shut-off valve.

4. Pipe air vent discharge connections (except for glycol) separately to nearest building drain using 6.0 mm hard drawn copper tube. Label ends with permanent labels.

3.2 Air Vents – Manual – High Capacity

1. Install manual air vents at high points in piping systems and where indicated on drawings.

2. Install on tees and not on horizontal pipe runs or elbows.

3. Install isolating gate valve ahead of each vent valve.

4. Pipe air vent discharge connections to nearest building drain.

3.3 Air Vents Manual Radiator Type

1. Install manual/automatic low capacity air vents on return side of each water heating/cooling terminal element installed above connection to main piping.

2. Fit air vent on top of air collecting chamber of NPS 19 mm pipe, 150 mm high.

3. Arrange air vents so screwdriver slots or key opening are easily accessible.

4. Drill access holes through radiation enclosures, where necessary.

5. DO NOT USE on glycol systems.

3.4 Air Separator

1. Provide on suction side of system circulation pump.

3.5 Combination Balance/Check Valves

1. Install combination stop/balance/check valves on discharge of centrifugal pumps as indicated on drawings and/or where scheduled.

2. Install in accordance with Manufacturer's recommendations.

3. Minimum 5 pipe diameters from pump connections.

3.6 Expansion Tank – Diaphragm Type

1. Install expansion/contraction tanks at each location indicated on drawings and as scheduled.

2. Install gate valve in system connection.

3. Install globe valve in tank drain connection.

3.7 Flexible Pipe Connectors

1. Install convoluted and arched pipe connectors, for misalignment connections, where indicated on drawings or required.

2. Install in accordance with Manufacturer's recommendations.

3. Three Victaulic Style 77 couplings may be used in lieu of flexible connectors for vibration attenuation and stress relive. The couplings shall be placed in close proximity to the source of the vibration.

3.8 Pressure Reducing Stations – Cold Water

1. Install water make-up stations for each hot water, chilled water and other closed water systems where indicated on drawings.

2. Pipe relief valve to drain.

3.9 Pressure Relief Valves – Water

1. Install pressure relief valve(s) on each heat exchanger to prevent over pressuring.
2. Select relief valves to relieve full heat input of heat supply side.
3. Pipe relief valve to drain.
4. Where one line vents several relief valves, cross sectional area shall equal sum of individual vent areas.

3.10 Pressure Relief Valves – Pump Bypass

1. Install pressure relief valves to relieve flow from supply main to return main where indicated on drawings.

3.11 Strainers

1. Install pipe line strainers where indicated on drawings.
2. Provide isolation valves on either side of strainer to permit cleaning without draining system.
3. Blowdown connections:
    1. Strainers, NPS 50 mm and under – hot services: nipple and cap.
    2. Strainers, NPS 65 mm and over – hot services: nipple, globe valve and nipple.
    3. Strainers, all sizes – cold services: plug.

END OF SECTION

1. GENERAL

1.1 Related Work

1. This Specification Section forms part of Contract Documents and are to be read, interpreted and coordinated with other parts.

1.2 Shop Drawings

1. Submit shop drawings in accordance with Section 23 05 00.

2. Submit shop drawings of pump curves with operating points indicated. Include NPSH curve when applicable.

3. Submit motor efficiencies for motors 0.746 KW and over, refer to Section 23 05 13 for minimum efficiencies.

1.3 Quality Assurance

1. Ensure pumps operate at specified system fluid temperatures without binding and cavitation, are non- overloading in parallel or individual operation; operate within 25% of midpoint of published maximum efficiency curve.

2. Where pumps are operated in conjunction with others such as parallel pumps, show operating points on pump curve.

1.4 General

1. Provide ECM motors complete with manual speed control switch, and 0-10V DC control signal terminal for variable speed control. See Section 23 05 13 for ECM motor requirements.

2. Acceptable Pump Products – General: Bell & Gossett, Armstrong, Taco, Grundfos, Wilo.

2. PRODUCTS

2.1 General

1. Statically dynamically balance rotating parts.

2. Construction shall permit complete servicing without breaking piping or motor connections.

3. Pumps shall operate at 1750 r/min unless specified otherwise.

2.2 In-Line Circulator Pumps

1. Suitable for maximum working pressure of 860 kPa and maximum temperature of 107°C.

2. Casing: Cast-iron radially split, with flanged connections. Supplied with matching companion flanges.

3. Impellor: Corrosion resistant cadmium plated steel.

4. Shaft: Alloy steel with bronze sleeve bearing, integral thrust collar.

5. Seal Assembly: Mechanical.

6. Coupling: Flexible self-aligning.

7. Motor: Resilient mounted, drip proof, sleeve bearing.

2.3 Vertical In-Line Centrifugal Pumps

1. Suitable for maximum working pressure of 1,210 kPa and maximum temperature of 107°C.

2. Casing: Cast-iron radially split, single stage, flanged suction and discharge connections, separate tapped opening for venting, draining and gauge connections.

3. Impellor: Bronze dynamically balanced, keyed drive with locking nut.

4. Shaft: Stainless steel on split coupled pumps and carbon steel with bronze sleeve on close coupled pumps.

5. Seal Assembly: Inside unbalanced mechanical seal with factory installed seal flushing line.

6. Coupling: Close coupled on motors less than 5.6 KW and split couplers for motors 5.6 KW and larger to permit removal of seal without disturbing motor.

7. Motor: EEMAC Class B, squirrel cage induction, continuous duty, drip proof, ball bearings.

8. Accessories: Strainer/suction guide, combination check/balance valve where scheduled.

3. EXECUTION

3.1 General

1. Ensure pumps are installed so no piping or equipment loads are imposed on pump body. Provide stanchions or hangers for this purpose. Refer to Manufacturer's installation instructions for details.

2. Pumps shall be aligned by qualified millwright and alignment certified.

3. Check pump rotation.

4. Pipe drain tapping to floor drain.

5. "Start-up" strainer baskets in strainer/suction guides must be removed prior to commissioning of systems.

6. Provide air cock and drain connection on horizontal pump casings.

7. Provide line sized gate valve and strainer on suction and line sized soft seated check valve.

8. Decrease from line size, with long radius reducing elbows or reducers.

9. Shave or replace pump impellers to meet actual operating conditions.

10. Where remote control panels are used, Contractor shall allow for wiring from panel to pumps.

3.2 In-line Circulators:

1. Install as indicated by flow arrows.

2. Support at flanges on outlets of unit.

3. Install with bearing lubrication points accessible.

END OF SECTION

1. GENERAL

1.1 Read Basic Mechanical Requirements, Section 15010 as part of this Section.

2. MOTORS

2.1 Provide motors for electrically driven equipment specified under Division 15000. Motors shall be high efficiency in accordance to ASHRAE 90.1 requirements.

2.2 Nameplate rating of motor:
- .1 Not less than input brake horsepower of driven equipment at specified operating condition.
- .2 Not less than minimum horsepower specified or shown.

2.3 Motors less than 1/2 hp:
- .1 Continuous duty, resilient mount, single phase, 120 volt, 60 Hz, with speed as indicated.
- .2 Built-in overload protection.

2.4 1/2 hp Motors:
- .1 EEMAC, Class B, squirrel cage induction, 1725 rpm, continuous duty, drip proof, ball bearing, 40EC temperature rise, 3 phase, 120/1/60 or 203/230/1/60, 60 Hz type.
- .2 Sized to come up to rated rpm under load within 12 seconds.

2.5 Motors 1 hp and larger:
- .1 EEMAC, Class B, squirrel cage induction, 1770 rpm, continuous duty, drip proof, ball bearing, 40EC temperature rise, 3 phase, 575 volt, 60 Hz, with performance equal to or greater than Ontario Hydro Enermark motor Efficiency Level when tested to CSA 390 M 1985, or IEE 112b.
- .2 Sized to come up to rated rpm under load within 12 seconds.

2.6 Motors larger than 40 HP shall be Y Delta start. Provide starter to suit. Provide motor winding thermistors complete with high temperature cut-outs in all 20 HP and UP motors.

2.7 Provide motors of any size in air ducts, plenum chambers or in air stream inside air conditioning equipment, with Klixon motor winding thermostats if motor is single phase or three phase up to 20 hp.

3. STARTERS

3.1 Rating: NEMA size

3.2 Starters for single phase motors to be manual type, combination switch with overload relay and pilot lights.

3.3 Starters for three phase motors to be combination magnetic type with HRC fused disconnect and fuses selected in accordance with Article "Motor Protection". Starter for three phase motors to be combination magnetic type with breaker type disconnect selected for symmetrical interrupting rating of 50,000 RMS amperes at 600 volts.

3.4 Starters for three phase motors

.1 Three overload elements sized to suit characteristics of motor wired ahead of holding coil.
.2 Overload relay with manual reset button, resectable only from inside cover.
.3 CSA 22.2 No. 94 Type 3 enclosure, weatherproof, with flange mounted disconnect handles on starter compartment.
.4 Auxiliary contacts as required to satisfy interlocking and automatic control requirements.
.5 120 volt and 24 volt fused control transformers inside starter enclosure where control wiring extends outside starter enclosure.
.6 Cover mounted 120 V "push-to-test" pilot lights as specified on drawing schedules.
.7 Additional coil for BAS control as required.
.8 Additional features as shown on drawing schedules.

3.5 Provide each starter or disconnect switch with engraved lamicoid nameplate identifying load served.

3.6 Starters for motors equipped with temperature sensing devices in winding to have compatible control unit supplied by motor manufacturer installed in starter enclosure, with 120 volt control transformer, miniature "push-to-test" pilot light to indicate high motor winding temperature, and separately identified push button to reset control unit.

3.7 All starters to be supplied by one manufacturer.

3.8 Where three or more starters are shown grouped together, use wall mounted enclosures.

3.9 Provide wiring diagrams for control circuits in accordance with accepted industry standards.

3.10 Starters to be (excluding OEM equipment):

Standard of Acceptance:

- Allen-Bradley
- Cutler-Hammer/Eaton
- Furnas
- Square D
- Klockner-Moeller

4. MOTOR PROTECTION

4.1 Circuit breakers in starters to be sized in accordance with motor starter manufacturer's recommendations.

4.2 Fuses in starters to be CSA certified Form 1, current and energy limiting type 200,000 ampere interrupting capacity with NEMA Class "J" rejection type mountings.

Standard of Acceptance:

- Chase Shawmutt - Amp. Trap
- English Electric Company of Canada
- Appleton Electric Company

4.3 Size fuses installed in starters or in disconnect switches used in conjunction with magnetic starters, for branch circuit and motor protection in accordance with fuse manufacturer's recommendations. Note fan motors are sized for maximum start-up time specified in Article "Motors".

4.4 Provide one spare set of three fuses for each rating and type of fuse used.

5. VARIABLE FREQUENCY DRIVES (VFD)

5.1 Provide complete Variable Frequency Motor Drive (VFD) consisting of a pulse width modulated (PWM) inverter designed for use on a standard NEMA Design B induction motor.

5.2 Drive manufacturer to have an existing:
- .1 Sales representative exclusively for HVAC products, with expertise in HVAC systems and controls.
- .2 Independent service organization

5.3 Drive manufacturer to supply drive and all drive controls as specified.

5.4 Referenced Standards:
- .1 Institute of Electrical and Electronic Engineers (IEEE) Standard 519-1992, IEEE Guide for Harmonic Content and Control.
- .2 Underwriters laboratories UL508C.
- .3 National Electrical Manufacturer's Association (NEMA) ICS 7.0, AC Adjustable Speed Drives.
- .4 IEC 16800 Parts 1 and 2.
- .5 Canadian Standards Association (CSA).
- .6 Ontario Electrical Code.

5.5 Qualifications:
- .1 VFDs and options to be UL listed and CSA approved as complete assembly.
- .2 VFD's that require Owner to supply external fuses for VFD to be UL listed and/or CSA approved are not acceptable.
- .3 VFD to be UL listed for 100 KAIC without need for input fuses.

5.6 VFD manufacturer to have available comprehensive, HVAC Drive Computer Based Training (CBT) product.
- .1 CBT product to include detailed, interactive sections covering VFD unpacking, proper mechanical and electrical installation, and programming.
- .2 CBT product to allow user to provide just-in-time training to new personnel or refresher training for maintenance and repair personnel on user's site.
- .3 CBT product to be repeatable, precise and include record keeping capability.
- .4 CBT product to record answers to simulations and tests by student ID.
- .5 CBT product must be professionally produced and have interactive sections, student tests, and include video clips of proper wiring and installation.

5.7 Submittals to include following information:

.1 Outline dimensions, conduit entry locations and weight.
.2 Customer connection and power wiring diagrams.
.3 Complete technical product description to include complete list of options provided.

5.8 Variable Frequency Drives (VFD)

.1 Standard of Acceptance:
- ABB ACH550 Series, with E-bypass
- DANFOSS VLT 6000 with E-bypass

.2 VFD package to be enclosed in UL Listed Type 1 enclosure, completely assembled and tested by manufacturer in ISO9001 facility.

.1 Environmental operating conditions: 0 degC to 40 degC continuous rating

.2 VFD's that can operate at 40 C intermittently (during a 24 hour period) are not acceptable and must be oversized. Altitude 0 to 3300 feet above sea level, less than 95% humidity, non-condensing.

.3 Enclosure to be rated UL type 1 and be UL listed as plenum rated VFD. VFD's without these ratings are not acceptable.

.4 For 600V networks, input voltage of VFD to be rated for 500V to 600V +/- 10% minimum. VFD rated for 575V +/- 10% or less are not acceptable. 480V drives converted to 600V drives are not acceptable.

.3 All VFDs to have following standard features:

.1 All VFDs to have same customer interface, including digital display, and keypad, regardless of horsepower rating. Keypad to be removable, capable of remote mounting and allow for uploading and downloading of parameter settings as an aid for start-up of multiple VFDs.

.2 Keypad to include Hand-Off-Auto selections and manual speed control. Drive to incorporate "bumpless transfer" of speed reference when switching between "Hand" and "Auto" modes. "Fault reset" and "Help" buttons to be on keypad. Help button to include "on-line" assistance for programming and troubleshooting.

.3 VFD keypad to include built-in real time clock with date function. Clock to have battery back up with 10 years minimum life span. Clock to be used to date and time stamp faults and record operating parameters at time of fault. If battery fails, VFD to automatically revert to hours of operation since initial power up. Clock to also be programmable to control start/stop functions, constant speeds, PID parameter sets and output relays. VFD to have digital input that allows an override to time clock (when in off mode) for programmable time frame. There are to be four (4) separate, independent timer functions that have both weekday and weekend settings.

.4 VFD's to utilize pre-programmed application macro's specifically designed to facilitate start-up. Drive to incorporate following pre-programmed application software (macros):
- HVAC Default
- Supply fan
- Return Fan
- Cooling tower fan
- Condenser
- Booster pump
- Pump alternation
- Internal Timer

- Internal timer with constant speed
- Floating point
- Dual set point PID
- Dual set point PID with constant speed
- E-Bypass
- Hand control

.5 Application Macros to provide one command to reprogram all parameters and customer interfaces for particular application to reduce programming time. VFD to have two user macros to allow end-user to create and save custom settings.

.6 VFD to have cooling fans that are designed for easy replacement. Cooling fans to be designed for replacement without requiring removal of VFD from wall or removal of circuit boards. VFD cooling fans to operate only when required. To extend fan and bearing operating life, operating temperature will be monitored and used to cycle cooling fans on and off as required.

.7 VFD to be capable of starting into coasting load (forward or reverse) up to full speed and accelerate or decelerate to setpoint without safety tripping or component damage (flying start).

.8 VFD to have ability to automatically restart after an over-current, over-voltage, under-voltage, or loss of input signal protective trip. Number of restart attempts, trial time, and time between attempts to be programmable.

.9 Overload rating of drive to be 110% of its normal duty current rating for 1 minute every 10 minutes, 130% overload for 2 seconds.

.10 VFD to have integral 5% impedance to reduce harmonics to power line and to add protection from AC line transients. 5% impedance may be from dual (positive and negative DC bus) reactors, or 5% AC line reactors. VFD's with only one DC reactor (positive or negative DC bus) to add AC line reactors. VFD with DC bus reactors to have 1800V PIV rated input bridge.

.11 Input current rating of VFD to be no more than 3% greater than output current rating.

.12 VFD to include coordinated AC transient protection system consisting of 4-120 joule rated MOV's (phase to phase and phase to ground), capacitor clamp, and 5% impedance reactors.

.13 VFD to be capable of sensing loss of load (broken belt / broken coupling) and signal loss of load condition. Drive to be programmable to signal this condition via keypad warning, relay output and/or over serial communications bus. Relay outputs to include programmable time delays that will allow for drive acceleration from zero speed without signaling false underload condition.

.14 If input reference (4-20mA or 2-10V) is lost, VFD to give user option of either stopping and displaying fault running at programmable preset speed hold VFD speed based on last good reference received cause warning to be issued, as selected by user. Drive to be programmable to signal this condition via keypad warning, relay output and/or over serial communication bus.

.15 VFD to have programmable "Sleep" and "Wake up" functions to allow drive to be started and stopped from level of process feedback signal.

.16 All VFDs to have following adjustments:

- Three (3) programmable critical frequency lockout ranges to prevent VFD from operating load continuously at an unstable speed.

- Two (2) PID Setpoint controllers to be standard in drive, allowing pressure or flow signals to be connected to VFD, using microprocessor in VFD for closed loop control. VFD to have 250 ma of 24 VDC auxiliary power and be capable of loop powering a transmitter supplied by others. PID setpoint to be adjustable from VFD keypad, analog inputs, or over communications bus. There are to be two parameter sets for first PID that allow sets to be switched via a digital input, serial communications or from the keypad for night setback, summer/winter setpoints, etc. There is to be an independent, second PID loop that can utilize the second analog input and modulate one analog output to maintain setpoint of an independent process (ie. valves, dampers, etc.).

.17 All setpoints, process variables, etc. to be accessible from serial communication network. Setpoints to be set in Engineering units and not require percentage of transducer input.

- Two (2) programmable analog inputs to accept current or voltage signals.
- Two (2) programmable analog outputs (0-20ma or 4-20 ma). Outputs may be programmed to output proportional to Frequency, Motor Speed, Output Voltage, Output Current, Motor Torque, Motor Power (kW), DC Bus voltage, Active Reference, and other data.
- Six (6) programmable digital inputs for maximum flexibility in interfacing with external devices, typically programmed as follows:
  - There is to be run permissive circuit for damper or valve control. Regardless of source of run command (keypad, input contact closure, time-clock control, or serial communications) VFD to provide dry contact closure that will signal damper to open (VFD motor does not operate). When damper is fully open, normally open dry contact (end-switch) to close. Closed end-switch wired to an VFD digital input and allows VFD motor operation. Two separate safety interlock inputs to be provided. When either safety is opened, motor to be commanded to coast to stop, and damper to be commanded to close. Keypad to display "start enable 1 (or 2) missing". Safety status to also be transmitted over serial communications bus. All digital inputs to be programmable to initiate upon an application or removal of 24VDC.
- Three (3) programmable digital Form-C relay outputs. Relays to include programmable on and off delay times and adjustable hysteresis. Default settings to be for run, not faulted (fail safe), and run permissive. Relays to be rated for maximum switching current 8 amps at 24 VDC and 0.4 A at 250 VAC; Maximum voltage 300 VDC and 250 VAC; continuous current rating 2 amps RMS. Outputs to be true form C type contacts; open collector outputs are not acceptable.
- Seven (7) programmable preset speeds.
- Two independently adjustable accel and decel ramps with 1 - 1800 seconds adjustable time ramps.
- VFD to include motor flux optimization circuit that will automatically reduce applied motor voltage to the motor to optimize energy consumption and audible motor noise.
- VFD to include carrier frequency control circuit that reduces carrier frequency based on actual VFD temperature that allows highest carrier frequency without derating VFD or operating at high carrier frequency only at low speeds.
- VFD to include password protection against parameter changes.

.18 Keypad to include backlit LCD display. Display to be in complete English words for programming and fault diagnostics (alpha-numeric codes are not acceptable). Keypad to utilize following assistants:

.19 All applicable operating values to be capable of being displayed in engineering (user) units. Minimum of three operating values from list below to be capable of being displayed at all times. Display shall be in complete English and French text (alpha-numeric codes only are not acceptable):

- Output Frequency
- Motor Speed (RPM, %, or Engineering units)
- Motor Current
- Calculated Motor Torque
- Calculated Motor Power (kW)
- DC Bus Voltage
- Output Voltage

.20 VFD to include fireman's override input. Upon receipt of contact closure from fireman's control station, VFD to operate at an adjustable preset speed. Mode to override all other inputs (analog/digital, serial communication, and all keypad commands) and force motor to run at adjustable, preset speed. "Override Mode" to be displayed on keypad. Upon removal of override signal, VFD to resume normal operation.

.21 VFD manufacturer to have available PC based Software (for Windows NT, 2000 and XP) allowing parameter back-up, programming and monitoring of VFD.

.22 Serial Communications

- VFD to have RS-485 port as standard. Standard protocols to be Modbus, Johnson Controls N2 bus, and Siemens Building Technologies FLN. Optional protocols for LonWorks, BACnet, Profibus, Ethernet, and DeviceNet to be available. Each individual drive to have protocol in base VFD. Use of third party gateways and multiplexers is not acceptable. All protocols to be "certified" by governing authority. Use of non-certified protocols is not allowed.
- BACnet connection to be an RS485, MSTP interface operating at 9.6, 19.2, 38.4, or 76.8 Kbps. Connection to be tested by BACnet Testing Labs (BTL) and be BTL Listed. BACnet interface to conform to BACnet standard device type of Applications Specific Controller (B-ASC). Interface tosupport all BIBBs defined by BACnet standard profile for B-ASC including, but not limited to:
  - Data Sharing - Read Property - B.
  - Data Sharing - Write Property - B.
  - Device Management - Dynamic Device Binding (Who-Is; I-AM).
  - Device Management - Dynamic Object Binding (Who-Has; I-Have).
  - Device Management - Communication Control – B
- If additional hardware is required to obtain BACnet interface, VFD manufacturer to supply one BACnet gateway per drive. Multiple VFDs sharing one gateway are not acceptable.
- Serial communication capabilities to include, but not be limited to; run-stop control, speed set adjustment, proportional/integral/derivative PID control adjustments, current limit, accel/decel time adjustments, and lock and unlock

keypad. Drive to have capability of allowing DDC to monitor feedback such as process variable feedback, output speed / frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), and drive temperature. BAS (Building Automation System) to also be capable of monitoring VFD relay output status, digital input status, and all analog input and analog output values. All diagnostic warning and fault information to be transmitted over serial communications bus. Remote VFD fault reset to be possible. Following additional status indications and settings to be transmitted over serial communications bus - keypad "Hand" or "Auto" selected, bypass selected, ability to change PID setpoint, and ability to force unit to bypass (if bypass is specified). The BAS to also be able to monitor if motor is running in VFD mode or bypass mode (if bypass is specified) over serial communications. Minimum of 15 field parameters to be capable of being monitored.

- VFD to allow BAS to control all available drive digital and analog outputs via serial interface. This control to be independent of any VFD function. For example, analog outputs may be used for modulating chilled water valves or cooling tower bypass valves. Drive's digital (relay) outputs may be used to actuate damper, open valve or control any other device that requires maintained contact for operation. In addition, all of drive's digital and analog inputs to be capable of being monitored by BAS.
- VFD to include an independent PID loop for customer use. Independent PID loop may be used for cooling tower bypass valve control, chilled water valve control, etc. Both VFD control PID loop and the independent PID loop to continue functioning even if serial communications connection is lost. VFD to keep the last good set-point command and last good DO and AO commands in memory in event of serial communications connection being lost.
- VFD's through 60 hp to be protected from input and output power mis-wiring. VFD to sense this condition and display alarm on keypad.

.4 OPTIONAL FEATURES - Following optional features to be furnished and mounted by drive manufacturer. All optional features to be UL Listed and CSA Approved by drive manufacturer as complete assembly and carry UL508 and CSA label.

.1 Complete factory wired and tested bypass system consisting of output contactor and bypass contactor. Overload protection to be provided in both drive and bypass modes.

.2 Door interlocked, padlockable circuit breaker that will disconnect all input power from drive and all internally mounted options.

.3 Fused VFD only disconnect (service switch). Fast acting fuses exclusive to VFD - fast acting fuses allow VFD to disconnect from the line prior to clearing upstream branch circuit protection, maintaining bypass capability. Bypass designs, which have no such fuses, or that incorporate fuses common to both VFD and bypass will not be accepted. Three contactor bypass schemes are not acceptable.

.4 Drive / bypass to provide single-phase motor protection in both VFD and bypass modes.

.5 Following operators to be provided:

- Bypass Hand-Off-Auto
- Drive mode selector

- Bypass mode selector
- Bypass fault reset

.6 Following indicating lights (LED type) to be provided. Test mode or push to test feature to be provided.

- Power-on (Ready)
- Run enable (safeties) open
- Drive mode select damper opening
- Bypass mode selected
- Drive running
- Bypass running
- Drive fault
- Bypass fault
- Bypass H-O-A mode
- Automatic transfer to bypass selected
- Safety open
- Damper end-switch made

.7 Following relay (form C) outputs from bypass to be provided:

- System started
- System running
- Bypass override enabled
- Drive fault
- Bypass fault (motor overload or underload (broken belt))
- Bypass H-O-A position

.8 Digital inputs for the system to accept 24V or 115VAC (selectable). Bypass to incorporate internally sourced power supply and not require an external control power source.

.9 Customer Interlock Terminal Strip - provide separate terminal strip for connection of freeze, fire, smoke contacts, and external start command. All external safety interlocks to remain fully functional whether system is in Hand, Auto, or Bypass modes (not functional in Fireman's Override 2). Remote start/stop contact to operate in VFD and bypass modes.

.10 Dedicated digital input that will transfer motor from VFD mode to bypass mode upon dry contact closure for fireman's override. Two modes of operation are required.

- One mode forces motor to bypass operation and overrides both VFD and bypass H-O-A switches and forces motor to operate across line (test mode). System will only respond to digital inputs and motor protections.
- Second fireman's override mode remains as above, but will also defeat overload and single-phase protection for bypass and ignore all keypad and digital inputs to system (run until destruction).

.11 VFD to include "run permissive circuit" that will provide normally open contact whenever run command is provided (local or remote start command in VFD or bypass mode). VFD system (VFD or bypass) not to operate motor until it receives dry contact closure from damper or valve end-switch. When VFD system safety interlock (fire detector, freezestat, high static pressure switch, etc) opens, motor to coast to stop and run permissive contact to open, closing damper or valve.

.12 Class 20 or 30 (selectable) electronic motor overload protection to be included.

.13 Internal switch to select manual or automatic bypass.
.14 Adjustable current sensing circuit for bypass to provide loss of load indication (broken belt) when in bypass mode.

.5 Installation
.1 Installation to be responsibility of mechanical contractor. Contractor to install drive in accordance with recommendations of VFD manufacturer as outlined in installation manual.
.2 Power wiring to be completed by electrical contractor. Contractor to complete all wiring in accordance with recommendations of VFD manufacturer as outlined in installation manual.

.6 Start-up
.1 Certified factory start-up to be provided for each drive by factory authorized representative. Certified start-up form to be filled out for each drive with copy provided to Owner, and copy kept on file at manufacturer.

.7 Product Support
.1 Factory trained application engineering and service personnel that are thoroughly familiar with the VFD products offered, to be locally available at both specifying and installation locations. 24/365 technical support line to be available on toll-free line.
.2 Computer based training CD to be available to Owner at time of project closeout. Training to include installation, programming and operation of VFD, bypass and serial communication.

.8 Warranty
.1 Warranty to be 24 months from date of certified start-up, not to exceed 30 months from date of shipment. Warranty to include on site parts and labor. There is to be 365/24 support available via toll free phone number.

6. WIRING FOR MECHANICAL DIVISION 15000

6.1 Division 15000 to supply all electrical motors, starters, controls, relays,thermostats, float switches, pressure switches, flow switches, pilot lights, remote control stations, safety devices, aquastats, control transformers, disconnects for control circuits, and interlocks.

6.2 Division 15000 to mount the above equipment, except for line voltage wall thermostats and starters; these to be mounted by Division 16000.

6.3 Division 16000 to supply and mount isolation switches where required for safe servicing of motors, as well as at electrical panels of all factory assembled package equipment, e.g. rooftop make-up air units, chiller units.

6.4 Isolation switch to be located within sight of and not more than 10 m from the motor and machinery driven by the motor.

6.5 Unless otherwise indicated, Division 16000 to provide all power wiring as defined herein.

6.6 Division 15000 to provide all control and interlock wiring, including connection to equipment and source of supply.

6.7 Power wiring is defined as all single or three phase wiring carrying the full line current of the mechanical equipment, including all the wiring of line voltage controls and isolation disconnects connected in line between the source and the mechanical equipment and including connection to the equipment.

6.8 Control and interlock wiring is defined as all mechanical equipment wiring other than power wiring outlined above.

6.9 Division 15000 to provide detailed wiring diagrams for each motor.

6.10 Division 15000, unless specifically indicated otherwise, will provide all wiring for damper motor power and control from nearest lighting panel, except where the drawings indicate power outlets by Division 16000. For these instances Division 15000 will wire from the outlet to the damper motor..

6.11 Wiring methods and standards to conform with those specified in Electrical Division 16000 for area of building in which installation is to be made.

6.12 Submit shop drawings for control wiring in accordance with Article "Electric Control Wiring Shop Drawings".

6.13 Electrical materials, equipment and installation procedures under Mechanical Division 15000 to conform to Canadian Electrical Code as amended to date.

6.14 Conform to requirements of Division 16000 for Division 15000 work under this Section.

6.15 Wiring

.1 RW-90 X-link type sized to carry 125% of full load running current in accordance with Electrical Code.

.2 Minimum no. 12 gauge for power.

.3 Colour coded no. 14 gauge for control.

6.16 Mechanical contractor shall provide 2-pole contactor for 120V/1 ph equipment controlled from BAS. BAS will operate contactor through contactor coil and maintained contact on BAS output.

7. ELECTRICAL CONTROL WIRING SHOP DRAWINGS

7.1 Submit control wiring diagrams for electrical equipment provided under this Division.

7.2 Wiring diagrams

.1 In ladder diagram form with 215 mm (8 1/2 in) space between 120 volt energized conductor on left and grounded conductor on right.

.2 Individual horizontal lines numbered sequentially starting from 100 and every conductor terminal matching identifying terminal numbers.

.3 Show electrical contacts, relays, thermostats, timers and components in control circuits.

8. GROUNDING

8.1 Ground electrical equipment and wiring in accordance with Canadian Electrical Code and Local Authority's Rules and Regulations.

8.2 Ground all motors with separate ground wire back to ground terminal in starter and provide ground lug bolted directly to motor frame inside terminal box of motor.

END OF SECTION

1 GENERAL

1.1 SUMMARY

.1 Section Includes:
- .1 Materials and installation for copper tubing and fittings for refrigerant.
- .2 Sustainable requirements for construction and verification:

.2 Related Sections:
- .1 Section 01 00 10 - General Instructions.
- .2 Section 23 05 01 - Installation of Pipework.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME)
- .1 ASME B16.22-2012, Wrought Copper and Copper Alloy Solder - Joint Pressure Fittings.
- .2 ASME B16.24-2011, Cast Copper Pipe Flanges and Flanged Fittings: Class 150, 300, 400, 600, 900, 1500 and 2500.
- .3 ASME B16.26-2006, Cast Copper Alloy Fittings for Flared Copper Tubes.
- .4 ASME B31.5-2010, Refrigeration Piping and Heat Transfer Components.

.2 American Society for Testing and Materials International (ASTM)
- .1 ASTM A307-12, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .2 ASTM B280-13, Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

.3 Canadian Standards Association (CSA International)
- .1 CSA B52-05, Mechanical Refrigeration Code.

.4 Environment Canada (EC)
- .1 EPS 1/RA/1-96, Environmental Code of Practice for the Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.

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

1.3 SUBMITTALS

.1 Submittals in accordance with Section 01 00 10 - General Instructions.

.2 Co-ordinate submittal requirements and provide submittals.

.3 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet for piping, fittings and equipment.
.2 Submit WHMIS MSDS. Indicate VOC's for adhesive and solvents during application and curing.

.4 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

.5 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.6 Instructions: submit manufacturer's installation instructions.

.7 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 00 10 - General Instructions.

1.4 QUALITY ASSURANCE

.1 Health and Safety:
.1 Do construction occupational health and safety in accordance with Section 01 00 10 - General Instructions.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:
.1 Separate waste materials for reuse and recycling in accordance with Section 01 00 10 - General Instructions.
.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
.3 Collect and separate for disposal paper packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan (WMP).
.4 Separate for reuse and place in designated containers Steel waste in accordance with Waste Management Plan (WMP).
.5 Divert unused metal materials from landfill to metal recycling facility as approved by DCC Representative.

2 PRODUCTS

2.1 TUBING

.1 Processed for refrigeration installations, deoxidized, dehydrated and sealed.
  .1 Hard copper: to ASTM B280, type ACR.
  .2 Annealed copper: to ASTM B280, with minimum wall thickness as per CSA B52 and ASME B31.5.

2.2 FITTINGS

.1 Service: design pressure 2070 kPa and temperature 121 degrees C.
.2 Brazed:
  .1 Fittings: wrought copper to ASME B16.22.
  .2 Joints: silver solder, 15% Ag-80% Cu-5%P and non-corrosive flux.
.3 Flanged:
  .1 Bronze or brass, to ASME B16.24, Class 150 and Class 300.
  .2 Gaskets: suitable for service.
  .3 Bolts, nuts and washers: to ASTM A307, heavy series.
.4 Flared:
  .1 Bronze or brass, for refrigeration, to ASME B16.26.

2.3 PIPE SLEEVES

.1 Hard copper or steel, sized to provide 6 mm clearance around between sleeve and uninsulated pipe or between sleeve and insulation.

2.4 VALVES

.1 22 mm and under: Class 500, 3.5 Mpa, globe or angle non-directional type, diaphragm, packless type, with forged brass body and bonnet, moisture proof seal for below freezing applications, brazed connections.
.2 Over 22 mm: Class 375, 2.5 Mpa, globe or angle type, diaphragm, packless type, back-seating, cap seal, with cast bronze body and bonnet, moisture proof seal for below freezing applications, brazed connections.

3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications,

including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 GENERAL

.1 Install in accordance with CSA B52, EPS1/RA/1 and ASME B31.5 Section 23 05 01 - Installation of Pipework.

3.3 BRAZING PROCEDURES

.1 Bleed inert gas into pipe during brazing.
.2 Remove valve internal parts, solenoid valve coils, sight glass.
.3 Do not apply heat near expansion valve and bulb.

3.4 PIPING INSTALLATION

.1 General:
  .1 Soft annealed copper tubing: bend without crimping or constriction.
.2 Hot gas lines:
  .1 Pitch at least 1:240 down in direction of flow to prevent oil return to compressor during operation.
  .2 Provide trap at base of risers greater than 2400 mm high and at each 7600 mm thereafter.
  .3 Provide inverted deep trap at top of risers.
  .4 Provide double risers for compressors having capacity modulation.
    .1 Large riser: install traps as specified.
    .2 Small riser: size for 5.1 m/s at minimum load. Connect upstream of traps on large riser.

3.5 PRESSURE AND LEAK TESTING

.1 Close valves on factory charged equipment and other equipment not designed for test pressures.
.2 Leak test to CSA B52 before evacuation to 2MPa and 1MPa on high and low sides respectively.
.3 Test Procedure: build pressure up to 35 kPa with refrigerant gas on high and low sides. Supplement with nitrogen to required test pressure. Test for leaks with electronic or halide detector. Repair leaks and repeat tests.

3.6 FIELD QUALITY CONTROL

.1 Site Tests/Inspection:
  .1 Close service valves on factory charged equipment.
.2 Ambient temperatures to be at least 13 degrees C for at least 12 hours before and during dehydration.
.3 Use copper lines of largest practical size to reduce evacuation time.
.4 Use two-stage vacuum pump with gas ballast on 2nd stage capable of pulling 5Pa absolute and filled with dehydrated oil.
.5 Measure system pressure with vacuum gauge. Take readings with valve between vacuum pump and system closed.
.6 Triple evacuate system components containing gases other than correct refrigerant or having lost holding charge as follows:
  .1 Twice to 14 Pa absolute and hold for 4 h.
  .2 Break vacuum with refrigerant to 14 kPa.
  .3 Final to 5 Pa absolute and hold for at least 12 h.
  .4 Isolate pump from system, record vacuum and time readings until stabilization of vacuum.
  .5 Submit test results to DCC Representative.
.7 Charging:
  .1 Charge system through filter-drier and charging valve on high side. Low side charging not permitted.
  .2 With compressors off, charge only amount necessary for proper operation of system. If system pressures equalize before system is fully charged, close charging valve and start up. With unit operating, add remainder of charge to system.
  .3 Re-purge charging line if refrigerant container is changed during charging process.
.8 Checks:
  .1 Make checks and measurements as per manufacturer's operation and maintenance instructions.
  .2 Record and report measurements to DCC Representative.
.9 Manufacturer's Field Services:
  .1 Have manufacturer of products, supplied under this Section, review Work involved in the handling, installation/application, protection and cleaning, of its products and submit written reports, in acceptable format, to verify compliance of Work with Contract.
  .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with

manufacturer's instructions.

.3 Schedule site visits, to review Work, at stages listed:

.1 After delivery and storage of products, and when preparatory Work, or other Work, on which the Work of this Section depends, is complete but before installation begins.

.2 Twice during progress of Work at 25% and 60% complete.

.3 Upon completion of the Work, after cleaning is carried out.

.4 Obtain reports, within 3 days of review, and submit, immediately, to DCC Representative.

3.7 DEMONSTRATION

.1 Instructions:

.1 Post instructions in frame with glass cover in accordance with Section 01 00 10 - General Instructions and CSA B52.

3.8 CLEANING

.1 Perform cleaning operations as specified in Section 01 00 10 - General Instructions and in accordance with manufacturer's recommendations.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

End of Section

1. GENERAL

1.1 Related Work

1. This Specification Section forms part of Contract Documents and is to be read, interpreted and coordinated with other parts.

1.2 Scope

1. Provide for cleaning and degreasing of systems that use water as heat transfer medium.
2. Provide for cleaning and disinfection of domestic hot and cold systems.
3. Provide temporary strainers, connections and by-pass lines as required.
4. Provide equipment to add chemicals to systems as specified herein.
5. Provide equipment to operate and control system as specified herein. Provide appropriate protection so capped off unused piping does not corrode.
6. Provide corrosion coupons for closed and open loop circulation systems as specified herein, to include testing and analysis at least twice in the first year of warranty.
7. Piping systems to be chemically treated include the following systems:
    1. Provide complete start-up and Commissioning, including the amounts of chemicals and filter media change-outs sufficient to calibrate the system and provide supplied for the first year of warranty.

1.3 Quality Assurance

1. Water treatment chemicals and treatment process shall be supplied and performed by Contractor. Work shall be supervised by Water Treatment Specialist who, upon completion, shall certify process is satisfactory and submit report outlining cleaning operation and treatment process. Contractor shall provide name and supplier of chemical treatment specialist as part of the post-tender submittals and Progress Claim breakdown.

1.4 Reference Standards

1. Provide HVAC water treatment in accordance with ASME Boiler Code Section VII, and requirements and standards of regulating authorities, except where specified otherwise.

1.5 Submittals

1. Submit shop drawings including proposed chemicals, quantities, procedures and equipment to be supplied. Provide written operating instructions and system schematics,

including MSDS Data and safe disposal instructions. Provide samples of testing record sheet, with recommended water treatment testing schedule for the proposed treatments.

2. Provide written report containing log and procedure of system cleaning, giving times, dates, problems encountered and condition of water.

3. Submit written report containing test results and list of chemicals added every 14 days from time of commissioning to acceptance.

4. Notify Consultant 48 hours prior to chemical cleaning so work may be verified and reviewed.

1.6 Water Treatment Service

1. **Contractor to use the school board's approved contractor Aquarian, no alternates permitted.**

2. Water Treatment Specialist shall provide supervision of installations, set-up and adjustments and shall submit written report on system operations.

3. Chemicals, feed systems and test equipment shall be provided by Water Treatment Specialist.

4. Treatment chemicals shall not contain hydrazine.

5. Treatment chemicals shall be non-foaming.

6. Water Treatment Specialist shall instruct maintenance personnel before substantial completion. Written instructions of treatment, dosages, control charts and test procedures shall be included in maintenance manuals.

7. Provide test kit suitable for chemical treatments used. Test kit shall be made available for on-site tests and provide Myron 3 range TDS meter to check conductivity. Hand kit over to Building Operator at project completion; obtain receipt.

8. Provide one mild steel and one copper corrosion coupon package to monitor corrosion rate for each open and closed systems.

9. Coordinate with and obtain approval of Board chemical treatment technician and consultant.

2. PRODUCTS

2.1 Materials

1. System Cleaner:

    1. Sodium Metasilicate, Sodium Nitrite or acceptable equal and wetting agent

compound, which in solution removes grease and petroleum products. Concentration level to be determined by Water Treatment Specialist (PACE Chemicals Ltd. – PURGEX L-24 or approved equal).

2. Closed System Treatment (Hot Water):

    1. Borated Nitrite-Molybdate based corrosion inhibitor. Maintain levels at 200 to 400 ppm (PACE Chemicals Ltd. – BAR COR CWS-55 or approved equal). The use of Nitrite only, Molybdate only or Sulphite only will not be accepted.

2.2 Equipment

1. Chemical Feed System – Closed Systems (hot water heating):

    1. Bypass Pot Feeder: Closed water systems shall have by-pass chemical pot feeder with 7.6 L capacity, constructed of heavy-duty cast-iron or welded steel (suitable for 1,380 kPa working pressure), with quick opening cap and complete with NPS 3/4 connections. Install isolating valves on inlet, outlet and drain.

    2. Side Stream Filters: Closed systems shall have side stream filters. 304 L stainless steel or polypropylene plastic filter housing to accept 30 micron – 65 mm x 1.0 m long filter cartridges and complete with swing bolt lid. Minimum flow rate of 35 L/min. A Flow Indicator with stainless steel impeller shall be installed as per Manufacturer's instructions. Include 10 filter replacement cartridges for each side stream filter unit.

    3. Chemical Feed Piping shall be Schedule 40 black steel.

    4. Provide makeup water meter to equal Neptune T-10, Neptune Trident 8, or Rockwell Hersey, complete with electronic output for analog flow monitoring by Building Automation System.

    5. Corrosion Coupon and Holder Assembly:

        1. Mild steel or copper corrosion coupon to match hydronic piping.

        2. Holder, NPS 3/4 or NPS 1 connection.

        3. Provide malleable or cast-iron cross, NPS 3/4 or NPS 1 connection.

END OF SECTION

1. GENERAL

1.1 Related Work

1. This Specification Section forms part of Contract Document and is to be read, interpreted and coordinated with other parts.

1.2 Reference Standards

1. The construction and installation of ductwork and plenums shall be in accordance with the latest edition of the
following referenced SMACNA manuals and ASHRAE handbooks.

    1. SMACNA - HVAC Duct Construction Standards.
    2. SMACNA - HVAC Air Duct Leakage Test Manual.
    3. ASHRAE - Handbook - Equipment Volume.

1.3 General

1. Duct sizes on drawings indicate clear inside dimensions. For acoustically lined or internally insulated ducts, maintain inside duct dimensions.

2. Where duct sizes are shown in nominal metric sizes, round and oval duct sizes may be supplied in nearest available sizes in equivalent imperial units.

3. Provide for openings in correct locations through slabs and walls. Openings shall be planned to include installation of fire dampers at rated fire separations.

4. Where ducts penetrate roofs, provide roof curbs with flashing and counterflashing.

5. Arrange for 100 mm high by 100 mm wide concrete curbs around duct penetrations through floor slabs outside of duct shafts.

6. Project drawings are diagrammatic and efforts have been made to provide information regarding number of offsets and transitions, but all are not necessarily shown. Changes may be required in duct routings, elevation and duct shape to eliminate interference with structure and other services. Required adjustments shall be established when coordinating and field measuring work prior to fabrication and must be provided as part of contract and association costs must be considered and included.

7. Ductwork shall be clean and free from scale, corrosion and deposits. Ductwork shall be degreased and wiped clean of oil and other surface films with appropriate solvents prior to installation.

8. Ductwork shall be delivered clean to site and maintained in clean condition. Dirty ductwork shall be removed from site.

2. PRODUCTS

2.1 Galvanized Steel

1. Galvanized steel shall have 380 g/m² galvanizing coat both sides to ASTM A525 G90.

2.2 Ductwork and Plenum Pressures

1. 1,000 Pa static pressure.
    1. Supply air ductwork downstream from supply air handling units discharge, to the upstream side of mixing boxes/air valves.
    2. Exhaust and return air ductwork downstream from return/exhaust air valves to return/exhaust fans and downstream from return/exhaust fans to air handling units and/or outdoor relief.
    3. Outdoor intake plenums in mechanical room(s).
2. 500 Pa static pressure.
    1. Supply ductwork downstream from mixing boxes/air valves to terminal air outlets.
    2. Supply ductwork and plenums on systems without mixing boxes/air valves.
    3. Return air ductwork and plenums, except where otherwise specified.
    4. Exhaust and relief air ductwork and plenums, except where otherwise specified (welding/sawdust exhaust).
    5. Outdoor air ductwork and plenums, except as otherwise specified.

2.3 Ductwork – Under 500 Pa Static Pressure

1. Provide galvanized steel duct work for system operating pressures 500 Pa and less. Ductwork shall be constructed, reinforced, sealed and installed to withstand 1-1/2 times working static pressure.

2. Construct rectangular ductwork in accordance with SMACNA Duct Construction Standards, Third Edition – 2005.

3. Nomasco “Ductmate System, Lockformer TDC” or Exanno “Nexus System” may be used for rectangular duct joints.

4. At least two opposite faces of rectangular ductwork shall be joined together using joint which cannot pull apart.

5. Construct rectangular duct fittings in accordance with Section 2 and 4 including Figures 4-1 to 4-9 of SMACNA Duct Construction Standards, but excluding beaded crimp joints and snaplock seams.

6. Construct round ductwork in accordance with Section III, including Tables 3-1 to 3-15 and Figures 3-1 and 3-11, of SMACNA Duct Construction Standards, but excluding beaded crimp joints and snaplock seams.

7. Construct flat oval ductwork in accordance with Section III of SMACNA Duct Construction Standards. Joints and seams shall be similar to those indicated for round ducts. Flat oval duct to be used for positive pressure application only.

8. Construct round and flat oval duct fittings in accordance with Section III of SMACNA Duct Construction Standards, Third Edition - 2005. Round elbows shall have centreline radius of 1.0 times duct diameter. Sheet metal gauge of fittings and elbows shall have centreline radius of 1.0 times duct diameter. Sheet metal gauge of fittings and elbows shall not be less than thickness specified for longitudinal seam straight duct. Adjustable elbows are not permitted.

2.4 Ductwork - 500 Pa and Greater Static Pressure

1. Provide galvanized steel duct work for system operating pressures 750 Pa and over. Ductwork shall be constructed, reinforced, sealed and installed to withstand 1-1/2 times working static pressure.

2. Construct rectangular ductwork in accordance with SMACNA Duct Construction Standards.

3. Nomasco “Ductmate System”, Exanno “Nexus System” or “ Lockformer TDC, TDF system” may be used for rectangular duct joints.

4. Construct rectangular duct fittings in accordance with Section 2 and 4 of SMACNA Duct Construction Standards.

5. Construct round ductwork in accordance with Section III, including Tables 3-1 to 3-15 and Figures 3-1 and 3-11, of SMACNA Duct Construction Standards.

6. Construct flat oval ductwork in accordance with Section 3.3 of SMACNA Duct Construction Standards. Joints and seams shall be similar to those indicated for round duct. Flat oval duct to be used for positive pressure application only.

7. Construct round and flat oval duct fittings in accordance with Section III, of SMACNA Duct Construction Standards. Round elbows shall have centreline radius of 1.5 times duct diameter. Construct 90° elbows of not less than 5 tapered section. Seams and joints in round or oval duct fittings and elbows shall be spot welded lap seams at not more than 50 mm spacing and inside seams sealed with approved duct sealant. If zinc coating is burned the steel during welding, joints shall be painted to prevent corrosion. Sheet metal gauges of fittings and elbows shall not be less than thickness specified for longitudinal seam straight duct, but suitably thick for welding methods used.

2.5 Plenums – Under 500 Pa Static Pressure

1. Provide galvanized steel low pressure plenums, suitable for 500 Pa positive or negative pressure, for central plant ventilating and air conditioning equipment.

2. Construct plenums in accordance with Chapter 9, including of SMACNA Duct Construction

Standards, Third Edition - 2005.

3. Where building structure does not form bottom surface of walk-in plenum, fabricate plenum floor panels of
1.99 mm galvanized steel, with angle iron reinforcing to limit deflection of floor panels to 6.0 mm under concentrated load of 115 kg at mid span.

4. Where plenum floors are internally lined, install 1.61 mm thick galvanized steel panel on top of insulation.

5. Apply silicone sealant CGE Silpruf 2000 series or Dow Corning 781/732 between plenum base angles and concrete or curbs before bolting together.

6. Reinforce openings in plenum walls with 38 mm x 38 mm x 4.8 mm angle iron, secured to main vertical and horizontal reinforcing angles.

7. Construct access door and casing around door as per SMACNA Standards, casing access doors, with angle iron frame sized to suit plenum wall. Doors constructed of 1.61 mm metal.

8. Arrange access doors to open against airflow and static pressure.

9. Weld joints on condensate drains pans. Construct pans of 1.59 mm thick stainless steel Type #302 or #304. Install 32 mm piping connection, complete with water seal at least 100 mm deep, from pan drain connection to nearest building drain. Install drain connections to completely drain pans.

10. Seal piping penetrations through plenum walls, with gland seals as detailed in SMACNA Duct Construction Standards, Third Edition - 2005.

11. Bulkheads mounting air filters and air coils shall be airtight to prevent air bypass around filters and/or coils.

2.6 Plenums - 500 Pa and Greater Static Pressure

1. Provide medium/high pressure galvanized steel plenums, suitable for specified pressures.

2. Construct plenums in accordance with Chapter 9, of the SMACNA Duct Construction Standards, Third Edition - 2005. If requested, pressure test plenums to specified static pressure (positive or negative) to demonstrate structural integrity.

3. Where building structure does not form bottom surface of walk-in plenum, fabricate plenum floor panels of
1.99 mm galvanized steel, with angle iron reinforcing to limit deflection of floor panels to 6.0 mm under concentrated load of 115 kg at mid span.

4. Where plenum floors are internally lined, install 1.61 mm thick galvanized steel panel on top of insulation.

5. Apply silicone sealant CGE Silpruf 2000 series or Dow Corning 781/732 between plenum base angles and concrete or curbs before bolting together.

6. Reinforce openings in plenum walls with 50 mm x 50 mm x 6.0 mm angle iron, secured to main vertical and horizontal reinforcing angles.

7. Construct access door and casing around door as per SMACNA Standards, casing access doors, with angle iron frame sized to suit plenum wall. Doors constructed of 16 gauge metal.

8. Arrange access doors to open against airflow and static pressure.

9. Weld joints on condensate drains pans. Construct pans of 1.59 mm thick stainless steel Type #302 or #304. Install 32 mm piping connection, complete with water seal, from pan drain connection to nearest building drain. Install drain connections to completely drain pans.

10. Water Seal Depth:

    1. 100 mm for 500 Pa systems.
    2. 130 mm for 750 Pa systems.
    3. 150 mm for 1,000 Pa systems.
    4. 200 mm for 1,500 Pa systems.
    5. 300 mm for 2,500 kPa systems.

11. Seal piping penetrations through plenum walls with gland seals as detailed in the SMACNA Duct Construction Standards, Third Edition - 2005.

12. Bulkheads mounting air filters and air coils shall be airtight to prevent air bypass around filters and/or coils.

2.7 Ductwork - Aluminum

1. The following ductwork shall be fabricated from aluminum:

    1. Discharge ductwork through roof, where indicated on drawings.

2. Low Pressure Aluminum ductwork shall be constructed in accordance with clause 2.2 “Ductwork - 500 Pa Static Pressure.”

3. For round and rectangular aluminum ductwork, use four gauges heavier than scheduled in SMACNA Duct Construction Standards, Third Edition - 2005 for galvanized ductwork.

4. Aluminum shall be utility grade.

5. Support aluminum ductwork using aluminum straps, cadmium plated threaded rods, aluminum flat bar or aluminum angle hangers. Support shall be similar to specified for galvanized iron ductwork.

2.8 Ductwork - Concrete

1. Provide concrete, below grade, air ductwork where specifically indicated on drawings.

2. Duct may be concrete sewer pipe with hub and spigot joints with Portland cement joints on oakum gasket or mechanical joint to ASTM C14M-80a.

3. Duct may be cast-in-place concrete. Where duct has circular cross section, use Sono-Air-Duct forms, conforming to requirements of authorities having jurisdiction.

2.9 Ductwork - Acoustically Lined

1. Where rectangular ductwork is indicated acoustically insulated with flexible acoustic duct liner, it shall be installed in accordance with instructions in SMACNA Duct Construction Standards, Third Edition - 2005. Duct sizes shown are inside duct liner.

2. Where round ductwork is indicated acoustically insulated, it shall consist of two concentric round ducts with 25 mm thick flexible fibrous glass duct liner between ducts. Inner duct shall be perforated and correspond to duct diameter noted on drawings. Outer duct shall be suitable for static pressure and shall be sealed airtight where it joins adjacent ductwork.

2.10 Ductwork - Outdoors

1. Joints shall be caulked with water impervious sealant. TDC clips should be continuous on top and sides of ducts.

2. Top of finished product (waterproof membrane) shall be pitched to avoid pooling of water.

2.11 Wire Mesh Screens

1. Provide wire mesh screens in air intake openings.
2. Screens shall be constructed from aluminum wire 1.29 mm diameter.
3. Screen mesh shall be 12 mm.
4. Mount screens in 0.81 mm thick folded aluminum frames.

2.12 Counter Flashings

1. Counter flashings - galvanized sheet steel of 0.85 mm minimum thickness.

2. Counter flashings are attached to mechanical equipment and lap base flashings on roof curbs.

3. Joints in counter flashings shall be flattened and solder double seam. Storm collars shall be adjustable to draw tight to pipe with bolts. Caulk around top edge. Storm collars shall be used above roof jacks.

4. Vertical flange section of roof jacks shall be screwed to face of curb.

3. EXECUTION

3.1 Ductwork & Plenum Installation

1. Where duct contains a fire or smoke damper, construct duct so free area is maintained through damper.

2. Where duct is internally insulated, enlarge duct to not reduce free area.

3. Make taper of diverging transitions less than 20° and taper of converging transitions less than 30° in accordance with SMACNA Duct Construction Standards, Third Edition - 2005. Maximum divergence upstream of equipment to be 30° and 45° convergence downstream.

4. Make inside radius of rectangular duct elbow at least equal to duct width, measured in direction of radius. If space conditions do not permit full radius elbow, use square elbows with multi-blade turning vanes.

5. Turning vanes shall be single wall type. Vanes in galvanized sheet metal ducts shall be constructed from galvanized steel, minimum thickness 0.85 mm. Vanes shall be spaced at 38 mm centres and shall turn through 90° with radius of 50 mm. Vanes shall not include straight trailing edge. Vanes and runners in aluminum ducts shall be constructed from aluminum. Aluminum vanes shall be 1.02 mm.

6. For under 500 Pa pressure systems, install tie rods to limit maximum unsupported vane length to 914 mm. Refer to Figure 2-4 of the SMACNA Duct Construction Standards, Third Edition – 2005.

7. For 500 Pa and greater pressure systems, install tie rods to limit maximum unsupported vane length to 450 mm. Refer to Figure 2-4 of SMACNA Duct Construction Standards, Third Edition - 2005.

8. Install duct necks before grilles, registers and diffusers and cushion heads after diffuser take-offs to suit site conditions.

9. Where indicated, install adjustable air turning devices, where full radius take-off fittings cannot be installed, in accordance with SMACNA Duct Construction Standards, Third Edition - 2005. Adjustment shall be accessible outside duct with lockable quadrant operator or through grille or register with key-operated worm gear mechanism.

10. Cross-break or bead metal duct panels unless otherwise noted.

11. Do not cross-break duct panels on 500 Pa and greater static pressure systems.

12. Do not cross-break bottom duct panels when ductwork is handling moisture.

13. Roof mounted ducts shall have standing seams and shall be sealed weather tight.

14. Grade ductwork handling moist/humid air, minimum of 25 mm in 3.0 m back to source. At low points in

ductwork, provide 150 mm deep drain sump and 32 mm diameter drain connection with deep seal trap and pipe to drain.

15. Construct ductwork handling moisture with three sided bottom sections and separate top panel. Install three sided bottom sections and internally seal transverse joints with CGE Silicone Sealant "Silpruf". Then install top panels and seal top panel seams and joints.

16. Provide floor drains in outside air and humidifier sections with deep seal traps.

17. Provide moisture collection sections inside louvres for outside air and exhaust air.

18. Support ductwork using galvanized steel straps, cadmium plated threaded rods, flat bar or angle hangers. Attachments to structure shall be compatible with structure and selected for load of ductwork. Install ductwork hangers in accordance with Chapter 5 of SMACNA Duct Construction Standards, Third Edition – 2005.

19. Support duct risers at base and each floor and not greater than 3.6 m intervals.

20. Prior to fabrication of ductwork, co-ordinate and field measure to ensure complete installation respecting other services. Provide necessary fittings, offsets, and alternate construction methods to facilitate installation.

21. Arrange ductwork and plenums so duct and plenum mounted equipment can be removed.

22. Arrange access doors to open against airflow and static pressure.

23. Ducts passing through non-rated fire separations, sound insulated walls and through non-rated walls and floors shall be tightly fitted and sealed on both sides of separation with silicon sealant to prevent passage of smoke and/or transmission of sound (ULC approved fire stop sealant is not required). Where ducts are insulated, provide 0.70 mm thick galvanized steel band tightly fitted around insulation and caulk to band.

24. During construction, protect openings in ductwork from dust infiltration by covering with polyethylene and protect floor outlet duct openings with metal caps.

25. Where ductwork passes through open web steel joists, coordinate with joist fabricator before fabricating ductwork.

26. Where ducts penetrate roofs, install sleeves and roof curb complete with flashing and counterflashing. Pack sleeves in roof with fibreglass insulation.

27. Provide drip pans under piping and shields for protection of electrical panels and equipment.

28. Unless noted otherwise, line builder's shafts and air plenums used as ducts and plenums with sheet metal.

3.2 Ductwork Leakage Test

1. Leakage test all 500 Pa and greater static pressure supply ductwork as recommended in SMACNA HVAC Air Duct Leakage Test Manual, 1985 Standards, to static pressure 500 Pa in excess of specified ductwork design static pressure.

2. Use equipment capable of demonstrating leakage.

3. Test the first 30 m of installed ductwork in presence of Consultant.

4. Test 30 m section of under 500 Pa static pressure ductwork, where complete systems over 30 m long are installed to static pressure of 500 Pa.

5. The total allowable leakage for system shall be no greater than [5]% of total system capacity.

6. Submit test reports for ducts tested.

3.3 Ductwork and Plenum Cleaning

1. All ductwork and equipment installed shall be free of scale, debris and dirt.

2. Maintain duct and equipment openings covered with poly or equivalent to prevent entry of dirt.

3. Clean plenums and buried supply ductwork with industrial vacuum cleaner on completion of duct and plenum installation.

4. Install air filters for specified performance.

5. Blow out supply ductwork, (by means of supply fan) at completion of duct and plenum installation and prior to installation of air terminals.

6. Ductwork shall be considered clean when foreign material visible to naked eye has been removed. Random sampling review by Consultant will be conducted to check for cleanliness.

END OF SECTION 23 31 00

PART 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Fire and smoke dampers, and fire stop flaps.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 35 29.06 – Health and Safety Requirements.

.3 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.4 Section 23 31 13.01 – Metal Ducts – Low Pressure to 500 Pa.

1.3 REFERENCES

.1 American National Standards Institute/National Fire Protection Association (ANSI/NFPA)

.1 ANSI/NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Safety Data Sheets (SDS).

.3 Underwriters Laboratories of Canada (ULC)

.1 CAN4-S112, Fire Test of Fire Damper Assemblies.

.2 CAN4-S112.2, Standard Method of Fire Test of Ceiling Firestop Flap Assemblies.

.3 ULC-S505, Fusible Links for Fire Protection Service.

1.4 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.2 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS) in accordance with Section 01 33 00 - Submittal Procedures.

.3 Indicate the following:

.1 Fire dampers.

.2 Smoke dampers.

.3 Fire stop flaps.

.4 Operators.

.5 Fusible links.

.6 Design details of break-away joints.

.2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.3 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals

1.5 QUALITY ASSURANCE

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.2 Certificates:

.1 Catalogue or published ratings those obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.6 MAINTENANCE

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Section 01 78 00 – Closeout Submittals.

.2 Provide the following:

.1 6 fusible links of each type.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 PRODUCTS

2.1 FIRE DAMPERS

.1 Fire dampers: arrangement Type B or C, blades out of air stream listed and bear label of ULC, meet requirements of provincial fire authority and ANSI/NFPA 90A. Fire damper assemblies to be fire tested in accordance with CAN4-S112. Minimum rating 1 ½ hours, dynamically rated.

.2 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.

.3 Top hinged: offset, round or square; multi-blade hinged or interlocking type; roll door type; or guillotine type; sized to maintain full duct cross section.

.4 Fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type or roll door type in horizontal position with vertical air flow.

.5 Retaining angle iron frame, 40 x 40 x 3.0 mm, on full perimeter of fire damper, on both sides of fire separation being pierced.

.6 Equip fire dampers with steel sleeve or frame installed to prevent disruption of ductwork or impair damper operation.

.7 Equip sleeves or frames with perimeter mounting angles attached on both sides of wall or floor opening. Construct ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce ceiling to conform with ULC.

.8 Design and construct dampers to not reduce duct or air transfer opening cross-sectional area.

.9 Dampers shall be installed so that the centerline of the damper depth or thickness is located in the centerline of the wall, partition or floor slab depth or thickness.

.10 Unless otherwise indicated, the installation details given in SMACNA Fire, Smoke, and Radiation Damper Installation Guide for HVAC and in manufacturer's instructions for fire dampers shall be followed.

2.2 SMOKE DAMPERS

.1 To be ULC or UL listed and labelled.

.2 Normally closed reverse action smoke vent (S/D-RASV): folding blade type, opening by gravity upon detection of smoke, and/or from remote alarm signalling device actuated by an electro thermal link. Two flexible stainless steel blade edge seals to provide required constant sealing pressure.

.3 Normally open smoke/seal (S/D-SSSD): folding blade type, closing when actuated by means of electro thermal link and/or from remote alarm signalling device. Blade edge seals of flexible stainless steel shall provide required constant sealing pressure. Stainless steel negator springs with locking devices shall ensure positive closure for units mounted horizontally in vertical ducts.

.4 Motorized (S/D-M): folding blade type, normally open with power on. When power is interrupted damper shall close automatically. Both damper and damper operator shall be ULC listed and labelled.

.5 Electro thermal link (S/D-ETL): dual responsive fusible link which melts when subjected to local heat of 74° C and from external electrical impulse of low power and short duration; ULC or UL listed and labelled.

2.3 COMBINATION FIRE AND SMOKE DAMPERS

.1 Damper: similar in all respects to smoke dampers specified above.

.2 Combined actuator: electrical control system actuated from smoke sensor or smoke detection system and from fusible link.

2.4 FIRE STOP FLAPS

.1 To be ULC listed and labelled and fire tested in accordance with CAN4-S112.2.

.2 Construct of minimum 1.5 mm thick sheet steel with 1.6 mm thick non-asbestos ULC listed insulation and corrosion-resistant pins and hinges.

.3 Flaps to be held open with fusible link conforming to ULC-S505 and close at 74° C.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install in accordance with ANSI/NFPA 90A and in accordance with conditions of ULC listing.

.2 Maintain integrity of fire separation.

.3 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.

.4 Install access door adjacent to each damper. See Section 23 33 00 – Air Duct Accessories.

.5 Coordinate with installer of firestopping to Section 07 84 00 – Firestopping.

.6 Ensure access doors/panels, fusible links, damper operators are easily observed and accessible.

.7 Install break-away joints of approved design on each side of fire separation.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 00 - Cleaning.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.4 COMMISSIONING

.1 Commission in accordance with Section 01 91 13.13 – Commissioning (Cx) Requirements.

END OF SECTION

1. GENERAL

1.1 Related Work:

1. This Specification Section forms part of Contract Documents and is to be read, interpreted and coordinated with other parts.

1.2 Quality Assurance:

1. Catalogued or published ratings shall be from tests carried out by Manufacturer or from independent testing agency signifying adherence to codes and standards.

1.3 Submittals:

1. Fan shop drawings shall include sound rating data and fan curves showing operating point plotted on curves.

2. Fan shop drawings shall include motor efficiencies. Refer to Section 23 05 13 for minimum motor efficiencies.

1.4 General:

1. Provide ECM DC motors complete with manual speed dial and 0-10V controls signal terminal for variable speed control. See Section 23 05 13 for ECM motor requirements.

2. PRODUCTS

2.1 Fans – General:

1. Provide fans selected for maximum efficiency and generating noise levels on site not exceeding levels indicated. If fans are not specified at maximum efficiency, advise mechanical Consultant before tendering and submit alternate price for maximum efficiency fans. If approval to supply noisier fans is not obtained prior to tendering, provide equipment meeting ASHRAE levels on site without loss in efficiency.

2. Submit fan sound power levels with shop drawings measured to applicable AMCA standards, or other data acceptable to Engineer. Provide test data, if requested. Indicate on shop drawings test configuration, including ductwork, and end reflection corrections applied to data and/or if such corrections have been omitted.

3. Fans: statically and dynamically balanced, constructed in conformity with AMCA-99-83. Dynamically balance fans to 1.5 mm/s vibration amplitude, maximum measured on bearing housings. Provide fan shafts with critical speed at least 1.5 times operational speed.

4. Ratings: based on tests performed in accordance with AMCA 210, and ASHRAE 51-85. Unit shall bear AMCA certified rating seal.

5. Refer to drawings for motor position, rotation and discharge arrangements.

6. For motors less than 7.5 KW provide standard adjustable pitch drive sheaves +/- 10% range. Use mid-position of range for specified r/min.

7. For motors 7.5 KW and larger, provide fixed pitch drive sheaves with split tapered bushing and keyway. Provide final drive sheaves of size to suit final balancing.

8. Match drive and driven sheaves.

9. V-belts shall conform with American Belt Manufacturers standards. Multiple belts shall be matched sets.

10. Minimum drive rating shall be 150% of nameplate rating of motor.

11. Not less than 2-belt configuration required for motors 0.56 KW and larger.

12. Provide OSHA style belt guard with tachometer ports for belt drive fans.

13. Bearings shall have minimum L-10 life of 100,000 hours based on maximum safe speed of fan class.

14. Where required, fans shall be treated to suit airstream in which they are used.

2.2 Fans – Cabinet:

1. Steel cabinet arranged for ducted inlet and outlet connections complete with duct collars (where shown) or ceiling exhaust opening complete with exhaust grille (where shown).
2. Acoustically insulated cabinet.
3. Centrifugal fan on rubber isolators.
4. Backdraft damper.
5. Access panel.
6. Integral motor thermal overload protection.
7. Motor disconnect plug and integral receptacle.
8. Solid state speed control – where scheduled.
9. Acceptable Products: Greenheck, Cook, Penn, Carnes.
10. Roof Fan

3. EXECUTION

3.1 Fans:

1. Install fans as indicated, complete with vibration isolators and seismic restraints as specified in Sections 23 05 48 and 23 05 49.

2. Install fans with flexible connections on inlet ductwork and on discharge ductwork. Ensure metal bands of connectors are parallel with minimum 25 mm flex between ductwork and fan during running.

3. Install connectors to be clear of air stream. Provide flange extensions as necessary. Ensure

accurate alignment of duct of fan.

4. Provide safety screens where fan inlet or outlet is exposed.
5. Provide belt guards on belt driven fans.
6. Provide and install sheaves and belts required for final air balance.
7. Assist Balancing Agency in altering blade pitch angles as required for final air balance. Provide access to fan wheel for blade adjustment.
8. Mount floor mounted fans on 100 mm thick concrete housekeeping bases (bases under Division 3).
9. Mount roof mounted fans on curbs 200 mm minimum above roof.

END OF SECTION 23 34 00

1. GENERAL

1.1 Related Work

1. This Specification Section forms part of Contract Documents and is to be read, interpreted and coordinated with other parts.

1.2 Quality Assurance

1. Motors shall be UL listed and CSA certified.
2. Full Voltage Start Applications:
    1. All motors shall be in accordance with the National Electrical Manufacturers Association (NEMA) standards, and CSA C390. Motors also shall comply with applicable portions of Canadian Electrical Code.
3. Variable Frequency Drive and soft start applications:
    1. Motors shall be in accordance with NEMA standards (MG-1) Part 31 and inverter duty class. Motors also shall comply with applicable portions of Canadian Electrical Code.
    2. Motors connected to VFDs shall be wound using inverter spike resistant magnet wire capable of 1600V.
4. Electronic Commutation Motors (ECM) shall be provided in unitary equipment as specified in their respective sections (small fans, pumps, etc.).
5. Noise level of each motor shall comply with NEMA standards, less than 80 dBA at 1 meter.

1.3 Submittals

1. Submit data of test method used and motor efficiencies with shop drawings.

2. PRODUCTS

2.1 Electric Motors - General

1. Provide motors for mechanical equipment as specified.
2. Unless noted otherwise, provide open drip-proof, ball or roller bearing motors with grease fittings.
3. Motors shall have standard voltage ratings consistent with project distribution voltages. Motors less than 0.37 KW to be 120 volt, 60 cycle, single phase power. Motors 0.37 KW and larger to be 3 phase power and for scheduled voltage. Confirm electric voltage, phase and starter requirements with electrical specification.
4. Motors shall be designed and manufactured to operate with ±10% voltage and ±5%

frequency variations of the nameplate ratings.

5. Motors shall be rated for 1.15 service factor in 40°C ambient environment.

6. Motors shall be standard 1750 RPM unless specifically scheduled otherwise.

7. Provide motors with terminal boxes, suitable for power connections.

8. Provide screw adjustable bases on belt-connected motors.

9. Motors shall be of capacitor start type when they may be manually cycled from starting switch, located in finished space.

10. Lubricate motors exposed to outdoor temperature with lubricants suitable for operation at the lowest temperature indicated by the Climatic Information contained in the National Building Code for the location in which they are installed.

2.2 Electric Motors - Premium Efficient

1. Motors shall be provided with premium efficiency inverter duty classification with non-wicking leads, class 'B' for ODP motors (pumps only) and class 'F' for TEFC motors insulation (minimum)., complete with motor shaft grounding for all variable speed/frequency driven motors.

    1. Premium efficiency open drip-proof motors shall have the following typical full load efficiencies (nominal):

HP	Premium Efficient - Minimum Efficiency (%)		
	3500 RPM	1750 RPM	1150 RPM
1	80.0	85.5	82.5
1.5	84.0	86.5	86.5
2	85.5	86.5	87.5
3	86.5	89.5	88.5
5	91.0	89.5	90.2
7.5	88.5	91.0	92.4
10	90.2	91.7	92.4
15	91.0	93.0	92.4
20	92.5	93.0	92.4

    2. Premium efficiency inverter duty totally enclosed fan cooled motors shall have the following typical load efficiencies (nominal).

HP	Premium Efficient - Minimum Efficiency (%)		
	3500 RPM	1750 RPM	1150 RPM
1	n/a	85.5	81.5
1.5	85.5	85.5	86.5

2	85.5	85.5	87.5
3	87.5	88.5	88.5
5	89.5	89.5	89.5
7.5	91.0	91.7	91.7
10	91.7	91.7	91.7
15	91.7	92.4	91.7
20	92.4	93.0	92.4

2. ECM Motors (Electronic Commutation Motors) shall be provided for unitary equipment in their respective sections. ECM motors shall be permanently lubricated complete with heavy duty ball bearings to match the device (fan, pump, equipment type) and pre-wired to the specific voltage and phase. Interior motor circuitry

   shall convert the supplied AC power to the motor to DC power to operate the motor. Motor shall be speed controllable down to 20% of rated full speed. Speed shall be controlled by either a Potentiometer dial mounted at the motor, or by a 0-10V signal from controls. Motor shall be a minimum of 85% efficiency at all speeds.

2.3 Belt Drives

1. Provide belt drives to the following requirements:

   1. Steel, cast-iron or aluminum sheaves for motors less than 0.56 KW.
   2. Steel or cast-iron sheaves keyed to shafts, for motors 0.56 KW and larger.
   3. For motors less than 10 HP, provide standard adjustable pitch drive sheaves having ±10% range. Use mid- position of range for specified RPM.
   4. For motors 7.5 KW and larger, provide fixed pitch drive sheaves with split tapered bushing and keyway. Provide final drive sheaves of size to suit final balancing.

2. Match drive and driven sheaves.

3. V-belts shall conform with the American Belt Manufacturers standards. Multiple belts shall be matched sets.

4. Not less than 2-belt configuration is required for each drive for motors 0.56 KW and larger.

5. Minimum drive rating shall be 150% of nameplate rating of motor. Keep overhung loads within Manufacturer's design requirements on prime mover shafts.

6. Motor slide rail adjustment baseplate with double draw bolt shall allow for centre line adjustment.

7. Tension belts to manufactures recommendations before start-up and after 100 hours of operation using calibrated belt tensioning gauge.

8. Provide one spare set of belts for each piece of equipment with each belt separately identified for the equipment item served.

2.4 Shaft Couplings

1. Shaft couplings shall be of the pin or jaw neoprene insert type, gear type, or flexing steel insert type and shall allow coupling inserts to be easily removed without disassembly of equipment.

2.5 Guards

1. Provide removable protective guards on exposed V-belt drives and shaft couplings in accordance with Worker's Compensation Board requirements.

2. Guards for drives shall have:

    1. 1.31 mm expanded metal screen welded to 25 mm steel angle frame.
    2. 1.61 mm thick galvanized sheet metal tops and bottom.
    3. Removable sides(s) for servicing.
    4. 38 mm diameter holes on both shaft centres for insertion of tachometer.
    5. Sectionalize if necessary so one man can handle removal.

3. Provide means to permit lubrication and use of test instruments with guards in place.

4. Fabricate and install belt guards for V-belt drives to permit movement of motors for adjusting belt tension and for belt slap.

5. Provide removable "U" shaped guards for flexible couplings with 2.75 mm thick galvanized frame and 1.61 mm thick expanded mesh face.

6. Provide guards on unprotected fan inlets and outlets. Guards to be provided by fan Manufacturer.

7. Prime coat guards and finish paint to match equipment.

8. Secure guards to equipment allowing for ease of removal.

3. EXECUTION

3.1 Electric Motors

1. Unless otherwise noted starters and protection devices will be included under Electrical Division.

2. Assist Electrical Division to ensure proper connection, correct thermal overload protection and correct motor controls.

3. Where starters included in this Division as integral part of packaged equipment, they shall contain thermal overload protection.

3.2 Setting and Alignment

1. Employ journeyman millwright to align V-belt drives and/or shaft coupling drives prior to initial start-up. Millwright shall check that centrifugal fan wheels are properly centered on fan shafts.

2. Align shaft couplings to within ±0.051 mm after grouting is complete and piping system is operational.

3. Align V-belt drives using straight edge.

4. Submit certificate from millwright, certifying that shaft couplings and V-Belt drives have been aligned and centrifugal fan wheels centered prior to initial start-up and checked again after final system balance adjustment.

END OF SECTION

1. GENERAL

1.1 Read Mechanical General Requirements, Section 23 00 00 as part of this Section.

1.2 Provide terminal boxes as required.

1.3 Shop drawings

.1 Submit manufacturer's data sheets for terminal boxes with equipment model numbers, performance and design data, outline dimensions, enclosure details, support and connection arrangements and electrical power requirements where applicable.

2. PRODUCTS

2.1 General

.1 Selection of units to meet air quantities to be based on:

- Maximum Inlet Air Pressure: 750 Pa (3 in wg)
- Minimum Inlet Air Pressure: 75 Pa (0.3 in wg)
- Maximum room NC sound pressure level (2×10^{-4} microbar reference) at maximum inlet pressure to be less than 40 at discharge and 42 radiated for box with attenuator mounted exposed (without ceiling).

Standard of Acceptance:

- E.H. Price
- Titus
- Krueger
- Nailor Industries

.2 Provide clean room type foil face insulation in all VAV or CV boxes.

2.2 Constant volume boxes:

.1 pressure independent type with velocity sensor, DDC factory calibrated controller, operator and damper assembly with adjustable minimum stop.

.2 maintain air quantity within ∀5% of rated value with sound level below specified values when operating from minimum to maximum inlet static pressure as given above.

.3 open end or multiple outlet attenuator on box discharge acoustically treated with foil faced rigid ductliner held in place with adhesive and pins

2.3 Variable volume boxes:

.1 pressure independent type with velocity sensor, DDC factory calibrated controller, operator and damper assembly with adjustable minimum stop.

.2 damper arranged "normally open" for morning warm-up.

.3 maintain air quantity within ∀5% of set value, between zero and specified rating, and sound level below specified values when operating from minimum to maximum inlet static pressure as given above.

.4 open end or multiple outlet attenuator on box discharge acoustically treated with foil faced rigid ductliner held in place with adhesive and pins

3. EXECUTION

3.1 Installation

.1 Support terminal boxes from building structure with angles, hangers and supplementary steel before installation of piping and connecting ductwork..

.2 Connect inlet ductwork with minimum four diameters of round ductwork matching box inlet size.

.3 Support outlet ductwork independently from boxes.

.4 Division 26 to provided 120/1/60 power to junction box adjacent to VAV/CV boxes. Division 23 to wire from junction boxes to VAV/CV boxes.

END OF SECTION

1. GENERAL

1.1 Related Work

1. This Specification Section forms part of Contract Documents and is to be read, interpreted and coordinated with other parts.

1.2 Quality Assurance

1. Catalogued or published ratings shall be those obtained from tests carried out by Manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

2. PRODUCTS

2.1 Air Terminals

1. General:

    1. Grilles, registers and diffusers shall be product of one Manufacturer.
    2. Refer to drawings for sizes and air quantities.
    3. Refer to schedules on drawings for details.
    4. Base air outlet application on space noise level of NC 30 maximum.
    5. Air terminals shall be checked for compatibility with ceiling types. Refer to Architectural reflected ceiling plans.
    6. Manufacturer (other than design listed) shall match performance data and indicate specific comparison for each item, with shop drawing submission.
    7. Ceiling mounted air terminals shall be provided with means for attachment of two seismic security wires at opposite corners on each air terminal.
    8. Provide concealed baffles, where necessary, to direct air away from walls, columns or other obstructions within radius of air terminal operation.
    9. Provide auxiliary frames for diffusers located in drywall ceilings and grilles mounted in gypsum walls in public areas. In other areas grilles should be attached to ductwork, or flanged to outside of the opening.
    10. Standard of Acceptance for general grilles, registers, and diffusers: EH Price, Nailor, Titus, Kruger, Tuttle & Bailey

2.2 Louvres - Stationary

1. General:

    1. Extruded aluminum frames and blades.
    2. Welded construction with exposed joints ground flush and smooth or mechanically fastened with stainless steel fasteners.
    3. Lower assembly sealed and water tight.
    4. Removable 1.29 mm diameter aluminum wire bird screen with 12 mm mesh. Bird screen

mounted in 0.81 mm thick aluminum folded frame. Frame to be installed inside louvre.

5. Mill finish.

2.3 Hoods - Gooseneck

1. Galvanized steel construction.

2. Thickness and fabrication to ASHRAE & SMACNA standards.
3. 12 mm aluminum wire bird screen mounted in removable U-frame.
4. Mount unit on minimum 300 mm high curb base.

3. EXECUTION

3.1 Louvres

1. Provide necessary flashing and counterflashing for louvres installed in walls.

2. Caulk louvre and flashing and counterflashing to make installation water tight.

3. Blank-off panels shall be constructed to SMACNA standards, minimum 1.00 mm sandwich panel with 25 mm thick fibreglass insulation.

4. Blank-off panels shall have painted flat black enamel finish.

END OF SECTION

PART 1 GENERAL

PART 1.01 SUMMARY

A. Section Includes: Packaged rooftop units and commercial packaged, gas/electric and electric/electric

PART 1.02 REFERENCES

A. Agency Listings:
   1. Intertek ETL
   2. Canadian Standards Association (CSA).

B. Safety Standards:
   1. Underwriters Laboratories (UL).
   2. Underwriters Laboratories of Canada (ULC).
   3. National Electric Code (NEC).
   4. Canadian Electric Code (CEC).

C. Air-Conditioning, Heating and Refrigeration Institute (AHRI):
   1. AHRI 340/360 Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment.
   2. AHRI 370 Sound Rating of Large Outdoor Refrigerating and Air Conditioning Equipment.
   3. AHRI 210/240 Performance Rating of Unitary Air Conditioning and Air-Source Heat Pump Equipment.

D. American Society for Testing and Materials (ASTM):
   1. ASTM B117–Standard Practice for Operating Salt Spray.
   2. ASTM 1153-Standard Method for Methyl Isobutyl Ketone.

E. ISO 9001, Quality Management Systems.

F. Meet Military Specification MIL-P-53084

PART 1.03 SYSTEM DESCRIPTION

A. Performance Requirements:
   1. gas/electric packaged roof top units or equivalent
   2. 4 ton capacity
   3. Electrical Characteristics:
      a. 60Hz, 575v-3 Phase

PART 1.04 SUBMITTALS

A. General: Submit listed submittals in accordance with Section 01 00 10-General Instructions.

B. Product Data: Submit product data for specified products.

C. Shop Drawings:

1. Submit shop drawings in accordance with Section 01 00 10 - General Instructions.
2. Indicate:

a. Equipment, piping and connections, together with valves, strainers, control assemblies, thermostatic controls, auxiliaries and hardware, and recommended ancillaries which are mounted, wired and piped ready for final connection to building system, its size and recommended bypass connections.

b. Piping, valves and fittings shipped loose showing final location in assembly.

c. Control equipment shipped loose, showing final location in assembly.

d. Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, mounting curb details, sizes and location of mounting bolt holes; include mass distribution drawings showing point loads.

e. Detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices or ancillaries, accessories and controllers.

f. Fan performance curves.

g. Details of vibration isolation.

h. Estimate of sound levels to be expected across individual octave bands in dB.

1. Type of refrigerant used.

j. Plan view, front view end view, back view and curb detail with dimensions.

D. Quality Assurance:

1. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
2. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
3. Manufacturer's Instructions: Manufacturer's installation instructions.

E. Manufacturer's Field Reports: Manufacturer's field reports specified.

F. Closeout Submittals: Submit following:

1. Warranty: Warranty documents specified.
2. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operation Data) Section. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance. Include names and addresses of spare part suppliers.
3. Provide brief description of unit, with details of function, operation, control and component service.

4. Provide equipment inspection report and equipment operation test report.

PART 1.05 QUALITY ASSURANCE

A. Qualifications:

1. Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.
2. Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements. Comply with Division 1 Project Management and Coordination (Project Meetings).

PART 1.06 DELIVERY, STORAGE & HANDLING

A. General: Comply with Division 1 Product Requirements.

B. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

C. Packing, Shipping, Handling and Delivery:

1. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
2. Ship, handle and unload units according to manufacturer's instructions.

D. Storage and Protection:

1. Store materials protected from exposure to harmful weather conditions.
2. Factory shipping covers to remain in place until installation.

PART 1.07 PROJECT CONDITIONS

A. Installation Location: On roof, refer to Mechanical Drawing

PART 1.08 WARRANTY

A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.

B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.

C. Warranty: Commencing on Date of installation.

1. Compressors: 5 years (limited).
2. Other Covered System Components: 1 year (limited).
3. Stainless Steel Heat Exchangers: 15 years (limited).
4. Unit Controller 3 years (limited).

PART 2 PRODUCTS

PART 2.01 ROOFTOP UNITS

A. Products/Systems: Packaged Rooftop Units (or equivalent), including the following equipment:

1. Cabinet:
   a. Heavy gauge steel panels.
   b. Pre-painted steel panels.
   c. Heavy Gauge galvanized steel base rail.
   d. Rigging holes on all four corners.
   e. Forklift slots (on three sides, not directly below condenser coil) on base rail.
   f. Raised or flanged edges around duct and power entry openings.
   g. Electrical lines can be brought through the base of the unit or through horizontal knockouts.
   h. Insulation:
      1) All panels adjacent to conditioned air are fully insulated with foil faced fiberglass insulation.
      2) Unit base is fully insulated.
      3) Unit base insulation also serves as a roof curb seal.
   i. Access Panels: Hinged for compressor/controls/heating areas, blower access and air filter/economizer access; and, sealed with quarter-tum latching handles and tight air and water seal.
   j. Corrosion resistant double sloped condensate Drain Pan.
   k. Service Valves

2. Cooling System:
   a. Refrigerant type: R-41OA.
   b. Capable of operating from 0 - 125 degrees F (-18 - 52 degrees C) without installation of additional controls.
   c. Compressors:
      1) Scroll Type.
      2) Resiliently mounted on rubber mounts for vibration isolation.
      3) Overload Protected
      4) Internal excessive current and temperature protection
      5) Isolated from condenser and evaporator fan air streams
      6) Refrigerant cooled
   d. TXV

e. High pressure switch
f. Freezestat
g. High capacity filter driers
h. Crankcase heater
i. Low pressure switch

3. Coil Construction:
   a. Condensing/evaporator coil general construction:
      1) Aluminum Rippled and Lanced fins.
      2) Copper tube construction.
      3) Aluminum fins mechanically bonded to copper tubes.
      4) All coils are high pressure leak tested at manufacturing facility.
   b. Evaporator Coils:
      1) With balanced port thermal expansion valves, freeze protection on each compressor circuit, pressure and leak tested to 500 psi.
      2) Each compressor circuit on coil divided across face of coil and active through full depth of coil.
      3) With flexible immersed coating electrodeposited by dry film process, meets standards: Military Specification MIL-P-53084, ASTM Bl 17 and ASTM 1153.
   c. Condenser Coils:
      1) With flexible immersed coating electrodeposited by dry film process, meets standards: Military Specification MIL-P-53084, ASTM B117 and ASTM 1153.
4. Wiring:
   a. Keyed and labeled connections, color coded and continuously marked wire to identify point-to-point component connections.
   b. Not in contact with hot-gas refrigerant lines or sharp metal edges.

5. Gas Heating System:
   a. Induced draft
   b. Natural gas fired system with direct spark ignition
   c. Electronic flame sensors
   d. Flame rollout switches
   e. High heat limit switches
   f. Induced draft failure switch and capable of operating to altitude of 2000 feet (610 m) with no derate to manifold pressure.
   g. Service access for controls, burners and heat exchanger
   h. Heat Exchanger:
      1) Tubular Design
      2) Stainless steel.

i. Gas piping system tight and free of leaks when pressurized to maximum supply pressure.

j. Gas Valve: redundant type gas heat valve with manual shutoff

k. Two stage gas heating

l. Gas Burners: Aluminized steel in shot-type gas burners

m. Direct spark pilot ignition

n. Fan and Limit Control

o. Safety Switches

p. Gas piping system tight and free of leaks

6. Heating Controls:
   a. Support 2 stages of heating control from DDC
   b. With delay time of 30 seconds between low and high heat stages
7. Supply Air Fan Motor and Drives:
   a. Belt drive
   b. Permanently lubricated ball bearings (for belt drive motors)
   c. Thermal overload protected motors with automatic reset
   d. Adjustable sheaves on belt drive motors for blower speed adjustment
   e. Optional low and high static motor/drive combinations and optional drive kits
   f. Auto Blower Belt Tensioner: Factory
9. Supply Air Fan:
   a. Double inlet type, galvanized steel with forward curved blades
   b. Statically and dynamically balanced
   c. Continuous or automatic control for occupied periods
10. Supply Air Filters:
    a. Disposable Merv 13
11. Condenser Fan Motor:
    a. ECM motors on 3-5 ton models. Direct drive with permanently lubricated ball bearings. With the exception of the first sentence, these three items (a, b, c) are not mentioned in the EHB
    b. Watertight with thermal overload protection and automatic reset
    c. Motor mount isolated from fan safety guard
12. Condenser Fans:
    a. Corrosion resistant propeller type
13. Unit Controller:
    a. Solid state control board to operate unit
    b. Scrolling digital display
    c. Shall provide a 5° F temperature difference between cooling and heating set points to meet ASHRAE 90.l Energy Standard

d. Shall provide and display alarms, alarm history and system status
e. Service run test capability
f. Shall accept input from a C02 sensor (both indoor and outdoor)
g. Economizer control
h. Blower on/off delay
1. 2-stage heat/4-stage cool thermostat compatible and warm-up mode
j. Diagnostics code storage
k. DDC compatible
l. Indoor air quality input
m. Low ambient controls
n. Runtime
o. Blower proving switch strike 3
p. Phase/voltage monitoring/protection: Factory
q. Realtime clock (timestamps)
r. Guided setup
s. USB memory stick communication interface
t. Controls Options:
    1) $C0_2$ Sensor: Field Mounted
    2) Dirty Filter Switch: Factory
    3) Blower Proving Switch: Factory
    4) Phase Monitor: Factory
    5) BACnet Interoperability: Factory
    6) Fresh Air Tempering Sensor: Field

14. Accessories:
    a. Economizer dry bulb temperature : Factory
    b. Motorized Outdoor Air Damper: Factory
    c. Power exhaust fan: Factory
    g. Roof curb: Field
    h. Outdoor air hood: Field
    j. 2" MERV 13 Filters: Factory
    k. Coil Guards: Field
    l. Disconnect Switch: Field
    m. Condensate drain trap plastic: Factory
    n. Circuit breaker: Factory

PART 2.02 PRODUCT SUBSTITUTIONS

A. Substitutions: Engineer approved equivalent.

PART 3 EXECUTION

PART 3.01 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalog installation instructions, product carton installation instructions and manufacturer's SPEC-DATA sheets.

PART 3.02 EXAMINATION

A. Site Verification of Conditions: Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions

PART 3.03 INSTALLATION

A. Install packaged rooftop units in accordance with manufacturer's instructions on roof curbs as indicated.

END OF SECTION

Engineering Specification –
Air-to-Air Wheel Energy Recovery Ventilator

1.0 GENERAL

a) Packaged Air-to-Air Wheel Energy Recovery Ventilator (ERV) from manufacturer specified or approved equivalent by consultant.
b) ERV must include the following components:
   - an enthalpy air-to-air energy recovery wheel;
   - a fresh air blower;
   - an exhaust air blower;
   - filters ahead the wheel in both fresh and exhaust air circuits;
   - an insulated cabinet for an outdoor installation;
   - sensors and microprocessor controls for an autonomous operation.
c) The ERV must be capable of transferring both sensible and latent energy.
d) The ERV must be designed to be used as a stand-alone unit or as a component in a dedicated HVAC system or as complete ventilation/HVAC unit with optional conditioning.
e) The unit must be complete, fully assembled with gauges and controls, ready to be field wired.

2.0 QUALITY ASSURANCE

a) The energy recovery wheel must be AHRI certifies for the 1060 standard. Noncertified product will not be considered.
b) The unit must be tested as per ANSI/UL 1995 and CAN/CSA C22.2 No. 236, Fourth Edition, October 14, 2011.
c) The unit must be ETL certified.
d) The insulation shall comply with NFPA 90A requirements for flame spread and smoke generation.
e) Unit must be free of fabrication defect and maintain proper operation under normal use for a period of ***two years*** from purchasing date.
f) Unit must be fully tested before delivery.

3.0 CONSTRUCTION

3.1 CABINET

a) The cabinet must have a double-wall construction with a 1-inch thick fiberglass insulation.
b) The floor of the unit must be insulated 1 inch with fiberglass and protected with a 22-ga galvanized steel sheet metal.
c) The interior and external wall must be made of G90 galvanized steel 22 ga.

d) The exterior wall of the unit must be made of prepainted steel 22 ga. The paint must be made of a silicone-based polyurethane and withstand 150 rubs (back and forth) with methyl ethyl ketone (MEK) when tested as per ASTM-D5402. [Optional]
e) The interior wall must be designed to support the structural loads of the cabinet.
f) The structural base of the unit must be constructed with 14-gauge galvanized steel.
g) The peripheral base must be equipped with lifting lugs.
h) The access doors must be equipped with ¼ turns handles with integrated locks.
i) The access doors must be equipped with 180° hinges.
j) The cabinet must allow access to all inside components and allow access for maintenance on one side of the unit; no clearance is needed on the back side.
k) The cabinet must be constructed in a manner that there are no screw tips inside the unit.
l) Every joint must be sealed with polyurethane-based high strength elastomeric sealant that contains no solvents or isocyanates.

3.2 Rotary Air-to-Air Energy Recovery Wheel

a) The energy recovery component shall incorporate a rotary wheel air-to-air heat exchanger in an insulated cassette frame complete with seals, drive motor and drive belt.
b) The total energy recovery wheel shall be coated with silica gel desiccant permanently bonded by a patented and proprietary process without the use of binders or adhesives, which may degrade desiccant performance. The substrate shall be lightweight polymer and shall not degrade nor require additional coatings for application in marine or coastal environments. Coated segments shall be washable with detergent or alkaline coil cleaner and water. Desiccant shall not dissolve nor deliquesce in the presence of water or high humidity.
c) The wheel shall be provided with removable energy transfer matrix. Wheel frame construction shall be a welded hub, spoke and rim assembly of stainless, plated and/or coated steel and shall be self-supporting without matrix segments in place. Segments shall be removable without the use of tools to facilitate maintenance and cleaning. Wheel bearings shall be selected to provide an L-10 life in excess of 400,000 hours. Rim shall be continuous rolled stainless steel. Wheels shall be connected to the shaft by means of taper lock hubs.
d) All diameter and perimeter seals shall be provided as part of the cassette assembly and shall be factory set. Drive belt(s) of stretch urethane shall be provided for wheel rim drive without the need for external tensioners or adjustment.
e) The energy recovery cassette shall be an Underwriters Laboratories Recognized Component for electrical and fire safety. The wheel drive motor shall be an Underwriters Laboratory Recognized Component and shall be mounted in the cassette frame and supplied with a service connector or junction box. Thermal performance shall be certified by the manufacturer in accordance with ASHRAE Standard 84, Method of Testing Air-to-Air Heat Exchangers and ARI Standard 1060, Rating Air-to-Air Heat Exchangers For Energy Recovery Ventilation Equipment. Cassettes shall be listed in the ARI Certified Products Directory and bear the ARI Certified Product Seal.

3.3 FANS

a) The supply and exhaust fan must be double with double inlet forward curve.
b) The Supply and Exhaust fan must be Plenum type with a direct drive.
d) The bearings must be sealed and permanently lubricated.
e) The fans must be dynamically and statically balanced.
f) The drive assembly must be with pulley and adjustable sheave mounted on an 11-gauge galvanized steel base.
g) The performances of the fans must be tested as per AMCA-210 standard.

3.6 FILTERS

a) Each air circuit must have 2-inches thick pleated and replaceable filters.
b) Filters must be installed ahead the Energy recovery wheel in both air stream to protect the wheel against dust and airborne contaminant that may reduce its efficiency.
c) Fresh air circuit filters must be MERV8 rated when tested as per ASHRAE 52.2 standard.
d) Exhaust air circuit filters must be MERV8 rated when tested as per ASHRAE 52.2 standard.

3.7 ELECTRICAL WIRING

a) The unit must have a single point power connection.
b) The unit voltage must be 575 V/3 Φ/60 Hz.
c) The unit must be equipped with a non-fused disconnect NEMA 4.
d) The electrical data must be as specified on schedule.

3.8 FROST CONTROL [UPDATE THIS SECTION IN LINE WITH OPTIONS FROM SECTION 4.0.]

a) Defrost must be controlled with a temperature sensor.
b) ERV must come with Exhaust only defrost setting.
   - The unit will undergo cycles of exhaust only. The fresh air motor will stop, and fresh air motorized damper will close for a duration depending on the outside air temperature.

3.9 CONTROLS

a) The unit shall be provided with factory mounted and factory wired microprocessor controls and sensors.
b) The unit controller shall be BACnet compatible for future.
c) The unit shall be able to be controlled by Dry contact,
d) Unit must be able to provide a 24VAC 20VA power supply for external accessories.
e) Every component shall be properly protected against current overload.
f) Each motor must have its own magnetic contactor and thermal overload.

4.0 FROST PROTECTION/DEFROST

4.1 RECIRCULATION

a) The wheel defrost must be made with air recirculation cycles.
b) The unit will undergo cycles of recirculation where the exhaust air motor will stop, the fresh air motorized damper will close, and the recirculation damper will open for a duration depending on the outside air temperature.

4.2 Wheel Speed Variation

a) The wheel's motor will be controlled using a VFD.
b) The unit will monitor the exhaust air temperature using a Temperature sensor and will vary the wheel speed in order to maintain it above freezing.

6.0 Options

6.1 Dirty Filters Contacts

a) Each set of filters in the unit must be equipped with an air pressure drop switch that closes when the filters are dirty.

6.2 Low Temperature Limit

a) A temperature sensor monitors the supply air temperature and stops the unit if the temperature drops below an adjustable set point. [Available with post-heating only].

6.3 Low Airflow Switch

a) Opening of a dry contact (NC) when no airflow is detected on supply blower.

6.4 Phase Loss Detection

a) A sensor monitors all three phases of the power supply and stops the unit if a phase is lost.

6.5 Motorized Damper Fresh Air

a) Motorized damper on the fresh air duct made of extruded aluminum insulated and activated with an actuator. Dampers must be low leaks and have integrated thermal breaks.

6.6 Motorized Damper Exhaust

a) Motorized damper on the exhaust air duct made of extruded aluminum insulated and activated with an actuator. Dampers must be low leaks and have integrated thermal breaks.

6.7 Backdraft Damper Exhaust

a) Non insulated backdraft damper made of extruded aluminum on the exhaust air opening.

6.8 Wheel Rotation Detection Sensor

a) An induction sensor confirms the wheel rotation and triggers an alarm if the wheel isn't operating properly

6.9 VFD on Motors

a) Each motor speed must be controlled with variable frequency drive.

6.10 Independent Blower Control

a) Each motor can be started/stopped individually with external dry contacts.

6.11 Free-Cooling Management

a) The unit will monitor the outside air temperature and automatically set the unit into free-cooling mode when the outside air temperature allows it.

6.12 Roof Curb

a) The unit must come with a 24 inches high insulated roof curb.

1 GENERAL

1.1 This section of the specification shall be read in conjunction with and be governed by the requirements outlined in Section 15010.

1.2 Shop drawings
- .1 Submit shop drawings in accordance with Section 20M01 01.
- .2 Indicate:
  - Equipment, capacity, piping, and connections.
  - Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, sizes and location of mounting bolt holes.

1.3 Maintenance data
- .1 Provide maintenance data for incorporation into maintenance manual specified in Section 23 00 00

2 PRODUCTS

2.1 General
- .1 Finish cabinet shall be 16 gauge with factory applied baked enamel finish. Colour to match wall architectural colour.
- .2 Provide for noiseless expansion of all components.
- .3 Radiation to give output indicated on the schedule.

2.2 Force flow unit heaters
- .1 Cabinet: type as indicated, 16 gauge steel with rounded exposed corners and edges, removable panels, glass fibre insulation and integral air outlet and inlet.
- .2 Coils: aluminium fins mechanically bonded to copper tubes. Capacity as indicated in schedule.
- .3 Fans: centrifugal double width wheels, statically and dynamically balanced, direct drive, sleeve bearings, resilient mounted.
- .4 Motor: multi-speed, tapped wound permanent split capacitor type with sleeve bearings, built-in thermal overload protection and resilient rubber isolation mounting.
- .5 Filters: permanent washable type.
- .6 Provide integral control system incorporating heavy duty switch with integral thermal overload with integral/remote electric thermostat as shown.
- .7 Control: 3 speed switch located in cabinet.
- .8 Model as per schedule.
- .9 Unit covers shall have vandal proof access doors.
- .10 Standard of Acceptance: Engineered Air, Rosemex, Sterling, Durham Bush.

3 EXECUTION

3.1 Installation - General
- .1 Install according to piping layout. Provide for pipe movement during normal operation.
- .2 Maintain proper clearance around equipment to permit performance of service maintenance. Check final location with Consultant if different from that indicated prior to installation.
- .3 Should deviations beyond allowable clearances arise, request and follow Consultant=s

directive.

.4 Refer to manufacturer=s installation drawings. Verify electrical service work with characteristics stamped on unit.

.5 Check that all openings for appurtenances and operating weight conform to shop drawings.

.6 Valves:

.1 Install valves with steams upright or horizontal unless approved otherwise.

.2 Install isolating gate valves or ball valves and balancing valves on each force flow unit.

.3 Provide screwdriver vent on force flow heaters. Clean all finned tubes and comb straight.

END OF SECTION

1 General

.1 General Requirements

.1 Conform to General Conditions for Mechanical Trades

.2 Related Work Specified Elsewhere

(1) General Conditions for Mechanical Trades
(2) Heating, Ventilation & Air Conditioning
(3) Heating, Ventilation & Air Conditioning Equipment
(4) Electrical

.2 Description of System

.1 Furnish and install all components, devices and control wiring for a fully integrated Energy Management and Environmental Control System incorporating Direct Digital Control (DDC), and equipment monitoring. The system shall control/monitor HVAC and plumbing equipment and systems as specified in this section. The work shall include but is not limited to the following:

(1) All necessary hardware, software, control panels, web access modules, control wiring, field devices, installation, documentation and owner training as specified.
(2) The installed system shall incorporate electronic and digital control devices to perform the control sequences and monitoring outlined herein. Specific control sequence requirements are as detailed elsewhere in this Section of the specification.
(3) VVT zone control dampers shall be installed in the duct system by the Sheet Metal Trade complete with necessary duct transitions, access doors, etc. The Temperature Control Contractor shall be responsible for coordination with the HVAC Contractor and the installation of the actuators.
(4) Control valves shall be installed in the piping system by the Mechanical Trade complete with transitions and unions as required.
(5) Testing, debugging, calibrating, adjustment, programming and confirmation of total system operation.

.3 Manufacturer and Installing Contractor

.1 The temperature control manufacturer shall be Distech Controls – local rep 519-893-2638.

.2 Any new building must be a seamless extension of the current Energy Management and Building Control System.

(1) The existing TAC Vista software is, and shall continue to be, the only head-end BAS server for the entire School Board.

(2) The head-end server contains the secure Energy Management Settings (i.e. Master Setpoints & Schedules) that are sent to all schools in real-time. The control system must be an extension of the head-end server and be able to be managed exclusively through the Vista head-end server.
(3) Monitoring of all school board control systems are done in real-time and must be presented at the exclusive Vista head-end server as first-priority data.
(4) The Vista head-end server has all the required controller databases and software to be able to centrally maintain and modify network configuration and controller software for the entire School Board. The Vista head-end server is the only system that can access the LacNet programming variables inside the controllers for real-time configuration of setpoint and time scheduling parameters.
(5) The graphics and controller database must be presented inside the Vista head-end server in its native format in order to preserve the real-time speed, integrity and multi-site administration of the entire system.

.3 The controls company shall have a service office and maintenance facility with in 6 kilometers of the Waterloo Region District Public School Board main office. The controls company shall be able to provide service to any school within 4 hours during normal working hours.

.4 Quality Assurance

.1 The system components shall be listed by Underwriters Laboratories Inc. and Canadian Standards Association.

.2 The system control products shall be stored and handled according to manufacturer's recommendations.

.3 The work shall be performed by skilled technicians all of whom shall be properly trained and qualified for this work.

2 PRODUCTS

.1 General

.1 The system shall integrate the operation of intelligent building management controllers distributed into the network.

.2 Provide web based access. Two Ethernet connections for communication shall be provided by the Electrical Division.

.3 The DDC System shall be generally comprised of the following devices to achieve the control functions described in this section:

(1) Distech Controls programmable controllers.
(2) Network repeaters as required by network lengths.

(3) Control relays.
(4) Control dampers and valves.
(5) Sensors, actuators and other input/output devices.

.4 Controllers shall execute the application programs, calculations, and commands to provide the control function specified for that unit. Each controller shall include its own micro-computer controller, power supply, input/output modules, termination modules and real time clock.

.5 Controllers shall be capable of full control functionality and alarm reporting independently or as a part of the DDC network.

.6 The system shall be stored in flash ram so no batteries are required.

.7 Each control device shall be modular and expandable to provide additional inputs and outputs and control functionality for that device

.8 Each controller shall be able to transfer and receive data via the network for performance of control functions.

.9 The system shall be modular, permitting expansion by adding hardware and software without changes in communication or processing equipment.

.10 The complete system shall be capable of communication over a BACnet network.

.11 The controllers shall monitor the status of all overrides and include this information in logs and summaries to inform the operator that automatic control has been inhibited.

.12 Controllers shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all subsidiary equipment and provide both local and remote annunciation of any component failures.

.13 Controllers shall activate an orderly shutdown of their operation in the event of loss of normal electrical power. Non-volatile memory shall be incorporated for all controller configuration data. The controllers shall automatically resume full operation without manual intervention.

.14 The controllers shall have sufficient memory to support their own operating system and data bases including:

(1) control processes
(2) energy management applications
(3) alarm management
(4) trend data
(5) operator input/output
(6) remote communications

(7) manual override monitoring

.15 Controllers shall incorporate the following software features:

(1) Energy management:
  (a) Time of Day Scheduling
  (b) Calendar Based Scheduling
  (c) Holiday Scheduling
  (d) Optimal Start and Stop
  (e) Demand Limiting
  (f) Heating/Cooling Interlock

(2) Alarm Management:
  (a) Alarm Management shall be provided to monitor, buffer and direct alarm reports to operator devices and memory files. The controllers shall perform alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic and prevent alarms from being lost.
  (b) All alarm or point change report shall include the points' English language description and the time and date of occurrence.
  (c) The user shall be able to define the specific reaction for each point, the priority level (3 in total) and ability to inhibit alarm reporting for each point.
  (d) The user shall be able to define conditions under which point changes need to be acknowledged by an operator and logged for analysis at a later date.
  (e) The user shall be able to print, display or store a unique 60 character alarm message to more fully describe the alarm condition or direct operator response. The message shall be customizable to describe each individual alarm.
  (f) In web access applications only critical alarms shall initiate a call to a remote operator device, otherwise call activity shall be minimized by time stamping and saving reports until a manual request is received or until the buffer space (minimum 50 alarms) is full.

(3) Trend Logs:
  (a) Controllers shall provide an automatic roll-over trend log, which stores records up to an operator-selected number at an operator-selected sampling rate and then overwrites the oldest record with each new record.
  (b) Sample intervals shall be from 1 minute to 24 hours.
  (c) Provide graphical and tabular displays

(4) Runtime Totalization:
  (a) The controllers shall automatically accumulate and store runtime hours for binary points with a sampling resolution of 1 minute. The user shall have the ability to define a warning limit to trigger maintenance or user-defined messages.

(5) Event Totalization:
  (a) Controllers shall have the ability to count events (such as on/off) and store up to 10 million events before reset with a user-defined limit used to trigger a user-defined message.

(6) Custom Programming:
  (a) The controllers shall permit user defined custom control processes based on:
    (i) any system measured data or status
    (ii) any calculated data
    (iii) any results from other processes
    (iv) Boolean logic
  (b) The custom processes may be triggered by:
    (i) Time-of-day
    (ii) calendar date
    (iii) events (point alarm etc.)

.16 The control strategy for each control loop shall be performed by software within the controller. The sequence of events required for each control loop is described for each system in the control sequence.

.17 Outdoor air temperature indication shall be available at each controller as an integral part of the control strategies for that controller. Should the network transmission of the common outdoor air temperature (or any other common value) fail, then each controller shall use the last good value received.

.18 Controls and Requirements for VVT Systems

(1) Where VVT controls are specified, units are to operate as part of a Variable Volume/Variable Temperature System complete with all necessary controls including zone dampers, temperature sensors, static pressure sensor probes and bypass damper.
(2) There shall be no zone controllers for the room control. Control shall be from a designated programmable controller for each air handling unit to ensure information transfer is fast enough to react to the changes in the environment.
(3) The VVT Control System shall include but not be limited to individual DDC room/zone sensors, corresponding zone dampers, bypass damper, connecting communication network, all required duct sensors, all required relays and other required control components and algorithms for complete control of the HVAC system according to the sequence of operation.
(4) Each VVT system shall be capable of operating as a stand alone system. Note that each VVT rooftop unit shall have its own designated controller that controls all zones directly in order to keep information exchange quicker and more efficient.

.2 Network Architecture

.1 The controllers on the local network shall communicate via a two wire LonTalk TP/FT-10 network.

.2 The control network shall be able to expand to match the requirements of the facility, including any future building additions.

.3 The control network shall be able to support a total developed length of 305 meters without using a network repeater.

.3 Control Panels

.1 Control panels shall be fully enclosed cabinets with all steel construction. Cabinets shall have a hinged door with locking latch or bolt-on cover plate. All cabinet locks shall be common keyed. Cabinets shall be finished with two coats of paint.

.4 Temperature Sensors

.1 Provide thermistor temperature sensors, not requiring transmitters, to measure temperature.

.2 Accuracy shall be +/-0.2°C from 0 to 70°C.

.3 Space sensors in occupied areas shall be Greystone TE200 series, type AE or Distech Smart Comfort SO having an integral push button for unoccupied override and an integral slider to adjust set point (LED display not required).

.4 In corridors and where noted on the drawings, provide stainless steel plate type sensors (push button override and LED display not required), Greystone TE200 series, type AS or equal.

.5 Duct temperature sensors shall be Greystone TE200 series, type B or equal having a stainless steel probe length to suit application and ABS enclosure. Duct averaging temperature sensors shall be Greystone TE200 series, type FD or equal having an element length to suit application, copper probe and ABS enclosure.

.6 Immersion temperature sensors shall be Greystone TE200 series, type C or equal having a ¼" OD stainless steel probe, 4" long and ABS enclosure. Immersion sensors shall be complete with thermowells. Thermal conductive compound shall be added inside the thermowell to provide optimum thermal transfer from the fluid to sensor. Stainless steel thermowells shall be used for steel pipe and brass thermowells shall be used in copper pipe.

.7 Outdoor temperature sensors shall be Greystone TE200 series, type F or equal having an ABS gasketed cover. A thermal radiation cover shall limit the sensor to solar radiation exposure.

.5 Carbon Dioxide Sensors

.1 Sensors shall Greystone CDD series or equal having the following features:

(1) 0-2000 ppm factory default detection range, field adjustable.
(2) Non-dispersive infrared sensing element with self-calibration algorithm.
(3) Guaranteed 5 year calibration interval.
(4) Powered by either AC or DC source.

(5) Accuracy: within 50 ppm or 3% of reading (whichever is greater).
(6) Operating humidity range: 0-95% RH.
(7) Operating temperature range: 0 to 50°C or greater.
(8) Stability: less than 2% full scale in 15 years
(9) Response time: less than 2 minutes for 90% step change.

.2 Duct mounted sensors shall be complete with ABS enclosure complete with sampling tube.

.3 Space mounted sensors shall be executive space type without LCD display.

.6 VVT System Dampers and Operators

.1 Rectangular dampers shall be Nailor 1010 or equal, parallel blade type complete with blade and edge seals. Use low profile dampers for heights less than 12" (300 mm). Dampers with heights less than 10" (250 mm) shall be single blade.

.2 Round dampers shall be Nailor 1090 or equal complete with blade gaskets and mounting bracket.

.3 Actuators shall be Belimo LMB24-SR-T or equal, proportional control, non-spring return, direct coupled, 24 V for 2-10 VDC or 4-20 mA, 45 in-lb torque, suitable for a maximum damper size of 6 square feet.

.7 Water Control Valves

.1 Heating and cooling control valves shall be Belimo CCV series characterized ball valves, complete with chrome plated brass trim and NPT female pipe connections. Radiation valves shall be complete with non-spring return modulating actuators. Control valves for coils heating a portion of outdoor air shall have spring return modulating actuators.

.2 Control valves shall be sized to provide approximately one half the circuit branch pressure drop to obtain good modulation control but they shall be no smaller than two pipe sizes less than the pipe they are installed in.

.3 Control valves in contact with domestic water (domestic flush valve) shall be Belimo HTCCV high temperature characterized ball valve with stainless steel ball and stem, NPT female pipe connections and TFX24 spring return to closed position actuator.

.8 Differential Pressure sensors

.1 Differential pressure sensors shall be provided for liquid or air differential pressure applications. The differential pressure range shall be selected to match the application. Select materials suitable for the measured variable, i.e.: water or air, and to withstand a minimum of two times the maximum pressure of the highest pressure range.

.2 Each sensor shall be provided with an industry standard, 0 to 10 Vdc output signal mounted at the sensor. The transmitter and sensor shall have a combined accuracy and repeatability of 1.0% of the differential pressure range. A pushbutton zero adjustment shall be provided.

.9 Freezestats

.1 Freezestats shall be complete with a vapour filled 20 foot bulb and 4 foot capillary. Wire freezestats to shut down the respective fans should temperature over any 12 in. of sensor length drop below the adjustable setpoint (2°C). Freezestats shall have manual reset.

3 EXECUTION

.1 Installation

.1 All controllers and components in the system and on the network shall be installed according to manufacturer recommendations, general installation standards for digital controls and in accordance with the approved shop drawings.

.2 Locate room sensors in the locations shown on the mechanical drawings. All sensors shall be mounted at barrier free height (3’-11” (1175 mm) above finished floor).

.3 All control components for off site system access shall be located where noted on the drawings. The Electrical Contractor shall provide all required connections / cabling for off site access to the web access components.

.4 All programmable controllers, web access components, relays and other control components shall be located within control panels. Control Panels shall be wall mounted and shall be located within suspended ceiling spaces or other locations approved by the Consultant.

.5 The Electrical Contractor will provide hand-off-auto switches in all starters controlled by the BAS.

.6 The Electrical Contractor will provide dedicated 120 VAC, 15 ampere power circuits wired to junction boxes on each floor for controls transformers.

.7 The supply of all motorized temperature control dampers complete with actuators shall be by this Section, except for dampers and actuators supplied with packaged air handlers. All dampers shall be installed into the duct system by the HVAC Trade complete with necessary duct transitions, access doors, etc. The Temperature Control Contractor shall be responsible for the actuators and all coordination with the HVAC Contractor.

.8 The supply of all automatic control valves shall be by This Section. All valves shall be installed into the piping system by Plumbing Trade complete with necessary fittings, etc. The Temperature Control Contractor shall be responsible for all coordination with the Plumbing Contractor.

.2 Generally duct mount carbon dioxide sensors shall be used where specified for air handling units; but, for gyms and single zone libraries, a wall mount carbon dioxide sensor shall be mounted next to the room temperature sensor.

.3 All carbon dioxide levels which are measured by the carbon dioxide sensors shall be made available to the Owner in the form of trend logs. Record readings at 10 minute intervals and keep them for at least 30 days.

.4 Freezestats shall be installed so that their sensing element runs horizontally across the coil face (not diagonally) with no more than 12" vertical drops at the outside coil frame. The full face of the coil shall be covered with no horizontal runs being more than 12" apart. The top and bottom horizontal run shall be within 6" of the coil frame. If more than one freezestat is required they shall be wired in series in order to detect a low temperature in portion of the coil. The sensing elements shall be firmly secured in place to avoid vibration without added air restriction.

.5 System Start-up and Acceptance

.1 Upon completion of installation, test, adjust and calibrate controls provided under this Section.

.2 On system completion, a demonstration of complete system operation shall be made to the Owner's authorized representative and Consultant.

.3 The Consultant shall verify through the Owners representatives that the entire system is complete and operating to the satisfaction of the Owner before final acceptance is approved.

.6 Training

.1 The Contractor shall provide competent instructors to give full instruction to designated personnel in the adjustment, operation and maintenance of the system installed rather than a general training course. Instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach. All training shall be held during normal work hours of 8:00 a.m. to 4:30 p.m. weekdays as follows:

.2 Provide 4 hours of training for Owner's operating personnel. Training shall include:

(1) Explanation of drawings, operations and maintenance manuals
(2) Explanation of web access program
(3) Explanation of adjustment procedures
(4) Trend Analysis

.7 Identification

.1 Provide system identification and provide nameplates identifying the following (nameplates shall be keyed to the wiring diagrams):

(1) Duct mounted sensors.
(2) Control panels (identify as to equipment / systems controlled). Each panel shall include an as-built drawing showing all the connected control points.
(3) Identify the emergency ventilation control switch with 'GLOBAL ROOFTOP UNIT CONTROL - VENTILATION LOCKOUT'

.8 Testing and Balancing

.1 During the system testing and balancing by the Testing and Balancing Agency, demonstrate the operation of all controls. During balancing procedures, set controls to a fixed mode (bypass damper locked fully closed and all zone dampers locked fully open) to prevent any changes during the balancing procedure.

.2 To ensure excessive noise is not generated by the VVT systems, the following shall be performed:

(1) For each VVT system, the Test and Balance Agency shall measure the static pressure in the main duct at the location of the bypass damper using a manometer when the system has been stabilized (all zone dampers are full open and the bypass damper is full closed). This information shall be given to the Temperature Control Contractor for verification that the VVT system is properly calibrated.
(2) For each VVT system, 10% of the dampers shall be set to the full open position and 90% shall be set at their minimum position (fully closed). When operating with these damper positions, the static pressure in the main duct at the location of the bypass damper shall again be measured by the Test and Balance Agency using a manometer to ensure it remains at the value measured when in the stabilized mode. This information shall be given to the Temperature Control Contractor for verification that the VVT system is operating correctly and is properly calibrated.

.9 Electrical Wiring

.1 Control transformers for the building automation / VVT temperature control systems shall be supplied and wired by the Temperature Control Trade from 120 V power sources in junction boxes provided by the Electrical Contractor. (At least one at each end of each floor accessible above ceiling tile in a corridor). All low voltage wiring (below 50 V) to the building automation / VVT temperature control systems shall be by the Temperature Control Contractor.

.2 The electrical contractor will rough-in thermostats in new and or existing concrete block walls.

.3 All wiring shall be installed to the standards specified in the Electrical Division.

.4 Use Echelon recommended orange jacket cable for all network wiring.

.5 Run all wiring in EMT conduit where exposed, where running within concrete block walls and where required by the Ontario Electrical Code (conduit supplied and installed by the Temperature Control Contractor). Plenum rated cable shall be used in return air ceiling plenums.

.6 Where wiring runs through Corridor suspended ceiling spaces, run in wall hooks where possible. The wall hooks shall be provided by the Electrical Contractor where indicated on the electrical drawings.

.7 Control relays necessary for BAS operation shall be provided by the Temperature Control Contractor but all contactors and their power supplies handling power wiring to the equipment shall be by the Electrical Contractor.

.10 General Requirements for VVT Systems

.1 Each VVT system shall be capable of maintaining an independent setback schedule. If any over-ride pushbutton in the associated system is activated, the complete VVT system shall reset to occupied mode for a pre-set time period. At the end of the override time period, setback mode will resume.

.2 Each zone thermostat shall be capable of maintaining independent comfort setpoints, adjustable by the zone occupants. The upper and lower limits of the permissible setpoint range shall be adjustable by the operator.

.3 When the HVAC unit is not in the heating or the cooling mode, the system shall go to ventilation mode. Ventilation mode is automatically sequenced every 20 minutes to avoid stale air in the space. The duration of ventilation mode is 5 minutes, after which the system resumes heating / cooling mode as required.

.4 Zone damper control shall be proportional modulation, not two- position control. Each zone thermostat shall be capable of initiating a heating or cooling mode. Averaging zone systems are not acceptable.

.5 The pressure control system must display duct static pressure and modulate the bypass damper or supply fan speed to maintain the desired system static pressure. During changeover from heating to cooling or cooling to heating the bypass controller will take control of all dampers in order to purge the duct system of extreme temperature air. Systems that use a time delay during system mode changeover are not acceptable.

4 Sequence of Operation

.1 General:

.1 All setpoints shall be adjustable.

.2 Outdoor air temperature shall be broadcasted to all controllers.

.3 A new outdoor air sensor shall be provided on a different north face and the minimum of this sensor and the original will be used for this building.)

.4 Heating mode: Heating is enabled between October 15 and April 15 or if the outdoor air temperature is below 10°C. This heating mode is used in all controllers for the building.

.5 Cooling Mode: Mechanical cooling is enabled if the outdoor air temperature is above 14°C.

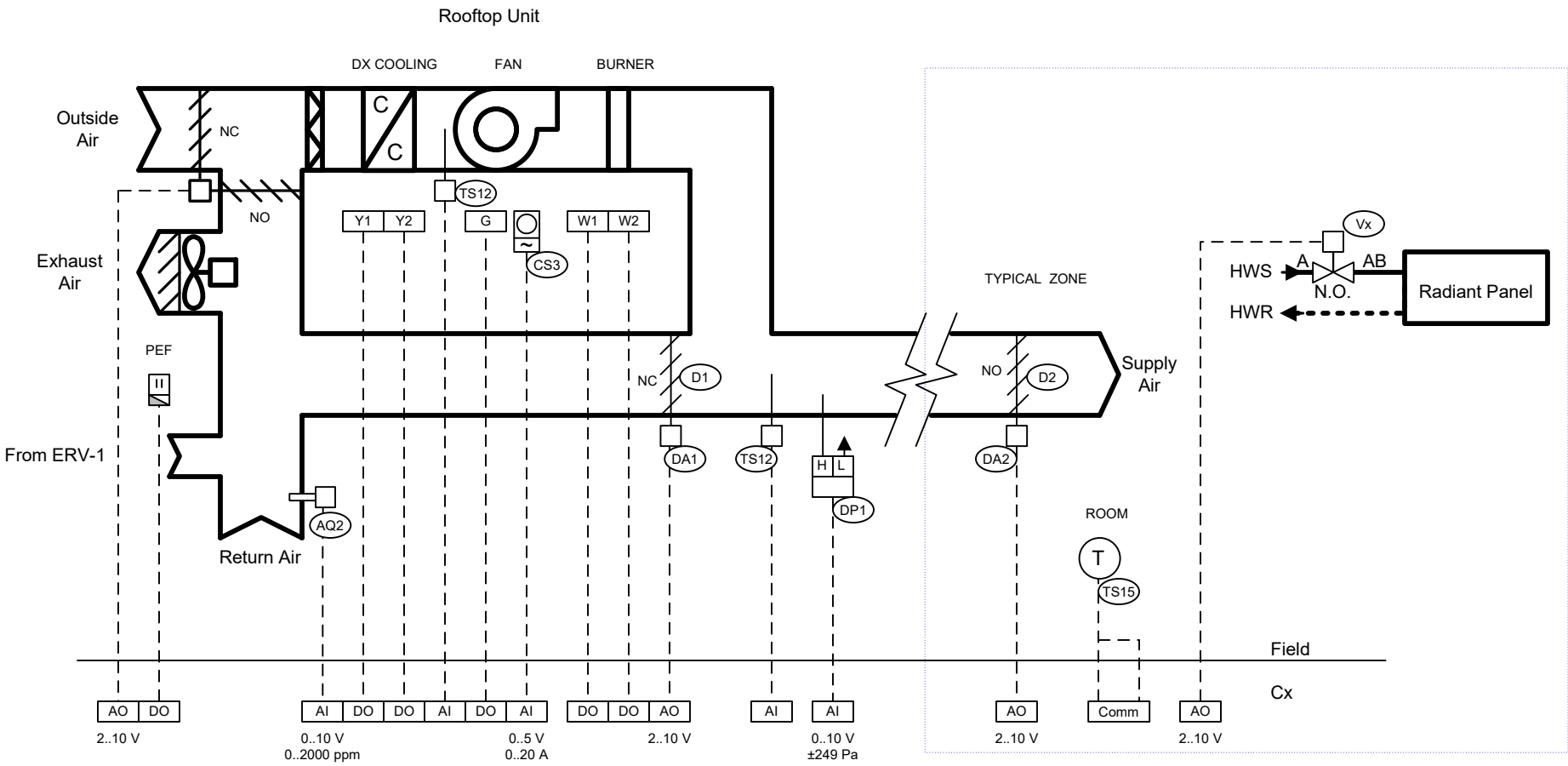
.6 Carbon Dioxide Damper Override: In any air handling system with a return air or room air carbon dioxide sensor, it shall override the minimum position of the outdoor air damper during occupied mode. It shall override the minimum outdoor air damper between 0 and 40 % as the carbon dioxide varies between 1000 and 1200 ppm. All limit controls shall take priority to maintain safe supply air temperatures. An alarm shall be generated if the carbon dioxide level is higher than 1700 ppm or lower than 200 ppm.

.7 Occupancy mode shall be determined by a weekly schedule with an annual holiday schedule. Each system shall have this schedule but there shall be provision for operating under a general (to the building) schedule as well. An adjustable parameter shall be available to select the local or general schedule for each system.

.8 Lead/lag: Devices designed for lead lag operation shall operate in automatic lead/lag mode to equalize run time. If the lead unit fails the lag shall automatically start and an alarm shall be generated. The lead unit shall be advanced through the series of devices in sequence every Tuesday at noon.

.2 See the graphical sequences at the end of this specification.

END OF SECTION



			Five Systems As Shown							
Unit	Serves	Supply Air	Zones	Cooling	Heating	Power Exh.	Rad Panels	Control	ERV	Notes
		(cfm)		Stages	Stages					
HVAC-1	Administration	1600	6	1	2	Yes	4	C1	No	
HVAC-2	North Wing SouthEast	2400	4	1	2	Yes	4	C2	ERV-1	
HVAC-3	North Wing SouthWest	4000	6	2	2	Yes	6	C3	ERV-1	
HVAC-4	North Wing NorthEast	3000	4	2	2	Yes	4	C4	ERV-2	
HVAC-5	North Wing NorthWest	3400	3	2	2	Yes	3	C5	ERV-2	

	Job #:	Owner: Waterloo Region District School Board	Drawn By:	Title: **VVT Rooftop Units**
	Job Name: Smithson Public School 2022 HVAC Upgrades		Revision Date: January 28, 2022	1

SEQUENCE OF OPERATION

UNOCCUPIED MODE

The supply fan is off, the power exhaust fan is off, the mixing dampers are in the 0% outside air position, the heating is off and the cooling is off. The bypass damper is in the 100% open position. The zone dampers are in the 50% open position. The system cycles on a call for unoccupied heating, with the supply air static pressure setpoint increased by 20%. If the override pushbutton is pressed, the system will switch to the occupied mode for 2 hours (adjustable).

OCCUPIED MODE

Fan Operation

The supply fan operates continuously. An optimized start routine is provided for heating and cooling.

Zone Damper

The room sensor modulates the zone damper between minimum and maximum settings to maintain setpoint. The setpoint is adjustable +/-1℃ at the sensor. The control is reverse acting when the supply air temperature is more than 1℃ above room temperature and direct acting when the supply air temperature is more than 1℃ below room temperature. If the system mode is different from the zone mode (e.g. system is in heating mode but zone requires cooling), the zone damper closes to a reduced minimum position to minimize overheating/overcooling.

System Heating/Cooling Decision Process

The system mode is determined by the number of zones that deviate from their respective zone heating/cooling setpoints. If the total number of zones requesting heating outnumber (or are equal to) the total number of zones requesting cooling, the system will go to heating mode. If the total number of zones requesting cooling outnumber the total number of zones requesting heating, the system will go to cooling mode. Once in the heating or cooling mode, the reference zone becomes the zone with the greatest call. The system will lock-in the selected mode until all zones are satisfied. If any zone is deprived of ventilation air for more than 20 minutes, the system will "unlock", go into forced ventilation mode for 5 minutes, and then reselect the required mode of operation. Zones designated as "slave zones" (typically corridors) cannot request heating or cooling, but will utilize heating/cooling when it is available.
The rad valve operates as the first stage of heating.

Ventilation Mode

The system operates in ventilation mode (no heating or cooling) under the following conditions:

1) No zones are calling for heating or cooling.
2) System is switching between heating and cooling (system operates in ventilation mode for 5 minutes).
3) One or more zones have been operating at a reduced min. position for more than 20 minutes (system operates in forced ventilation mode for 5 minutes).

System Heating Control

Stage 1 and stage 2 heating are controlled from the reference zone as follows:

	Reference Zone Call for Heat
Stage 1 On	1.0℃
Stage 1 Off	0.5℃
Stage 2 On	1.5℃
Stage 2 Off	1.0℃

System Cooling Control

Stage 1 and stage 2 cooling are controlled from the reference zone as follows:

	Reference Zone Call for Cooling
Stage 1 On	1.2℃
Stage 1 Off	0.5℃
Stage 2 On	1.5℃
Stage 2 Off	0.9℃

SEQUENCE OF OPERATION (CONTINUED)

Economizer Operation

Economizer operation will be substituted for first stage cooling when the outside air temperature is suitable. The power exhaust fan runs when the outside air damper is more than 50% open. The CO_2 sensor will increase the amount of minimum outside air as the CO_2 level increases from 1000 ppm to 1200 ppm. During morning warm-up or cool-down the outside air minimum position is set to zero.

Bypass Operation

The supply air static pressure sensor modulates the bypass damper between minimum and maximum settings to maintain setpoint.

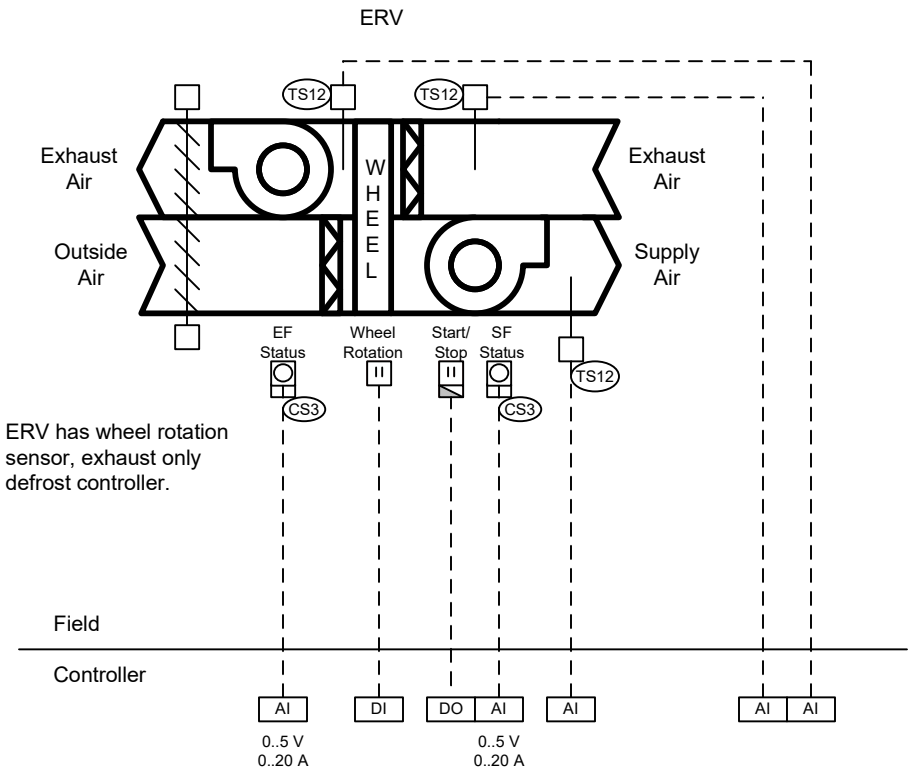
Limits & Safeties (VVT ver. 3)

1) If the outside air temperature exceeds the global free cooling setpoint, the mixing dampers return to minimum outside air position.
2) The maximum amount of outside air is limited based on the outside air temperature to prevent excessively low supply air temperatures during startup.
3) The mixed air temperature sensor acts as a low limit to ensure temperature does not fall below setpoint. In applications where the mixed air sensor is located after the DX coil, the setpoint is reduced when DX cooling is enabled.
4) The supply air temp. sensor acts as a high limit for heating (70/55℃, 60/45℃) and a low limit for cooling (5/10℃, 8/13℃).
5) The supply air temperature sensor acts as a software freezestat (1/5℃, 3 minute delay, auto reset after 5 minute delay).
6) The supply fan has a delay-off time of 90 seconds.
7) DX cooling has a minimum-off time of 5 minutes.
8) DX cooling is disabled when the outside air temperature is below the global DX disable setpoint or when the fan is off.
9) Gas heating is disabled when the outside air temperature is above the global heating disable setpoint or when the fan is off.
10) Stage 1 gas heating has a minimum run time of 3 minutes.
11) During ventilation mode, if the supply air temperature falls below 15℃ for more than two minutes, stage 1 heating will turn on until the temperature exceeds 25℃ (to improve comfort).
12) The default zone setpoint is increased by 1℃ when mechanical cooling is enabled (providing heating is disabled).
13) When the ventilation lockout switch is engaged, the outside air dampers close, and the system switches to unoccupied mode of operation.
14) Minimum outside air is set to zero when the global ventilation schedule is off (stand-by occupancy).

Alarms

An alarm will be generated upon the following conditions:

1) Fan status does not match start/stop signal.
2) Mixed air temperature too high (50/48℃) or too low (5/7℃).
3) Supply air temperature too high (65/63℃) or too low (5/7℃).
4) Space temperature too high (38/36℃) or too low (14/16℃).
5) Supply air static pressure too low (10/20 Pa) or too high (240/230 Pa).
6) Weekly fan runtime limit exceeded.
7) Return air CO_2 too high (1700/1650 ppm) or too low (250/300 ppm).
8) Software freezestat tripped.



		Four Systems As Shown		
UNIT	Air	Make	Control	Notes
	(cfm)	Model		
ERV-1	1500			Serves HVAC-2 & 3
ERV-2	1500			Serves HVAC-4 & 5

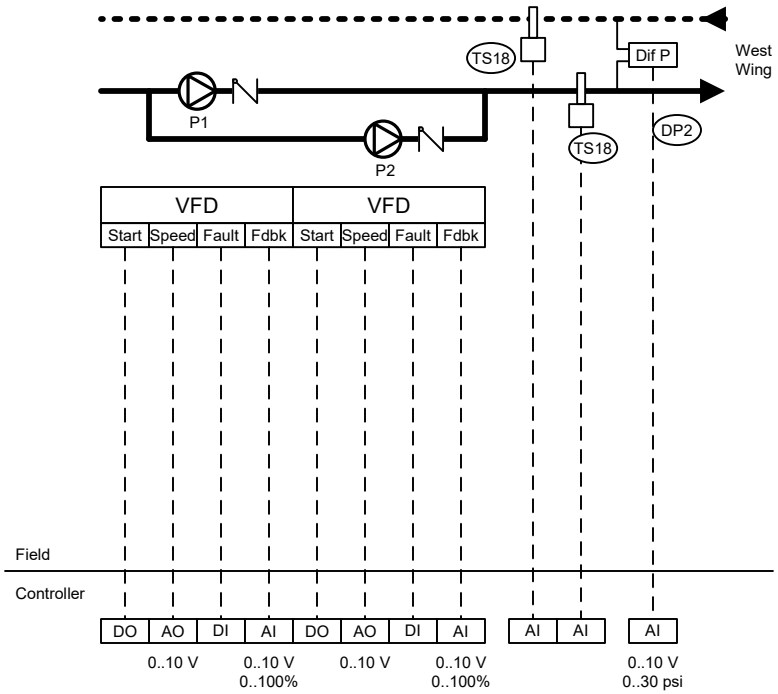
SEQUENCE OF OPERATION

Unoccupied Mode
The exhaust fan is off, supply fan is off, heat wheel is off and the dampers are closed.

Occupied Mode
The supply and exhaust fans run continuously when the associated rooftop unit is operating and the ventilation time schedule is on. The heat wheel operates from internal controls.

Limits & Safeties
1) The unit has internal frost controls (exhaust fan only).
2) The supply air temperature sensor acts as a software freezestat (-1/5°C, 3 minute delay, auto reset after 5 minute delay).
3) The fans stop on a fire alarm condition.
4) If all conected mixed air damper positions exceed 30% outside air, the ERV stops.

Alarms
An alarm will be generated upon the following conditions:
1) Supply fan or exhaust fan in incorrect state.
2) Supply air temperature too high (35/33°C) or too low (1/3°C).
3) Return air temperature too high (40/38°C) or too low (14/15°C).
4) Exhaust air temperature too high (40/38°C) or too low (-10/-8°C)..
5) Fan runtime exceeded weekly setpoint.
6) Wheel rotation in incorrect state.



SEQUENCE OF OPERATION

One of the pair of pumps runs continuously. Lead/lag switchover is provided weekly. Differential pressure sensor DP2 controls the pump speed to maintain setpoint. If one pump fails (30 s delay), or cannot maintain the differential pressure setpoint (5 minute delay), the other pump starts (and runs for minimum of 2 hours).

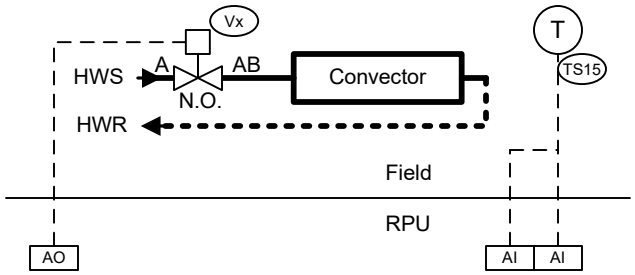
Alarms

An alarm will be generated upon the following conditions:

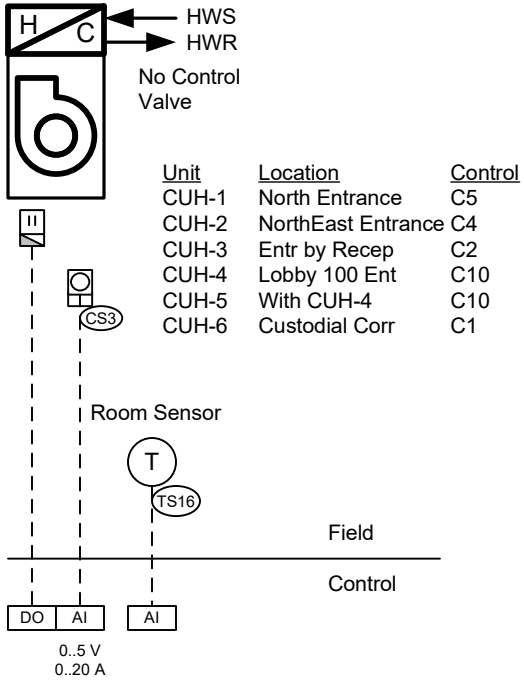
1) Loop supply water temperature too high (30/29℃) or too low (2/3℃).
2) Loop return water temperature too high (30/29℃) or too low (2/3℃).
3) Loop differential pressure too high (32/30psi) or too low (2/3psi, 5 min delay).
4) Pump in incorrect state.

PERIMETER CONVECTORS

CH3	Lobby 100	C10
CH7	Cust Closet 108	C1
CH8	Cust WR	C1



CABINET HEATERS



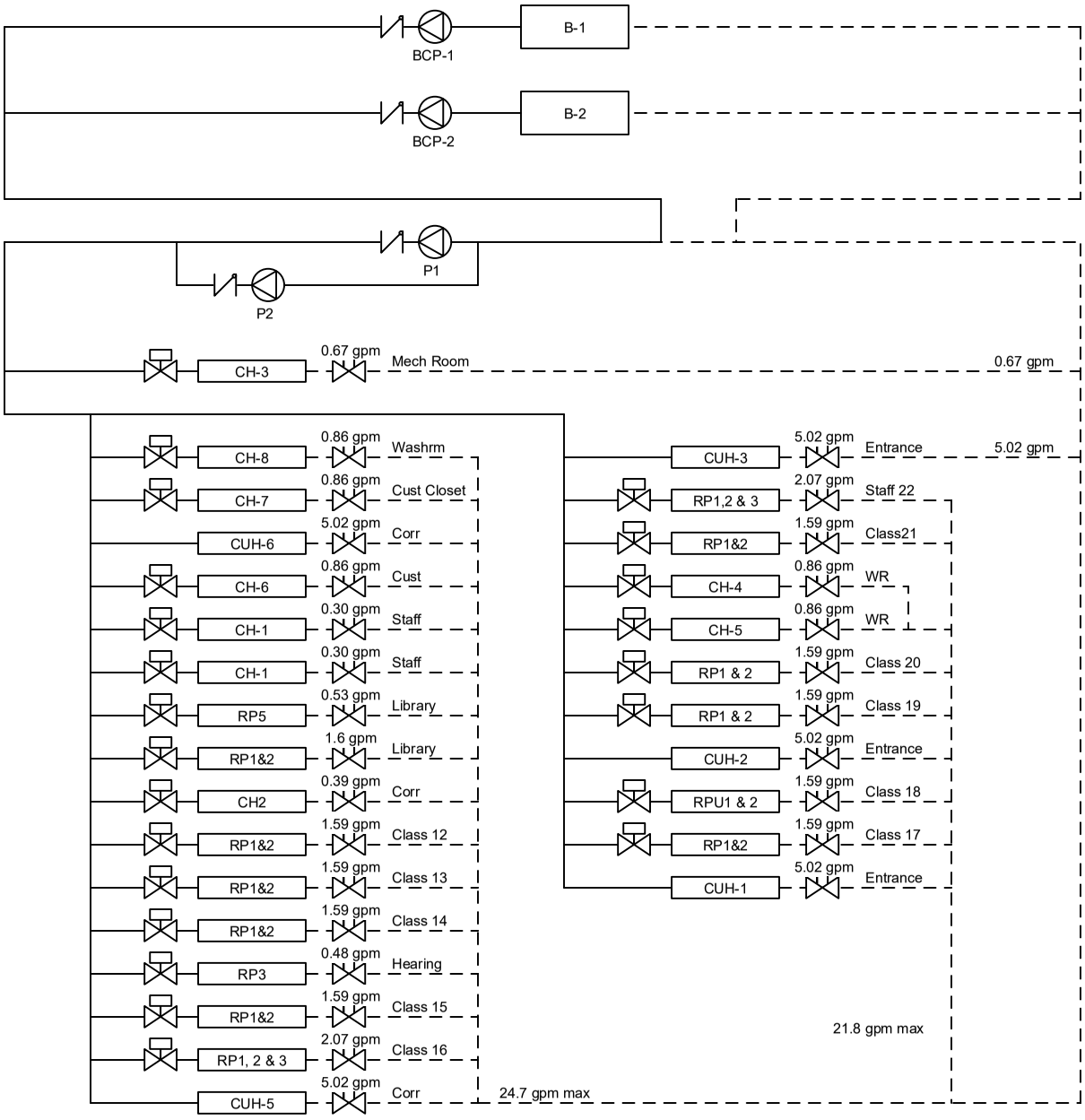
Unit	Location	Control
CUH-1	North Entrance	C5
CUH-2	NorthEast Entrance	C4
CUH-3	Entr by Recep	C2
CUH-4	Lobby 100 Ent	C10
CUH-5	With CUH-4	C10
CUH-6	Custodial Corr	C1

SEQUENCE OF OPERATION

Room sensor TS15 modulates the valve for heating to maintain room temperature setpoint, which is reduced during unoccupied hours.
Local setpoint adjust and pushbutton override is provided.
An alarm is generated at the BAS if the room temperature falls below 14°C.

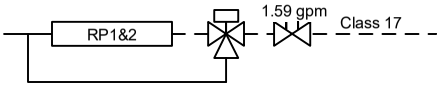
SEQUENCE OF OPERATION

Space sensor TS16 cycles unit heater for heating to maintain setpoint.
An alarm is generated at the BAS if the space temperature falls below 14°C.



Circuit 1	Circuit 2	Circuit 3	Circuit 4
0.67	0.86	2.07	5.02
	0.86	1.59	
	5.02	0.86	
	0.86	0.86	
	0.30	1.59	
	0.30	1.59	
	0.53	5.02	
	1.60	1.59	
	0.39	1.59	
	1.59	5.02	
	1.59		
	1.59		
	0.48		
	1.59		
	2.07		
	5.02		
0.67	24.65	21.78	5.02

3-Way Control Valve Detail



Circuit balancing valve x gpm

Automatic control valve

Hydronic Heating Piping Schematic

Drawn By:

Revision Date: February 17, 2022

Owner: Waterloo Region District School Board

Job #:

Job Name: Smithson Public School 2022 HVAC Upgrades

Tender Documents B20-349.02-A for

WRDSB – Smithson Public School
HVAC Upgrades and Interior Renovations

150 Belleview Avenue, Kitchener, Ontario

1.0 GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1 - 2012, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations.

.2 CSA C22.2. No. 0-10, General Requirements – Canadian Electrical Code Part II – Latest Edition.

.3 CAN/CSA-C22.3 No. 1-10, Overhead Systems – Latest Edition.

.4 CAN3-C235-83R2010, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.5 C22.2 NO. 18.1-13 - Metallic outlet boxes

1.2 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.

.3 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.4 Language operating requirements: provide identification nameplates and labels for control items in English.

1.3 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data: submit WHMIS MSDS in accordance with Section 01 47 15 - Sustainable Requirements: Construction and Section 02 61 33 - Hazardous Materials as applicable to this project.

.3 Shop drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada.

.2 Submit 2 copies of shop drawing product data to Engineer for review.

.3 If changes are required, notify Engineer of these changes before they are made.

.4 Shop drawings shall indicate clearly the materials and/or equipment actually being supplied, all details of construction, accurate dimensions, capacity, operating characteristics and performance. Each shop drawing shall give the identifying number of the specific piece of equipment etc. for which it was prepared (e.g. panel #2A).

.5 Each shop drawing for non-catalogue items shall be prepared specifically for this project. Shop drawings and brochures for catalogue items shall be marked clearly to show the items being supplied.

.6 Each shop drawing or catalogue sheet shall be stamped and signed by the contractor to indicate that he has checked the drawing for conformance with all requirements of the drawings and specifications, that he has coordinated this equipment with other equipment to which it is attached and/or connected thereto and that he has verified all dimensions to ensure the proper installation of equipment within the available space and without interference with the work of other trades. Ensure that mechanical co-ordination is complete before submitting drawings for review.

.7 Installation of any equipment shall not start until after final review of shop drawings has been obtained.

.8 When requested, shop drawings shall be supplemented by data explaining the theory of operation.

.4 Quality Control: in accordance with Section 01 45 00 - Quality Control as applicable.

.1 Provide CSA certified equipment and material.

.2 Where CSA certified equipment and material is not available, submit such equipment and material to ESA for special approval before delivery to site.

.3 Submit test results of installed electrical systems and instrumentation.

.4 Permits and fees: in accordance with General Conditions of contract.

.5 Submit, upon completion of Work, load balance report.

.6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Engineer.

1.4 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control as applicable.

.2 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices in accordance with authorities having jurisdiction as per the conditions of the Provincial Act respecting manpower vocational training and qualification.

.1 Employees registered in provincial apprentices' program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.

.2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.

.3 Site Meetings:

.1 In accordance with Division 01 Requirements .

.4 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety Requirements as applicable.

1.5 DELIVERY STORAGE AND HANDLING

.1 Material Delivery Schedule: provide Departmental Representative and Engineer with schedule within 1 week after award of Contract.

.2 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Construction/Demolition Waste Management and Disposal as applicable.

1.6 SYSTEM STARTUP

.1 Instruct Engineer and operating personnel in operation, care and maintenance of systems, system equipment and components.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant will aspects of its care and operation.

1.7 CONSTRUCTION DRAWINGS

.1 The drawings for the electrical work are performance drawings and diagrammatic, intended to convey the scope of the work and indicate general arrangement and approximate location of apparatus, fixtures and conduit runs. The drawings do not intend to show architectural

and structural details.

.2 Do not scale drawings. Obtain information involving accurate dimensions shown on architectural and structural drawings, or by site measurements. Consult general construction drawings as well as detail drawings to become familiar with all conditions affecting work, and verify spaces in which the work will be installed.

.3 Make, at no additional cost, any changes or additions to materials and/or equipment necessary to accommodate structural conditions (runs around beams, columns, etc.).

.4 Alter, at no additional cost, the location of materials and/or equipment as directed, provided that the changes are made before installation and any such outlet is not relocated in excess of 10' in any direction.

.5 Install all ceiling mounted components (luminaires, speakers, bells, etc.) in accordance with reflected ceiling drawings, approved by the Consultant.

.6 Leave space clear and install all work to accommodate future materials and/or equipment as indicated, and to accommodate equipment and/or material supplied by another division of work or contract. Verify spaces in which work is to be installed. Install all conduit runs, etc., to maintain headroom and clearances and to conserve space in shafts and ceiling spaces.

.7 Confirm on the site the exact location of outlets for equipment supplied under other divisions of work or contracts.

.8 Confer with all trades installing equipment which may affect the work of this division, and arrange equipment in proper relation to equipment installed under all divisions of the contract.

.9 Timeously furnish all items to be built in, complete with all pertinent information, commensurate with the progress of the work.

.10 Store materials neatly and out of the way and clean up daily all refuse caused by the work.

.11 Relocate equipment and/or material installed, but not coordinated with the work of other divisions, as directed by the Consultant at no extra cost.

1.8 EXISTING CONDITIONS

.1 Visit the site and examine the existing conditions affecting the work of this Division.

.2 No claim for extra payment shall be made for extra work made necessary by circumstances encountered due to conditions which were visible upon, or reasonably inferable from an examination of the site prior to submission of the Bid.

.3 The Engineer will make periodic visits to the site during construction to ascertain reasonable conformity to plans and specifications. The Engineer is not responsible for quality control. The contractor shall maintain their own quality control and will be responsible for the execution of the Work in conformity with the Contract Documents and the requirements of the Authorities having Jurisdiction.

.4 The Owner and Engineer shall have access to the site at all times for periodic inspections. The contractor shall maintain a complete set of contract documents on site for field reference by the Engineer.

.3 The Contractor shall provide all gauges, instruments, and other equipment necessary for field review by the Engineer.

.4 Application for final review will be considered when the Work has been completed and written declarations submitted that all commissioning, adjustment, set up and documentation is complete. Final review shall be completed when:

.1 All reported deficiencies have been corrected.

.2 All systems have been tested, commissioned and are operational.

.3 The Owner has been instructed in the operation and maintenance of all equipment.

.4 All reports have been submitted and reviewed.

.5 All instruction manuals have been submitted and reviewed.

.6 All directories and nameplates are in place.

.7 Cleaning up is finished in all respects.

.8 All spare parts and replacement parts specified have been provided.

.9 All record drawings have been submitted and reviewed.

1.9 GUARANTEE

.1 The Contractor shall furnish a written guarantee, countersigned, stating that all work executed under this division will be free from defects of materials and workmanship for a period of two years from the date of final acceptance of this work. The above contractor further agrees that he will, at his own expense, repair, and replace all such defective work, and all other work damaged during the process of repair during the term of the warranty period, except where damage is due to negligence on the part of the Owner.

.2 Furnish all extended guarantees for equipment requiring same in the specifications.

1.10 HOISTING AND MOVING

.1 Carefully study the architectural and structural drawings with particular reference to the portions of the structure which are reinforced to withstand the forces applied during the transporting of heavy equipment across that structure.

.2 Devise methods and schedules for the hoisting and transportation of equipment from grade to roof and then into the building, to ensure that no damage occurs to the structure, finish, or any other part of the building. Ensure that the schedule meets with the approval of the Construction Manager.

1.11 INTENT

.1 Provide all items, articles, materials, operations and methods listed, mentioned and scheduled in the contract documents. Include all labour, equipment, tools, scaffolds and other incidentals necessary and required for the complete installation.

.2 Consider the specifications as an integral part of the drawings which accompany them. Do not use the drawings or the specifications alone. Consider any item or subject omitted from one, mentioned or reasonably implied in the other, as properly and sufficiently specified and provide same under the work of this division.

.3 Each Contractor is considered to be an expert in his field.

1.12 OPERATION AND MAINTENANCE MANUALS

.1 Submit operation and maintenance manuals in accordance with Division 01.

.2 Include the following information in the Operation and Maintenance manuals:

.1 Names and address of local suppliers for the items included.

.2 Engineering and operating manuals for installed equipment.

.3 Details of design elements, construction features, component function and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion or feature of the installation. This includes, but is not limited to:

- Digital photos of ductbanks showing conditions during installation.
- Digital photos of properly labelled distribution panels with covers off.
- Updated panel schedules.
- Megger test results and transformer tap adjustment reports.
- Detailed receipts for spare parts delivered to site, signed by WRDSB project coordinator as delivered in good order.

.4 Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items and parts lists. Advertising or sales literature is not acceptable.

.5 Review information provided in the maintenance instructions and manuals with the Owners' operating personnel to ensure a complete understanding of the electrical equipment and systems and their operation.

1.13 PERMITS, FEES AND INSPECTIONS

.1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.

.2 Pay associated fees.

.3 Engineer will provide drawings and specifications required by Electrical Inspection Department and Supply Authority at no cost. Drawings are to be submitted by the Electrical Contractor.

.4 Notify Engineer of changes required by Electrical Inspection Department prior to making changes.

.5 Furnish Certificates of Acceptance from Electrical Inspection Department authorities having jurisdiction on completion of work to Consultant.

1.14 RECORD DRAWINGS

.1 The contractor shall clearly mark, as the job progresses, all changes and deviations from that shown on contract drawings. Drawings shall be kept up-to-date during construction and in addition to field measurements shall include variation orders, field instructions and all other changes.

.2 On completion of the building, the contractor shall forward to the consultant the two sets of drawings indicating all such changes and deviations for review.

1.15 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 – Construction / Demolition Waste Management and Disposal.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility as approved by Consultant.

.5 Fold up metal banding, flatten and place in designated area for recycling

2.0 PRODUCTS

2.1 ACCESS PANELS AND DOORS

.1 Provide all access panels and/or doors to facilitate the maintenance and/or servicing of all electrical equipment installed in concealed spaces.

.2 Indicate on the "as-built" drawings the location of these panels and doors.

.3 Doors and panels in fire rated enclosures shall be ULC listed sandwich doors and shall have the same rating as the enclosure.

.4 Doors shall have concealed hinges and screwdriver operated lock. Doors shall be as follows:

.1 Concrete Block and Drywall: 12 gauge prime painted steel door.

.2 Plaster and Acoustic Tile: recessed dish shaped door to accept ceiling tile or welded metal lath for plaster.

.5 All access doors and locations shall be to the Consultant's approval.

2.2 CONDUIT IDENTIFICATION

.1 Colour code conduits, boxes and metallic sheathed cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.

.3 Colours: 25 mm wide prime colou.

System	Prime
up to 250 V	White
up to 600 V	Yellow
Telephone	Green
Other Communications	Green
Fire Alarm	Red
Emergency Voice	Orange
Other Security	TBC with WRDSB

2.3 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates and labels as follows:

.1 Nameplates: plastic limacodid 3 mm, black backing with white lettering mechanically attached with self tapping screws.

.2 Sizes as follows:

NAMEPLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

.2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.

.3 Wording on nameplates and labels to be approved by Departmental Representative and Engineer prior to manufacture.

.4 Allow for minimum of twenty-five (25) letters per nameplate and label.

.5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.6 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.7 Terminal cabinets and pull boxes: indicate system and voltage.

.8 Transformers: indicate capacity, primary and secondary voltages.

2.4 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

2.5 MATERIALS AND EQUIPMENT

.1 Provide materials and equipment in accordance with Division 01.

.2 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment, which is not CSA certified, obtain special approval from Electrical Inspection Department.

.3 Factory assemble control panels and component assemblies.

2.6 VIBRATION ISOLATION

.1 Provide vibration isolation control as necessary so as to prevent transmission of objectionable vibration to the building structure, and from one area to another.

.2 Provide all steel bases and concrete inertia pads. Install all bases to clear the sub-base (housekeeping pads) by minimum 1" (25mm) for steel bases, and 2" (50mm) for concrete bases.

.3 All floor mounted equipment shall be erected on 4" (102mm) high reinforced concrete pads. Concrete pads shall be of similar dimensions to that of the foot print of the equipment. Wherever vibration eliminating devices and/or concrete inertia blocks are specified, these items shall, in all cases, be mounted upon the 4" (102mm) high reinforced concrete pads; unless specified to the contrary.

.4 All concrete foundations and supports shall be provided by this division. This contractor shall provide dimensioned drawings and details of all such work required and shall submit same to the Consultant for approval.

2.7 WARNING SIGNS

.1 As specified and to meet requirements of Electrical Inspection Department, Local Authority and Consultant.

.2 Decal signs, minimum size 8" x 10" (175mm x 250mm).

2.8 WIRING TERMINATIONS

.1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

2.9 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, numbered, coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

3.0 EXCECUTION

3.1 CLEANING

.1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

.3 Clean all fixtures and equipment. Polish all plated surfaces.

.4 Set all relays to operating condition.

.5 Remove all temporary protection and covers.

.6 Vacuum clean the inside of switchgear, panel boards, motor control centre, and fire alarm control panel and annunciators. Ensure that they are free from debris and dust.

.7 Change all lamps, all lamps to be new at time of system acceptance.

.8 Leave electrical work in new working order.

3.2 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete.

.1 Sleeves through concrete: plastic, sized for free passage of conduit, and protruding 2" (50mm).

.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.3 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

3.3 CUTTING AND PATCHING

.1 Perform all cutting and patching required for the installation of new equipment and surface restoration after the removal of existing equipment. Work will be carried out by others at this Contractor's cost. For patching use materials equal to those comprising the surrounding area.

.2 Inform other Division Contractors in sufficient time with regard to required openings. Where this requirement is not met, bear the cost of all cutting and patching.

.3 In existing work, and work already finished, cutting and patching will be carried out by the General Contractor at the Electrical Contractors' expense.

.4 Be aware of fire rated partitions, minimize the area affected by the work, and return all surfaces to a condition encountered before the work. Acceptance of the finished work is at the sole discretion of the Consultant.

.5 Painting of finished surfaces will be by the General Contractor to match adjacent surfaces.

3.4 DEMOLITION

.1 Make safe and disconnect all power and systems, as and when, and to the extent required to facilitate with the demolition.

.2 Ensure that all electrical, life safety services, and services for existing equipment, in areas outside the areas of this work, that are required to remain in service, shall do so.

.3 Relocate any electrical feeders or equipment that are required to remain in service, that are secured to existing walls, floors or ceilings to be demolished or that are buried and required to be excavated for new work.

.4 Remove and replace any electrical equipment on walls or ceilings that will be demolished and rebuilt.

.5 When deleting and/or making safe existing electrical work, ensure that it includes all wiring back to the associated panelboard or control panel.

.6 Disconnect and remove existing light fixtures, devices, outlets, etc. which are not to be reused. Such items shall be cartoned and turned over to the Owner at a place designated by the Owner. Cut back and cap unused raceway and outlets and remove unused wiring back to panelboard in an approved manner.

.7 Ensure that all existing equipment which is to be reused and/or relocated is thoroughly inspected and refurbished to ensure correct operation when put back into service and to meet Ontario Hydro approval.

.8 All existing electrical equipment which is no longer required shall be removed and disposed of, off site. Removed equipment shall be detailed and listed for WRDSB review and to exercise "First right of refusal" for turnover of equipment to School Board.

.9 Be responsible and pay for any damage to the base building incurred by work of this Division, or repair to the satisfaction of the Consultant.

.10 Carry out the work with a minimum of noise, dust and disturbance.

.11 Provide tools and clean up equipment. Obtain the Owner's permission for the use of electrical, plumbing or drainage outlets.

.12 Provide daily clean-up and proper disposal of debris generated by daily operations. On completion of the work, all tools, surplus materials and waste materials shall be removed and the premises left in a clean, perfect condition.

3.5 EXPANSION JOINTS AND LOOPS

.1 Supply and install expansion joints or loops in conduits crossing expansion joints in the structure without imposing undue stress on structure, apparatus or conduit.

3.6 FIELD QUALITY CONTROL

.1 Load Balance:

.1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.3 Provide upon completion of work, load balance report as directed in PART 1 - Submittals: phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.

.2 Conduct following tests in accordance with Section 01 45 00 - Quality Control as applicable:

.1 Power distribution system including phasing, voltage, grounding and load balancing.

.2 Circuits originating from branch distribution panels.

.3 Lighting and its control.

.4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.

.5 Systems: fire alarm system, communications as applicable.

.6 Insulation resistance testing:

.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.

.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.

.3 Check resistance to ground before energizing.

.3 Carry out tests in presence of Engineer when requested.

.4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.5 Submit test results to Engineer for review.

3.7 FIRE STOPPING

.1 Where cable, bus ducts, cable tray or conduits pass through floors and fire rated walls, provide fire stopping and smoke seal in accordance with Division 01.

3.8 LOCATION OF OUTLETS

.1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings and contract drawings.

.2 Do not install outlets back-to-back in wall; allow minimum 6” (150 mm) horizontal clearance between boxes.

.3 Change location of outlets at no extra cost or credit, providing distance does not exceed 10’ (3000 mm), and information is given before installation.

.4 Locate light switches on latch side of doors unless shown otherwise.

3.9 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: 44” (1100 mm).

.2 Wall receptacles:

.1 General: 18” (450 mm).

.2 Above top of continuous baseboard heater: 8” (200 mm).

.3 Above top of counters or counter splash backs: 6” (150 mm).

.3 Panelboards: as required by Code or as indicated.

.4 Telephone and interphone outlets: 18” (450mm).

.4 Contractor shall verify mounting heights with latest applicable CSA requirements and report any discrepancies with Engineer prior to installation.

3.10 PROTECTION

.1 Protect building and structure from damage due to carrying out this work.

.2 Protect all electrical work from damage. Keep all equipment dry and clean at all times.

.3 Cover all opening in equipment and materials.

.4 Be responsible for and make good any damage caused directly or indirectly to any walls, floors, ceilings, woodwork, brickwork, finishes, etc.

3.11 TEMPORARY SERVICES

.1 Temporary electrical services shall be provided by others, unless otherwise noted. Coordinate with General Contractor for further detail.

.2 Do not use any of the permanent electrical systems during construction, unless specific written approval is obtained from the Consultant or unless allowed elsewhere in the contract documents.

.3 The use of permanent facilities for temporary construction service shall not affect in any way the commencement period in which correction after completion is the Contractor's responsibility. Such period will commence only when the overall project is completed and certificates are issued.

3.12 WORKMANSHIP

.1 Install conduits and pipes parallel and perpendicular to the building planes and concealed in chases, behind furring or above ceiling, except in unfinished areas. Install all exposed systems neatly and grouped together, to present a neat appearance.

.2 Install meters and switches to permit easy reading.

.3 Install all equipment and apparatus requiring maintenance, adjustment or replacement with sufficient clearance for servicing.

.4 Install control devices to guarantee proper sensing. Shield element from direct radiation and avoid placing them behind any obstruction.

.5 Include in the work all requirements of the manufacturer and as shown on the shop drawings.

.6 Replace any work unsatisfactory to the Consultant/owner without extra cost.

END OF SECTION

1.0 GENERAL

1.1 SUMMARY

.1 Canadian Standards Association (CSA International)

.1 This Section includes requirements for selective demolition and removal of electrical safety and security components including removal of conduit, junction boxes, and panels to source and incidentals required to complete work described in this Section ready for new construction.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

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

1.3 DEFINITIONS

.1 Demolish: Detach items from existing construction and legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.

.2 Remove: Planned deconstruction and disassembly of electrical items from existing construction including removal of conduit, junction boxes, cabling and wiring from electrical component to panel taking care not to damage adjacent assemblies designated to remain; legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.

.3 Remove and Salvage: Detach items from existing construction and deliver them to Owner ready for reuse.

.4 Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

.5 Existing to Remain: Existing items of construction that are not removed and that are not otherwise indicated as being removed and salvaged, or removed and reinstalled.

.6 Hazardous Substances: Dangerous substances, dangerous goods, hazardous commodities and hazardous products may include asbestos, mercury and lead, PCB's, poisons, corrosive agents, flammable substances, radioactive substances, or other material that can endanger human health or wellbeing or environment if handled improperly as defined by Federal Hazardous Products Act including latest amendments.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Action Submittals: Provide in accordance with Section 01 33 00– Submittal Procedures before starting work of this Section:

.1 Construction Waste Management Plan: Submit plan addressing opportunities for reduction, reuse, or recycling of materials prepared in accordance with Construction Waste Management and Disposal.

.2 Landfill Records: Indicate receipt and acceptance of selective demolition waste and hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate work of this Section to avoid interference with work by other Sections.

.2 Scheduling: Account for Owner's continued occupancy requirements during selective demolition and schedule staged occupancy and worksite activities as a defined item in accordance.

1.6 QUALITY ASSURANCE

.1 Regulatory Requirements: Perform work of this Section in accordance with:

.1 Provincial/Territorial Workers' Compensation Boards/Commissions.

1.7 SITE CONDITIONS

.1 Existing Conditions: Condition of materials identified as being salvaged or demolished are based on their observed condition at time of site examination before tendering.

.2 Existing Hazardous Substances: Owner performed a hazardous substances assessment and it is not expected that hazardous substances will be encountered in Work.

.1 Hazardous substances will be removed by a hazardous abatement specialist engaged by Owner before start of Work.

.3 Existing Hazardous Substances: Owner has performed a hazardous substances assessment and identified materials requiring abatement as follows:

.1 Hazardous substances are as defined in Hazardous Products Act.

.4 Discovery of Hazardous Substances: It is not expected that Hazardous Substances will be encountered in Work; immediately notify Consultant if materials suspected of containing hazardous substances are encountered and perform following activities:

.1 Hazardous substances will be as defined in Hazardous Products Act.

.2 Stop work in area of suspected hazardous substances.

.3 Take preventative measures to limit users' and workers' exposure, provide barriers and other safety devices and do not disturb.

.4 Hazardous substances will be removed by Owner under a separate contract or as a change to Work.

.5 Proceed only after written instructions have been received from Owner.

1.8 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 – Construction / Demolition Waste Management and Disposal.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility as approved by Consultant.

.5 Fold up metal banding, flatten and place in designated area for recycling.

2.0 PRODUCTS

2.1 NOT USED REPAIR MATERIALS

.1 N/A

3.0 EXCECUTION

3.1 EXAMINATION

.1 Verification of Existing Conditions: Visit site, thoroughly examine and become familiar with conditions that may affect work of this Section before tendering Bid; Owner will not consider claims for extras for work or materials necessary for proper execution and completion of contract that could have been determined by a site visit.

3.2 PREPARATION

.1 Protection of Existing Systems to Remain: Protect systems and components indicated to remain in place during selective demolition operations and as follows:

.1 Prevent movement and install bracing to prevent settlement or damage of adjacent services and parts of existing buildings scheduled to remain.

.2 Notify Consultant and cease operations where safety of buildings being demolished, adjacent structures or services appears to be endangered and await additional instructions before resuming demolition work specified in this Section.

.3 Prevent debris from blocking drainage inlets.

.4 Protect mechanical systems that will remain in operation.

.2 Protection of Building Occupants: Sequence demolition work so that interference with use of the building by Owner and users is minimized and as follows:

.1 Prevent debris from endangering safe access to and egress from occupied buildings.

.2 Notify Consultant and cease operations where safety of occupants appears to be endangered and await additional instructions before resuming demolition work specified in this Section.

3.3 EXECUTION

.1 Removal: Coordinate requirements of this Section with information contained in and as follows:

.1 Disconnect electrical circuits and panel feeders; maintain electrical service and main distribution panel as is, ready for subsequent Work.

.2 Disconnect and remove existing fire alarm system including associated conduits, boxes, wiring, and similar items unless specifically noted otherwise.

.3 Perform demolition work in a neat and workmanlike manner:

.1 Remove tools or equipment after completion of work, and leave site clean and ready for subsequent renovation work.

.2 Repair and restore damages caused as a result of work of this Section to match existing materials and finishes.

.4 Seal open ends of conduit with silicone sealant and leave in place where they are inaccessible or cannot be removed without damaging adjacent construction.

3.4 CLOSEOUT ACTIVITIES

.1 Demolition Waste Disposal: Arrange for legal disposal and remove demolished materials to accredited provincial landfill site or alternative disposal site (recycle centre).

END OF SECTION

1.0 GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA C22.2 No .0.3, Test Methods for Electrical Wires and Cables.

.2 CAN/CSA-C22.2 No. 131, Type TECK 90 Cable.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Section 01300 - Submittal Procedures.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 – Construction / Demolition Waste Management and Disposal.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility as approved by Consultant.

.5 Fold up metal banding, flatten and place in designated area for recycling.

2.0 PRODUCTS

2.1 BUILDING WIRES

.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

.2 Copper conductors: size as indicated, with 1000 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.

2.2 TECK CABLE

.1 Cable: to CAN/CSA-C22.2 No. 131.

.2 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated.

.3 Insulation:

.1 Type: ethylene propylene rubber.

.2 Chemically cross-linked thermosetting polyethylene rated type RW90, 600 V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking galvanized steel.

.6 Overall covering: thermoplastic polyvinyl chloride material.

.7 Fastenings:

.1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables at 1500 mm centers.

.3 Threaded rods: 6 mm dia. to support suspended channels.

.8 Connectors:

.1 Watertight approved for TECK cable.

2.3. ARMOURED CABLES

.1 Conductors: insulated, copper, size as indicated.

.2 Type: AC90.

.3 Armour: interlocking type fabricated from aluminum strip.

.4 Type: ACWU90 flame retardant jacket over armour meeting requirements of Vertical Tray Fire Test of CSA C22.2 No. 0.3 with maximum flame travel of 1.2 m.

.5 Connectors: standard as required.

2.4. ALUMINUM SHEATHED CABLE

.1 Conductors: copper, size as indicated.

.2 Insulation: typeRA90 rated 600 V.

.3 Sheath: aluminum applied to form continuous corrugated sheath.

.4 Outer jacket of PVC applied over sheath for direct burial or wet locations.

.5 Fastenings for aluminum sheathed cable:

.1 One hole steel straps to secure surface cables 25 mm and smaller. Two-hole steel straps for cables larger than 25 mm. Use aluminum strap only with single conductor cable.

.2 Channel type supports for two or more cables at 1500 mm centers.

.3 Threaded rods: 6 mm dia. to support suspended channels.

2.5. CONTROL CABLES

.1 Type LVT: 2 soft annealed copper conductors, sized as indicated, with thermoplastic insulation, outer covering of thermoplastic jacket.

.2 Low energy 300 V control cable: stranded annealed copper conductors sized as indicated, with PVC insulation type TW -40°C polyethylene insulation with shielding of tape coated with paramagnetic material wire braid over each conductor and overall covering of PVC jackets.

3.0 EXECUTION

3.1. INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 26 05 34.

.2 In cabletroughs in accordance with Section 26 05 33.

.3 In underground ducts in accordance with Section 26 05 43.

.4 In trenches in accordance with Section 26 05 43.

.5 In underfloor distribution system in accordance with Section 26 05 39.

.6 In cellular floor raceways in accordance with Section 26 05 38.

.7 In surface and lighting fixture raceways in accordance with Section 26 50 00.

.8 In wireways and auxiliary gutters in accordance with Section 26 05 37.

.9 Overhead service conductors in accordance with Section 26 24 01.

3.2. INSTALLATION OF TECK CABLE 0 -1000 V

.1 Install cables.

.1 Group cables wherever possible on channels.

.2 Installation of Teck cable to be avoided where possible to complete installations in EMT conduit.

.3 Install cable in trenches in accordance with Section 26 05 43.

.4 Lay cable in cabletroughs in accordance with Section 26 05 33.

.5 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - 0 - 1000V.

3.3. INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible.

.2 Use to be limited to final drops to devices/fixtures within 3.0m limit.

.3 Install cable in trenches in accordance with Section 26 05 43.

.4 Lay cable in cable troughs in accordance with Section 26 05 33.

.5 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - 0 - 1000V.

3.4. INSTALLATION OF ALUMINUM SHEATHED CABLES

.1 Group cables wherever possible on channels.

.2 Installation of aluminum sheathed cable to be avoided where possible to complete installations in EMT conduit.

.3 Install cable in trenches in accordance with Section 26 05 43.

.4 Lay cable in cable troughs in accordance with Section 26 05 33.

.5 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - 0 - 1000V.

3.5. INSTALLATION OF CONTROL CABLES

.1 Install control cables in conduit, under floor raceways, cable troughs and underground ducts by direct burial as indicated.

.2 Ground control cable shield.

3.6. INSTALLATION OF NON-METALLIC SHEATHED CABLE

.1 Install cables.

.2 Install straps and box connectors to cables as required.

END OF SECTION

1.0 GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA C22.2 No .0.3, Test Methods for Electrical Wires and Cables.

.2 CAN/CSA-C22.2 No. 131, Type TECK 90 Cable.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Section 01300 - Submittal Procedures.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 – Construction / Demolition Waste Management and Disposal.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility as approved by Consultant.

.5 Fold up metal banding, flatten and place in designated area for recycling.

2.0 PRODUCTS

2.1 BUILDING WIRES

.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

.2 Copper conductors: size as indicated, with 1000 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.

2.2 TECK CABLE

.1 Cable: to CAN/CSA-C22.2 No. 131.

.2 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated.

.3 Insulation:

.1 Type: ethylene propylene rubber.

.2 Chemically cross-linked thermosetting polyethylene rated type RW90, 600 V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking galvanized steel.

.6 Overall covering: thermoplastic polyvinyl chloride material.

.7 Fastenings:

.1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables at 1500 mm centers.

.3 Threaded rods: 6 mm dia. to support suspended channels.

.8 Connectors:

.1 Watertight approved for TECK cable.

2.3. MINERAL-INSULATED CABLES

.1 Conductors: solid bare soft-annealed copper, size as indicated.

.2 Insulation: compressed powdered magnesium oxide to form compact homogeneous mass throughout entire length of cable.

.3 Overall covering: annealed seamless copper sheath, Type M1 rated 600 V, 250°C.

.4 Overall covering: annealed seamless copper sheath type LWM1 rated 600 V, 250°C.

.5 Outer jacket: PVC applied over sheath.

.6 Two-hour fire rating.

.7 Connectors: standard as required.

.8 Termination kits: standard as required.

2.4. ARMOURED CABLES

.1 Conductors: insulated, copper, size as indicated.

.2 Type: AC90.

.3 Armour: interlocking type fabricated from aluminum strip.

.4 Type: ACWU90 flame retardant jacket over armour meeting requirements of Vertical Tray Fire Test of CSA C22.2 No. 0.3 with maximum flame travel of 1.2 m.

.5 Connectors: standard as required.

2.5. ALUMINUM SHEATHED CABLE

.1 Conductors: copper, size as indicated.

.2 Insulation: typeRA90 rated 600 V.

.3 Sheath: aluminum applied to form continuous corrugated sheath.

.4 Outer jacket of PVC applied over sheath for direct burial or wet locations.

.5 Fastenings for aluminum sheathed cable:

.1 One hole steel straps to secure surface cables 25 mm and smaller. Two-hole steel straps for cables larger than 25 mm. Use aluminum strap only with single conductor cable.

.2 Channel type supports for two or more cables at 1500 mm centers.

.3 Threaded rods: 6 mm dia. to support suspended channels.

2.6. CONTROL CABLES

.1 Type LVT: 2 soft annealed copper conductors, sized as indicated, with thermoplastic insulation, outer covering of thermoplastic jacket.

.2 Low energy 300 V control cable: stranded annealed copper conductors sized as indicated, with PVC insulation type TW -40°C polyethylene insulation with shielding of tape coated with paramagnetic material wire braid over each conductor and overall covering of PVC jackets.

2.7. NON-METALLIC SHEATHED CABLE

.1 Non-metallic sheathed copper] cable type: NMD-7 nylon, size as indicated.

3.0 EXECUTION

3.1. INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 26 05 34.

.2 In cabletroughs in accordance with Section 26 05 33.

.3 In underground ducts in accordance with Section 26 05 43.

.4 In trenches in accordance with Section 26 05 43.

.5 In underfloor distribution system in accordance with Section 26 05 39.

.6 In cellular floor raceways in accordance with Section 26 05 38.

.7 In surface and lighting fixture raceways in accordance with Section 26 50 00.

.8 In wireways and auxiliary gutters in accordance with Section 26 05 37.

.9 Overhead service conductors in accordance with Section 26 24 01.

3.2. INSTALLATION OF TECK CABLE 0 -1000 V

.1 Install cables.

.1 Group cables wherever possible on channels.

.2 Install cable in trenches in accordance with Section 26 05 43.

.3 Lay cable in cabletroughs in accordance with Section 26 05 33.

.4 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - 0 - 1000V.

3.3. INSTALLATION OF MINERAL-INSULATED CABLES

.1 Install cable in trenches in accordance with Section 26 05 43.

.2 Run cable exposed, securely supported by straps.

.3 Support 2 h fire rated cables at 1m intervals.

.4 Make cable terminations by using factory-made kits.

.5 At cable terminations use thermoplastic sleeving over bare conductors.

.6 Install cable in cable troughs in accordance with Section 26 05 33.

.7 Where cables are buried in cast concrete or masonry, sleeve for entry and exit of cables.

.8 Do not splice cables.

3.4. INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible.

.2 Install cable in trenches in accordance with Section 26 05 43.

.3 Lay cable in cable troughs in accordance with Section 26 05 33.

.4 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - 0 - 1000V.

3.5. INSTALLATION OF ALUMINUM SHEATHED CABLE

.1 Group cables wherever possible on channels.

.1 Install cable in trenches in accordance with Section 26 05 43.

.2 Lay cable in cabletroughs in accordance with Section 26 05 33.

.3 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors – 0 -1000V.

3.6. INSTALLATION OF CONTROL CABLES

.1 Install control cables in conduit, under floor raceways, cable troughs and underground ducts by direct burial as indicated.

.2 Ground control cable shield.

3.7. INSTALLATION OF NON-METALLIC SHEATHED CABLE

.1 Install cables.

.2 Install straps and box connectors to cables as required.

END OF SECTION

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6HSDUDWH DQG UHF\FOH ZDVWH PDWHULDOV LQ DFF
&RQVWUXFWLRQ 'HPROLWLRQ :DVWH 0DQDJHPHQW DQG 'LV

5HPRYH IURP VLWH DQG GLVSRVH RI DOO SDFNDJLQJ PDW

&ROOHFW DQG VHSDUDWH IRU GLVSRVDO SDFNDJLQJ PDW
0DQDJHPHQW 3ODQ

'LYHUW XQXVHG PHWDO PDWHULDOV IURP ODQGILOO W
&RQVXOWDQW

)ROG XS PHWDO EDQGLQJ IODWWHQ DQG SODFH LQ GHVL

352'8&76

6833257 &+$11(/6

8 VKDSH VL]H [PP PP WKLFN VXUIDFH PRXQWHG
ZDOOV DQG FHLOLQJV DV UHTXLUHG

(;(&87,21

,167$//$7,21

6HFXUH HTXLSPHQW WR KROORZ RU VROLG PDVRQU\ WL
Q\ORQ VKLHOGV

6HFXUH HTXLSPHQW WR SRXUHG FRQFUHWH ZLWK H[SDQG

6HFXUH HTXLSPHQW WR KROORZ PDVRQU\ ZDOOV RU VXV

6HFXUH VXUIDFH PRXQWHG HTXLSPHQW ZLWK WZLVW FOL
WKDW 7 EDUV DUH DGHTXDWHO\ VXSSRUWHG WR FDUU\ ZH

6XSSRUW HTXLSPHQW FRQGXLW RU FDEOHV XVLQJ FOLS
DV DFFHVVRULHV WR EDVLF FKDQQHO PHPEHUV

)DVWHQ H[SRVHG FRQGXLW RU FDEOHV WR EXLOGLQJ FR

2QH KROH VWHHO VWUDSV WR VHFXUH VXUIDFH FRQG

7ZR KROH VWHHO VWUDSV IRU FRQGXLWV DQG FDEOH

%HDP FODPSV WR VHFXUH FRQGXLW WR H[SRVHG VWH

6WUDS $& FDEOH DW ER[ORFDWLRQ SOXV HYHU\

6XVSHQGHG VXSSRUW V\VWHPV

6XSSRUW LQGLYLGXDO FDEOH RU FRQGXLW UXQV ZLW

6XSSRUW RU PRUH FDEOHV RU FRQGXLWV RQ FKDQQ
KDQJHUV ZKHUH GLUHFW IDVWHQLQJ WR EXLOGLQJ FR

)RU VXUIDFH PRXQWLQJ RI WZR RU PRUH FRQGXLWV XVH

3URYLGH PHWDO EUDFNHWV IUDPHV KDQJHUV FODPSV
LQGLFDWHG RU DV UHTXLUHG WR VXSSRUW FRQGXLW DQG

(QVXUH DGHTXDWH VXSSRUW IRU UDFHZD\V DQG FDEOHV
LV QR ZDOO VXSSRUW

'R QRW XVH ZLUH ODVKLQJ ZRRG EORFNLQJ SODVWLF V
UDFHZD\V RU FDEOHV

'R QRW XVH VXSSRUWV RU HTXLSPHQW LQVWDOOHG IRU R
ZLWK SHUPLVVLRQ RI RWKHU WUDGH DQG DSSURYDO RI 2Z

,QVWDOO IDVWHQLQJV DQG VXSSRUWV DV UHTXLUHG IRU
LQ DFFRUGDQFH ZLWK PDQXIDFWXUHU V LQVWDOODWLRQ

(1' 2) 6(&7,21

*(1(5$/

5(/$7(' 6(&7,216

VHFWLRQ ± 6XEPLWWDO 3URFHGXUHV

6HFWLRQ ± &RPPRQ :RUN 5HVXOWV ± (OHFWULFDO

6+23 '5$:,1*6 $1' 352'8&7 '$7$

6XEPLW VKRS GUDZLQJV DQG SURGXFW GDWD IRU FDELQ
6XEPLWWDO 3URFHGXUHV

:$67(0$1$*(0(17 $1' ',6326$/

6HSDUDWH DQG UHF\FOH ZDVWH PDWHULDOV LQ DFFRUG
'HPROLWLRQ :DVWH 0DQDJHPHQW DQG 'LVSRVDO

5HPRYH IURP VLWH DQG GLVSRVH RI DOO SDFNDJLQJ PDW

&ROOHFW DQG VHSDUDWH IRU GLVSRVDO SDFNDJLQJ PDW
0DQDJHPHQW 3ODQ

'LYHUW XQXVHG PHWDO PDWHULDOV IURP ODQGILOO W
&RQVXOWDQW

)ROG XS PHWDO EDQGLQJ IODWWHQ DQG SODFH LQ GHVL

352'8&76

63/,77(56

6KHHW PHWDO HQFORVXUH ZHOGHG FRUQHUV DQG IRUPH
SRVLWLRQ

0DLQ DQG EUDQFK OXJV WR PDWFK UHTXLUHG VL]H D
FRQGXFWRUV DV LQGLFDWHG

$W OHDVW WKUHH VSDUH WHUPLQDOV RQ HDFK VHW RI O

-81&7,21 $1' 38// %2;(6

:HOGHG VWHHO FRQVWUXFWLRQ ZLWK VFUHZ RQ IODW FR

&RYHUV ZLWK PP PLQLPXP H[WHQVLRQ DOO DURXQG IR

&$%,1(76

7\SH (VKHHW VWHHO KLQJHG GRRU DQG UHWXUQ IODQ
IRU VXUIDFH PRXQWLQJ

7\SH 7 VKHHW VWHHO FDELQHW ZLWK KLQJHG GRRU C
SO\ZRRG EDFNERDUG IRU VXUIDFH IOXVK PRXQWLQJ

(;(&87,21

63/,77(5 ,167$//$7,21

,QVWDOO VSOLWWHUV DQG PRXQW SOXPE WUXH DQG VTX

([WHQG VSOLWWHUV IXOO OHQJWK RI HTXLSPHQW DUUDQ

-81&7,21 38// %2;(6 $1' &$%,1(76 ,167$//$7,21

,QVWDOO SXOO ER[HV LQ LQFRQVSLFXRXV EXW DFFHVVLE

0RXQW FDELQHWV ZLWK WRS QRW KLJKHU WKDQ P DERY

,QVWDOO WHUPLQDO EORFN DV LQGLFDWHG LQ 7\SH 7 FD

2QO\ PDLQ MXQFWLRQ DQG SXOO ER[HV DUH LQGLFDWHG
RI FRQGXLW UXQ EHWZHHQ SXOO ER[HV

,'(17,),&$7,21

3URYLGH HTXLSPHQW LGHQWLILFDWLRQ LQ DFFRUGDQFH
5HVXOWV (OHFWULFDO

,QVWDOO VL]H LGHQWLILFDWLRQ ODEHOV LQGLFDWLQJ

(1' 2) 6(&7,21

*(1(5$/

5(/$7(' 6(&7,216

6HFWLRQ ± &RPPRQ :RUN 5HVXOWV ± (OHFWULFDO

6HFWLRQ ± +DQJHUV DQG 6XSSRUWV IRU (OHFWULF

6HFWLRQ ± &RQGXLWV &RQGXLW)DVWHQLQJV DQG

5()(5(1&(6

&DQDGLDQ 6WDQGDUGV $VVRFLDWLRQ &6$

&6$ & &DQDGLDQ (OHFWULFDO &RGH 3DUW

:$67(0$1$*(0(17 $1' ',6326$/

6HSDUDWH DQG UHF\FOH ZDVWH PDWHULDOV LQ DFFRUG 'HPROLWLRQ :DVWH 0DQDJHPHQW DQG 'LVSRVDO

5HPRYH IURP VLWH DQG GLVSRVH RI DOO SDFNDJLQJ PDW

&ROOHFW DQG VHSDUDWH IRU GLVSRVDO SDFNDJLQJ PDW 0DQDJHPHQW 3ODQ

'LYHUW XQXVHG PHWDO PDWHULDOV IURP ODQGILOO W &RQVXOWDQW

)ROG XS PHWDO EDQGLQJ IODWWHQ DQG SODFH LQ GHVL

352'8&76

287/(7 $1' &21'8,7 %2;(6 *(1(5$/

6L]H ER[HV LQ DFFRUGDQFH ZLWK &6$ &

PP VTXDUH RU ODUJHU RXWOHW ER[HV DV UHTXLUHG I

*DQJ ER[HV ZKHUH ZLULQJ GHYLFHV DUH JURXSHG

%ODQN FRYHU SODWHV IRU ER[HV ZLWKRXW ZLULQJ GHYL

9 RXWOHW ER[HV IRU 9 VZLWFKLQJ GHYLFHV

&RPELQDWLRQ ER[HV ZLWK EDUULHUV ZKHUH RXWOHWV I

*$/9$1,=(' 67((/ 287/(7 %2;(6

(OHFWUR JDOYDQL]HG VWHHO VLQJOH DQG PXOWL JDQJ
PLQLPXP VL]H [[PP RU DV LQGLFDWHG PP VTX
RQH FRQGXLW HQWHUV RQH VLGH ZLWK H[WHQVLRQ DQG S

(OHFWUR JDOYDQL]HG VWHHO XWLOLW\ ER[HV IRU RXWOH
PLQLPXP VL]H [[PP

PP VTXDUH RU RFWDJRQDO RXWOHW ER[HV IRU OLJKW

PP VTXDUH RXWOHW ER[HV ZLWK H[WHQVLRQ DQG SO
ILQLVKHG SODVWHU ZDOOV

0$6215< %2;(6

(OHFWUR JDOYDQL]HG VWHHO PDVRQU\ VLQJOH DQG PXO
H[SRVHG EORFN ZDOOV

&21&5(7(%2;(6

(OHFWUR JODYDQL]HG VKHHW VWHHO FRQFUHWH W\SH ER
H[WHQVLRQ DQG SODVWHU ULQJV DV UHTXLUHG

)/225 %2;(6

&RQFUHWH WLJKW HOHFWUR JDOYDQL]HG VKHHW VWHHO
IORRU ILQLVK ZLWK EUDVV IDFHSODWH 'HYLFH PRXQWLQ
GXSOH[UHFHSWDFOHV 0LQLPXP GHSWK PP IRU UHFH
HTXLSPHQW

$GMXVWDEOH ZDWHUWLJKW FRQFUHWH WLJKW FDVW IO
PP DQG PP FRQGXLW 0LQLPXP VL]H PP GHHS

&21'8,7 %2;(6

&DVW)6 RU)' DOXPLQXP ER[HV ZLWK IDFWRU\ WKUHDGH
ZLULQJ RI VZLWFKHV DQG UHFHSWDFOH

287/(7 %2;(6)25 121 0(7$//,& 6+($7+(' &$%/(

(OHFWUR JDOYDQL]HG VHFWLRQDO VFUHZ JDQJLQJ VWH
WZR GRXEOH FODPSV WR WDNH QRQ PHWDOOLF VKHDWKH
RQO\

),77,1*6 *(1(5$/

%XVKLQJ DQG FRQQHFWRUV ZLWK Q\ORQ LQVXODWHG WK

.QRFN RXW ILOOHUV WR SUHYHQW HQWU\ RI GHEULV

&RQGXLW RXWOHW ERGLHV IRU FRQGXLW XS WR PP DQ

'RXEOH ORFNQXWV DQG LQVXODWHG EXVKLQJV RQ VKHHW

'RXEOH VSOLW ULQJV IRU $& WHUPLQDWLRQV

6(59,&( ),77,1*6

+LJK WHQVLRQ UHFHSWDFOH ILWWLQJ PDGH RI SLHFH KRXVLQJ ILQLVK IRU GXSOH[UHFHSWDFOHV %RWWRP SO LQVWDOODWLRQ

3HGHVWDO W\SH ORZ WHQVLRQ ILWWLQJ PDGH RI SLH KRXVLQJ ILQLVK WR DFFRPPRGDWH WZR DPSKHQRO MDFN

(;(&87,21

,167$//$7,21

6XSSRUW ER[HV LQGHSHQGHQWO\ RI FRQQHFWLQJ FRQGX

)LOO ER[HV ZLWK SDSHU VSRQJHV RU IRDP RU VLPLODU GXULQJ FRQVWUXFWLRQ 5HPRYH XSRQ FRPSOHWLRQ RI Z

)RU IOXVK LQVWDOODWLRQV PRXQW RXWOHWV IOXVK ZLW ILQLVK WR FRPH ZLWKLQ PP RI RSHQLQJ

3URYLGH FRUUHFW VL]H RI RSHQLQJV LQ ER[HV IRU FRQ FRQQHFWLRQV 5HGXFLQJ ZDVKHUV DUH QRW DOORZHG

9DFXXP FOHDQ LQWHULRU RI RXWOHW ER[HV EHIRUH LQV

,GHQWLI\ V\VWHPV IRU RXWOHW ER[HV DV UHTXLUHG

(1' 2) 6(&7,21

*(1(5$/

6(&7,21 ,1&/8'(6

0DWHULDOV DQG LQVWDOODWLRQ IRU FDEOH VSOLFH DQ

5(/$7(' 6(&7,216

6HFWLRQ 6XEPLWWDO 3URFHGXUHV

6HFWLRQ ± &RQVWUXFWLRQ 'HPROLWLRQ :DVWH

352'8&7 '7

6XEPLW SURGXFW GDWD LQ DFFRUGDQFH ZLWK 6HFWLRQ

:$67(0$1$*(0(17 $1' ',6326$/

6HSDUDWH DQG UHF\FOH ZDVWH PDWHULDOV LQ DFFRUG
'HPROLWLRQ :DVWH 0DQDJHPHQW DQG 'LVSRVDO

5HPRYH IURP VLWH DQG GLVSRVH RI DOO SDFNDJLQJ PDW

&ROOHFW DQG VHSDUDWH IRU GLVSRVDO SDFNDJLQJ PDW
0DQDJHPHQW 3ODQ

'LYHUW XQXVHG PHWDO PDWHULDOV IURP ODQGILOO W
&RQVXOWDQW

)ROG XS PHWDO EDQGLQJ IODWWHQ DQG SODFH LQ GHVL

352'8&76

63/,&(%2;(6

6SOLFH ER[HV FDVW LURQ HQFORVXUHV PP WKLFN SDL
WR SURYLGH PHFKDQLFDO SURWHFWLRQ DQG PRLVWXUH
DQG FRQVLVWLQJ RI

7ZR KDOYHV VSOLW DORQJ FDEOH D[LV ILQHO\ JUR
JDOYDQL]HG VWHHO EROWV WRS KDOI ZLWK ODUJH IL
KDUG DVSKDOW EDVH FRPSRXQG ERWWRP KDOI ZLWK
ER[HQG RSHQLQJV VHDOHG E\

:UDSSLQJ FDEOHV ZLWK DQK\GURXV WDSH DQG FO
VSOLFHV

)LWWLQJ ER[HV ZLWK FDEOH HQWUDQFH ILWWLQJV
ZD\ VSOLFHV

-81&7,21 %2;(6 ',675,%87,21 /(9(/

:HOGHG VWHHO UHFWDQJXODU ER[HV PP WKLFN SDLQW
ZLWK UHPRYDEOH SODWH RQ IURQW VLGH GHVLJQHG IRU
HQFORVHG GLVFRQQHFWLQJ EUDQFKHV RI VLQJOH FRQGX
GLVFRQQHFWRUV HQFORVHG LQ SRUFHODLQ WXEHV DQG
GLVFRQQHFWLQJ DQG IRU ZDOO PRXQWHG EUDQFK FDEO

-81&7,21 %2;(6 $1' 32:(5 /(9(/

&DVW LURQ RFWDJRQDO ER[SDLQWHG ZLWK FKURPDWH
VPRRWK DQG ILWWHG ZLWK JDVNHW FRQWDFWV PRXQWH
DUH IDVWHQHG E\ VROGHUHG RQ OXJV PHGLXP KDUG DVS
0&0 PD[LPXP FDEOH VL]H ZLWK VWXIILQJ ER[HQWUDQF

:HOGHG VWHHO UHFWDQJXODU ER[HV RLO UHVLVWDQW J
EURQ]H EROWV VKRW EODVWHG DQG SDLQWHG ZLWK FKU
PHGLXP KDUG DVSKDOW FRPSRXQG ILOOHG FDSXW VHDO
ILOOHG GLVFRQQHFWLQJ OLQNV LQVXODWHG VZLWFK VW
GUDZLQJV IRU ZDOO PRXQWLQJ

(;(&87,21

,167$//$7,21

,QVWDOO VSOLFH ER[HV DW FDEOH MRLQW 7LJKWHQ DUP

,QVWDOO MXQFWLRQ ER[HV RQ WUHQFK IORRU DURXQG F
WHUPLQDOV WR ER[FRQWDFWV)DVWHQ OLG VHFXUHO
EDFNILOOHG

,QVWDOO VXEZD\ OHYHO VWHHO ER[HV RQ ZDOO RI PDQ
IDVWHQ OLG DQG ILOO ZLWK FRPSRXQG

,QVWDOO GLVWULEXWLRQ OHYHO VWHHO ER[HV RQ ZDO
FRQQHFW EUDQFK IHHGHU)DVWHQ FRYHU DQG ILOO ZLW

,QVWDOO SRZHU OHYHO ER[HV DV IROORZV

&DVW LURQ W\SH RQ WUHQFK IORRU FRQQHFW FDEO
ILOO ZLWK FRPSRXQG EHIRUH WUHQFK LV EDFNILOOHG

6WHHO W\SH PRXQW RQ ZDOO RI PDQKROH FRQQH
GLVFRQQHFW OLQNV IDVWHQ OLG VHFXUHO\ FKHFN IR

(1' 2) 6(&7,21

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5()(5(1&(6

&DQDGLDQ 6WDQGDUGV $VVRFLDWLRQ &6$

&$1 &6$ & 1R 2XWOHW %R[HV &RQGXLW %R[HV +DUGZDUH

&6$ & 1R)OH[LEOH 0HWDO &RQGXLW DQG /LTXLG 7

&6$ & 1R (OHFWULFDO 0HWDOOLF 7XELQJ

&6$ & 1R 5LJLG 39& 8QSODVWLFL]HG &RQGXLW

&$1 &6$ & 1R)OH[LEOH 1RQPHWDOOLF 7XELQJ

:$67(0$1$*(0(17 $1' ',6326$/

6HSDUDWH DQG UHF\FOH ZDVWH PDWHULDOV LQ DFFRUG 'HPROLWLRQ :DVWH 0DQDJHPHQW DQG 'LVSRVDO

5HPRYH IURP VLWH DQG GLVSRVH RI DOO SDFNDJLQJ PDW

&ROOHFW DQG VHSDUDWH IRU GLVSRVDO SDFNDJLQJ PDW 0DQDJHPHQW 3ODQ

'LYHUW XQXVHG PHWDO PDWHULDOV IURP ODQGILOO W &RQVXOWDQW

)ROG XS PHWDO EDQGLQJ IODWWHQ DQG SODFH LQ GHVL

352'8&76

&21'8,76

(SR[\ FRDWHG FRQGXLW WR &6$ & 1R ZLWK]LQF F ILQLVK LQVLGH DQG RXWVLGH

(OHFWULFDO PHWDOOLF WXELQJ (07 WR &6$ & 1R

5LJLG SYF FRQGXLW WR &6$ & 1R

)OH[LEOH PHWDO FRQGXLW WR &6$ & 1R OLTXLG W

)OH[LEOH SYF FRQGXLW WR &$1 &6$ & 1R

&21'8,7)$67(1,1*6

2QH KROH VWHHO VWUDSV WR VHFXUH VXUIDFH FRQGXLW
FRQGXLWV ODUJHU WKDQ PP

%HDP FODPSV WR VHFXUH FRQGXLWV WR H[SRVHG VWHHO

&KDQQHO W\SH VXSSRUWV IRU WZR RU PRUH FRQGXLWV

7KUHDGHG URGV PP GLD WR VXSSRUW VXVSHQGHG FK

&21'8,7),77,1*6

)LWWLQJV PDQXIDFWXUHG IRU XVH ZLWK FRQGXLW VSHF

)DFWRU\ HOOV ZKHUH ƒ EHQGV DUH UHTXLUHG IRU P

:DWHUWLJKW FRQQHFWRUV DQG FRXSOLQJV IRU (07 6HW

(;3$16,21),77,1*6)25 5,*,' &21'8,7

:HDWKHUSURRI H[SDQVLRQ ILWWLQJV ZLWK LQWHUQDO E
H[SDQVLRQ

:DWHUWLJKW H[SDQVLRQ ILWWLQJV ZLWK LQWHJUDO ERQ
PP GHIOHFWLRQ LQ DOO GLUHFWLRQV

:HDWKHUSURRI H[SDQVLRQ ILWWLQJV IRU OLQHDU H[SDQ

),6+ &25'

3RO\SURS\OHQH

(;(&87,21

,167$//$7,21

,QVWDOO FRQGXLWV WR FRQVHUYH KHDGURRP LQ H[SRVH
LQ VSDFHV WKURXJK ZKLFK WKH\ SDVV

&RQFHDO FRQGXLWV H[FHSW LQ PHFKDQLFDO DQG HOHFW

6XUIDFH PRXQW FRQGXLWV H[FHSW DV QRWHG

8VH HOHFWULFDO PHWDOOLF WXELQJ (07 ZKHUH QRW V

8VH ULJLG SYF FRQGXLW XQGHUJURXQG DQG LQ FRUURVL

8VH IOH[LEOH PHWDO FRQGXLW IRU FRQQHFWLRQ WR PRV

8VH OLTXLG WLJKW IOH[LEOH PHWDO FRQGXLW IRU FRQ
GDPS ZHW RU FRUURVLYH ORFDWLRQV

0LQLPXP FRQGXLW VL]H IRU OLJKWLQJ DQG SRZHU FLUFX

%HQG FRQGXLW FROG 5HSODFH FRQGXLW LI NLQNHG RU
GLDPHWHU

0HFKDQLFDOO\ EHQG VWHHO FRQGXLW RYHU PP GLD

,QVWDOO ILVK FRUG LQ HPSW\ FRQGXLWV

5XQ PP VSDUH FRQGXLWV XS WR FHLOLQJ VSDFH DQG
VSDFH IURP HDFK IOXVK SDQHO 7HUPLQDWH WKHVH FRQG
LQ FHLOLQJ VSDFH RU LQ FDVH RI DQ H[SRVHG FRQFUHWH
ER[

5HPRYH DQG UHSODFH EORFNHG FRQGXLW VHFWLRQV 'R

'U\ FRQGXLWV RXW EHIRUH LQVWDOOLQJ ZLUH

685)$&(&21'8,76

5XQ SDUDOOHO RU SHUSHQGLFXODU WR EXLOGLQJ OLQHV

/RFDWH FRQGXLWV EHKLQG LQIUDUHG RU JDV ILUHG KHD

5XQ FRQGXLWV LQ IODQJHG SRUWLRQ RI VWUXFWXUDO V

*URXS FRQGXLWV ZKHUHYHU SRVVLEOH RQ VXUIDFH FKDQ

'R QRW SDVV FRQGXLWV WKURXJK VWUXFWXUDO PHPEHUV

'R QRW ORFDWH FRQGXLWV OHVV WKDQ PP SDUDOOHO
PP DW FURVVRYHUV

&21&(/(' &21'8,76

5XQ SDUDOOHO RU SHUSHQGLFXODU WR EXLOGLQJ OLQHV

'R QRW LQVWDOO KRUL]RQWDO UXQV LQ PDVRQU\ ZDOOV

'R QRW LQVWDOO FRQGXLWV LQ WHUUD]]R RU FRQFUHWH

&21'8,76 ,1 &$67 ,1 3/$&(&21&5(7(

/RFDWH WR VXLW UHLQIRUFLQJ VWHHO ,QVWDOO LQ FHQ

3URWHFW FRQGXLWV IURP GDPDJH ZKHUH WKH\ VWXE RX

,QVWDOO VOHHYHV ZKHUH FRQGXLWV SDVV WKURXJK VOD

3URYLGH RYHUVL]HG VOHHYH IRU FRQGXLW SDVVLQJ
PHPEUDQH LV LQVWDOOHG 8VH FROG PDVWLF EHWZHHQ V

'R QRW SODFH FRQGXLWV LV VODEV LQ ZKLFK VODE WKLF

(QFDVH FRQGXLWV FRPSOHWHO\ LQ FRQFUHWH ZLWK PLQ

2UJDQL]H FRQGXLWV LQ VODE WR PLQLPL]H FURVV RYHUV

&21'8,76 ,1 &$67 ,1 3/$&(6/$%6 21 *5$'(

5XQ FRQGXLWV PP DQG ODUJHU EHORZ VODE DQG HQFD
PP RI VDQG RYHU FRQFUHWH HQYHORSH EHORZ IORRU V

&21'8,76 81'(5*5281'

6ORSH FRQGXLWV WR SURYLGH GUDLQDJH

:DWHUSURRI MRLQWV SYF H[FHSWHG ZLWK KHDY\ FRDW

(1' 2) 6(&7,21

*(1(5$/

5(/$7(' 6(&7,216

6HFWLRQ ± &RQVWUXFWLRQ 'HPROLWLRQ :DVWH 0

6HFWLRQ &RPPRQ :RUN 5HVXOWV (OHFWULFDO

5()(5(1&(6

&DQDGLDQ 6WDQGDUGV $VVRFLDWLRQ &6$

,QVXODWHG &DEOH (QJLQHHUV $VVRFLDWLRQ ,QF ,&($

352'8&76

&$%/(3527(&7,21

[PP SODQNV SUHVVXUH WUHDWHG ZLWK FRSSHU C VROXWLRQ ZDWHU UHSHOOHQW SUHVHUYDWLYH

0$5.(56

&RQFUHWH W\SH FDEOH PDUNHUV [[PP ZLWK LPSUHVVHG LQ WRS VXUIDFH ZLWK DUURZV WR LQGLFDW UXQV

:RRGHQ SRVW W\SH PDUNHUV [PP P ORQJ SUH QDSWKHQDWH RU SHQWDFKORURSKHQRO VROXWLRQ Z QDPHSODWH IDVWHQHG QHDU SRVW WRS RQ VLGH IDFL GLUHFWLRQ RI GXFW DQG FDEOH UXQV

1DPHSODWH DOXPLQXP DQRGL]HG [PP PP SRVW ZLWK P\ODU ODEHO PP WKLFN ZLWK ZRUG DUURZV WR LQGLFDWH FKDQJH LQ GLUHFWLRQ

(;(&87,21

&$%/(,167$//$7,21 ,1 '8&76

,QVWDOO FDEOHV DV LQGLFDWHG LQ GXFWV

'R QRW SXOO VSOLFHG FDEOHV LQVLGH GXFWV

,QVWDOO PXOWLSOH FDEOHV LQ GXFW VLPXOWDQHRXVO

8VH &6$ DSSURYHG OXEULFDQWV RI W\SH FRPSDWLEOH
WHQVLRQ

7R IDFLOLWDWH PDWFKLQJ RI FRORXU FRGHG PXOWLFR
GLUHFWLRQ GXULQJ LQVWDOODWLRQ

%HIRUH SXOOLQJ FDEOH LQWR GXFWV DQG XQWLO FDEO
FRYHUHG FDEOHV ZLWK ZLSLQJ VROGHU VHDO HQGV RI
WDSH

$IWHU LQVWDOODWLRQ RI FDEOHV VHDO GXFW HQGV ZL

0$5.(56

0DUN FDEOH HYHU\ P DORQJ FDEOH UXQV DQG FKDQJ

0DUN XQGHUJURXQG VSOLFHV

:KHUH PDUNHUV DUH UHPRYHG WR SHUPLW LQVWDOODW
PDUNHUV

,QVWDOO ZRRGHQ SRVW W\SH PDUNHUV

/D\ FRQFUHWH PDUNHUV IODW DQG FHQWUHG RYHU FDE

),(/' 48$/,7< &21752/

3HUIRUP WHVWV LQ DFFRUGDQFH ZLWK 6HFWLRQ
DQG 6HFWLRQ ± &RPPLVVLRQLQJ &[5HTXLUHP

3HUIRUP WHVWV XVLQJ TXDOLILHG SHUVRQQHO 3URYLG

&KHFN SKDVH URWDWLRQ DQG LGHQWLI\ HDFK SKDVH FR

&KHFN HDFK IHHGHU IRU FRQWLQXLW\ VKRUW FLUFXLWV
RI FLUFXLWV LV QRW OHVV WKDQ PHJRKPV

3UH DFFHSWDQFH WHVWV

- $IWHU LQVWDOOLQJ FDEOH EXW EHIRUH VSOLFLQJ D
  UHVLVWDQFH WHVW ZLWK 9 PHJJHU RQ HDFK SK
- &KHFN LQVXODWLRQ UHVLVWDQFH DIWHU HDFK VSO
  FDEOH V\VWHP LV UHDG\ IRU DFFHSWDQFH WHVWLQ

$FFHSWDQFH 7HVWV

(QVXUH WKDW WHUPLQDWLRQV DQG DFFHVVRU\ HTX
*URXQG VKLHOGV JURXQG ZLUHV PHWDOOLF DUPR
+LJK 3RWHQWLDO +LSRW 7HVWLQJ
&RQGXFW KLSRW WHVWLQJ DW RI RULJLQDO
DFFRUGDQFH ZLWK PDQXIDFWXUHU V UHFRPPHQ
/HDNDJH &XUUHQW 7HVWLQJ
5DLVH YROWDJH LQ VWHSV IURP]HUR WR PD[LP
PDQXIDFWXUHU IRU W\SH RI FDEOH EHLQJ WHVV
+ROG PD[LPXP YROWDJH IRU VSHFLILHG WLPH S
5HFRUG OHDNDJH FXUUHQW DW HDFK VWHS

3URYLGH 2ZQHU¶V 5HSUHVHQWDWLYH ZLWK OLVW RI WH
WHVW ZDV PDGH FLUFXLW WHVWHG DQG UHVXOW RI HD
0DQXDO

5HPRYH DQG UHSODFH HQWLUH OHQJWK RI FDEOH LI FD

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7KH FRQWUDFWRU VKDOO IXUQLVK VKRUW FLUFXLW DQ
SUHSDUHG E\ WKH HOHFWULFDO HTXLSPHQW PDQXIDFWXU

7KH FRQWUDFWRU VKDOO IXUQLVK DQ $UF)ODVK +D]DUG
LQ &6$ = ± :RUNSODFH (OHFWULFDO 6DIHW\

7KH VFRSH RI WKH VWXGLHV VKDOO LQFOXGH DOO GLVWU

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$PHULFDQ 1DWLRQDO 6WDQGDUGV ,QVWLWXWH $16,

$16, & ± 6WDQGDUG $SSOLFDWLRQ *XLGH IRU $&
5DWHG RQ D 6\PPHWULFDO &XUUHQW %DVLV

$16, & ± 6WDQGDUG IRU /RZ 9ROWDJH $& 3RZHU
(QFORVXUHV

$16, & ± 6WDQGDUG 'HVLJQ 7HVWV IRU +LJK 9RO
6LQJOH 3ROH $LU 6ZLWFKHV)XVH 'LVFRQQHFWLQJ 6Z

$16, & ± 6WDQGDUG *HQHUDO 5HTXLUHPHQWV IR
3RZHU DQG 5HJXODWLQJ 7UDQVIRUPHUV

&6$ *URXS &6$

&6$ = ± :RUNSODFH (OHFWULFDO 6DIHW\

,QVWLWXWH RI (OHFWULFDO DQG (OHFWURQLFV (QJLQHH

,(((± 5HFRPPHQGHG 3UDFWLFH IRU (OHFWULF 3RZ
RI ,QGXVWULDO DQG &RPPHUFLDO 3RZHU 6\VWHPV

,(((± 5HFRPPHQGHG 3UDFWLFH IRU (OHFWULF 3
%XLOGLQJV

,(((± 5HFRPPHQGHG 3UDFWLFH IRU 3URWHFWLRQ I
&RPPHUFLDO 3RZHU 6\VWHPV

,(((± 5HFRPPHQGHG 3UDFWLFH IRU ,QGXVWULDO
$QDO\VLV

,(((± 5HFRPPHQGHG 3UDFWLFH IRU $SSO\LQJ /RZ 9
LQ ,QGXVWULDO DQG &RPPHUFLDO 3RZHU 6\VWHPV

,(((± *XLGH IRU 3HUIRUPLQJ $UF)ODVK +D]DUG &I

7KH 1DWLRQDO)LUH 3URWHFWLRQ $VVRFLDWLRQ 1)3$

1)3$ 1DWLRQDO (OHFWULFDO &RGH

1)3$ (± 6WDQGDUG IRU (OHFWULFDO 6DIHW\ LQ WKH

68%0,77$/6

6XEPLWWDOV LQ DFFRUGDQFH ZLWK 6HFWLRQ 6X

7KH VKRUW FLUFXLW DQG SURWHFWLYH GHYLFH FRRUGLQ
5HSUHVHQWDWLYH SULRU WR UHFHLYLQJ ILQDO DSSURYD
DQG RU SULRU WR UHOHDVH RI HTXLSPHQW GUDZLQJV IR
VWXGLHV PD\ FDXVH GHOD\ LQ HTXLSPHQW PDQXIDFWXUL
WKH 2ZQHU¶V 5HSUHVHQWDWLYH PD\ EH REWDLQHG IRU SU
WR HQVXUH WKDW WKH VHOHFWLRQ RI GHYLFH DQG FKDUD

7KH UHVXOWV RI WKH VKRUW FLUFXLW SURWHFWLYH GH
VWXGLHV VKDOO EH VXPPDUL]HG LQ D ILQDO UHSRUW

7KH UHSRUW VKDOO LQFOXGH WKH IROORZLQJ VHFWLRQV

2QH OLQH GLDJUDP VKRZLQJ SURWHFWLYH GHYLFH
GHVLJQDWLRQV FDEOH VL]H DQG OHQJWKV WUDQVIR
JHQHUDWRU N9$ UDWLQJV DQG VZLWFKJHDU VZLWFK

'HVFULSWLRQV SXUSRVH EDVLV DQG VFRSH RI WKH

7DEXODWLRQV RI WKH ZRUVW FDVH FDOFXODWHG VK
DSSOLHG GHYLFH UDWLQJ DXWRPDWLF WUDQVIHU VZL
FLUFXLW GXWLHV VKDOO EH XSZDUG DGMXVWHG IRU ;
UDWLQJV

3URWHFWLYH GHYLFH WLPH YHUVXV FXUUHQW FRRU
GLDJUDP LGHQWLI\LQJ WKH SORWWHG GHYLFHV WDEX
DQG DGMXVWDEOH FLUFXLW EUHDNHU WULS XQLW VHW

)DXOW VWXG\ LQSXW GDWD FDVH GHVFULSWLRQV DQ
RI WHUPV DQG JXLGH IRU LQWHUSUHWDWLRQ RI WKH F

,QFLGHQW HQHUJ\ DQG IODVK SURWHFWLRQ ERXQGDU

&RPPHQWV DQG UHFRPPHQGDWLRQV IRU V\VWHP LPSU

([HFXWLYH 6XPPDU\ LQFOXGLQJ VRXUFH RI LQIRUPDW

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7KH VKRUW FLUFXLW SURWHFWLYH GHYLFH FRRUGLQDWI
FRQGXFWHG XQGHU WKH VXSHUYLVLRQ DQG DSSURYDO RI
VNLOOHG LQ SHUIRUPLQJ DQG LQWHUSUHWLQJ WKH SRZHU

7KH 5HJLVWHUHG 3URIHVVLRQDO (OHFWULFDO (QJLQHHU
UHJLVWHUHG WR SUDFWLFH LQ WKH 3URYLQFH RI 2QWDUL

7KH 5HJLVWHUHG 3URIHVVLRQDO (OHFWULFDO (QJLQHHU
H[SHULHQFH LQ SHUIRUPLQJ SRZHU V\VWHP VWXGLHV

7KH HTXLSPHQW PDQXIDFWXUHU RU DSSURYHG HQJLQHHU
$UF)ODVK +D]DUG $QDO\VLV E\ VXEPLWWLQJ TXDOLILFDW

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&RQWUDFWRU WR IXUQLVK VKRUW FLUFXLW DQG SURWHF
HTXLSPHQW PDQXIDFWXUHU RU DQ DSSURYHG HQJLQHHU
PRGLILHG VWXG\ VKDOO EHJLQ ZLWK WKH XWLOLW\ FRPSD
RI WKH HOHFWULFDO SURWHFWLYH GHYLFHV GRZQ WR DQ
9ROW SDQHOERDUGV 6WXG\ VKDOO DOVR LQFOXGH YL
SRZHU IDFWRU FRUUHFWLRQ HTXLSPHQW WUDQVIRUPHU
YDULDEOH IUHTXHQF\ GULYHV HPHUJHQF\ VWDQGE\ JHQH

7KH FRQWUDFWRU VKDOO IXUQLVK DQ $UF)ODVK +D]DUG

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&RQWUDFWRU VKDOO IXUQLVK DOO GDWD DV UHTXLUHG
SHUIRUPLQJ WKH VKRUW FLUFXLW SURWHFWLYH GHYLFH
VWXGLHV VKDOO IXUQLVK WKH &RQWUDFWRU ZLWK D OLV
WKH FRQWUDFW 7KH &RQWUDFWRU VKDOO H[SHGLWH FR
VWXGLHV DV UHTXLUHG IRU ILQDO DSSURYDO RI WKH GLV
WR WKH UHOHDVH RI WKH HTXLSPHQW IRU PDQXIDFWXULQ

6RXUFH FRPELQDWLRQ PD\ LQFOXGH SUHVHQW DQG IXWX

,I DSSOLFDEOH LQFOXGH IDXOW FRQWULEXWLRQ RI H[LV
REWDLQ UHTXLUHG H[LVWLQJ HTXLSPHQW GDWD LI QHFHV

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8VH DFWXDO FRQGXFWRU LPSHGDQFHV LI NQRZQ ,I XQN
EDVHG RQ ,(((6WDQGDUG ODWHVW HGLWLRQ

7UDQVIRUPHU GHVLJQ LPSHGDQFHV DQG VWDQGDUG ; 5 U
DUH QRW DYDLODEOH

3URYLGH WKH IROORZLQJ

&DOFXODWLRQ PHWKRGV DQG DVVXPSWLRQV

6HOHFWHG EDVH SHU XQLW TXDQWLWLHV

2QH OLQH GLDJUDP RI WKH V\VWHP EHLQJ HYDOXDWH
LQWHUUXSWLQJ UDWLQJ RI GHYLFHV QRWHG

6RXUFH LPSHGDQFH GDWD LQFOXGLQJ HOHFWULF XW
FKDUDFWHULVWLFV

7DEXODWLRQV RI FDOFXODWHG TXDQWLWLHV

5HVXOWV FRQFOXVLRQV DQG UHFRPPHQGDWLRQV

&DOFXODWH VKRUW FLUFXLW PRPHQWDU\ DQG LQWHUUX
HDFK

(OHFWULF XWLOLW\¶V VXSSO\ WHUPLQDWLRQ SRLQW

/RZ YROWDJH VZLWFKJHDU

%UDQFK FLUFXLW SDQHOERDUGV

2WKHU VLJQLILFDQW ORFDWLRQV WKURXJKRXW WKH V

)RU JURXQGHG V\VWHPV SURYLGH D EROWHG OLQH WR J
IRU WKH WKUHH SKDVH EROWHG IDXOW VKRUW FLUFXLW V

3URWHFWLYH 'HYLFH (YDOXDWLRQ

(YDOXDWH HTXLSPHQW DQG SURWHFWLYH GHYLFHV D

$GHTXDF\ RI VZLWFKJHDU PRWRU FRQWURO FHQWHUV VKRUW FLUFXLW VWUHVVHV

$GHTXDF\ RI WUDQVIRUPHU ZLQGLQJV WR ZLWKVWDQG

&DEOH DQG EXVZD\ VL]HV IRU DELOLW\ WR ZLWKVWDQ

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3URSRVHG SURWHFWLYH GHYLFH FRRUGLQDWLRQ WLPH FORJ VFDOH JUDSKV

,QFOXGH RQ HDFK FXUYH VKHHW D FRPSOHWH WLWOH DQG VSHFLILF SRUWLRQ RI WKH V\VWHP FRYHUHG

7HUPLQDWH GHYLFH FKDUDFWHULVWLF FXUYHV DW D SDV\PPHWULFDO IDXOW FXUUHQW WR ZKLFK GHYLFH LV H[S

,GHQWLI\ GHYLFH DVVRFLDWHG ZLWK HDFK FXUYH E\ PDQ WDS WLPH GHOD\ DQG LQVWDQWDQHRXV VHWWLQJV UHF

3ORW WKH IROORZLQJ FKDUDFWHULVWLFV RQ WKH FXUYH

(OHFWULF XWLOLW\¶V RYHUFXUUHQW SURWHFWLYH G

/RZ YROWDJH IXVHV LQFOXGLQJ PDQXIDFWXUHU¶V PL DQG GDPDJH EDQGV

/RZ YROWDJH HTXLSPHQW FLUFXLW EUHDNHU WULS GH EDQGV

7UDQVIRUPHU IXOO ORDG FXUUHQW PDJQHWL]LQJ LQ SURWHFWLRQ FXUYHV

&RQGXFWRU GDPDJH FXUYHV

*URXQG IDXOW SURWHFWLYH GHYLFHV DV DSSOLFDEO

3HUWLQHQW PRWRU VWDUWLQJ FKDUDFWHULVWLFV D

3HUWLQHQW JHQHUDWRU VKRUW FLUFXLW GHFUHPHQ

3URYLGH DGHTXDWH WLPH PDUJLQV EHWZHHQ GHYLFH FK SURYLGHG ZKLOH SURYLGLQJ SURSHU SURWHFWLRQ

$5&)/$6+ +$=$5' 1/<6,6

7KH DUF IODVK KD]DUG DQDO\VLV VKDOO EH SHUIRUPHG

7KH IODVK SURWHFWLRQ ERXQGDU\ DQG WKH LQFLGHQW
ORFDWLRQV LQ WKH HOHFWULFDO GLVWULEXWLRQ V\VWHP
DQG VSOLWWHUV ZKHUH ZRUN FRXOG EH SHUIRUPHG RQ

7KH $UF)ODVK +D]DUG $QDO\VLV VKDOO LQFOXGH DOO Q
FRXOG EH SHUIRUPHG RQ HQHUJL]HG SDUWV

6DIH ZRUNLQJ GLVWDQFHV VKDOO EH EDVHG XSRQ WKH P
LQFLGHQW HQHUJ\ RI FDO FP

:KHQ DSSURSULDWH WKH VKRUW FLUFXLW FDOFXODWLRQ
GHYLFHV ZLOO EH UHWULHYHG IURP WKH VKRUW FLUFXL
RYHUFXUUHQW UHOD\V VKRXOG QRW EH WDNHQ LQWR FRQ
ZKHQ SHUIRUPLQJ LQFLGHQW HQHUJ\ FDOFXODWLRQV

7KH VKRUW FLUFXLW FDOFXODWLRQV DQG WKH FRUUHVS
V\VWHP VFHQDULRV PXVW EH FRPSDUHG DQG WKH JUHDWH
IRU HDFK HTXLSPHQW ORFDWLRQ &DOFXODWLRQV PXVW E
PLQLPXP FRQWULEXWLRQV RI IDXOW FXUUHQW PDJQLWXG
FRQGLWLRQV 7KH PLQLPXP FDOFXODWLRQ ZLOO DVVXPH
DQG ZLOO DVVXPH D PLQLPXP PRWRU FRQWULEXWLRQ DO
FDOFXODWLRQ ZLOO DVVXPH D PD[LPXP FRQWULEXWLRQ
PD[LPXP DPRXQW RI PRWRUV WR EH RSHUDWLQJ

7KH LQFLGHQW HQHUJ\ FDOFXODWLRQV PXVW FRQVLGHU
SHUIRUPLQJ DUF IODVK FDOFXODWLRQV RQ EXVHV ZLWK P
WDNH LQWR DFFRXQW WKH FKDQJLQJ FXUUHQW FRQWUL
GHFUHPHQWHG ZLWK WLPH)DXOW FRQWULEXWLRQ IURP P
DV IROORZV

)DXOW FRQWULEXWLRQ IURP LQGXFWLRQ PRWRUV VKP

)DXOW FRQWULEXWLRQ IURP V\QFKURQRXV PRWRUV D
WKH DFWXDO GHFUHPHQW RI HDFK DV FORVHO\ DV SRV
PDJQHW JHQHUDWRUV ZLOO W\SLFDOO\ GHFD\ IURP

)RU HDFK HTXLSPHQW ORFDWLRQ ZLWK D VHSDUDWHO\ H
VHSDUDWLRQ EHWZHHQ WKH OLQH VLGH WHUPLQDOV RI WK
FDOFXODWLRQV IRU LQFLGHQW HQHUJ\ DQG IODVK SURWH
ORDG VLGH RI WKH PDLQ EUHDNHU

:KHUH SHUIRUPLQJ LQFLGHQW HQHUJ\ FDOFXODWLRQV RQ
SHU DERYH WKH OLQH VLGH DQG ORDG VLGH FRQWULEXV

0LV FRRUGLQDWLRQ VKRXOG EH FKHFNHG DPRQJVW DOO
LPPHGLDWH SURWHFWLYH GHYLFH XSVWUHDP RI WKH FDC
XWLOL]H WKH IDVWHVW GHYLFH WR FRPSXWH WKH LQFLGH

$UF)ODVK FDOFXODWLRQV VKDOO EH EDVHG RQ DFWXDO

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,QSXW GDWD VKDOO LQFOXGH EXW QRW EH OLPLWHG WR

8WLOLW\ SKDVH DQG / * DYDLODEOH FRQWULEXWLRQ

)HHGHU LQSXW GDWD LQFOXGLQJ IHHGHU W\SH FDEO
FRQGXLW W\SH PDJQHWLF RU QRQ PDJQHWLF DQG FR

7UDQVIRUPHU LQSXW GDWD LQFOXGLQJ ZLQGLQJ FR
FRQQHFWLRQ SULPDU\ DQG VHFRQGDU\ YROWDJH UDW
SKDVH VKLIW

5HDFWRU GDWD LQFOXGLQJ YROWDJH UDWLQJ DQG I

*HQHUDWLRQ FRQWULEXWLRQ GDWD V\QFKURQRXV
FLUFXLW UHDFWDQFH ;´G UDWHG 09$ UDWHG YROW
FRQWULEXWLRQ IRU 8WLOLW\ VRXUFHV DQG ; 5 UDWL

0RWRU FRQWULEXWLRQ GDWD LQGXFWLRQ PRWRUV I
FLUFXLW UHDFWDQFH UDWHG KRUVHSRZHU RU N9$ UD

6KRUW &LUFXLW 2XWSXW 'DWD VKDOO LQFOXGH EXW QR

/RZ YROWDJH)DXOW 5HSRUW VKDOO LQFOXGH D VHF
FDOFXODWLRQV DQG VKDOO VKRZ WKH IROORZLQJ LQI

9ROWDJH

&DOFXODWHG IDXOW FXUUHQW PDJQLWXGH DQG D

)DXOW SRLQW ; 5 UDWLR

(TXLYDOHQW LPSHGDQFH

0RPHQWDU\ 'XW\ 5HSRUW VKDOO LQFOXGH D VHFWLR
FDOFXODWLRQV DQG VKDOO VKRZ WKH IROORZLQJ LQI

9ROWDJH

&DOFXODWHG V\PPHWULFDO IDXOW FXUUHQW PDJ

)DXOW SRLQW ; 5 UDWLR

&DOFXODWHG DV\PPHWULFDO IDXOW FXUUHQWV

%DVHG RQ IDXOW SRLQW ; 5 UDWLR

%DVHG RQ FDOFXODWHG V\PPHWULFDO YDOXH

%DVHG RQ FDOFXODWHG V\PPHWULFDO YDOXH

(TXLYDOHQW LPSHGDQFH

,QWHUUXSWLQJ 'XW\ 5HSRUW VKDOO LQFOXGH D VHF\
FDOFXODWLRQV DQG VKDOO VKRZ WKH IROORZLQJ LQI

9ROWDJH

&DOFXODWHG V\PPHWULFDO IDXOW FXUUHQW PDJ

)DXOW SRLQW ; 5 UDWLR

1R $& 'HFUHPHQW 1$&' 5DWLR

(TXLYDOHQW LPSHGDQFH

0XOWLSO\LQJ IDFWRUV IRU DQG F\FOH FLU
EDVLV

0XOWLSO\LQJ IDFWRUV IRU DQG F\FOH FLU

5HFRPPHQGHG 3URWHFWLYH 'HYLFH 6HWWLQJV

3KDVH DQG *URXQG 5HOD\V

&XUUHQW WUDQVIRUPHU UDWLR

&XUUHQW VHWWLQJ

7LPH VHWWLQJ

,QVWDQWDQHRXV VHWWLQJ

5HFRPPHQGDWLRQV RQ LPSURYHG UHOD\LQJ V\VW

&LUFXLW %UHDNHUV

$GMXVWDEOH SLFNXSV DQG WLPH GHOD\V ORQJ W

$GMXVWDEOH WLPH FXUUHQW FKDUDFWHULVWLF

$GMXVWDEOH LQVWDQWDQHRXV SLFNXS

5HFRPPHQGDWLRQV RQ LPSURYHG WULS V\VWHPV

,QFLGHQW HQHUJ\ DQG IODVK SURWHFWLRQ ERXQGDU\ FD

$UFLQJ IDXOW PDJQLWXGH

3URWHFWLYH GHYLFH FOHDULQJ WLPH

'XUDWLRQ RI DUF

$UF IODVK ERXQGDU\

:RUNLQJ GLVWDQFH

,QFLGHQW HQHUJ\

+D]DUG 5LVN &DWHJRU\

5HFRPPHQGDWLRQV IRU DUF IODVK HQHUJ\ UHGXFWLR

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),(/' $'-8670(17

$GMXVW UHOD\ DQG SURWHFWLYH GHYLFH VHWWLQJV D
SURYLGHG E\ WKH FRRUGLQDWLRQ VWXG\

0DNH PLQRU PRGLILFDWLRQV WR HTXLSPHQW DV UHTXLU
FLUFXLW DQG SURWHFWLYH GHYLFH FRRUGLQDWLRQ VWXG

1RWLI\ 2ZQHU¶V 5HSUHVHQWDWLYH LQ ZULWLQJ RI DQ\ U

$5&)/$6+ :$51,1* /$%(/6

7KH FRQWUDFWRU RI WKH $UF)ODVK +D]DUG $QDO\VLV
WUDQVIHU W\SH ODEHO RI KLJK DGKHVLRQ SRO\HVWHU IR

$OO ODEHOV ZLOO EH EDVHG RQ UHFRPPHQGHG RYHUFX
DIWHU WKH UHVXOWV RI WKH DQDO\VLV KDYH EHHQ SUHVH
XSJUDGHV RU PRGLILFDWLRQV KDYH EHHQ LQFRUSRUDWHG

7KH ODEHO VKDOO KDYH DQ RUDQJH KHDGHU ZLWK WK
+$=$5'´ DQG VKDOO LQFOXGH WKH IROORZLQJ LQIRUPDWLL

/RFDWLRQ GHVLJQDWLRQ

1RPLQDO YROWDJH

)ODVK SURWHFWLRQ ERXQGDU\

+D]DUG ULVN FDWHJRU\

,QFLGHQW HQHUJ\

:RUNLQJ GLVWDQFH

(QJLQHHULQJ UHSRUW QXPEHU UHYLVLRQ QXPEHU DQ

/DEHOV VKDOO EH PDFKLQH SULQWHG ZLWK QR ILHOG PD

$UF IODVK ODEHOV VKDOO EH SURYLGHG LQ WKH IROOR
UHFRPPHQGHG RYHUFXUUHQW GHYLFH VHWWLQJV

)RU HDFK DQG YROW SDQHOERDUG RQH DUF IO

)RU HDFK PRWRU FRQWURO FHQWHU RQH DUF IODVK

)RU HDFK ORZ YROWDJH VZLWFKERDUG RQH DUF IOD

)RU HDFK VZLWFKJHDU RQH IODVK ODEHO VKDOO EH

)RU PHGLXP YROWDJH VZLWFKHV RQH DUF IODVK ODE

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&RRUGLQDWH UHTXLUHPHQWV RI WKLV 6HFWLRQ ZLWK LQ
6HOHFWLYH ,QWHUUR 'HPROLWLRQ DQG DV IROORZV

'LVFRQQHFW HOHFWULFDO FLUFXLWV DQG SDQHO IHH
GLVWULEXWLRQ SDQHO DV LV UHDG\ IRU VXEVHTXHQW

5HPRYH H[LVWLQJ OXPLQDLUHV HOHFWULFDO GHYLF
FRQGXLWV ER[HV ZLULQJ DQG VLPLODU LWHPV XQOH

'LVFRQQHFW DQG UHPRYH H[LVWLQJ ILUH DODUP V\VW
ZLULQJ DQG VLPLODU LWHPV XQOHVV VSHFLILFDOO\ Q

'LVFRQQHFW DQG UHPRYH FRPPXQLFDWLRQ V\VWHPV
FDEOLQJ DQG VLPLODU LWHPV XQOHVV VSHFLILFDOO\

'LVFRQQHFW DQG UHPRYH WHOHSKRQH RXWOHWV DV
EDFNERDUGV DQG UHODWHG DFFHVVRULHV PDLQWDL
EDFNERDUG DV LV

3HUIRUP GHPROLWLRQ ZRUN LQ D QHDW DQG ZRUNPD

5HPRYH WRROV RU HTXLSPHQW DIWHU FRPSOHWL
UHDG\ IRU VXEVHTXHQW UHQRYDWLRQ ZRUN

5HSDLU DQG UHVWRUH GDPDJHV FDXVHG DV D UH
H[LVWLQJ PDWHULDOV DQG ILQLVKHV

'LVFRQQHFW SDQHO IHHGHUV EDFN WR PDLQ GLVWULE
EUHDNHU DV ³63$5(´

3ODFH ZHDWKHUSURRI EODQN FRYHU SODWHV RQ H
GHPROLWLRQ DQG UHPRYDO DFWLYLWLHV

5HPRYH H[LVWLQJ FRQGXLWV ER[HV FDEOLQJ DQG
OXPLQDLUHV HOHFWULFDO GHYLFHV DQG HTXLSPHQW

*ULQG RII FRQGXLWV DQG PDNH IOXVK ZLWK VXUIDFH
FRQFUHWH VHDO RSHQ HQGV RI FRQGXLW ZLWK VLOLF

6HDO RSHQ HQGV RI FRQGXLW ZLWK VLOLFRQH VHDO
LQDFFHVVLEOH RU FDQQRW EH UHPRYHG ZLWKRXW GD

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$UUDQJH IRU OHJDO GLVSRVDO DQG UHPRYH GHPROLVKH
VLWH RU DOWHUQDWLYH GLVSRVDO VLWH UHF\FOH FHQW
PDWHULDOV EHLQJ VDOYDJHG IRU UH XVH LQ QHZ FRQVWU

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*(1(5$/

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&DQDGLDQ 6WDQGDUGV $VVRFLDWLRQ &6$,QWHUQDWLR

&6$ & 1R 0RWRUV DQG *HQHUDWRUV

&6$ & 1R 0 0RWRUV DQG *HQHUDWRUV IRU 8

(OHFWULFDO DQG (OHFWURQLF 0DQXIDFWXUHUV $VVRFL

((0$& 0 RU ODWHVW UHYLVLRQ 6WDQGDUG IRU

352'8&7 '7

6XEPLW SURGXFW GDWD LQ DFFRUGDQFH ZLWK 6HFWLRQ

6XEPLW :+0,6 06'6 0DWHULDO 6DIHW\ 'DWD 6KHHWV LQ
+D]DUGRXV 0DWHULDOV

6XEPLW SURGXFW GDWD VKHHWV IRU PRWRUV ,QFOXGH
SK\VLFDO VL]H KRUVHSRZHU ZDWW UDWLQJ OLPLWDWLR

6+23 '5$:,1*6

6XEPLW VKRS GUDZLQJV LQ DFFRUGDQFH ZLWK 6HFWLRQ

,QGLFDWH GLPHQVLRQV UHFRPPHQGHG LQVWDOODWLRQ
RI PRXQWLQJ EROW KROHV DQG UHFRPPHQGHG VXSSRUW

4XDOLW\ $VVXUDQFH 6XEPLWWDOV

&HUWLILFDWHV VXEPLW FHUWLILFDWHV VLJQHG E\ PD
ZLWK VSHFLILHG SHUIRUPDQFH FKDUDFWHULVWLFV DQ

0DQXIDFWXUHU V ,QVWUXFWLRQV VXEPLW PDQXIDFW

&/26(287 68%0,77$/6

3URYLGH PDLQWHQDQFH GDWD IRU IUDFWLRQDO KRUVHS
VSHFLILHG LQ 6HFWLRQ &ORVHRXW 6XEPLWWDOV

:$67(0$1$*(0(17 $1' ',6326$/

6HSDUDWH DQG UHF\FOH ZDVWH PDWHULDOV LQ DFFRUG 'HPROLWLRQ :DVWH 0DQDJHPHQW DQG 'LVSRVDO

5HPRYH IURP VLWH DQG GLVSRVH RI DOO SDFNDJLQJ PDW

&ROOHFW DQG VHSDUDWH IRU GLVSRVDO SDFNDJLQJ PDW 0DQDJHPHQW 3ODQ

'LYHUW XQXVHG PHWDO PDWHULDOV IURP ODQGILOO W &RQVXOWDQW

)ROG XS PHWDO EDQGLQJ IODWWHQ DQG SODFH LQ GHVL

352'8&76

)5$&7,21$/ +256(32:(5 02725

1RQ KD]DUGRXV ORFDWLRQV WR &6$ & 1R DQG ((

+D]DUGRXV ORFDWLRQV WR &6$ & 1R

5DWLQJ $V LQGLFDWHG

7\SH $V LQGLFDWHG

%HDULQJV $V LQGLFDWHG

)UDPH VL]H $V LQGLFDWHG

(QFORVXUH $V LQGLFDWHG

0RXQWLQJ $V LQGLFDWHG

0RWRU ZLWK LQKHUHQW RYHUKHDWLQJ SURWHFWRUV

(;(&87,21

0$18)$&785(5 6 ,16758&7,216

&RPSOLDQFH FRPSO\ ZLWK PDQXIDFWXUHU V ZULWWH LQFOXGLQJ SURGXFW WHFKQLFDO EXOOHWLQV KDQGOL GDWDVKHHWV

,167$//$7,21

,QVWDOO ZLULQJ IOH[LEOH FRQQHFWLRQV DQG JURXQG

&KHFN URWDWLRQ EHIRUH FRXSOLQJ WR GULYHQ HTXLSP

&/($1,1*

3URFHHG LQ DFFRUGDQFH ZLWK 6HFWLRQ &OHDQ

2Q FRPSOHWLRQ DQG YHULILFDWLRQ RI SHUIRUPDQFH H[FHVV PDWHULDOV UXEELVK WRROV DQG HTXLSPHQW

(1' 2) 6(&7,21

*(1(5$/

5()(5(1&(6

(OHFWULFDO DQG (OHFWURQLF 0DQXIDFWXUHU¶V $VVRFL

((0$& 0 0RWRUV DQG *HQHUDWRUV

((0$& 0 /HDG 0DUNLQJ DQG &RQQHFWLRQV IRU 3RO

352'8&7 '7

6XEPLW SURGXFW GDWD LQ DFFRUGDQFH ZLWK 6HFWLRQ

6XEPLW :+0,6 06'6 0DWHULDO 6DIHW\ 'DWD 6KHHWV LQ
+D]DUGRXV 0DWHULDOV

6XEPLW SURGXFW GDWD VKHHWV IRU PRWRUV ,QFOXGH
SK\VLFDO VL]H KRUVHSRZHU ZDWW UDWLQJ OLPLWDWLR

0DQXIDFWXUHU¶V ,QVWUXFWLRQV 3URYLGH WR LQGLF
VHTXHQFH FOHDQLQJ SURFHGXUHV

6+23 '5$:,1*6

6XEPLW VKRS GUDZLQJV LQ DFFRUGDQFH ZLWK 6HFWLRQ

,QGLFDWH

2YHUDOO GLPHQVLRQV RI PRWRU

6KDIW FHQWUHOLQH WR EDVH GLPHQVLRQ

6KDIW H[WHQVLRQ GLDPHWHU DQG NH\ZD\ FRXSOLQJ

)L[LQJ VXSSRUW GLPHQVLRQV

'LPHQVLRQHG SRVLWLRQ RI YHQWLODWLRQ RSHQLQJV

7HUPLQDO ER[ORFDWLRQ DQG VL]H RI WHUPLQDOV

$UUDQJHPHQW DQG GLPHQVLRQV RI DFFHVVRULHV

'LDJUDP RI FRQQHFWLRQV

6WDUWLQJ FXUUHQW DQG UHODWLYH GDWD QHFHVV
HTXLSPHQW

6SHHG WRUTXH FKDUDFWHULVWLF

:HLJKW

,QVWDOODWLRQ GDWD

&/26(287 68%0,77$/6

3URYLGH PDLQWHQDQFH GDWD IRU PRWRUV IRU LQFRUSR
&ORVHRXW 6XEPLWWDOV

'DWD QHFHVVDU\ IRU PDLQWHQDQFH RI PRWRUV

0DQXIDFWXUHU V UHFRPPHQGHG OLVW RI VSDUH SDUWV

'(/,9(5< 6725$*($1' +$1'/,1*

+DQGOH PRWRUV ZLWK VXLWDEOH OLIWLQJ HTXLSPHQW

6WRUH PRWRUV LQ KHDWHG GU\ ZHDWKHU SURWHFWHG

48$/,7< $6685$1&(

(QJLQHHU UHVHUYHV WKH ULJKW WR ZLWQHVV VWDQGDU

:$67(0$1$*(0(17 $1' ',6326$/

6HSDUDWH DQG UHF\FOH ZDVWH PDWHULDOV LQ DFFRUG
'HPROLWLRQ :DVWH 0DQDJHPHQW DQG 'LVSRVDO

5HPRYH IURP VLWH DQG GLVSRVH RI DOO SDFNDJLQJ PDW

&ROOHFW DQG VHSDUDWH IRU GLVSRVDO SDFNDJLQJ PDW
0DQDJHPHQW 3ODQ

'LYHUW XQXVHG PHWDO PDWHULDOV IURP ODQGILOO W
&RQVXOWDQW

)ROG XS PHWDO EDQGLQJ IODWWHQ DQG SODFH LQ GHVL

(;75$ 0$7(5,$/6

3URYLGH PDLQWHQDQFH PDWHULDOV DQG VSDUH SDUWV 6XEPLWWDOV

352'8&76

+256(32:(5 02725

0$7(5,$/6

0RWRUV WR ((0$& 0

/HDG PDUNLQJV WR ((0$& 0

5DWLQJ $V LQGLFDWHG

0RWRU 7\SH $V LQGLFDWHG RQ GUDZLQJV

6HUYLFH)DFWRU

'(6,*1 /(77(56

3RO\SKDVH VTXLUUHO FDJH LQGXFWLRQ PRWRUV GHVLJQ

(1&/2685(

7RWDOO\ HQFORVHG IDQ FRROHG

7RWDOO\ HQFORVHG H[SORVLRQ SURRI IRU XVH LQ &OD

,168/$7,21

&ODVV DV LQGLFDWHG RQ GUDZLQJV

$PELHQW WHPSHUDWXUH ž& RU DV LQGLFDWHG

%($5,1*6

$QWLIULFWLRQ W\SH EHDULQJV ILWWHG ZLWK UHDGLO\ UXQQLQJ RU VWDWLRQDU\

67$57,1* 0(7+2'

$OO PRWRUV VKDOO EH ,QYHUWHU 'XW\ UDWHG

,QFOXGH DQFKRU GHYLFHV DQG VHWWLQJ WHPSODWHV

(;(&87,21

,167$//$7,21

'U\ RXW PRWRU LI GDPSQHVV SUHVHQW LQ DFFRUGDQFH

,QVWDOO ZLULQJ IOH[LEOH FRQQHFWLRQV DQG JURXQGI

0DNH ZLULQJ FRQQHFWLRQV 8VH OLTXLG WLJKW 39& M FRQGXLW DQG PRWRU

0DNH IOH[LEOH FRQGXLW ORQJ HQRXJK WR SHUPLW PRY UDLOV

&KHFN IRU FRUUHFW GLUHFWLRQ RI URWDWLRQ ZLWK PR

$OLJQ DQG FRXSOH PRWRU WR GULYHQ PDFKLQHU\ WR PI SDUWV VXFK DV FRXSOLQJV EHOWV VKHDYHV DV SURYL

),(/' 48$/,7< &21752/

3HUIRUP WHVWV LQ DFFRUGDQFH ZLWK 6HFWLRQ

(1' 2) 6(&7,21

*(1(5$/

5(/$7(' 6(&7,216

6HFWLRQ ± 6XEPLWWDO 3URFHGXUHV

6HFWLRQ ± &ORVHRXW 3URFHGXUHV

6HFWLRQ ± &RPPRQ :RUN 5HVXOWV (OHFWULFDO

6<67(0 '(6&5,37,21

/RZ YROWDJH FRQWURO V\VWHP GHVLJQHG WR SURYLGH

/RZ YROWDJH PRPHQWDU\ FRQWDFW VZLWFKHV

/RZ YROWDJH UHOD\V

&RQWURO 7UDQVIRUPHUV

/RZ YROWDJH UHFWLILHUV

0DQXDO VZLWFK FRQWURO

352'8&7 '7

6XEPLW PDQXIDFWXUHU V SULQWHG SURGXFW OLWHUDWX
FKDUDFWHULVWLFV SHUIRUPDQFH FULWHULD DQG OLPLW

6XEPLW WZR FRSLHV RI :RUNSODFH +D]DUGRXV 0DWH
0DWHULDO 6DIHW\ 'DWD 6KHHWV 06'6

6+23 '5$:,1*6

6XEPLW VKRS GUDZLQJV LQ DFFRUGDQFH ZLWK 'LYLVLRQ

&/26(287 '2&80(176

6XEPLW PDLQWHQDQFH GDWD LQ DFFRUGDQFH ZLWK 6HF

7(67 5(32576

6XEPLW FHUWLILHG WHVW UHSRUWV LQGLFDWLQJ FRP
SHUIRUPDQFH FKDUDFWHULVWLFV DQG SK\VLFDO SURSHU

&HUWLILFDWHV VXEPLW FHUWLILFDWHV VLJQHG E\ PDQX
VSHFLILHG SHUIRUPDQFH FKDUDFWHULVWLFV DQG SK\VLF

0DQXIDFWXUHU V ,QVWUXFWLRQV VXEPLW PDQXIDFWXU

0DQXIDFWXUHU V)LHOG 5HSRUWV PDQXIDFWXUHU V ILH

48$/,7< $66685$1&(

'R FRQVWUXFWLRQ RFFXSDWLRQDO KHDOWK DQG VDIHW
+HDOWK DQG 6DIHW\ 5HTXLUHPHQWV

'(/,9(5< 6725$*($1' +$1'/,1*

3DFNLQJ VKLSSLQJ KDQGOLQJ DQG XQORDGLQJ

'HOLYHU VWRUH DQG KDQGOH LQ DFFRUGDQFH ZLW
5HTXLUHPHQWV

'HOLYHU VWRUH DQG KDQGOH PDWHULDOV LQ DFF
LQVWUXFWLRQV

:$67(0$1$*(0(17 $1' ',6326$/

6HSDUDWH DQG UHF\FOH ZDVWH PDWHULDOV LQ DFFRUG
'HPROLWLRQ :DVWH 0DQDJHPHQW DQG 'LVSRVDO

5HPRYH IURP VLWH DQG GLVSRVH RI DOO SDFNDJLQJ PDW

&ROOHFW DQG VHSDUDWH IRU GLVSRVDO SDFNDJLQJ PDW
0DQDJHPHQW 3ODQ

'LYHUW XQXVHG PHWDO PDWHULDOV IURP ODQGILOO W
&RQVXOWDQW

)ROG XS PHWDO EDQGLQJ IODWWHQ DQG SODFH LQ GHVL

352'8&76

0$7(5,$/6

&RQWURO V\VWHP E\ RQH PDQXIDFWXUHU DQG DVVHPEO

5(027(&21752/ 6:,7&+(6

6LQJOH SROH GRXEOH WKURZ PRPHQWDU\ FRQWDFW KH
DFWLRQ ZLWK SLORW OLJKWV ZKHUH LQGLFDWHG

/2: 92/7$*(5(/$<6

(OHFWULFDOO\ RSHUDWHG E\ PRPHQWDU\ LPSXOVH PHFK

7ZR FRLO VROHQRLG W\SH ZLWK RQH FRLO WR FORVH UHC

2SHUDWLQJ YROWDJH 9 $&

/RDG FRQWDFWV $ RU 9 $& DV LQGLFDWHG

$X[LOLDU\ FRQWDFWV IRU SLORW OLJKW

&RORXUHG SUH VWULSSHG OHDGV

&21752/ 75$16)250(5

/RZ YROWDJH SRZHU &ODVV LQSXW RU 9 $& +

5(&7,),(5

6HOHQLXP W\SH 9 $& +] LQSXW $ FRQWLQXRXV

6LOLFRQ W\SH 9 $& +] LQSXW $ FRQWLQXRXV G

0$18$/ &21752/

,QGLYLGXDO UHPRWH FRQWURO VZLWFKHV DV LQGLFDWH

(LJKW FLUFXLW PDQXDO PDVWHU VHOHFWRU VZLWFK PRX

0DVWHU ORFN RXW VZLWFK

,QGLYLGXDO UHG MHZHOOHG SLORW OLJKWV

1LQH FLUFXLW PDQXDO GLDO W\SH PDVWHU VHOHFWRU

7ZHOYH FLUFXLW PDQXDO GLDO W\SH PDVWHU VHOHFWRU

02725 23(5$7(' 0$67(5 &21752/

0RWRU GULYHQ PXOWLSOH FRQWDFW PRPHQWDU\ VZLWFK

5DGLDO FRQWDFW DUP WR URWDWH WKURXJK RQH UHYRC

&RQWDFW PDGH LQ VXFFHVVLRQ EHWZHHQ SRLQWV DU

2QH PDVWHU UHTXLUHG IRU 21 RSHUDWLRQ DQG RQH IR

0RWRU PDVWHU XQLWV FRQQHFWHG LQ FDVFDGH WR FRQ

,QWHUIDFH HTXLSPHQW DV UHTXLUHG WR FRQYHUW PDL
FRQWURO SXOVHV

(;(&87,21

,167$//$7,21

/RFDWH DQG LQVWDOO HTXLSPHQW LQ DFFRUGDQFH ZL
LQGLFDWHG

),(/' 48$/,7< &21752/

3HUIRUP WHVWV LQ DFFRUGDQFH ZLWK 6HFWLRQ
6HFWLRQ ± *HQHUDO &RPPLVVLRQLQJ &[5HTXLUH

$FWXDWH FRQWURO XQLWV LQ SUHVHQFH RI 2ZQHU¶V 5H
DUH FRQWUROOHG DV GHVLJQDWHG

(1' 2) 6(&7,21

*(1(5$/

5(/$7(' '2&80(176

'UDZLQJV DQG JHQHUDO SURYLVLRQV RI WKH &RQWUDFW &RQGLWLRQV DQG 'LYLVLRQ 6SHFLILFDWLRQ 6HFWLRQ

6(&7,21 ,1&/8'(6

0DWHULDOV DQG FRPSRQHQWV IRU GU\ W\SH WUDQVIRUPHU LGHQWLILFDWLRQ DQG WUDQVIRUPHU LQVWDOODWLRQ

7KLV 6HFWLRQ LQFOXGHV WKH IROORZLQJ W\SHV RI GU\ ZLWK FDSDFLWLHV XS WR N9$

'LVWULEXWLRQ WUDQVIRUPHUV
%XFN ERRVW WUDQVIRUPHUV

5(/$7(' 6(&7,216

6HFWLRQ 6XEPLWWDO 3URFHGXUHV

6HFWLRQ ± &RPPRQ :RUN 5HVXOWV (OHFWULFDO

5()(5(1&(6

&DQDGLDQ 6WDQGDUGV $VVRFLDWLRQ &6$

&$1 &6$ & 1R $LU &RROHG 7UDQVIRUPHUV 'U\
&6$ & 'U\ 7\SH 7UDQVIRUPHUV

1DWLRQDO (OHFWULFDO 0DQXIDFWXUHUV $VVRFLDWLRQ

68%0,77$/6

3URGXFW 'DWD IRU HDFK W\SH DQG VL]H RI WUDQVIRUPH

3K\VLFDO ,QFOXGH UDWHG QDPHSODWH GDWD FDS PLQLPXP FOHDUDQFHV LQVWDOOHG GHYLFHV DQG
3URGXFW ZDUUDQW\
'HWDLOV RI FRQWULEXWLRQV WR /((' LQFOXGLQJ (
3URYLGH SURSRVHG HQHUJ\ VDYLQJV LQ $QQXD
FRPSDUHG WR D 1(0$ 73 HIILFLHQF\ EDVHOLQH
WKH SURMHFW

(IILFLHQF\ 'DWD

1R ORDG DQG IXOO ORDG ORVVHV SHU 1(0$ 73
/LQHDU ORDG (IILFLHQF\ GDWD #
/LQHDU /RDG (IILFLHQF\ # ORDGLQJ WHVWHG
(IILFLHQF\ XQGHU . ORDG SURILOH DW QDPHSODWH UDWLQJ

6KRS 'UDZLQJV 'HWDLO HTXLSPHQW DVVHPEOLHV DQG L
UHTXLUHG FOHDUDQFHV PHWKRG RI ILHOG DVVHPEO\ F
ILHOG FRQQHFWLRQ

:LULQJ 'LDJUDPV 3RZHU VLJQDO DQG FRQWURO ZL

4XDOLILFDWLRQ 'DWD)RU WHVWLQJ DJHQF\

6RXUFH TXDOLW\ FRQWURO WHVW UHSRUWV

)LHOG TXDOLW\ FRQWURO WHVW UHSRUWV

2SHUDWLRQ DQG 0DLQWHQDQFH 'DWD)RU WUDQVIRUPH
DQG PDLQWHQDQFH PDQXDOV

48$/,7< $66685$1&(

7HVWLQJ $JHQF\ 4XDOLILFDWLRQV $Q LQGHSHQGHQW D
FDSDELOLW\ WR FRQGXFW WKH WHVWLQJ LQGLFDWHG W
(OHFWULFDO 7HVWLQJ $VVRFLDWLRQ RU LV D QDWLRQDO
GHILQHG E\ 26+$ LQ &)5

7HVWLQJ $JHQF\¶V)LHOG 6XSHUYLVRU 3HUVRQ FXL
,QWHU1DWLRQDO (OHFWULFDO 7HVWLQJ $VVRFLDWL
&HUWLILFDWLRQ LQ (QJLQHHULQJ 7HFKQRORJLHV W
3DUW

7HVWLQJ $JHQF\ 4XDOLILFDWLRQV $Q LQGHSHQGHQW D
FDSDELOLW\ WR FRQGXFW WKH WHVWLQJ LQGLFDWHG W
ODERUDWRU\ 157/ DV GHILQHG E\ 26+$ LQ &)5

6RXUFH /LPLWDWLRQV 2EWDLQ HDFK WUDQVIRUPHU W\S
PDQXIDFWXUHU

(OHFWULFDO &RPSRQHQWV 'HYLFHV DQG $FFHVVRULHV
$UWLFOH DQG WR &DQDGLDQ (OHFWULFDO &RGH
WR DXWKRULWLHV KDYLQJ MXULVGLFWLRQ DQG PDUNH

&RPSO\ ZLWK ,(((& ³7HVW &RGH IRU 'U\ 7\SH 'LVW
7UDQVIRUPHUV ´

&RPSO\ ZLWK ,(((& ,(((UHFRPPHQGHG SUDFWLV
WUDQVIRUPHU FDSDELOLW\ ZKHQ IHHGLQJ QRQ VLQXVRL

'(/,9(5< 6725$*($1' +$1'/,1*

7HPSRUDU\ +HDWLQJ $SSO\ WHPSRUDU\ KHDW DFFRUGL
LQVWUXFWLRQV ZLWKLQ WKH HQFORVXUH RI HDFK YHQW
ZKLFK HTXLSPHQW LV QRW HQHUJL]HG DQG ZKHQ WUDQV
FRQWLQXRXVO\ XQGHU QRUPDO FRQWURO RI WHPSHUDW

&225',1$7,21

&RRUGLQDWH VL]H DQG ORFDWLRQ RI FRQFUHWH EDVHV
DQFKRU EROW LQVHUWV LQWR EDVHV &RQFUHWH UHLQ
VSHFLILHG LQ 'LYLVLRQ

&RRUGLQDWH LQVWDOODWLRQ RI ZDOO PRXQWLQJ DQG
WUDQVIRUPHU SURYLGHG

352'8&76

*(1(5$/ 75$16)250(5 5(48,5(0(176

'HVFULSWLRQ)DFWRU\ DVVHPEOHG DQG WHVWHG DLU

&RUHV *UDLQ RULHQWHG QRQ DJLQJ VLOLFRQ VWHHO

&RLOV &RQWLQXRXV ZLQGLQJV ZLWKRXW VSOLFHV H[FH

,QWHUQDO &RLO &RQQHFWLRQV %UD]HG RU SUHVV
&RLO 0DWHULDO &RSSHU

',675,%87,21 75$16)250(56

3URYLGH D \HDU SUR UDWHG SURGXFW :DUUDQW\

&RPSO\ ZLWK 1(0$ 67 DQG OLVW DQG ODEHO DV FRPS

&RUHV 2QH OHJ SHU SKDVH

(QFORVXUH 9HQWLODWHG 1(0$ 7\SH

&RUH DQG FRLO VKDOO EH LPSUHJQDWHG ZLWKLQ U
DQG DLU

7UDQVIRUPHU (QFORVXUH)LQLVK &RPSO\ ZLWK 1(0$

)LQLVK &RORU 0DQXIDFWXUHU¶V 6WDQGDUG

7DSV IRU 7UDQVIRUPHUV VPDOOHU WKDQ N9$ 1RQH

7DSV IRU 7UDQVIRUPHUV WR N9$ 2QH SHUFHQW V
EHORZ QRUPDO IXOO FDSDFLW\

7DSV IRU 7UDQVIRUPHUV N9$ DQG ODUJHU 7ZR SH
SHUFHQW WDSV EHORZ QRUPDO IXOO FDSDFLW\

,QVXODWLRQ &ODVV GHJ & 8/ FRPSRQHQW UHFRJQL
PD[LPXP RI GHJ & ULVH DERYH GHJ & DPELHQW WHI

(QHUJ\ (IILFLHQF\ IRU 7UDQVIRUPHUV 5DWHG N9$ DQG

&RPSO\ ZLWK &)5 3DUW -XO\ )('(5$/ 5HJ
'HSDUWPHQW RI (QHUJ\ 2IILFH RI (QHUJ\ (IILFLHQF\
(QHUJ\ &RQVHUYDWLRQ 3URJUDP IRU &RPPHUFLDO D
&RQVHUYDWLRQ 6WDQGDUGV IRU 'LVWULEXWLRQ 7U
0HHW RU H[FHHG '2(&)5 3DUW &6/ (IILFLHQF\
N9$
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.)DFWRU 5DWLQJ 7UDQVIRUPHUV VKDOO EH .)DFWRU
UHTXLUHPHQWV IRU QRQ VLQXVRLGDO ORDG FXUUHQ
GHILQHG E\ GHVLJQDWHG . IDFWRU

8QLW VKDOO QRW RYHUKHDW ZKHQ FDUU\LQJ IXOO
FRUUHVSRQGLQJ WR GHVLJQDWHG . IDFWRU

,QGLFDWH YDOXH RI . IDFWRU RQ WUDQVIRUPHU QD

(OHFWURVWDWLF 6KLHOGLQJ (DFK ZLQGLQJ VKDOO KDY
FRSSHU HOHFWURVWDWLF VKLHOG DUUDQJHG WR PLQLP

$UUDQJH FRLO OHDGV DQG WHUPLQDO VWULSV WR P
LQSXW DQG RXWSXW WHUPLQDOV

,QFOXGH VSHFLDO WHUPLQDO IRU JURXQGLQJ WKH

6KLHOG (IIHFWLYHQHVV

&DSDFLWDQFH EHWZHHQ 3ULPDU\ DQG 6HFRQGD
SLFRIDUDGV RYHU D IUHTXHQF\ UDQJH RI +

&RPPRQ 0RGH 1RLVH $WWHQXDWLRQ 0LQLPXP
N+] PLQLPXP RI PLQXV G% DW WR N

1RUPDO 0RGH 1RLVH $WWHQXDWLRQ 0LQLPXP
N+]

:DOO %UDFNHWV 0DQXIDFWXUHU¶V VWDQGDUG EUDFNH

)XQJXV 3URRILQJ 3HUPDQHQW IXQJLFLGDO WUHDWPHQW

/RZ 6RXQG /HYHO 5HTXLUHPHQWV 1(0$ 67 VWDQGDUG
WHVWHG DFFRUGLQJ WR ,(((&

237,216 72 $''5(66 1)3$ (&6$ = $5&)/$6+ 67$1'$5'

,QWHJUDWHG ([WHUQDO 0HDVXUHPHQW 3RUW

,QFOXGH H[WHUQDO SRUWV ZLWK 9 VDIHW\ FODVV
VDIH DFFHVV WR WUDQVIRUPHU SULPDU\ DQG VHFR
UHYHQXH FODVV DFFXUDF\ $FFXUDWH DQG G\QD
SURYLGHG YLD WKHUPLVWRUV ORFDWHG LQ HDFK O

,QWHJUDWHG 3RZHU (QHUJ\ 3RZHU 4XDOLW\ 0HWHU

%DVLV RI GHVLJQ (TXLYDOHQW RU VXSHULRU WR 3
0HWHU VKDOO EH IDFWRU\ LQVWDOOHG RQ WKH WU
VHFRQGDU\ FRPSOHWH ZLWK IXVHG YROWDJH FRQ
LQGLYLGXDOO\ FKDUDFWHUL]HG WR DQG &7 VKX

3URYLGH ORFDO GLVSOD\ RI UHDO WLPH HQHUJ\ DQ
UHODWHG WR WKH ORDG IHG IURP WKH WUDQVIRUPH

3DUDPHWHUV PHDVXUHG LQFOXGH 9 , 7+' 9 , 3
$G .:G N9$G N9$5G

5HPRWH FRPPXQLFDWLRQV 0RGEXV 7&3 RYHU (WKH
DFFHVV YLD D VWDQGDUG ZHE EURZVHU

(GXFDWLRQ IRU 6XVWDLQDELOLW\ 6\VWHP 5HDG\ (
PHWHU VSHFLILHG DERYH VKDOO FRPH FRPSOHWH Z
FRQQHFWLYLW\ LQFOXGLQJ (WKHUQHW 0RGEXV 7&3
VXSSRUW D ZHE EDVHG EXLOGLQJ EHQFKPDUNLQJ D
V\VWHP WKDW JUDSKLFDOO\ LOOXVWUDWHV WKH SH
HQYLURQPHQWDO DQG HQHUJ\ VWUDWHJLHV LQFOXC

,QWHJUDWHG ,QIUDUHG ,QVSHFWLRQ :LQGRZ

$OORZV 6DIH ([WHUQDO 7KHUPDO ,PDJLQJ RI)XOO\
&RPSRQHQWV ZLWKRXW UHPRYLQJ WKH WUDQVIRUPI
,3 1(0$ UDWHG ERWK RSHQ DQG FORVHG

/RFNDEOH +LQJHG)URQW $FFHVV 'RRUV

$OORZV VDIH DQG UDSLG DFFHVV WR WKH WUDQVIR
PXOWLSOH VFUHZV DQG KDQGOH KHDY\ PHWDO FRYH
WR OLYH HOHFWULFDO SRLQWV
'RRUV VKDOO EH DEOH WR EH VHFXUHG XVLQJ D SD

,'(17,),&$7,21 '(9,&(6

1DPHSODWHV (QJUDYHG ODPLQDWHG SODVWLF RU PHW
WUDQVIRUPHU PRXQWHG ZLWK FRUURVLRQ UHVLVWDQW
VSHFLILHG LQ 'LYLVLRQ 6HFWLRQ ³,GHQWLILFDWLRQ I

6285&(48$/,7< &21752/

7HVW DQG LQVSHFW WUDQVIRUPHUV DFFRUGLQJ WR ,(((

)DFWRU\ 6RXQG /HYHO 7HVWV &RQGXFW VRXQG OHYHO

(;(&87,21

(;$0,1$7,21

([DPLQH FRQGLWLRQV IRU FRPSOLDQFH ZLWK HQFORVXU
UHTXLUHPHQWV IRU HDFK WUDQVIRUPHU

9HULI\ WKDW ILHOG PHDVXUHPHQWV DUH DV QHHGHG WR
2(6& ODWHVW HGLWLRQ DQG PDQXIDFWXUHU¶V ZULWWHQ

([DPLQH ZDOOV IORRUV URRIV DQG FRQFUHWH EDVHV
WUDQVIRUPHUV ZLOO EH LQVWDOOHG

9HULI\ WKDW JURXQG FRQQHFWLRQV DUH LQ SODFH DQG
³*URXQGLQJ DQG %RQGLQJ IRU (OHFWULFDO 6\VWHP¶V K
UHVLVWDQFH VKDOO EH RKPV DW ORFDWLRQ RI WUDQV

3URFHHG ZLWK LQVWDOODWLRQ RQO\ DIWHU XQVDWLVID

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,QVWDOO ZDOO PRXQWLQJ WUDQVIRUPHUV OHYHO DQG S
WUDQVIRUPHU PDQXIDFWXUHU

%UDFH ZDOO PRXQWLQJ WUDQVIRUPHUV DV VSHFLIL
DQG VHLVPLF &RQWURO IRU (OHFWULFDO 6\VWHPV

&RQVWUXFW FRQFUHWH EDVHV DQG DQFKRU IORRU PRX
PDQXIDFWXUHU¶V ZULWWHQ LQVWUXFWLRQV VHLVPLF F
LQ 'LYLVLRQ 6HFWLRQ ³9LEUDWLRQ DQG 6HLVPLF &RQ

0RXQW PHWHULQJ SDFNDJH RQ WUDQVIRUPHU HQFORVXU

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*URXQG HTXLSPHQW DFFRUGLQJ WR 'LYLVLRQ 6HFWLR
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&RQQHFW ZLULQJ DFFRUGLQJ WR 'LYLVLRQ 6HFWLRQ ³
&RQGXFWRUV DQG &DEOHV´

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3HUIRUP WHVWV DQG LQVSHFWLRQV DQG SUHSDUH WHVW

0DQXIDFWXUHU¶V)LHOG 6HUYLFH (QJDJH D IDFWRU
WR LQVSHFW FRPSRQHQWV DVVHPEOLHV DQG HTXL
FRQQHFWLRQV DQG WR DVVLVW LQ WHVWLQJ

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3HUIRUP HDFK YLVXDO DQG PHFKDQLFDO LQVSHFWL
$FFHSWDQFH 7HVWLQJ 6SHFLILFDWLRQ &HUWLI\ FR

7HVW WUDQVIRUPHUV IRU ORVVHV DQG HIILFLHQF\
ORVV GDWD SURYLGHG RQ WKH VXEPLWWDO GRFXPH
FODVV HIILFLHQF\

5HPRYH DQG UHSODFH XQLWV WKDW GR QRW SDVV WHVW
DERYH

,QIUDUHG 6FDQQLQJ 7ZR PRQWKV DIWHU 6XEVWDQWLDO WUDQVIRUPHU FRQQHFWLRQV

8VH DQ LQIUDUHG VFDQQLQJ GHYLFH GHVLJQHG WR VLJQLILFDQW GHYLDWLRQV IURP QRUPDO YDOXHV FDOLEUDWLRQ

3HUIRUP IROORZ XS LQIUDUHG VFDQV RI WUDQVIR RWKHU DW PRQWKV DIWHU 6XEVWDQWLDO &RPSOH

3UHSDUH D FHUWLILHG UHSRUW LGHQWLI\LQJ WUDQ RI VFDQQLQJ ,QFOXGH QRWDWLRQ RI GHILFLHQFLH VFDQQLQJ REVHUYDWLRQV DIWHU UHPHGLDO DFWLR

7HVW /DEHOOLQJ 2Q FRPSOHWLRQ RI VDWLVIDFWRU\ W VLJQHG ³6DWLVIDFWRU\ 7HVW´ ODEHO WR WHVWHG FRPS

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5HFRUG WUDQVIRUPHU VHFRQGDU\ YROWDJH DW HDFK X RFFXSDQF\ SHULRG $GMXVW WUDQVIRUPHU WDSV WR S VHFRQGDU\ WHUPLQDOV 2SWLPXP LV GHILQHG DV QRW SHUFHQW DQG QRW EHLQJ ORZHU WKDQ QDPH SODWH YP FRQGLWLRQV 6XEPLW UHFRUGLQJ DQG WDS VHWWLQJV

&RQQHFW EXFN ERRVW WUDQVIRUPHUV WR SURYLGH QDI VHUYHG SOXV RU PLQXV SHUFHQW DW VHFRQGDU\ WH

2XWSXW 6HWWLQJV 5HSRUW 3UHSDUH D ZULWWHQ UHSR VHWWLQJV

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9DFXXP GLUW DQG GHEULV GR QRW XVH FRPSUHVVHG D

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,QVWUXPHQWV FRQWUROV DQG DFFHVVRULHV

6RXUFH TXDOLW\ FRQWURO

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*HQHUDO 6ZLWFKERDUGV DV VSHFLILHG KHUHLQ ZLO
EXW ZLOO EH SDLG IRU DV SDUW RI WKH &RQWUDFW OXP

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$PHULFDQ 6RFLHW\ IRU 7HVWLQJ DQG 0DWHULDOV $67

$670 $ $ 0 6WDQGDUG 6SHFLILFDWLRQ IRU 6WHHO
*DOYDQL]HG RU =LQF ,URQ $OOR\ &RDWHG
+RW 'LS 3URFHVV

&DOLIRUQLD &RGH RI 5HJXODWLRQV &&5

7LWOH 3DUW &DOLIRUQLD %XLOGLQJ &RGH

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,QVWLWXWH RI (OHFWULFDO DQG (OHFWURQLFV (QJLQH

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,(((,(((6WDQGDUG 5HTXLUHPHQWV IRU ,QVWUXPH

,(((6WDQGDUG IRU 0HWDO (QFORVHG /RZ 9ROWDJ
9GF DQG EHORZ 3RZHU &LUFXLW %UHDNH

,(((/RZ 9ROWDJH $& 3RZHU &LUFXLW %UHDNHUV

,(((7UL6 6\VWHPV IRU /RZ 9ROWDJH 9 DQG E
*HQHUDO 3XUSRVH 9 DQG EHORZ '& 3RZ
%UHDNHUV

1DWLRQDO (OHFWULFDO 0DQXIDFWXUHUV $VVRFLDWLRQ

1(0$ 3% 'HDGIURQW 'LVWULEXWLRQ 6ZLWFKERDUGV

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*HQHUDO 5HIHU WR 6HFWLRQ 6XEPLWWDO 3URFHGXUHV 'UDZLQJV 3URGXFW 'DWD DQG 6DPSOHV IRU VXEPLWWDO

5HIHU WR ORFDO XWLOLW\ HOHFWULFDO VHUYLFH UHTX

3URGXFW 'DWD 6XEPLW PDQXIDFWXUHU¶V SURGXFW GDW HTXLSPHQW 6XEPLW FHUWLILHG UHSRUWV RI IDFWRU\ WH

6KRS 'UDZLQJV 6XEPLW GHWDLOHG 6KRS 'UDZLQJV DV

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8QLW ZLULQJ GLDJUDPV

'UDZLQJV VKRZLQJ VSDFH DYDLODEOH IRU FRQGXLW HQ FDEOHV $YDLODEOH VSDFH VKDOO WDNH LQWR FRQVLG FDEOHV

6FKHPDWLF GLDJUDPV IRU HOHFWULFDOO\ RSHUDWHG

1DPHSODWHV 6FKHGXOH

&RPSRQHQW /LVW

6FKHPDWLF GLDJUDPV DQG WHPSODWHV LI DQFKRULQJ

6HWWLQJ GLDJUDPV DQG WHPSODWHV LI DQFKRULQJ LQ

$VVHPEO\ DQG HUHFWLRQ GLDJUDPV LI VKLSSHG LQ VH
VHSDUDWHO\ DQG QRW LQVWDOOHG DW WKH IDFWRU\ D

,QWHUFRQQHFWLRQ GLDJUDPV IRU FLUFXLWV KDYLQJ H
FRQWURO DODUPV RU VLPLODU GHYLFHV

$VVHPEO\ UDWLQJ LQFOXGLQJ

D 6KRUW FLUFXLW UDWLQJ

E 9ROWDJH

F &RQWLQXRXV FXUUHQW UDWLQJ

0DMRU FRPSRQHQW UDWLQJ LQFOXGHG

D 9ROWDJH

E &RQWLQXRXV FXUUHQW UDWLQJ F

,QWHUUXSWLQJ UDWLQJ

3URWHFWLYH 'HYLFH 7LPH &XUUHQW &XUYHV

2SHUDWLQJ DQG 0DLQWHQDQFH 'DWD 6XEPLW GDWD LQ D
2SHUDWLQJ DQG 0DLQWHQDQFH 'DWD LQFOXGLQJ WKH IR

'HVFULSWLRQ RI WKH VZLWFKERDUG DQG LWV FRPSRQH

0DQXIDFWXUHU¶V RSHUDWLQJ DQG PDLQWHQDQFH LQV
GLDJUDP IRU FRPSRQHQWV

5HFRPPHQGHG OLVW RI VSDUH SDUWV

:LULQJ GLDJUDP

(OHFWULFDO FKDUDFWHULVWLFV RI HDFK FRPSRQHQW
FLUFXLWU\ DQG

5HOD\ FRRUGLQDWLRQ FXUYHV

)LHOG 7HVW 5HSRUWV 6XEPLW FHUWLILHG ILHOG WH
6SHFLILFDWLRQ UHTXLUHPHQWV

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6HFXUHO\ ZUDS SDFNDJH DQG ODEHO HDFK XQLW IRU

%UDFH DQG SDFNDJH WKH HTXLSPHQW IRU HDV\ DQG V WHPSRUDU\ LQWHUQDO EUDFLQJ RI HTXLSPHQW DV ³7HPSR %HIRUH 2SHUDWLRQ ´

8VH D PHFKDQLFDO LPSDFW UHFRUGHU GXULQJ VKLSPHQ DFFHOHUDWLRQ 6XEPLW LPSDFW UHFRUG FKDUW WR WKH

6WRUH VZLWFKERDUG LQ VHFXUH DQG GU\ VWRUDJH ID

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6ZLWFKERDUG 5HTXLUHPHQWV

)XUQLVK GLVWULEXWLRQ VZLWFKERDUGV WKDW DUH FR GHDG IURQW IUHHVWDQGLQJ FLUFXLW EUHDNHU W\SH 1(0$ 3% WKH &DOLIRUQLD (OHFWULFDO &RGH DQG WK 8/

)XUQLVK WKH UHTXLUHG QXPEHU RI YHUWLFDO VHFWLR VZLWFKERDUG)XUQLVK WKH QXPEHU W\SH DQG UDWLQ GHYLFHV DV LQGLFDWHG

)XUQLVK VZLWFKERDUGV FRPSOHWHO\ DVVHPEOHG ZLU SODQW ,I DSSURYHG E\ WKH (QJLQHHU VZLWFKERDUGV VKLSSLQJ VHFWLRQV VXEVHTXHQW WR WKH FRPSOHWLR WHUPLQDOV VKDOO EH SURYLGHG DQG FRQQHFWLRQV G LGHQWLILHG DQG SURWHFWHG

6ZLWFKERDUGV LQ WKH VDPH OLQH XS IHG HOHFWULFD VXFK WKDW D ILUH FDXVHG E\ DQ LQWHUQDO IDXOW DW VZLWFKERDUG

5DWLQJV)XUQLVK FRPSOHWHG VZLWFKERDUGV UDWHG IR SRZHU V\VWHPV 6\PPHWULFDO VKRUW FLUFXLW FXUUHQW SROHV WULS XQLW FKDUDFWHULVWLFV LQVWUXPHQW UDV HTXLSPHQW UDWLQJV VKDOO EH DV LQGLFDWHG 6ZLWFKE RSHUDWLRQV LQ D GHJUHHV & URRP DPELHQW

3K\VLFDO 6L]H)XUQLVK VZLWFKERDUGV LQFKHV KLJK DFFRPPRGDWH DQG FRQQHFW WKH HTXLSPHQW 9HUWLFDO UHDU DQG VKDOO EH HTXLSSHG ZLWK UHDU GRRUV

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5HTXLUHPHQWV 3URYLGH VLOYHU SODWHG FRSSHU EXVH
GHQVLW\ WR $ SHU VTXDUH LQFK FURVV VHFWLRQ %UD
IRU WKH V\PPHWULFDO IDXOW FXUUHQW LQGLFDWHG

0DLQ %XVHV ([WHQG PDLQ EXVHV KRUL]RQWDOO\ IURP W
GLVWULEXWLRQ VHFWLRQV LI LQGLFDWHG RQ WKH VDPH O
EXVHV IRU IXWXUH YHUWLFDO VHFWLRQV 1HXWUDO EXV V
QHXWUDO SROH LQ WKH DXWRPDWLF WUDQVIHU VZLWFK

6HFWLRQ %XVHV ([WHQG VHFWLRQ EXVHV YHUWLFDOO\ IU
VHFWLRQ

*URXQG %XVHV ([WHQG D JURXQG EXV WKURXJK WKH OHG
HDFK YHUWLFDO VHFWLRQ LQ DW OHDVW WZR SODFHV 0D
VWDWLRQ JURXQGLQJ V\VWHP QHDU HDFK HQG RI WKH JUR
H[WHQVLRQ RI WKH JURXQG EXV

3KDVLQJ 3KDVH EXVHV $ % & IURP OHIW WR ULJKW WRS
IURP WKH IURQW RI WKH VZLWFKERDUG

%XV &RQQHFWLRQV %XV FRQQHFWLRQV VKDOO EH PDGH
WKUHDGHG KROHV RU ZLWK WKURXJK EROWV ZLWK ZDVKHU
ZLWK ORFN ZDVKHUV IRU PHFKDQLFDO ORFNLQJ

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3URYLGH FLUFXLW EUHDNHUV RI WKH GUDZ RXW PRXQWH
9 WKUHH SKDVH +] LQ DFFRUGDQFH ZLWK 1(0$ 3%
WKH IROORZLQJ DGGLWLRQDO UHTXLUHPHQWV

5DWHG FRQWLQXRXV FXUUHQW $V LQGLFDWHG

D 6\PPHWULFDO LQWHUUXSWLQJ UDWLQJ $V LQGLFDW

E 0D[LPXP RI ILYH F\FOH FORVLQJ WLPH

%UHDNHUV VKDOO EH HTXLSSHG ZLWK VROLG VWDWH W
DV LQGLFDWHG DQG DV UHTXLUHG DQG D PLQLPXP RI
FRRUGLQDWLRQ DGMXVWPHQW LQFOXGLQJ JURXQG IDX

,QVXODWLRQ UDWLQJ RI SOXJ VKDOO EH WKH VDPH DV

&LUFXLW EUHDNHUV VKDOO EH FDSDEOH RI SHUIRUPLQ
SHUFHQW SRZHU IDFWRU DQG UDWHG YROWDJH DQG
PDLQWHQDQFH DQG UHSODFHPHQW RI SDUWV

%UHDNHUV VKDOO KDYH FRQWURO SRZHU DQG PRWRU

%UHDNHUV VKDOO EH HTXLSSHG ZLWK ILHOG UHSODFHI

0ROGHG &DVH &LUFXLW %UHDNHUV

0ROGHG &DVH W\SH FLUFXLW EUHDNHUV VKDOO EH PHF WRJJOH

D 5DWHG FRQWLQXRXV FXUUHQW $V LQGLFDWHG DQG

E 6\PPHWULFDO LQWHUUXSWLQJ UDWLQJ $V LQGLFDW

F 0D[LPXP RI ILYH F\FOH FORVLQJ WLPH

%UHDNHUV VKDOO EH HTXLSSHG ZLWK D VROLG VWDWH DV LQGLFDWHG DQG DV UHTXLUHG DQG WLPH FXUUHQW LQFOXGLQJ JURXQG IDXOW DQG XQGHU YROWDJH VHWWL

,QVXODWLRQ UDWLQJ RI SOXJ VKDOO EH WKH VDPH DV

%UHDNHUV KDYH FRQWURO SRZHU DQG PRWRU FKDUJL

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3RWHQWLDO 7UDQVIRUPHUV ,(((& ZRXQG W\SH ZLWK RSHUDWLQJ PHWHUV DQG UHOD\V ZLWK WKH IROORZLQJ D

9ROWDJH UDWLR 9 SULPDU\ WR 9 VHFRQGDU\

,QVXODWLRQ FODVV 9 ZLWK EDVLF LPSXOVH LQVXO

7HPSHUDWXUH 5LVH 0D[LPXP DOORZDEOH WHPSHUDWX &HOVLXV XQGHU FRQWLQXRXV IXOO ORDG DERYH DQ DY GHJUHHV &HOVLXV

D %\ ZLQGLQJ UHVLVWDQFH GHJUHHV &HOVLXV

E %\ KRWWHVW VSRW LQ ZLQGLQJ GHJUHHV &HOVL

&XUUHQW 7UDQVIRUPHUV

3URYLGH FXUUHQW WUDQVIRUPHUV LQ D VHSDUDWH FH 3URYLGH PHWDOLF VKLHOGLQJ WR SURWHFW FXUUHQ LQGXFHG YROWDJHV DQG WR PLQLPL]H WKH SRVVLELOL

&XUUHQW 7UDQVIRUPHUV VKDOO EH EXVKLQJ RU HSR[\ 6HFRQGDU\ WHUPLQDO EORFNV VKDOO KDYH FRYHUV ZL ZLULQJ VKDOO EH FRQQHFWHG WR UHDGLO\ LGHQWLILDE LQ WKH FRQWURO FRPSDUWPHQW 7HUPLQDO EORFN SRL IRU WKH FXUUHQW WUDQVIRUPHU OHDGV

3URYLGH FXUUHQW WUDQVIRUPHUV FDSDEOH RI ZLWKV IURP WKH IORZ RI WKH LQWHUUXSWLQJ DQG PRPHQWDU &XUUHQW WUDQVIRUPHUV VKDOO KDYH D PRXQWLQJ IUD

IUDPH &XUUHQW WUDQVIRUPHUV VKDOO FRPSO\ ZLWK ,(
DFFXUDF\ FODVVLILFDWLRQ XQGHU WKH EXUGHQV LPSRV
KHUHLQ

0HWHUV

7\SH ,(& VTXDUH WDXW EDQG WUDQVIRUPHU UDV

'LDO $SSUR[LPDWHO\ LQFKHV VTXDUH JUDGXDWH
ILJXUHV RQ ZKLWH EDFNJURXQG

9ROWPHWHU UDWLQJ 9 $PPHWHU UDWLQJ SHUF
LQGLFDWHG

$FFXUDF\ &ODVV 2QH SHUFHQW RI IXOO VFDOH

5HOD\V

3URYLGH RQH ORFN RXW UHOD\ IRU SUHYHQWLQJ WKH
FRQGLWLRQV H[FHSW XQGHU YROWDJH

3URYLGH RQH WLPH GHOD\ UHOD\ DGMXVWDEOH IURP
UHOD\

&RQWURO 6ZLWFKHV

3URYLGH FRQWURO VZLWFK DV UHTXLUHG DQG LQGLFD

3URYLGH UHOD\ WHVW VZLWFK

3URYLGH PDQXDO SXVKEXWWRQ DW WKH IURQW RI EUH

&RQWURO DQG ,QVWUXPHQW :LULQJ 3URYLGH IDFWRU\ LQ
IROORZLQJ UHTXLUHPHQWV

:LUH 3URYLGH W\SH 6,6 WLQQHG FRSSHU ZLUH QRW VP
ZLUH QRW VPDOOHU WKDQ $:* VKDOO EH XVHG IRU Z

:LUH 7HUPLQDOV 7LQQHG FRSSHU ULQJ FRPSUHVVLRQ
LQVWDOOHG LQ DFFRUGDQFH ZLWK WKH PDQXIDFWXUHU

7HUPLQDO %ORFNV 3URYLGH ZDVKHUKHDG VFUHZV VXL
WHUPLQDOV ZLWK LQVXODWHG VOHHYH 3URYLGH D PLQ

3RVLWLRQ 6ZLWFK DQG $X[LOLDU\ &RQWDFWV 3URYLG
DX[LOLDU\ FRQWDFWV DV LQGLFDWHG

:LUH &RQQHFWLRQV &RQWURO UHOD\V DQG PHWHU
FRQQHFWLRQV VKDOO EH ZLUHG WR DFFHVVLEOH WHUPL
RQ WHUPLQDO EORFNV VKDOO EH SURYLGHG LQ HDFK FX

:LUH ,GHQWLILFDWLRQ (DFK ZLUH VKDOO EH SURYLGH
WHUPLQDO FRQQHFWLRQ PDUNHG ZLWK WKH QXPEHU LQ
SRVLWLRQHG ZLWK WKH ODEHO IDFLQJ RXW IRU HDVH R

)XVHV 3URYLGH FXUUHQW OLPLWLQJ IXVH LQ HDFK FR

(QFORVXUH)UHHVWDQGLQJ W\SH GHVLJQHG IRU JURXS
DF GLVWULEXWLRQ ZLWK WKH IROORZLQJ DGGLWLRQDO U

(QFORVXUH VKDOO EH UHLQIRUFHG ZLWK DGHTXDWH VV
VWUXFWXUH ZLWK D VPRRWK RXWHU VXUIDFH IUHH IURP

(QFORVXUH VKDOO EH IDEULFDWHG IURP]LQF FRDWHG
$ $ 0]LQF FRDWLQJ GHVLJQDWLRQ *

(QFORVXUH PHWDOOLF VXUIDFHV VKDOO EH WKRURXJK
SKRVSKDWH FKHPLFDO EDWK SULPHG ZLWK FRURVLRQ
ZLWK ILQLVK FRDW RI KHDY\ GXW\ LQGXVWULDO JUDGH
VHOHFWHG E\ WKH (QJLQHHU

1DPHSODWHV 3URYLGH QDPHSODWHV RQ HDFK VZLWFKER
DQG LQWHUQDO FRPSRQHQWV LQFOXGLQJ UHOD\V VZLWF

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,Q DGGLWLRQ WR WKH PDQXIDFWXUHU¶V VWDQGDUG WHV
WKH PDQXIDFWXUHU¶V SODQW

+] GLHOHFWULF WHVWV

0HFKDQLFDO RSHUDWLRQV WHVWV

*URXQGLQJ RI LQVWUXPHQWV

7UDQVIRUPHU FDVH WHVWV

(OHFWULFDO RSHUDWLRQ WHVWV DQG

&RQWURO ZLULQJ FKHFNV

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,QVWDOO ZLUH DQG FRQQHFW VZLWFKERDUGV UHDG\
6SHFLILFDWLRQV WKH PDQXIDFWXUHU¶V LQVWDOODWLRQ

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6HFWLRQ

6ZLWFKERDUGV

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5HIHU WR 6HFWLRQ *URXQGLQJ DQG %RQGLQJ I

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,QVWDOO VZLWFKERDUGV LQ WKH ORFDWLRQV LQGLFDWH
UHODWHG DGMRLQLQJ ZRUN 7KH VZLWFKERDUG DQFKRUDJ
&DOLIRUQLD %XLOGLQJ &RGH VHLVPLF UHVWUDLQW UHTXL
KLJK FRQFUHWH SDG ZLWK OHYHOLQJ FKDQQHOV

3URYLGH DQFKRU EROWV DQG DQFKRUDJH LWHPV DV UHT
DOLJQPHQW DQG ORFDWLRQ 3URYLGH WHPSODWHV OD\RX
HQVXUH FRUUHFW SODFLQJ RI DQFKRUDJH LWHPV LQ FRQF
FRUUHFWQHVV RI ORFDWLRQ DQG GHWDLO EHIRUH FRQFUH

,QVWDOO VXSSRUWLQJ PHPEHUV IDVWHQLQJV IUDPLQJ
DQG DQJOHV DV UHTXLUHG WR VHW DQG ULJLGO\ FRQQHFW

3URYLGH WHPSRUDU\ EUDFLQJ JX\V RU RWKHU GHYLFHV
SURYLGH VDIHW\ DQG VWDELOLW\ XQWLO ZRUN LV LQ ILQD

&RQWURO HUHFWLRQ WROHUDQFH UHTXLUHPHQWV VR DV
VHUYLFHDELOLW\ DQG DSSHDUDQFH

([HUFLVH VSHFLDO FDUH GXULQJ FRQVWUXFWLRQ WR DYR
VWUXFWXUH 5HSDLU RU UHSODFH LWHPV GDPDJHG GXH W

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$IWHU LQVWDOODWLRQV DUH FRPSOHWH WKRURXJKO\ FO
PLVVLQJ RU DEUDLGHG EDUH VWHHO LQFOXGLQJ EROWV
ZLWK WKH VDPH SDLQW V\VWHP DV XVHG IRU VKRS SDLQW
VSUD\ PHWKRGV RU EUXVK ZKHUH VSUD\ SDLQWLQJ LV QRV

),(/' 7(676

3URYLGH HTXLSPHQW IRU WHVWLQJ SRZHU OLJKWLQJ DQ
LQFOXGLQJ VHUYLFH WHVW NLW 7HVW XQGHU WKH REVHU
IROORZLQJ DWWULEXWHV

9HULI\ WKDW FLUFXLWV DUH FRQQHFWHG LQ DFFRUGDQ
GLDJUDPV

9HULI\ WKDW FLUFXLWV DUH FRQWLQXRXV DQG IUHH IU

9HULI\ WKDW WKH LQVXODWLRQ UHVLVWDQFH WR JURX
WHVWHG WR QRW OHVV WKDQ 0

9HULI\ WKDW WKH FRPSOHWHG HTXLSPHQW JURXQGLQJ
GLVFRQQHFW HQFORVXUH JURXQG EDU WR HQVXUH FRQ

9HULI\ WKDW FLUFXLWV DUH RSHUDEOH &RQGXFW WHV
WKDQ WHQ WLPHV DQG WKH FRQWLQXRXV RSHUDWLRQ F
WKDQ KRXU

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1.0 GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for standard an

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 06 10 53 – Miscellaneous Rough Car

.3 Section 26 05 00 – Common Work Results - E

.4 Section 26 28 16.02 - Moulded Case Circuit

1.3 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA C22.2 No.29, Panelboards and enclose

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Se

.5 Drawings to include electrical detail of p enclosure dimension.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in ac Demolition Waste Management and Disposal.

.2 Remove from site and dispose of all packag

.3 Collect and separate for disposal packagin Management Plan.

.4 Divert unused metal materials from landfi Consultant.

.5 Fold up metal banding, flatten and place i

2.0 PRODUCTS

2.1 PANELBOARDS

.1 Panelboards: to CSA C22.2 No.29 and produc

.1 Install circuit breakers in panelboards

.2 In addition to CSA requirements manufact panel including breakers has been built to

.2 250 and 600 V panelboards: bus and breaker minimum interrupting capacity respectively o

.3 Sequence phase bussing with odd numbered b breaker identified by permanent number ident

.4 Panelboards: mains, number of circuits, ar indicated.

.5 Two keys for each panelboard and key panel

.6 Tin plated aluminum bus with neutral of sa

.7 Mains: suitable for bolt-on breakers.

.8 Trim with concealed front bolts and hinges

.9 Trim and door finish: baked grey enamel.

2.2 CUSTOM BUILT PANELBOARD ASSEMBLIES

.1 125 mm relay section on one or both sides o remote control switching components.

.2 Double stack panels as indicated.

.3 Contactors in mains as indicated.

.4 Feed through lugs as indicated.

2.3 BREAKERS

.1 Breakers: to Section 26 28 16.02 - Moulded

.2 Breakers with thermal and magnetic trippin

.3 Main breaker: separately mounted on top or vertically, down position should open breake

.4 Lock-on devices for 10% of 15 to 30 A breal on devices to Departmental Representative.

.5 Lock-on devices for receptacles, fire ala intercom, stairway, exit and night light cir

2.4 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accor Results - Electrical.

.2 Nameplate for each panelboard size 4 engra

.3 Nameplate for each circuit in distribution

.4 Complete circuit directory with typewritte

3.0 EXECUTION

3.1 INSTALLATION

.1 Locate panelboards as indicated and mount surfaces.

.2 Install surface mounted panelboards on ply 00 - Rough Carpentry. Where practical, grou

.3 Mount panelboards to height specified in Electrical or as indicated.

.4 Connect loads to circuits.

.5 Connect neutral conductors to common neutr

END OF SECTION

1.0 GENERAL

1.1 RELATED SECTIONS

.1 Submit in accordance with Section 01 33 00 - Submittals.

1.2 REFERENCES

.1 The Munsell System of Colour Notation.

1.3 SHOP DRAWINGS

.1 Submit in accordance with Section 01 33 00 - Submittals.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for electrical cabinets and enclosures and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 77 00 - Closeout Procedures.

.2 Operation and Maintenance Data: submit operation and maintenance data for electrical cabinets and enclosures for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 60 00 – Products and workmanship, with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect electrical cabinets and enclosures from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.6 QUALITY ASSURANCE

.1 Products of This Section: Manufactured to ISO 14000, ISO 9000 and certification requirements.

.2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five (5) years documented experience.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 – Construction / Demolition Waste Management and Disposal.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility as approved by Consultant.

.5 Fold up metal banding, flatten and place in designated area for recycling.

2.0 PRODUCTS

2.1 MATERIALS

.1 Enclosure constructed with 2.7 mm thick minimum steel, with weather and corrosion resistant finish to CAN/CSA C22.2, Munsell Notation 7.5GY3.5/1.5, size as indicated.

.2 Entire enclosure to be capable of withstanding maximum impact force of 86 MN/m2 area without rupture of material.

.3 Removable enclosure panels with formed edges, galvanized steel external fasteners removable only from inside enclosure.

.4 Equip enclosure with hot dipped galvanized mounting rails, as required, adjustable horizontally and vertically to enable mounting of equipment at any location within housing.

.1 Rails: 14 mm holes and 50 x 14 mm slots on 100 mm centres for horizontal adjustment.

.2 Holes in side panel flanges in 60 mm increments for vertical adjustment.

.5 Cover: tamperproof, bolt-on, domed to shed water.

.6 Door: 3 point latching, with padlocking means.

.7 Ventilation panel constructed to allow air circulation yet preventing entry of foreign objects, wild life, and vermin.

.8 Door interlocks: As indicated, or as required.

.9 Enclosure construction such as to allow configuration of single or ganged enclosures.

.10 Enclosure capable of being shipped in knocked-down condition.

3.0 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for electrical cabinet and enclosure installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of the Client's Representative.

.2 Inform the Client's Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from the Client's Representative.

3.2 INSTALLATION

.1 Assemble enclosure in accordance with manufacturer's instructions and securely mount on building structure with channels, supports and fastenings.

.2 Mount equipment in enclosure.

.3 Label electrical cabinets and enclosure to Section 26 05 00 - Common Work Results for Electrical.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 13 – Progressive Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 13 – Progressive Cleaning.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

1.0 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 26 27 26 - Wiring Devices.

1.2 SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate type of multi-outlet assemblies with similar terminology to these documents.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 – Construction / Demolition Waste Management and Disposal.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility as approved by Consultant.

.5 Fold up metal banding, flatten and place in designated area for recycling.

2.0 PRODUCTS

2.1 SURFACE RACEWAY FOR WIRING DEVICES

.1 Two piece assembly manufactured for mounting wiring devices and associated wiring.

.2 Cross-section dimensions: as indicated.

.3 Finish: buff enamel.

2.2 WIRING DEVICES

.1 Wiring devices: as indicated, to Section 26 27 26 - Wiring Devices.

2.3 PREWIRED RECEPTACLE HARNESS

.1 Receptacle harness factory assembled with duplex receptacles at 1525 mm centres on 1 circuit.

2.4 GROUNDING

.1 Ground system through separate insulated conductor.

2.5 VINYL PLASTIC STRIP

.1 Extruded rigid vinyl plastic with 2- No.12 AWG copper wires and continuous ground strip.

.2 Unfused "U" ground lock-in receptacle for each 1.5 m of strip as indicated.

2.6 FITTINGS

.1 Elbows, tees, couplings, hanger fittings and other fittings providing directional or dimensional changes manufactured as accessories to product line supplied.

3.0 EXECUTION

3.1 FITTINGS

.1 Install supports, elbows, tees, connectors, fittings.

.2 Keep number of elbows, offsets and connections to minimum.

.3 Install barriers where required.

3.2 WIRING

.1 Install wiring as indicated Install receptacle harness.

3.3 VINYL STRIP RECEPTACLES

.1 Install receptacles.

END OF SECTION

1.0 GENERAL

1.1 SECTION INCLUDES

.1 Switches, receptacles, wiring devices, cover plates and their installation.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 26 05 00 – Common Work Results - Electrical.

1.3 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA-C22.2 No.42, General Use Receptacles, Attachment Plugs and Similar Devices.

.2 CSA-C22.2 No.42.1, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

.3 CSA-C22.2 No.55, Special Use Switches.

.4 CSA-C22.2 No.111, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 – Construction / Demolition Waste Management and Disposal.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility as approved by Consultant.

.5 Fold up metal banding, flatten and place in designated area for recycling.

2.0 PRODUCTS

2.1 SWITCHES

.1 15 A, 120 V, single pole, double pole, three-way, four-way switches as indicated to: CSA-C22.2 No.55 and CSA-C22.2 No.111.

.2 Manually-operated general purpose ac switches with following features:

.1 Terminal holes approved for No. 10 AWG wire.

.2 Silver alloy contacts.

.3 Urea or melamine moulding for parts subject to carbon tracking.

.4 Suitable for back and side wiring.

.5 Black finish, or as otherwise specified by project architect, or to match existing conditions.

.6 Specification grade.

.3 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.

.4 Switches of one manufacturer throughout project.

2.2 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA-C22.2 No.42 with following features:

.1 Ivory thermoplastic moulded housing.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Break-off links for use as split receptacles.

.4 Eight back wired entrances, four side wiring screws.

.5 Triple wipe contacts and rivetted grounding contacts.

.6 Specification grade.

.2 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:

.1 Black finish, or as otherwise specified by project architect, or to match existing conditions, with thermoplastic moulded housing.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Four back wired entrances, 2 side wiring screws.

.3 Other receptacles with ampacity and voltage as indicated.

.4 Receptacles of one manufacturer throughout project.

2.3 SPECIAL WIRING DEVICES

.1 Special wiring devices:

.1 Pilot lights as indicated, with neon type 0.04 W, 125 V lamp and red plastic jewel lense, flush type.

2.4 WIRING DEVICES FOR COMPUTER ROOMS

.1 As indicated.

2.5 COVER PLATES

.1 Cover plates for wiring devices to: CSA-C22.2 No.42.1.

.2 Cover plates from one manufacturer throughout project.

.3 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.4 Stainless steel cover plates as indicated, thickness 2.5 mm for wiring devices mounted in flush-mounted outlet box.

.5 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

.6 Weatherproof cover plates complete with gaskets and “heavy-duty in use” covers in conformance with ESA.

.7 Weatherproof spring-loaded cast aluminum cover plates complete with gaskets for single receptacles or switches.

.8 All wiring device cover plates to be labeled using clear adhesive strips with black type identifying panel and circuit number for each device.

3.0 EXECUTION

3.1 INSTALLATION

.1 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.3 Mount toggle switches at height in accordance with Section 26 05 00 – Common Work Results - Electrical.

.2 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Mount receptacles at height in accordance with Section 26 05 00 – Common Work Results - Electrical.

.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.3 Cover plates:

.1 Protect cover plate finish with paper or plastic film until painting and other work is finished.

.2 Install suitable common cover plates where wiring devices are grouped.

.3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

END OF SECTION

1.0 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 78 00 – Closeout Submittals.

.2 Section 26 05 00 – Common Work Results - Electrical.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA C22.2No.248.12, Low Voltage Fuses Part 12: Class R (Bi-National Standard with, UL 248-12 (1st Edition).

1.3 SUBMITTALS

.1 Submit fuse performance data characteristics for each fuse type and size above 600 A. Performance data to include: average melting time-current characteristics.

1.4 DELIVERY AND STORAGE

.1 Ship fuses in original containers.

.2 Do not ship fuses installed in switchboard.

.3 Store fuses in original containers in storage cabinet moisture free location.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 – Construction / Demolition Waste Management and Disposal.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility as approved by Consultant.

.5 Fold up metal banding, flatten and place in designated area for recycling.

2.0 PRODUCTS

2.1 FUSES GENERAL

.1 Fuse type references L1, L2, J1, R1, etc. have been adopted for use in this specification.

.2 Fuses: product of one manufacturer for entire project.

2.2 FUSE TYPES

.1 Class L fuses (formerly HRC-L).

.1 Type L1, time delay, capable of carrying 500% of its rated current for 10 s minimum.

.2 Type L2, fast acting.

.2 Class J fuses (formerly HRCI- J).

.1 Type J1, time delay, capable of carrying 500% of its rated current for 10 s minimum.

.2 Type J2, fast acting.

.3 Class R -R fuses (formerly HRCI- R). For UL Class RK1 fuses, peak let-through current and its' peak let-through values not to exceed limits of UL 198E-1982, table 10.2.

.1 Type R1, (UL Class RK1), time delay, capable of carrying 500% of its rated current for 10 s minimum, to meet UL Class RK1 maximum let-through limits.

.2 Type R2, time delay, capable of carrying 500% of its rated current for 10 s minimum.

.3 Type R3, (UL Class RK1), fast acting Class R, to meet UL Class RK1 maximum let-through limits.

.4 Class -C fuses (formerly HRCII- C).

3.0 EXECUTION

3.1 INSTALLATION

.1 Install fuses in mounting devices immediately before energizing circuit. Ensure correct fuses fitted to physically matched mounting devices.

.1 Install Class R rejection clips for HRCI-R fuses.

.2 Ensure correct fuses fitted to assigned electrical circuit.

.3 Where UL Class RK1 fuses are specified, install warning label "Use only UL Class RK1 fuses for replacement" on equipment.

.4 Install spare fuses in fuse storage cabinet.

END OF SECTION

1.0 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 26 05 00 - Common Work Results – Electrical.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA-C22.2 No. 5-02, Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

1.3 SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Include time-current characteristic curves for breakers with ampacity of 600 A and over or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 – Construction / Demolition Waste Management and Disposal.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility as approved by Consultant.

.5 Fold up metal banding, flatten and place in designated area for recycling.

2.0 PRODUCTS

2.1 BREAKERS GENERAL

.1 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient.

.2 Common-trip breakers: with single handle for multi-pole applications.

.3 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting. Trip settings on breakers with adjustable trips to range from 3-8 times current rating.

.4 Circuit breakers with interchangeable trips as indicated.

.5 Circuit breakers to have minimum of 10,000 A symmetrical rms interrupting capacity rating at 208V and 14,000 A at 600V.

2.2 THERMAL MAGNETIC BREAKERS

.1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

2.3 FUSED THERMAL MAGNETIC BREAKERS

.1 Fused thermal magnetic breakers with current limiting fuses internally mounted. Time current limiting characteristics of fuses coordinated with time current tripping characteristics of circuit breaker. Coordination to result in interruption by breaker of fault-level currents up to interrupting capacity of breaker. Fuses individually removable and interlocked with breaker. Removal of fuse cover, blowing of a fuse or removal of a fuse, to trip breaker.

2.4 SOLID STATE TRIP BREAKERS

.1 Moulded case circuit breaker to operate by means of a solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, and long time short time, instantaneous tripping for phase and ground fault short circuit protection.

2.5 OPTIONAL FEATURES

.1 Include:

.1 shunt trip.

.2 auxiliary switch.

.3 motor-operated mechanism c/w time delay unit.

.4 under-voltage release.

.5 on-off locking device.

.6 handle mechanism.

2.6 ENCLOSURE

.1 Mounted in NEMA 1 type enclosure, sprinkler proof as indicated.

3.0 EXECUTION

3.1 INSTALLATION

.1 Install circuit breakers as indicated.

END OF SECTION

1.0 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 26 05 00 - Common Work Results – Electrical.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CAN/CSA C22.2 No.4, Enclosed Switches.

.2 CSA C22.2 No.39, Fuseholder Assemblies.

1.3 SUBMITTALS

.1 Include time-current characteristic curves for breakers with ampacity of 600 A and over or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 – Construction / Demolition Waste Management and Disposal.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility as approved by Consultant.

.5 Fold up metal banding, flatten and place in designated area for recycling.

2.0 PRODUCTS

2.1 DISCONNECT SWITCHES

.1 Fusible and non-fusible, disconnect switch in CSA Enclosure type 1, size as indicated.

.2 Provision for padlocking in on-off switch position by three locks.

.3 Mechanically interlocked door to prevent opening when handle in ON position.

.4 Fuses: size as indicated, to Section 26 28 13.01 - Fuses - Low Voltage.

.5 Fuseholders: suitable without adaptors, for type and size of fuse indicated.

.6 Quick-make, quick-break action.

.7 ON-OFF switch position indication on switch enclosure cover.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.

.2 Indicate name of load controlled on size 4 nameplate.

3.0 EXECUTION

3.1 INSTALLATION

.1 Install disconnect switches complete with fuses as indicated.

END OF SECTION

1.0 GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for contactors for system voltages up to 600 V.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 26 05 00 – Common Work Results - Electrical.

.4 Section 26 29 03 - Control Devices.

1.3 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA C22.2 No.14, Industrial Control Equipment.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 – Construction / Demolition Waste Management and Disposal.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility as approved by Consultant.

.5 Fold up metal banding, flatten and place in designated area for recycling.

2.0 PRODUCTS

2.1 CONTACTORS

.1 Contactors: to CSA C22.2 No.14.

.2 Electrically held controlled by pilot devices as indicated and rated for type of load controlled. Half size contactors not accepted.

.3 Fused switch combination contactor as indicated.

.4 Complete with 2 normally open and 2 normally closed auxiliary contacts unless indicated otherwise.

.5 Mount in CSA Enclosure 1 unless otherwise indicated.

.6 Include following options in cover:

.1 Red indicating lamp.

.2 Hand-Off-Auto selector switch.

.7 Control transformer: in accordance with Section 26 29 03 - Control Devices, in contactor enclosure.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.

.2 Size 4 nameplate indicating name of load controlled as indicated.

3.0 EXECUTION

3.1 INSTALLATION

.1 Install contactors and connect auxiliary control devices.

END OF SECTION

1.0 GENERAL

1.1 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI C82.1, Electric Lamp Ballasts-Line Frequency Fluorescent Lamp Ballast.

.2 ANSI C82.4, Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps.

.2 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.1 ANSI/IEEE C62.41, Surge Voltages in Low-Voltage AC Power Circuits.

.3 American Society for Testing and Materials (ASTM)

.1 ASTM F1137, Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.

.4 United States of America, Federal Communications Commission (FCC)

.1 FCC (CFR47) EM and RF Interference Suppression.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 45 00 - Quality Control.

1.3 SUBMITTALS

.1 Submit complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by Owner's Representative.

.2 Photometric data to include: VCP Table and spacing criterion and luminaire coefficient of utilization (CU) tables.

.3 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.4 Quality assurance submittals: provide the following in accordance with Section 01 45 00 - Quality Control.

.1 Manufacturer's instructions: provide manufacturer's written installation instructions and special handling criteria, installation sequence, cleaning procedures and relamping schedule.

.5 Submit product literature for each type of lamp supplied, complete with the mercury content of each lamp.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Divert unused metal materials from landfill to metal recycling facility.

.4 Disposal and recycling of fluorescent lamps as per local regulations.

.5 Disposal of old PCB filled ballasts.

1.5 ACCEPTABLE PRODUCTS

.1 Luminaires described in the Lighting Fixture Schedule identify quality, performance criteria and other parameters, as indicated for this project. Named fixtures are acceptable with modifications and accessories, as indicated.

.2 Fixtures from other manufacturers may be acceptable provided:

.1 Appearance and lighting performance are similar.

.2 Quality is equal or better.

.3 Lamp and ballast criteria remain the same.

.4 The fixture is provided with modifications and accessories to provide a complete product in keeping with the intent of the project.

.5 Approval in writing is obtained from the Owner’s Representative to the supplier/manufacturer 5 days prior to tender closing date.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 – Construction / Demolition Waste Management and Disposal.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility as approved by Consultant.

.5 Fold up metal banding, flatten and place in designated area for recycling.

2.0 PRODUCTS

2.1 LAMPS

.1 LED, as indicated.

2.2 BALLASTS

.1 LED drivers:

.1 General requirements:

.1 Designed for 10 year operational life while operating at maximum case temperature and 90 percent non-condensing relative humidity.

.2 Designed and tested to withstand electrostatic discharges without impairment of performance when tested according to IEC 61000-4-2.

.3 UL 8750 recognized or listed as applicable.

.4 Complies with IEC 61347-2-13 as applicable.

.5 Surge Tolerance: Designed and tested to withstand Category A surges of 4,000 V according to IEEE C62.41.2 without impairment of performance.

.6 Manufactured in a facility that employs ESD reduction practices in compliance with ANSI/ESD S20.20.

.7 Class A sound rating; inaudible in a 27 dBA ambient.

.8 No visible change in light output with a variation of plus or minus 10 percent line voltage input.

.9 Total Harmonic Distortion (THD): Less than 20 percent for loads greater than 25W; complies with ANSI C82.11.

.10 Drivers to track evenly across multiple lamp lengths and all light levels.

.11 Configuration tool available to optimize the following for LED fixtures:

.1 Light level.

.2 Efficacy.

.3 Thermal performance.

.2 3-wire control:

.1 Provide integral fault protection to prevent driver failure in the event of a mis-wire.

.2 Operate from input voltage of 120 V through 347 V at 60 Hz, or as indicated.

.3 Product(s):

.1 Maximum Inrush Current: Meets NEMA 410 inrush requirements.

.2 Constant Current Drivers:

.1 Support from 220 mA to 1.4 A to ensure a compatible driver exists.

.2 Support LED arrays up to 60W.

2.3 FINISHES

.1 Light fixture finish and construction to meet ULC listings and CSA certifications related to intended installation.

2.4 LUMINAIRES

.1 As indicated in luminaire schedule on drawings.

2.5 OPTICAL CONTROL DEVICES

.1 As indicated in luminaire schedule on drawings.

3.0 EXECUTION

3.1 INSTALLATION

.1 Locate and install luminaires as indicated. Install lamps in all fixtures.

.1 Provide adequate support to suit ceiling system.

3.2 WIRING

.1 Connect luminaires to lighting circuits.

.1 Install flexible conduit for vertical power supply drop to luminaires as indicated. Horizontal wiring using flexible conduit is not permitted.

3.3 LUMINAIRE SUPPORTS

.1 For suspended ceiling installations support luminaires from ceiling grid in accordance with local inspection requirements.

3.4 LUMINAIRE ALIGNMENT

.1 Align luminaires mounted in continuous rows to form straight uninterrupted line.

.2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

3.5 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 – Common Work Results – Electrical.

END OF SECTION

1.0 GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for emergency lighting systems.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 26 05 00 - Common Work Results – Electrical.

.3 Section 26 05 21 - Wires and Cables (0-1000 V).

.4 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

1.3 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA C22.2 No.141, Unit Equipment for Emergency Lighting.

1.4 SUBMITTALS

.1 Data to indicate system components, mounting method, source of power and special attachments.

1.5 WARRANTY

.1 For batteries, the ten years warranty period is extended to 120 months, with no-charge replacement during the first 5 years and pro-rate charge on the second 5 years from the date of Substantial Completion.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 – Construction / Demolition Waste Management and Disposal.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility as approved by Consultant.

.5 Fold up metal banding, flatten and place in designated area for recycling.

2.0 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

.1 Acceptable Manufacturers include Beghelli, Emergi-Lite, Stanpro, Dual-Lite, Ready-Lite. All new fixtures shall be from the same manufacturer.

2.2 EQUIPMENT

.1 Emergency lighting equipment: to CSA C22.2 No.141.

.2 Supply voltage: 120 V, ac.

.3 Output voltage: 12 or 24 V dc.

.4 Operating time: as required by the latest edition of the OBC and NBC.

.5 Battery: sealed, maintenance free.

.6 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01V for plus or minus 10% input variations.

.7 Solid state transfer circuit.

.8 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.

.9 Signal lights: solid state, for 'AC Power ON'.

.10 Finish: standard.

.11 Auxiliary equipment:

.1 Test switch.

.2 Time delay relay.

.3 Battery disconnect device.

.4 RFI suppressors.

3.0 EXECUTION

3.1 INSTALLATION

.1 Install unit equipment and remote mounted fixtures.

.2 Direct heads.

.3 Connect exit lights to unit equipment.

.4 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical.

END OF SECTION

1.0 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 00 - Cleaning.

.3 Section 26 05 00 - Common Work Results – Electrical.

1.2 REFERENCES

.1 Atomic Energy Control Board Regulations

.2 Canadian Code for Preferred Packaging

.3 Canadian Standards Association (CSA)

.1 CSA C22.2 No.141, Unit Equipment for Emergency Lighting.

.2 CSA C860, Performance of Internally-Lighted Exit Signs.

.4 National Fire Protection Association (NFPA)

.1 NFPA 101, Life Safety Code.

1.3 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheets and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence, cleaning procedures and disposal.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 – Construction / Demolition Waste Management and Disposal.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility as approved by Consultant.

.5 Fold up metal banding, flatten and place in designated area for recycling.

2.0 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

.1 Acceptable Manufacturers include Beghelli, Lumacell, Stanpro, Emergi-Lite, Readylite, Dual Lite.

.2 All new fixtures shall be from the same manufacturer.

2.2 SELF-POWERED UNITS

.1 Exit lights: to CSA C22.2 No.141 and CSA C860, packaged in accordance with the Canadian Code for Preferred Packaging guidelines.

.2 Housing: cold rolled steel minimum 1.0 mm thick, satin aluminum enamel finish.

.3 Face and back plates: extruded aluminum.

.4 Lamps: multiple - LED over 500,000 hours.

.5 Operation: designed for 25 years of continuous operation without relamping.

.6 Face: Green Running Man Pictogram.

.7 Downlight: white glass in bottom of unit.

.8 Face plate to remain captive for relamping.

.9 Supply voltage: 120 V, ac.

.10 Output voltage: 12 or 24 V dc.

.11 Operating time: minimum 90 minutes and as required by code.

.12 Recharge time: 12 hours

.13 Battery: sealed, maintenance free, NiCd.

.14 Charger: solid state, voltage/current regulated, inverse temperature compensated, short circuit protected, with regulated output of plus or minus 0.01 V for plus or minus 10% V input variation.

.15 Solid state transfer circuit.

.16 Signal lights: solid state, for 'AC Power ON'.

.17 Mounting: suitable for universal mounting directly on junction box and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.

.18 Cabinet: finish: standard.

.19 Auxiliary equipment:

.1 Test switch.

.2 AC/DC output terminal blocks inside cabinet.

.3 RFI suppressor.

.4 Cord and single twist-lock plug connection for AC power supply.

3.0 EXECUTION

3.1 INSTALLATION

.1 Install exit lights to manufacturer's recommendations, listing requirements, NFPA standard and local regulatory requirements.

.2 Connect fixtures to exit light circuits using RW90 wire in EMT conduit.

.3 Connect emergency lamp sockets to emergency circuits.

.4 Ensure that exit light circuit breaker is locked in on position.

.5 Provide tests in accordance with Section 26 05 00 – Common Work Results – Electrical.

3.2 CLEANING

.1 Proceed in accordance with Section 01 74 00 – Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1.0 GENERAL

1.1 REFERENCES

.1 Telecommunications Industries Association (TIA) / Electronic Industries Alliance (EIA).

.1 TIA/EIA-606, Administration Standard for the Commercial Telecommunications Infrastructure.

.2 U.S. Department of Labor / Occupational Safety and Health Administration (OSHA)

.1 Nationally Recognized Testing Laboratory (NRTL).

1.2 SYSTEM DESCRIPTION

.1 Telecommunications grounding and bonding system consist of grounding busbars, bonding backbones, and other bonding conductors.

.2 Provides ground reference for telecommunications systems within building and bonding to it of telecommunications rooms.

.3 Metallic pathways, cable shields, conductors, and hardware within telecommunications spaces are bonded to telecommunications grounding and bonding system.

1.3 QUALITY ASSURANCE

.1 Products of This Section: Manufactured to ISO 14000, ISO 9000 and certification requirements.

.2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five (5) years documented experience.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 – Construction / Demolition Waste Management and Disposal.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility as approved by Consultant.

.5 Fold up metal banding, flatten and place in designated area for recycling.

2.0 PRODUCTS

2.1 TELECOMMUNICATIONS MAIN GROUNDING BUSBAR (TMGB)

.1 Existing on second floor.

2.2 TELECOMMUNICATIONS GROUNDING BUSBAR (TGB)

.1 Predrilled copper busbar, listed by NRTL, electrotin plated with holes 8 mm diameter for use with standard-sized lugs to: ANSI J-STD-607-A.

.2 Dimensions 6 mm thick, 50 mm wide, 300 mm long to: ANSI J-STD-607-A.

2.3 BONDING CONDUCTOR FOR TELECOMMUNICATIONS

.1 3/0 AWG copper conductor, green insulated to: ANSI J-STD-607-A.

2.4 TELECOMMUNICATIONS BONDING BACKBONE (TBB)

.1 #1/0 AWG copper conductor, green insulated to: ANSI J-STD-607-A.

2.5 GROUNDING EQUALIZER (GE)

.1 #1/0 AWG copper conductor, green insulated to: ANSI J-STD-607-A.

2.6 WARNING LABELS

.1 Non-metallic warning labels in English and French to: ANSI J-STD-607-A.

.2 Identify labels with wording "If this connector is loose or must be removed, please call the building telecommunications manager".

3.0 EXECUTION

3.1 TELECOMMUNICATIONS GROUNDING BUSBAR (TGB)

.1 Install TGB in main terminal/equipment room and each telecommunications room.

.2 Install #6 AWG copper bonding conductor from TGB to alternating current equipment ground (ACEG) of serving electrical power panel (panelboard).

3.2 BONDING CONDUCTORS GENERAL

.1 When placed in ferrous metallic conduit or EMT longer than 1 m, bond to each end of conduit or EMT using grounding bushing.

3.3 TELECOMMUNICATIONS BONDING BACKBONE (TBB)

.1 Install TBBs from TMGB to each TGB.

.2 Use exothermic welding, approved 2 hole compression lugs for connection to TMGB and TGBs.

3.4 GROUNDING EQUALIZER (GE)

.1 Install GE between TBBs in multi-storey building by bonding TGBs with GE on every floor.

3.5 BONDING TO TGB

.1 Bond metallic raceways in telecommunications room to TGB using #6 AWG green insulated copper conductor.

.2 For cables within telecommunications room having shield or metallic member, bond shield or metallic member to TGB using green insulated copper conductor.

.3 Bond equipment racks and cabinets located in telecommunications room to TGB using #6 AWG green insulated copper conductor.

3.6 LABELLING

.1 Apply warning labels to telecommunications bonding and grounding conductors.

.2 Apply additional administrative labels to: TIA/EIA-606.

END OF SECTION

1.0 GENERAL

1.1 RELATED SECTIONS

.1 Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.

.2 Section 26 05 33.01 - Cable Trays for Electrical Systems.

.3 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CAN/CSA C22.1 No.126.1, Metal Cable Tray Systems.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA VE 1, Metal Cable Tray Systems.

.2 NEMA VE 2, Cable Tray Installation Guidelines.

1.3 SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittals.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for communication raceway systems and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 SYSTEM DESCRIPTION

.1 Empty telecommunications raceway system for telephone, data TV consists of outlet boxes, cover plates, conduits, cabletroughs, pull boxes, sleeves and caps, fish wires, service fittings as indicated. Sizes of all raceways as per drawing.

.2 Overhead ceiling distribution system within interior of building.

1.5 QUALITY ASSURANCE

.1 Products of This Section: Manufactured to ISO 14000, ISO 9000 and certification requirements.

.2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five (5) years documented experience.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 – Construction / Demolition Waste Management and Disposal.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility as approved by Consultant.

.5 Fold up metal banding, flatten and place in designated area for recycling.

2.0 PRODUCTS

2.1 MATERIAL

.1 Conduits: EMT type, in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

.2 J-Hooks: Pre-galvanized complete with retainer clips.

.3 Junction boxes, cabinets type [E] [T]: in accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.

.4 Outlet boxes, conduit boxes, and fittings: in accordance with Section 26 05 32 – Outlet Boxes, Conduit Boxes and Fittings.

.5 Fish wire: polypropylene type.

3.0 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for communication raceway systems installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform the Client's Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of approval to proceed from the Client's Representative.

3.2 INSTALLATION

.1 Install empty raceway system, including underfloor and overhead distribution system, fish wire, terminal cabinets, outlet boxes, floor boxes, pull boxes, cover plates, conduit, sleeves and caps, miscellaneous and positioning material to constitute complete system.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 13 – Progressive Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 13 – Progressive Cleaning.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by pathways for communications systems installation.

END OF SECTION

1.0 GENERAL

1.1 RELATED WORK

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 00 - Closeout Procedures.

.3 Section 26 05 00 - Common Work Results - Electrical.

.4 Section 26 05 21 - Wires and Cables (0 - 1000 V).

.5 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

.6 Section 28 16 00 - Intrusion Detection.

1.2 REFERENCES

.1 Underwriter's Laboratories of Canada (ULC)

.1 CAN/ULC-S524, Installation of Fire Alarm Systems.

.2 ULC-S525, Audible Signal Appliances for Fire Alarm.

.3 CAN/ULC-S526, Visual Signal Appliances, Fire Alarm.

.4 CAN/ULC-S527, Control Units, Fire Alarm.

.5 CAN/ULC-S528, Manual Pull Stations.

.6 CAN/ULC-S529, Smoke Detectors, Fire Alarm.

.7 CAN/ULC-S530, Heat Actuated Fire Detectors, Fire Alarm.

.8 CAN/ULC-S536, Inspection and Testing of Fire Alarm Systems.

.9 CAN/ULC-S537, Verification of Fire Alarm Systems.

.10 CAN/ULC-S1001, Standard for Integrated Systems Testing.

1.3 SYSTEM DESCRIPTION

.1 Fully supervised, microprocessor-based, remote monitored fire alarm system, utilizing digital techniques for data control and multiplexing techniques for data transmission.

.2 System to carry out fire alarm and protection functions; including receiving alarm signals: initiating general alarm; supervising components and wiring; actuating auxiliary functions; initiating trouble signals and signaling to central monitoring system.

.3 Zoned, non-coded single stage.

.4 Modular in design to allow for future expansion.

.5 Operation of system shall not require personnel with special computer skills.

.6 System to include:

.1 Central Control Unit in separate enclosure with power supply, stand-by batteries, central processor with microprocessor and logic interface, main system memory, input-output interfaces for alarm receiving, annunciation/display, and program control/signaling.

.2 Power supplies.

.3 Initiating/input circuits.

.4 Output circuits.

.5 Auxiliary circuits.

.6 Wiring.

.7 Manual and automatic initiating devices.

.8 Audible and visual signaling devices.

.9 End-of-line resistors.

.10 Local and Remote annunciators.

.11 Historic event recorder.

.12 Drill button on main panel.

1.4 REQUIREMENTS OF REGULATORY AGENCIES

.1 System:

.1 Subject to Provincial Fire Commissioner’s approval.

.2 Subject to FC inspection for final acceptance.

.3 To electrical inspection approval.

.2 System components: listed by ULC and comply with applicable provisions of National Building Code and meet requirements of local authority having jurisdiction.

1.5 SUBMITTALS

.1 Include:

.1 Detail assembly and internal wiring diagrams for control unit.

.2 Details for devices.

.3 Details and performance specifications for control, annunciation and peripherals with item by item cross reference to specification for compliance.

.4 Step-by-step operating sequence, cross referenced to logic flow diagram.

1.6 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for fire alarm system for incorporation into manual specified in Section 01 78 00- Closeout Submittals.

.2 Include:

.1 Instructions for complete fire alarm system to permit effective operation and maintenance.

.2 Technical data - illustrated parts list with parts catalogue numbers.

.3 Copy of approved shop drawings with corrections completed and marks removed except review stamps.

.4 List of recommended spare parts for system.

1.7 MAINTENANCE MATERIALS

.1 Provide the following maintenance materials:

.1 Two (2) spare thermal detectors.

.2 Two (2) spare smoke detectors.

.3 Two (2) spare duct smoke detectors.

1.8 MAINTENANCE

.1 Provide one year, s free maintenance from date of substantial completion with two inspections by manufacturer during warranty period and following occupancy. Inspection tests to conform to CAN/ULC-S536. Submit inspection report to Owner.

1.9 TRAINING

.1 Provide on-site lectures and demonstration by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system.

1.10 WARRANTY

.1 Provide manufacturer produce warranty against defects in operation, material and workmanship for 2 years from date of substantial completion.

1.11 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 – Construction / Demolition Waste Management and Disposal.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility as approved by Consultant.

.5 Fold up metal banding, flatten and place in designated area for recycling.

2.0 PRODUCTS

2.1 MATERIALS

.1 Equipment and devices: ULC listed and labeled and supplied by single manufacturer.

.2 Power supply: to CAN/ULC-S524.

.3 Audible signal devices: to ULC-S524.

.4 Visual signal devices: to CAN/ULC-S526.

.5 Control unit: to CAN/ULC-S527.

.6 Manual pull stations: to CAN/ULC-S528.

.7 Thermal detectors: to CAN/ULC-S530.

.8 Smoke detectors: to CAN/ULC-S529.

2.2 SYSTEM OPERATION: SINGLE STAGE

.1 Actuation of any alarm initiating device to:

.1 Cause electronic latch to lock-in alarm at central control unit.

.2 Indicate zone of alarm at central control unit.

.3 Cause audible signaling devices to sound continuously throughout building and at central control unit.

.4 Transmit signal to monitoring agency via alarm panel.

.5 Cause air conditioning and ventilation units to shut down.

.2 Acknowledging alarm: indicated at central control unit.

.3 Possible to silence signals by Alarm silence@ switch at control unit, after 60 second period of operation.

.4 Subsequent alarm, received after previous alarm has been silenced, to re-activate signals.

.5 Actuation of supervisory devices to:

.1 Cause electronic latch to lock-in supervisory state at central control unit.

.2 Indicate respective supervisory zone at central control unit.

.3 Cause audible signal at central control unit to sound.

.4 Activate common supervisory sequence.

.6 Resetting alarm or supervisory device not to return system indications/functions back to normal until control unit has been reset.

.7 Trouble on system to:

.1 Indicate circuit in trouble at central control unit.

.2 Activate Asystem trouble@ indication, buzzer and common trouble sequence. Acknowledging trouble condition to silence audible indication; whereas visual indication to remain until trouble is cleared and system is back to normal.

.8 Trouble on system to be suppressed during course of alarm.

.9 Trouble condition on any circuit in system not to initiate any alarm conditions.

2.3 CONTROL PANEL

.1 Central control unit (CCU).

.1 Suitable for DCLA communication style: to CAN/ULC - S524.

.2 Features specified are minimum requirements for microprocessor-based system with digital data control and digital multiplexing techniques for data transmission.

.3 Minimum capacity of 250 addressable monitoring and 250 addressable control/signal points.

.4 System to provide for priority reporting levels, with fire alarm points assigned highest priority, supervisory and monitoring lower priority, and third priority for troubles. Possible to assign control priorities to control units in system to guarantee operation or allow emergency override as required.

.5 Integral power supply, battery charger and standby batteries.

.6 Basic life safety software: retained in non-volatile Erasable Programmable Read-Only-Memory (EPROM). Extra memory chips: easily field-installed. Random-Access Memory (RAM) chips in panel to facilitate password-protected field editing of simple software functions (e.g. zone labels, priorities) and changing of system operation software.

.7 Circuitry to continuously monitor communications and data processing cycles of microprocessor. Upon failure, audible and visual trouble indication to activate.

.8 Support up to 2 RS-232-C I/O ports. CCU output: parallel ASCII.

.9 Equipped with software routines to provide Event-Initiated-Programs (EIP); change is status of one or more monitor points, may be programmed to operate any or all of system, s control points.

.10 Software and hardware to maintain time of day, day of week, day of month, month and year.

2.4 POWER SUPPLIES

.1 120 V, 60 Hz as primary source of power for system.

.2 Voltage regulated, current limited distributed system power.

.3 Primary power failure or power loss (less than 102 V) will activate common trouble sequence.

.4 Interface with battery charger and battery to provide uninterruptible transfer of power to standby source during primary power failure or loss.

.5 During normal operating conditions fault in battery charging circuit, short or open in battery leads to activate common trouble sequence and standby power trouble indicator.

.6 Standby batteries: sealed, maintenance free.

.7 Continuous supervision of wiring for external initiating and alarm circuits to be maintained during power failure.

2.5 INITIATING/INPUT CIRCUITS

.1 Receiving circuits for alarm initiating devices such as manual pull stations, smoke detectors, and heat detectors wired in DCLA configuration to central control unit.

.2 Alarm receiving circuits (active and spare): compatible with smoke detectors and open contact devices.

.3 Actuation of alarm initiating device: cause system to operate as specified in ”System Operation“.

.4 Receiving circuits for supervisory, N/O devices. Devices: wired in DCLA configuration to central control unit.

.5 Actuation of supervisory initiating device: cause system to operate as specified in ”System Operation”.

2.6 ALARM OUTPUT CIRCUITS

.1 Alarm output circuit: connected to signals, wired in class B configuration to central control unit.

.1 Signal circuits operation to follow system programming; capable of sounding horns continuously. Each signal circuit: rated at 2 A, 24 V DC; fuse-protected from overloading/overcurrent.

.2 Manual alarm silence, automatic alarm silence and alarm silence inhibit to be provided by system’s common control.

2.7 AUXILIARY CIRCUITS

.1 Auxiliary contacts for control functions.

.2 Actual status indication (positive feedback) from controlled device.

.3 Alarm or supervisory trouble on system to cause operation of programmed auxiliary output circuits.

.4 Upon resetting system, auxiliary contacts to return to normal or to operate as pre-programmed.

.5 Auxiliary circuits: rated at 2 A, 24 V DC or 120 V AC, fuse-protected.

.6 Auxiliary contacts for shut down of all ventilation/exhaust units indicated.

.7 Auxiliary contacts for Building Automation System.

2.8 WIRING

.1 Multi-conductor cable assemblies with dedicated bonding wire CSA FAS105 and FT-4 rated.

.2 To initiating circuits: 18 AWG minimum, and in accordance with manufacturer's requirements.

.3 To signal circuits: 16 AWG minimum, and in accordance with manufacturer's requirements.

.4 To control circuits: 14 AWG minimum, and in accordance with manufacturer's requirements.

.5 Fire alarm cables to be run in EMT conduit unless otherwise noted.

2.9 MANUAL ALARM STATIONS

.1 Addressable manual pull station.

.1 Pull lever, break glass rod, semi-flush wall mounted type, single action, single stage, electronics to communicate station's status to addressable module/transponder over 2 wires and to supply power to station. Station address to be set on station in field.

2.10 AUTOMATIC ALARM INITIATING DEVICES

.1 Addressable thermal fire detectors, combination fixed temperature and rate of rise, non-restorable fixed temperature element, self-restoring rate of rise, fixed temperature 57EC, rate of rise 8.3 EC per minute.

.1 Electronics to communicate detector's status to addressable module/transponder.

.2 Detector address to be set on detector in field.

.2 Addressable thermal fire detector, fixed temperature, non-restorable, rated 57EC.

.1 Electronics to communicate detector's status to addressable module/transponder.

.2 Detector address to be set on detector in field.

.3 Addressable variable-sensitivity smoke detectors.

.1 Photo-electric type.

.2 Electronics to communicate detector's status to addressable module/transponder.

.3 Detector address to be set on detector in field.

.4 Addressable thermal fire detector, fixed temperature, non-restorable, rated 57EC constructed of moisture proof design.

.1 Electronics to communicate detector's status to addressable module/transponder.

.2 Detector address to be set on detector in field.

.5 Sensitivity settings: 3 settings, determined and operated by control panel. No shifting in detector sensitivity due to atmospheric conditions (dust, dirt) within certain parameters.

.6 Ability to annunciate minimum of 2 levels of detector contamination automatically with trouble condition at control panel.

2.11 AUDIBLE SIGNAL DEVICES

.1 Vibrating horn: semi-flush mounted, red enamel, 24 V DC, 94 dB.

.2 Exterior horns to be weatherproof design mounted in PVC yard hood.

2.12 VISUAL ALARM SIGNAL DEVICES

.1 Strobe: flashing white, 24 V dc semi-flush mounted in finished areas.

2.13 END-OF-LINE DEVICES

.1 End-of-line devices to control supervisory current in signaling circuits sized to ensure correct for each circuit. Open, short or ground fault in any circuit will alter supervisory current in that circuit, producing audible and visible alarm at main control panel and remotely as indicated.

2.14 ADDRESSABLE CONTROL/MONITOR MODULES

.1 Addressable modules with address set in field for control/monitoring of external circuits.

.2 Applications: ventilation unit shut down, sprinkler device monitoring, control of magnetic door hold open devices, door electric strikes, interface to electronic door hardware controllers to facilitate door control functions when required.

.3 Ensure that control circuits connected to addressable relay dry contacts are protected by fuse to limit current within manufacturer's requirements.

2.15 AS-BUILT RISER DIAGRAM

.1 Fire alarm system riser diagram: in glazed frame minimum size 600 x 600 mm.

.2 Provide complete riser diagram indicating all devices in relative position on communications loop. Indicate location of each device by Block reference and room name and number.

.3 Locate riser diagram in main electrical room.

2.16 ISOLATION MODULES

.1 Isolation modules for segmenting of fire alarm detection loop as indicated.

2.17 PASSIVE GRAPHIC DISPLAY

.1 Provide passive graphic display, to be mounted adjacent to the main fire alarm control panel. Plastic laminate type, black artwork on white background, framed under glass approximately size: 600 x 600 mm.

2.18 REMOTE ANNUNCIATOR

.1 LCD type annunciator providing information as per display on control panel display, to be located in main lobby of building.

2.19 WIRE GUARDS

.1 Provide factory manufactured wire guards in gymnasium for protection of manual pull stations, fire detectors, strobe lights and alarm horns.

2.20 REMOTE MONITORING

.1 Provide remote monitoring of fire alarm status to monitoring agency. Retain services of intrusion alarm service representative for connection to and programming of intrusion alarm control panel to accommodate alarm from fire alarm system. Include all charges in Division 26 Electrical Contract.

3.0 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Install systems in accordance with CAN/ULC-S524.

.2 Run all fire alarm wiring in conduit.

.3 Install central control unit and connect to ac power supply.

.4 Install manual alarm stations and connect to alarm circuit wiring.

.5 Locate and install detectors and connect to alarm circuit wiring. Do not mount detectors within 1 m of air outlets. Maintain at least 600 mm radius clear space on ceiling, below and around detectors. Locate duct type detectors in straight portions of ducts.

.6 Connect alarm circuits to main control panel.

.7 Install horns and visual signal devices and connect to signaling circuits.

.8 Connect signaling circuits to main control panel.

.9 Install end-of-line devices at end of signaling circuits.

.10 Install wiring to ventilation units as identified for shut down under alarm conditions.

.11 Splices are not permitted.

.12 Provide necessary raceways, cables and wiring to make interconnections to terminal boxes, annunciator equipment and CCU, as required by equipment manufacturer.

.13 Ensure that wiring is free of opens, shorts or grounds, before system testing and handing over.

.14 Identify circuits and other related wiring at central control unit, annunciators, and terminal boxes.

.15 Connect fire alarm control panel to intrusion alarm control panel for remote monitoring.

.16 Install factory wire guards in gymnasium on pull stations, fire detectors, strobes and fire alarm horns.

.17 Install remote annunciator and connect to main control panel.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical.

.2 Fire alarm system:

.1 Test each device and alarm circuit to ensure manual stations, thermal and smoke detectors transmit alarm to control panel and actuate general alarm and ancillary devices.

.2 Check annunciator panels to ensure alarms are shown correctly.

.3 Simulate grounds and breaks on alarm and signaling circuits to ensure proper operation of system.

.4 Addressable circuits system style DCLA:

.1 Test each conductor on all DCLA addressable links for capability of providing 3 or more subsequent alarm signals on each side of single open-circuit fault condition imposed near midmost point of each link. Operate Acknowledge/Silence switch after reception of each of the 3 signals. Correct imposed fault after completion of each series of tests.

.2 Test each conductor on all DCLA addressable links for capability of providing 3 or more subsequent alarm signals during ground-fault condition imposed near midmost point of each link. Operate Acknowledge/Silence switch after reception of each of the 3 signals. Correct imposed fault after completion of each series of tests.

.3 Provide final PROM program re-burn for system incorporating program changes made during construction.

.4 Provide programming for system to provide identification of alarm and trouble conditions to satisfaction of the owner. Coordinate with the owner prior to programming display items.

.5 Complete audibility testing for locations with new signalling devices or where architectural layouts have been revised.

6. Provide testing and verification of all existing initiating and signalling devices once connected to new panel.

7. Complete CAN/ULC S1001 standard for integrated systems testing which shall be performed as part of the system replacement work.

END OF SECTION

1.0 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM).

- .1 ASTM C117, Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
- .2 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- .3 ASTM D422, Standard Test Method for Particle-Size Analysis of Soils.
- .4 ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3) (600 kN-m/m^3).
- .5 ASTM D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3) (2,700 kN-m/m^3).
- .6 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

.2 Canadian General Standards Board (CGSB).

- .1 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.
- .2 CA/CGSB-8.2, Sieves, Testing, Woven Wire, Metric

.3 Canadian Standards Association (CSA)

- .1 CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
  - .1 CSA-A3001, Cementitious Materials for Use in Concrete.
- .2 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/ Methods of Test and Standard Practices for Concrete.

1.3 DEFINITIONS

.1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.

- .1 Rock excavation: excavation of material from solid masses of igneous, sedimentary or metamorphic rock which, prior to its removal, was integral with

its parent mass, and boulders or rock fragments having individual volume in excess of 1 m^3. Frozen material not classified as rock.

.2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.

.2 Unclassified excavation: excavation of deposits of whatever character encountered in work.

.3 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.

.4 Waste material: excavated material unsuitable for use in work or surplus to requirements.

.5 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of work.

.6 Unsuitable materials:

.1 Weak and compressible materials under excavated areas.

.2 Frost susceptible materials under excavated areas.

.3 Frost susceptible materials:

.1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM D422 and ASTM C136: Sieve sizes to CAN/CGSB-8.1.

Sieve Designation	%Passing
2.00 mm	100
0.10 mm	45-100
0.02 mm	10-80
0.005 mm	0-45

.2 Coarse grained soils containing more than 20% by mass passing 0.075 mm sieve.

1.4 SUBMITTALS

.1 Inform Owner's Representative at least 4 weeks prior to commencing work, of proposed source of fill materials and provide access for sampling.

.2 Submit 70 kg samples of type of fill specified including representative samples of excavated material.

.3 Ship samples as directed by Owner's Representative in tightly closed containers to prevent contamination.

1.5 QUALITY ASSURANCE

.1 Submit design and supporting data at least 2 weeks prior to commencing work.

.2 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in the province of Newfoundland and Labrador.

.3 Keep design and supporting data on site.

.4 Engage services of qualified professional engineer who is registered or licensed in Province of Newfoundland and Labrador to design and inspect cofferdams, shoring, bracing and underpinning required for work.

.5 Do not use soil material until written report of soil test results are reviewed and approved by Owner's Representative.

1.6 EXISTING CONDITIONS

.1 Buried services:

.1 Before commencing work verify location of buried services on and adjacent to site.

.2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work: pay costs of relocating services.

.3 Remove obsolete buried services within 2 m of foundations: cap cut-offs.

.4 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.

.5 Prior to commencing excavation work, notify applicable Owner or authorities having jurisdiction, establish location and state of use of buried utilities and structures. Owners or authorities having jurisdiction to clearly mark such locations to prevent disturbance during work.

.6 Confirm locations of buried utilities by careful test excavations.

.7 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered as indicated.

.8 Where utility lines or structures exist in area of excavation, obtain direction of Owner's Representative before removing or re-routing.

.9 Record location of maintained, re-routed and abandoned underground lines.

.10 Confirm locations of recent excavations adjacent to area of excavation.

.2 Existing buildings and surface features:

.1 Conduct, with Owner's Representative condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, survey bench marks and monuments which may be affected by work.

.2 Protect existing buildings and surface features from damage while work is in progress. In event of damage, immediately make repair to approval of Owner's Representative.

.3 Where required for excavation, cut roots or branches as approved by Owner's Representative.

2.0 PRODUCTS

2.1 MATERIALS

.1 Backfill Type 1 and Type 2 fill: properties to Section 31 05 16 - Aggregates for Earthwork and the following requirements:

.2 Crushed, pit run or screened stone, gravel or sand.

.3 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1.

Sieve Designation	%Passing	
	Type1	Type2
75 mm	-	100
50 mm	-	-
37.5 mm	-	-
25 mm	100	-
19 mm	75-100	-
12.5 mm	-	-
9.5 mm	50-100	-
4.75 mm	30-70	22-85
2.00 mm	20-45	-
0.425 mm	10-25	5-30
0.180 mm	-	-
0.075 mm	3-8	0-10

.2 Type 3 fill: selected material from excavation or other sources, approved by Owner's Representative for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.

3.0 EXECUTION

3.1 SITE PREPARATION

.1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.

3.2 PREPARATION/PROTECTION

.1 Protect existing features in accordance with Section 01 56 00 - Temporary Barriers and Enclosures and applicable local regulations.

.2 Keep excavations clean, free of standing water, and loose soil.

.3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Owner's Representative's approval.

.4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage. Protect buried services that are required to remain undisturbed.

3.3 STRIPPING OF TOPSOIL

.1 Commence topsoil stripping of areas as indicated by Owner's Representative after area has been cleared of brush, weeds and grasses and removed from site.

.2 Strip topsoil to depths as indicated by Owner's Representative. Do not mix topsoil with subsoil.

.3 Stockpile in locations as directed by Owner's Representative. Stockpile height not to exceed 2 m.

.4 Dispose of unused topsoil as directed by Owner's Representative.

3.4 STOCKPILING

.1 Stockpile fill materials in areas designated by Owner's Representative. Stockpile granular materials in manner to prevent segregation.

.2 Protect fill materials from contamination.

3.5 COFFERDAMS, SHORING, BRACING AND UNDERPINNING

.1 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with Section 01 35 30 - Health and Safety Requirements and Occupational Health and Safety Act for the Province of Newfoundland and Labrador.

.2 Obtain permit from authority having jurisdiction for temporary diversion of water course.

.3 Construct temporary works to depths, heights and locations as indicated or approved by Owner's Representative.

.4 During backfill operation:

.1 Unless otherwise as indicated or as directed by Owner's Representative remove sheeting and shoring from excavations.

.2 Do not remove bracing until backfilling has reached respective levels of such bracing.

.3 Pull sheeting in increments that will ensure compacted backfill is maintained at an elevation at least 500 mm above toe of sheeting.

.5 When sheeting is required to remain in place, cut off tops at elevations as indicated.

.6 Upon completion of substructure construction:

.1 Remove cofferdams, shoring and bracing.

.2 Remove excess materials from site and restore water courses as indicated and as directed by Owner's Representative.

3.6 DEWATERING AND HEAVE PREVENTION

.1 Keep excavations free of water while work is in progress.

.2 Submit for Owner's Representative's review details of proposed dewatering or heave prevention methods, such as dikes, well points, and sheet pile cut-offs.

.3 Avoid excavation below groundwater table if quick condition or heave is likely to occur. Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.

.4 Protect open excavations against flooding and damage due to surface run-off.

.5 Dispose of water in accordance with Section 01 35 43 - Environmental Procedures and in manner not detrimental to public and private property, or any portion of work completed or under construction.

.6 Provide flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers, water courses or drainage areas.

3.7 EXCAVATION

.1 Excavate to lines, grades, elevations and dimensions as indicated by Owner's Representative.

.2 Remove concrete, masonry, paving, walks, demolished foundations and rubble and other obstructions encountered during excavation in accordance with Section 02 41 13 - Selective Site Demolition.

.3 Excavation must not interfere with bearing capacity of adjacent foundations.

.4 Do not disturb soil within branch spread of trees or shrubs that are to remain. If excavating through roots, excavate by hand and cut roots with sharp axe or saw.

.5 For trench excavation, unless otherwise authorized by Owner's Representative in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.

.6 Keep excavated and stockpiled materials a safe distance away from edge of trench as directed by Owner's Representative.

.7 Restrict vehicle operations directly adjacent to open trenches.

.8 Dispose of surplus and unsuitable excavated material off site.

.9 Do not obstruct flow of surface drainage or natural watercourses.

.10 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.

.11 Notify Owner's Representative when bottom of excavation is reached.

.12 Obtain Owner's Representative approval of completed excavation.

.13 Remove unsuitable material from trench bottom to extent and depth as directed by Owner's Representative.

.14 Correct unauthorized over-excavation as follows:

.1 Fill under bearing surfaces and footings with concrete specified for footings.

.2 Fill under other areas with Type 2 fill compacted to not less than 95% of corrected maximum dry density.

.15 Hand trim, make firm and remove loose material and debris from excavations. Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil. Clean out rock seams and fill with concrete mortar or grout to approval of Owner's Representative.

3.8 FILL TYPES AND COMPACTION

.1 Use fill of types as indicated or specified below. Compaction densities are percentages of maximum densities obtained from ASTM D698 corrected maximum dry density.

.1 Exterior side of perimeter walls: use Type 3 fill to subgrade level. Compact to 95%.

.2 Within building area: use Type 2 to underside of base course for floor slabs. Compact to 98%.

.3 Under concrete slabs: provide 150 mm compacted thickness base course of Type 1 fill to underside of slab. Compact base course to 100%.

.4 Retaining walls: use Type 2 fill to subgrade level on high side for minimum 500 mm from wall and compact to 95%. For remaining portion, use Type 3 fill compacted to 95%.

.5 To correct over excavation in trenches: use Type 2 fill to underside of sand bedding compacted to 95%.

3.9 BEDDING AND SURROUND OF UNDERGROUND SERVICES

.1 Place and compact granular material for bedding and surround of underground services as indicated.

.2 Place bedding and surround material in unfrozen condition.

3.10 BACKFILLING

.1 Vibratory compaction equipment: approved by Owner's Representative.

.2 Do not proceed with backfilling operations until Owner's Representative has inspected and approved installations.

.3 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.

.4 Do not use backfill material which is frozen or contains ice, snow or debris.

.5 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.

.6 Backfill around installations.

.1 Place bedding and surround material as specified elsewhere.

.2 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.

.3 Place layers simultaneously on both sides of installed work to equalize loading. Difference not to exceed 600 mm.

.4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures.

.1 Permit concrete to cure for minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure, and approval obtained from Owner's Representative, or

.2 If approved by Owner's Representative, erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by Owner's Representative.

3.11 RESTORATION

.1 Upon completion of work, remove waste materials and debris, trim slopes, and correct defects as directed by Owner's Representative.

.2 Replace topsoil as indicated by Owner's Representative.

.3 Reinstate lawns to elevation which existed before excavation.

.4 Reinstate pavement and sidewalks distributed by excavation to thickness, structure, and elevation which existed before excavation.

.5 Clean and reinstate areas affected by work as directed by Owner's Representative.

.6 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 h.

END OF SECTION

1.0 GENERAL

1.1 SECTION INCLUDES

.1 Provision of rigid conduit and concrete - encased underground service ducts.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.3 Section 26 05 00 - Common Work Results - Electrical.

.4 Section 26 05 28 - Grounding - Secondary.

.5 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

.6 Section 26 05 43.01 - Installation of Cables in Trenches and in Ducts.

1.3 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.

1.4 REGULATORY REQUIREMENTS

.1 Co-ordinate and meet requirements of power supply authority. Ensure availability of power when required. Use cash allowance as per Section 01 21 00 – Allowances to cover costs associated with contribution-in-aid of construction to Utility authority for provision of building permanent power supply.

2.0 PRODUCTS

2.1 MATERIALS

.1 Underground ducts: Concrete Encased Duct Banks, DBII type.

.2 Epoxy coated rigid steel galvanized conduit and fittings: to Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings. Use for sections extending above finished grade.

.3 Conductors: copper, type RWU-90, to Section 26 05 21 – Wires and Cables (0 -1000v), size and number of conductors as indicated.

.4 Concrete: to CSA A23.1/A23.2 and Division 3 - Concrete.

.5 Backfill: clean and free from debris.

.6 Pulling Iron:

.1 22 mm diameter hot dipped galvanized steel bar with exposed triangular shaped opening.

3.0 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install cables in trenches and in ducts in accordance with Section 26 05 43.01 - Installation of Cables in Trenches and in Ducts.

.2 Allow adequate conductor length for connection to supply by power supply authority.

.3 Allow adequate conductor length for connection to service equipment.

.4 Make grounding connections in accordance with Section 26 05 28 - Grounding - Secondary.

.5 Provide concrete encasement in accordance with CSA A23.1 and as indicated on drawings.

.6 Install pulling irons as required.

.7 Seal ducts and conduits at building entrance location after installation of cable.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results – Electrical.

.2 Perform additional tests as required by authority having jurisdiction.

.3 Submit written test results for review and approval.

3.4 CLEANING

.1 Proceed in accordance with Section 01 74 00 – Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

7159-RW-22 - Smithson Public School - Office & HVAC Upgrades

Opening Date: February 18, 2022 3:30 PM

Closing Date: March 14, 2022 2:00 PM

Schedule of Prices

* Denotes a "**MANDATORY"** field

Do not enter $0.00 dollars unless you are providing the line item at zero dollars to the Board.

Bid Price Form

Note: Cash Allowances included in BID PRICE.

Blackout Period Protocol is understood and will be adhered to.

HST is additional.

Line Item	Description	Unit of Measure	Quantity	Bid Price *	Total
1	Smithson Public School - Office & HVAC Upgrades	Lump Sum	1		
				Subtotal:	

Summary Table

Bid Form	Amount
Bid Price Form	
HST (13%)	$ 0.00
Total Contract Amount:	

Specifications

Bidder's Contact Information

Provide contact information for the following employees for this project.

If any of the contacts are to change within the duration of the contract the Board must be immediately notified and pre-approve the change(s).

Title	Name *	E-mail *	Cell Phone Number *	
Project Manager				*
Site Supervisor				*

Documents

It is your responsibility to ensure the uploaded file(s) is/are not defective or corrupted and are able to be opened and viewed by the Owner. If the attached file(s) cannot be opened or viewed, your Bid Submission may be rejected.

COVID REPSONSE

Submit a work plan that outlines how the company plans to address COVID-19, including implementing workplace strategies that include, but are not limited to, social distancing, personal hygiene recommendations, and other relevant recommendations made by the government of Ontario, the government of Canada, the local municipal government, and their respective ministries, agencies, and departments, in respect of the employees and other personnel of the successful bidder, their subcontractors and suppliers, as well as the employees and other personnel of the Board, the Board's Consultant, and the general public.

- WSIB * (mandatory)
- Covid Response * (mandatory)

BONDING UPLOAD SECTION

Refer to the Bonding Requirements Section of the Terms and Conditions.

- Digital Bid Bond & Agreement to Bond * (mandatory)

Addenda, Terms and Conditions

I/We have read and understand this Bid Solicitation document, and agree to perform the Work required in accordance with this Bid

Solicitation document, including all addenda, at the price(s) detailed in the Bid.

I/We confirm that:

1. The person named in this Bid is authorized to sign and electronically submit this Bid through the Bidding System.

2. I/We meet all mandatory requirements of the Bid Solicitation document.

3. The bid will remain open for a specified acceptance period after the Closing Time. The Board may, at any time within this period, accept the Bid whether or not any other Bid has previously been accepted.

4. All prices provided in the Bid will remain fixed and firm for the duration of the term of the agreement, unless specified otherwise.

5. All prices provided in my/our Bid are in Canadian funds and include all charges of every kind attributable to the Work. Harmonized Sales Tax will be extra and not shown, unless specified otherwise.

6. To the best of my/our knowledge and belief:

a) the information provided in the Bid is correct; and

b) the Bid is made without any comparison of figures or arrangement with any other individual, corporation or person submitting a Bid for the same Work and is in all respects fair and without collusion or fraud.

7. I/We comply with the all applicable Board policies, provincial, and federal laws, and are aware of the Board's "Principles of Business Conduct" and will comply.

8. I/We agree and understand that the recommendation to award the Work may be subject to the approval from the Board as well as availability of funds.

9. I/We agree to be bound by the terms and conditions of the Bid Solicitation document and submit this Bid on behalf of the Bidder.

☐ I have the authority to bind the Bidder.

The Bidder/Proponent is to declare any actual, potential or perceived conflict of interest that could arise from submitting the Bid/Proposal.

Do you have a potential conflict of interest?

○ **Yes** ○ **No**

The Bidder acknowledges and agrees that the addendum/addenda below form part of the Bid Solicitation Document.

Please check the box in the column **"I have reviewed this addendum"** below to acknowledge each of the addenda.

File Name	I have reviewed the below addendum and attachments (if applicable)	Pages
There have not been any addenda issued for this bid.		