Halton District School Board

HDSB RFX Front End
- Goods & Services

RFT 26-031 (the RFX)

Milton #13 Elementary School and Child Care Facility

Issue Date: February 11, 2026

Closing Date and Time: All Submissions are to be submitted electronically via email to chatelaina@hdsb.ca no later than 2:00 p.m. local time, on March 5, 2026.

Questions:

All questions to be submitted in writing through hdsb.bidsandtenders.ca using the "Submit a Question" link associated with this bid request. Questions are required to be received no later than the question deadline outlined in the bid request.

Purchasing Representative:

Name: Amanda Chatelain
Email Address: chatelaina@hdsb.ca

Site Meeting

Date: February 18, 2026
Location: 1345 Trudeau Drive, Milton, ON (Meeting location: Trudeau Drive, one block south of Whitlock Ave. at the south end of Trudeau Drive, near the barricade.).
Time: 9:00 a.m.

Communications Notice

To obtain documents online please visit: https://hdsb.bidsandtenders.ca

If you subscribe to bids & tenders you can login to your account to download the document(s) without the preview watermark. You may also opt to purchase a one-time download for this opportunity. Documents are not provided in any other manner.

All Suppliers shall be registered as a Plan Taker for this opportunity, which will enable the Supplier to download the RFT without the watermark preview, to receive addenda email notifications, and to download addenda. Failure to register as a Plan Taker may result in disqualification of the submission, at the sole discretion of HDSB.

Should the HDSB receive a Submission that is subsequently found to be from a Supplier that is not registered with bids & tenders and the Supplier did not obtain the RFT document from https://hdsb.bidsandtenders.ca the HDSB reserves the right to remove the Submission from further consideration.

The following documents form part of all HDSB competitive proposal documents:

HDSB Procurement Administrative Procedure:

https://www.hdsb.ca/our-board/Policy/Procurement.pdf

HDSB Asbestos Management in Facilities Administrative Procedure:

https://www.hdsb.ca/our-board/Policy/AsbestosManagementInFacilities.pdf

HDSB Vendor Performance Management Administrative Procedure:

https://www.hdsb.ca/our-board/Policy/VendorPerformanceManagement.pdf

Broader Public Sector Procurement Directive

https://www.doingbusiness.mgs.gov.on.ca/mbs/psb/psb.nsf/Attachments/001-BPS_Procurement_Directive/$FILE/BPS_Procurement_Directive.pdf

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    Appendix E – Notice of Intent Not to Submit a Bid (1 page)
    Appendix F – Mandatory Incorporated Provisions (16 Pages)
    Appendix G – HDSB Prequalified Subcontractors (3 Pages)
    HDSB Standard Terms and Conditions (30 pages)

1. *Introduction to the Halton District School Board (HDSB)*

The Halton District School Board (HDSB) supports the learning of approximately 67,000 students across the municipalities of Burlington, Halton Hills, Milton, and Oakville within the Halton Region. As one of the largest English-language school boards in Ontario, the HDSB provides high-quality education from Kindergarten through Grade 12, as well as continuing education programs for adults and newcomers.

The HDSB's team of approximately 12,000 staff, including teachers, administrators, support personnel, and senior leadership, work collaboratively to provide a safe, caring, equitable, and inclusive learning environment for all students, while also promoting respect, civility, and academic excellence. The HDSB aims to create a positive school climate where every student, staff member, and member of the school community feels safe, included, and accepted and where students can learn, grow, and thrive within HDSB's 92 Elementary Schools and 18 Secondary Schools (including Gary Allan HS and Syl Apps HS).

Additional information about the HDSB can be found by visiting hdsb.ca.

2. *Objective of the RFX*

The HDSB is seeking qualified Suppliers to complete construction of Milton # 13 Elementary School and Child Care Facility located at 1345 Trudeau Drive, Milton ON.

In order to be considered for this project, the successful Supplier shall have the following attributes/characteristics:

a. Experience providing Services as described in this RFX;
b. Have all appropriate licenses, certifications, and operating authorities to provide the Services requested in this RFX;
c. Knowledge of leading-edge trends in the industry;
d. Ability to develop and follow detailed project timelines;
e. Sufficient, competent, trained, and experienced personnel to provide the requested Services;
f. Appropriate supervision, training, documentation, Information and Technology, and other resources are needed to provide the requested services.
g. Sufficient labor and equipment to meet timelines without overextension;
h. Strong coordination between disciplines and with other trades including a clear process for managing subcontractors, scope changes, delays, or issues; and,
i. Appropriate liability and WSIB insurance documentation.

The deliverables for the HDSB Milton # 13 Elementary School and Child Care Facility are set out in the Scope of Work and Deliverables. The HDSB intends to contract by issuance of a Letter of Intent, Award Letter, and/or issuance of a Purchase Order (PO) with one or more primary qualified Supplies to provide the services. This RFX includes the appendices and other supporting documents attached hereto, which form part of the RFX.

Suppliers are encouraged to read each section of the Request for Tender (“RFX”) thoroughly. While sections may appear similar, additional information may be included as applicable within each section. It is the Supplier's responsibility to understand each section's requirements. The procurement timetable represents the HDSB’s best estimated schedule. All dates may be subject to change at HDSB’s discretion. Awarding of the contract is funding dependent and may be delayed while funding is secured.

Additionally, suppliers must review and acknowledge the attached HDSB Standard Terms and Conditions.

3. Planned Schedule of Events

Event	**Date**
Release of RFX	February 12, 2026
Mandatory Site Visit	February 18, 2026
Question Deadline	February 24, 2026
Issuance of Final Addendum	February 26, 2026
RFX Closing	March 5, 2026
Supplementary Forms (3 low bidders)	24 hours or next business day
Project Timelines	Anticipated Construction Start Date – May 1, 2026 Substantial Completion - May 2028 or sooner Total Completion - August 2028
All times specified in this timetable are local times in Burlington, Ontario, Canada	

4. Bid Security and Bonding Requirements

Any bid submission equal to or greater than $500,000, must be submitted with a Bid Bond in the value of ten percent (10%) of the Total Cost and a Surety Consent in favour of the Halton District School Board. The Surety Consent shall cover a Performance Bond and a Labour & Materials Payment bond, each in the amount of fifty percent (50%) of the contract price as a guarantee that the Bidder shall execute the contract upon award.

The Bid Security so submitted shall be irrevocable and valid for 90 days from the closing date set for the submission of tender.

In order to be considered for award of a contract equal to or over $500,000, the Bidder shall submit as part of their Submission, a Surety Consent, completed by a Bonding Company. Any others will not be accepted.

Upon receipt of written notice from the Halton District School Board that it has been awarded the Contract, the successful Bidder shall provide, within five (5) working days of such notice, an original Performance Bond and a Labour and Material Payment Bond, each for the amount of fifty per cent (50%) of the total lump sum price, to guarantee the performance of all obligations of the Contract.

5. RFX Closing Information

All Suppliers shall have an Online Bidding System vendor account and be registered as a plan taker at https://hdsb.bidsandtenders.ca for this RFX, which will enable the Supplier to download the RFX, to receive addenda/addendum email notifications and to download addenda.

The HDSB **does not** accept electronic submissions via Bids and Tenders. **All Submissions are to be submitted electronically via email to chatelaina@hdsb.ca** no later than **2:00 p.m. local time in Burlington, Ontario, on March 5, 2026** as noted on the front cover of this document. Submissions submitted and/or received by any other method will be rejected unless the HDSB has instructed otherwise.

Submissions will be deemed to be officially received by the time stamp issued by the HDSB's email server. Suppliers are cautioned that the timing of their Submission is based on when the submission is received by the HDSB's email server, not when the Submission is submitted by the Supplier, as the submission transmission can be delayed in an 'Internet Traffic Jam' due to file transfer size, transmission speed, etc.

All Submissions must be received by the HDSB's designated email address no later than the closing date and time specified in this RFP. Submissions received after the official closing time, as determined by the HDSB's email server timestamp, may be declared non-compliant and not be considered for evaluation, in the sole discretion of the HDSB. It is the sole responsibility of the Supplier to ensure that its Submission is received on time.

By submitting, the Supplier acknowledges and accepts all terms and conditions in this solicitation document and all terms and conditions outlined in the attached HSDB Standard Terms and Conditions.

6. Site Meeting

Suppliers are responsible for conducting any site examination deemed necessary by the Supplier to inform themselves fully as to the existing conditions, limitations, access, surrounding site conditions and all other conditions, and for the proper preparation of

the Submission. Failure of Suppliers to familiarize themselves with site conditions will not be an allowable reason for an increase in Contract costs.

A Mandatory Site Meeting will be held on February 18, 2026, at 9:00 a.m. at 1345 Trudeau Drive, Milton ON. Bidders are asked to meet at Trudeau Drive, one block south of Whitlock Ave. at the south end of Trudeau Drive, near the barricade.

All Suppliers are required to sign in upon arrival. Late arrivals will not be permitted to attend the mandatory site meeting and will be disqualified from further consideration for this project. Suppliers who fail to attend and sign in at the Mandatory Site Meeting will have their submissions disqualified. No exceptions will be made for late arrivals or failure to sign in. Suppliers are responsible for ensuring timely attendance.

Where there is a mandatory site meeting(s), the HDSB, at its sole discretion, reserves the right to re-schedule a second visit, to ensure competitive submissions are received, in the event that no potential Supplier or only one potential Supplier attends the mandatory site meeting(s). Suppliers who fail to attend and register their attendance at the mandatory site meeting(s) will be disqualified from submitting a Submission.

7. Communication Protocol

All communication related to any aspect of this RFX must be conducted exclusively through the Online Bidding System.

Suppliers who fail to adhere to this communication requirement may be disqualified from further participation in this RFX process. Specifically, and without limitation, Suppliers shall not communicate or attempt to communicate regarding this RFX with:

1. Any employee, official, or agent of the Halton District School Board (HDSB), other than the designated RFX Purchasing contact; or
2. Any member of HDSB's governance, including but not limited to Trustees, the Director of Education, Superintendents, officers, or external advisors.

Suppliers are responsible for reviewing all RFX documents, including the HDSB Standard Terms and Conditions, all Appendices, and the Form of Tender. Should a Supplier identify any errors, omissions, or ambiguities, or require further clarification, such inquiries must be submitted to the RFX Purchasing contact via the Online Bidding System by the deadline specified for questions.

It is the sole responsibility of the Supplier to request clarification on any aspect of this RFX that appears unclear. The HDSB shall not be held responsible for any misunderstanding or misinterpretation by the Supplier.

If a Supplier believes there is an error, inconsistency, or ambiguity in the RFX documents, they must notify the RFX Authority via the Online Bidding System prior to submitting a response.

Where appropriate, the HDSB will issue a clarification through the Online Bidding System for the benefit of all Suppliers. Responses to inquiries will include both the question (edited for clarity if necessary and without identifying the Supplier) and the HDSB's response. The HDSB reserves the right to consolidate and respond to similar questions only once.

If a clarification results in a change to the RFX, such change will be communicated through a formal addendum issued via the Online Bidding System.

All addendum or addenda issued shall form part of this document, which forms part of the RFX. The onus is on the Supplier to verify that they have received and reviewed all addenda. Failure to acknowledge receipt of all addenda in the submission may result in disqualification.

8. Issuance of Addenda

Should the HDSB determine, for any reason, that it is necessary to provide additional information or clarification regarding this RFX, such information will be issued to all Suppliers in the form of an addendum, using the same method by which the original RFX was communicated. Each addendum will form an integral part of this RFX and shall be considered incorporated into all related documents.

This RFX may only be amended through the issuance of such addenda in accordance with this section. Amendments or clarifications issued in any other manner will not be considered binding on the HDSB.

All inquiries regarding this RFX must be **submitted in writing through the Online Bidding System no later than 2:00 p.m. (local time)** on **February 24, 2026**. **Any resulting addenda will be issued no later than February 26, 2026.**

It is the sole responsibility of each Supplier to ensure they have received all addenda prior to submitting their Submission.

9. Subcontractors

The General Contractor must select a subcontractor from the HDSB pre-qualified list of subcontractors attached in **Appendix G - HDSB Prequalified Subcontractors**.

The Contractor agrees to preserve and protect the rights of the parties under the contract with respect to work performed under subcontract, and shall:

- enter into contracts or written agreements with their subcontractors to require them to perform their work in accordance with and subject to the terms and conditions of the contract. Further, the Contractor shall be fully responsible to the Owner for acts and omissions of their subcontractors and of any persons directly or indirectly employed by them as for acts and omissions of persons directly employed by them.

- therefore, agree that they will incorporate the terms and conditions of the Contract Documents into all Subcontractor Agreements they enter into with their subcontractors.

The HDSB reserves the right, at its discretion to waive the requirement to utilized the mandatory list of pre-qualified sub-trades at any time during the tendering process based on market conditions.

Proposed subcontractors must be noted on the Form of Tender.

10. Submission of Required Documentation

Suppliers are required to submit all mandatory and supporting documentation as part of their response to this RFX. Failure to provide any required documentation may result in the Submission being deemed non-compliant and disqualified from further consideration. Incomplete submissions may be rejected without further review.

Required documents include, but are not limited to, the following:

- Form of Tender
- Appendix A: Declaration and Signature Sheet
- Appendix B: Supplier Attestation
- Appendix C: Procurement Restriction Policy Compliance Declaration
- Bid Security and Bonding
- Supplementary Forms from low three (3) bidders 24 hours or next business day

Suppliers must ensure that all forms are fully completed, signed by an authorized representative, and submitted in the manner and format specified in this RFX.

Optional documents include, but are not limited to, the following:

- Appendix D: Voluntary Declaration of Diverse Supplier Status (if applicable)

It is the sole responsibility of the Supplier to review all RFX documents and instructions to ensure that a complete submission is made. Incomplete submissions may be rejected without further consideration.

11. Notice of Intent Not to Submit a Bid

Suppliers who do not intend to submit a response to this RFX are requested to complete and return **Appendix E - Notice of Intent Not to Submit a Bid** form included in this RFX package.

The purpose of this form is to assist the HDSB in understanding reasons for non-participation and to help improve future procurement opportunities.

Please submit the completed form by email to **chatelaina@hdsb.ca** on or before the closing date and time indicated in this RFX.

12. HDSB Standard Terms and Conditions

All Suppliers must review the attached HDSB Standard Terms and Conditions which form an integral part of this RFX process.

All Suppliers to the HDSB will be bound by the standard terms and conditions set forth, except as specifically qualified in Special Terms and Conditions, issued in connection with any RFSQ, RFQ, RFP, RFI, Tender or any other type of request issued by the HDSB soliciting pricing and/or services, whether communicated formally or informally, including via email, phone, or verbal request.

13. Mandatory Terms for Definitive Agreements

As a condition of award, the Supplier agrees that this RFX and any Letter of Intent, Award Letter, Purchase Order, contract or other definitive agreement issued by HDSB (each, a "**Definitive Agreement**") will incorporate and be governed by: (i) this RFX and the HDSB Standard Terms and Conditions; and (ii) the mandatory provisions set out in Appendix F (the "**Mandatory Incorporated Provisions**").

The Mandatory Incorporated Provisions shall be included in or are deemed included in every Definitive Agreement (and prevail in the event of conflict), notwithstanding any Supplier terms, order forms, shrink-wrap/click-wrap or other documents, which are of no force or effect unless expressly accepted in writing by HDSB. Notwithstanding the foregoing, such provisions shall be interpreted and applied with such modifications, adaptions, and conforming changes as may be necessary to ensure consistency with the structure, terminology, and context of the applicable Definitive Agreement and to give full effect to the intent of the HDSB as expressed herein.

The Supplier shall flow down the Mandatory Incorporated Provisions to all permitted subcontractors and remains fully responsible for their compliance.

14. Order of Precedence

In the event of any conflict, inconsistency, ambiguity or discrepancy among the documents forming this RFX and any resulting Definitive Agreement, the documents shall take precedence in the following order, to the extent of the conflict only.

Supplier terms and conditions (including quotations, proposals, order forms, shrink-wrap/click-wrap, websites/portals) are of no force or effect unless expressly accepted by HDSB in writing and identified as prevailing.

<u>During the RFX process (prior to award)</u>

1. Most recent Addendum(da), in reverse chronological order.

2. Any Special Terms and Conditions or Special Instructions to Suppliers included in this RFX.
3. The main body of this RFX.
4. Appendix F – Mandatory Incorporated Provisions (notwithstanding the foregoing, Appendix F prevails over any conflicting RFX term).
5. Other Appendices and Attachments to this RFX (excluding Appendix F), including the Scope of Work/Specifications/Drawings, schedules and forms (as applicable).
6. Questions and answers/clarifications only to the extent formally issued by Addendum.
7. The Supplier's Submission (including any BAFO and any Supplier-written clarifications requested by HDSB and accepted by HDSB in writing).

<u>After award (Definitive Agreements: PO, Letter of Intent/Award Letter, standalone contract)</u>

1. Most recent Amendment/Change Order/Change Directive, in reverse chronological order.
2. The executed Definitive Agreement (including any schedules), or the HDSB Purchase Order (including any PO Terms), or the Letter of Intent/Award Letter (as applicable).
3. Appendix F – Mandatory Incorporated Provisions (these are deemed incorporated into every Definitive Agreement and prevail over any conflicting term).
4. The main body of this RFX (front end).
5. Special Terms and Conditions or Special Instructions to Suppliers included in this RFX (if not already incorporated above).
6. Scope of Work/Specifications/Drawings and all technical requirements.
7. Other RFX Appendices and Attachments (excluding Appendix F).
8. The Supplier's Submission (including any BAFO and any Supplier-written clarifications requested by HDSB and accepted by HDSB in writing).

<u>Additional rules of precedence</u>

Later-dated documents of the same tier prevail over earlier-dated documents.

Addenda prevail over any previously issued portion of the RFX they modify.

Figures govern over scaled measurements on drawings; detailed specifications govern over general; project-specific requirements govern over standard specifications.

In the case of a discrepancy between words and figures, the words govern.

Responses to questions, presentations, demonstrations or site-meeting discussions are not binding unless and only to the extent incorporated by formal Addendum or written amendment executed by HDSB.

Post-award, the executed Definitive Agreement (or PO) prevails over Appendix F except where Appendix F is expressly incorporated as a mandatory, non-variable provision and identified as prevailing in the Definitive Agreement.

Nothing in this Order of Precedence limits HDSB's rights or remedies set out in the HDSB Standard Terms and Conditions.

SCOPE OF WORK AND DELIVERABLES

Includes the following:

- Binder A: Milton # 13 Elementary School and Child Care Facility - Architectural and Structural Specifications (668 pages)
- Binder B: Milton # 13 Elementary School and Child Care Facility - Mechanical and Electrical Specifications (665 pages)
- Binder C: Milton # 13 Elementary School and Child Care Facility - Architectural Details and Geotechnical Report (201 pages)
- Drawings (88 pages)

PROJECT: MILTON #13 ELEMENTARY SCHOOL
AND CHILDCARE FACILITY
HDSB PROJECT NO. RFT 26-031

CLIENT: HALTON DISTRICT SCHOOL BOARD

PROJECT No.: 22124

DATE: JANUARY 2026

BINDER: A ARCHITECTURAL & STRUCTURAL



ARCHITECT & CONSULTANTS:

HOSSACK ARCHITECTURE

105-1939 IRONOAK WAY
OAKVILLE, ONTARIO L6H 3V8
Tel (905) 815-8284

Strategy 4
- Development Consulting
- Urban Transformation
- Urban Design
- Urban Engineering

MGM CONSULTING INC

DEI Consulting Engineers
MECHANICAL | ELECTRICAL | AQUATIC

KALOS ENGINEERING

PROJECT NAME

Milton #13 Elementary School and Childcare Facility
1345 Trudeau Drive
Milton, Ontario

HDSB Tender No. **RFT 26-031**

PROJECT OWNER

HALTON DISTRICT SCHOOL BOARD
J.W. Singleton Centre
2050 Guelph Line
Burlington, Ontario
L7R 3Z2

CONSULTANTS

Architect
HOSSACK ARCHITECTURE
105 – 1939 Ironoak Way
Oakville, ON L6H 3V8
Tel.: (905) 607-8284

Mechanical, & Electrical Engineers
DEI Consulting Engineers
55 Northland Rd.,
Waterloo, ON N2V 1Y8
Tel.: (519) 725-3555

Structural Engineer
KALOS ENGINEERING INC.
300 York Boulevard
Hamilton, ON L8R 3K6
Tel.: (905) 333-9119

Site Services (Civil) Engineer
MGM Consulting Inc.
400 Bronte Street South, Suite 201
Milton, Ontario, L9T 0H7
Tel. (905) 567 8678

Landscape Architect
STRATEGY 4
2620 Bristol Circle, Unit 100
Oakville, ON L6H 6Z7
Tel.: (905) 829-2544 Fax: (905) 829-1985

END OF SECTION

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SPECIFICATIONS BINDER "A"

HDSB STANDARD TERMS & CONDITIONS
RFT (REQUEST FOR TENDER) FRONT END

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1. INSTRUCTIONS TO BIDDERS

Instruction for tendering must be followed implicitly. Any tender that does not comply with the School Board's RFT front-end documents may be declared informal and might not be considered.

1.1. DEFINITIONS

1.1.1. The words "Bidder" & "Tenderer" and "Bids" & "Tenders" are interchangeable in the documents and their meanings are identical.

1.1.2. The words "Owner" & "Board" are interchangeable in the documents and their meanings are identical.

1.2. DESCRIPTION

1.2.1. Work under this Contract covers the construction of the Project as identified in the Contract Documents.

1.3. CONTRACT

1.3.1. Consult the RFT (RFX) documents for submission requirements.

1.3.1.1. Form of Tender and required Appendices are to be accompanied by a Bid Bond and Agreement to Bond.

1.3.1.2. The 'Supplementary Information Form Section 00 22 00' is to be completed and submitted by the THREE LOW BID prequalified General Contractors on or before 2:00pm local time the following day of the tender close, or the next business day, to the Architect by email (admin@hossackarch.com) and the School Board by email (chatelaina@hdsb.ca).

1.3.1.3 Mechanical Supplemental Tender Form and Electrical Supplemental Tender Form in specification Binder B are to be fully completed by the General Contractor's named subcontractors and submitted, along with Mechanical and Electrical Agreements to Bond, by the THREE Low Bid General Contractors on or before 2:00pm local time the following day of the tender close, or the next business day, to the Architect by email (admin@hossackarch.com) and the School Board by email (chatelaina@hdsb.ca).

And

1.3.1.3. Summary of Work Section 01 11 00

And

1.3.1.4. Specifications as listed in the Specification Index prepared by the Architect and Consultants.

1.3.1.5. Drawings as listed in the Drawing Index and Detail Sheets as listed in the Detail Sheet Index and as applicable - prepared by the Architects and Consultants.

1.3.1.6. Any Addenda issued prior to the closing of tenders.

1.4. BOARD

1.4.1. The "Owner" of the project is:

Halton District School Board
J.W. Singleton Centre
2050 Guelph Line
Burlington, ON L7R 3Z2

1.4.2. The words "Owner" & "Board" are interchangeable in the Documents and their meanings are identical.

1.5. ARCHITECT

1.5.1. The Prime Consultant (Architect) on this project is identified in the Contract Documents.

1.6. CONSULTANTS

1.6.1. The Sub-Consultants on this project are identified in the Contract Documents.

1.7. TENDER

1.7.1. The tender is to be submitted on the provided Tender Form, and shall be known as the **Bid Submission.**

1.7.2. The General Contractor must note that the Bid Submission requires the inclusion of the General Contractor's *Bid Bond* and *Agreement to Bond*.

1.7.3. The **Bid Submission**, submitted on the Request for Tender form supplied, to the location indicated on the Request or Tender form.

1.7.4. **Bid Submission** must be time stamped and received at the Board's, *Reception Counter* on, or before, the Tender Deadline Time outlined in the HDSB Request for Tender.

1.7.5. In the event of a discrepancy, the Board's stamp device shall be the standard of measurement. This clock shall be set to local time, within reasonable tolerances. See also Tender Deadline Time for official clock measurement.

1.7.6. Tenders received after this time and date will not be accepted, and the unopened tender will be returned. The Board will not be responsible for tenders that are delivered to any location within the Board's offices other than at the designated location identified in the Tender Documents.

1.7.7. The Tender shall be submitted for project on forms provided by the Owner.

1.7.8. All blanks in the Tender Form shall be fully completed or the Tender may be invalidated. *Tenders not completed in full, may, at the discretion of the Board, be rejected*.

1.7.9. On the day following (or next regular business day) the Bid Submission, only the THREE LOW BID General Contractors will be required to submit by **2:00 p.m. to the Architect**, by email (admin@hossackarch.com) and the School Board by email (chatelaina@hdsb.ca) the following:

Supplementary Information Form	Section 00 22 00
Mechanical Supplemental Tender Form	Binder B
Electrical Supplemental Tender Form	Binder B
Mechanical and Electrical Agreements to Bond (as noted in item 1.7.10)	

as completed by the Mechanical and Electrical Sub-Contractors named on the Stipulated Price Bid Form of the respective General Contractor.

1.7.10. Mechanical and Electrical Sub-Contract Bidders are required to submit bonds for this project. As part of their Bid, Mechanical and Electrical Bidders shall submit an Agreement to provide a 50% Performance Bond and a 50% Labour and Materials Payment Bond, duly signed and sealed by a Surety firm who is licensed to do business in the Provence of Ontario, stating that if awarded the Contract the Bidder will execute and enter into a formal agreement within the time required. These bonds shall be issued in favour of "The Successful General Contractor" and the Halton District School Board jointly. The Mechanical and Electrical contractors carried by the low three General Contractors must submit their Agreement to Bond to the General Contractor, along with the completed Supplementary Information Forms so that the General Contractor can submit to the Architect within 24 hours of the close of tenders.

1.7.11. *Section 002200 - Supplementary Information Form* shall be signed by the appropriate officers of the Contractor's firm. Incorporated companies shall affix their corporate seal under the hands of their authorized officers.

1.7.12. Drawings and specifications shall be returned to the Consultant within 10 days of the closing of tenders. A second copy of *Section 002110 – Stipulated Price Bid Form* shall be retained by the Bidder.

1.7.13. Tenders shall be valid for length of time outlined in the front end documents.

1.7.14. Tenderers must note, and include, any *Alternate, Separate, and Itemized Prices* requested by the Consultant, as well as all *List of Subtrades*, *List of Suppliers/Products*, *Labour Rates* and *Unit Prices* indicated on the *Supplementary Information Form.*

1.8. TENDER DEADLINE TIME

1.8.1. Time on the official clock is measured in hours and minutes only - not hours, minutes and seconds.

1.8.2. Submitted tenders shall be deemed "On Time" for as long as the official clock shows 2:00 p.m. Submitted tenders shall be deemed "Late" if the submission is stamped by the official clock as 2:01. p.m.

1.9. TENDER ACCEPTANCE AND OPENING

1.9.1. The Board endeavours to open all tenders in public as soon as possible after 2:00 p.m local time, on the date of the closing of the tender. Pre-Qualified Bidders who have submitted bids may attend the opening.

1.9.2. The Board's Administration anticipates that the formal award of the Contract will take place at a future Regular Meeting of the Board. A *Letter of Intent* to sign a Contract will be issued, by the Board, within the terms of acceptance.

1.10. TENDER REJECTION

1.10.1. The Board reserves the right to reject any or all proposals submitted, without explanations, and to waive any informality in same. The lowest or any tender shall not necessarily be accepted.

1.11. UNIT PRICES

1.11.1. Refer to *Supplementary Information Form.* The Bidder should be aware, however, that Unit Prices for additional Work shall not exceed Unit Prices for deducted Work by more than 20%.

1.11.2. Unit prices must be submitted at the time of *Section 002200 - Supplementary Information Form.*

1.11.3. The Board reserves the right to accept or reject any or all of the unit prices prior to entering into a contract.

1.11.4. The Board further reserves the right to negotiate any of all of the unit prices with the Contractor prior to the signing of the Contract.

1.11.5. Should the Board and the General Contractor be unable to mutually agree on the amounts of the unit prices, the Contractor agrees that the Board has the right to hire outside contractors to perform the Work concerned under a separate contract, without any financial penalty whatever to the Board and without additional overhead and profit to the General Contractor.

1.12. SUB-CONTRACTORS

1.12.1. The Construction Bid Depository will not be used for this project.

1.12.2. General Contractor is required to submit, on the provide Tender Form, the names of Mechanical, Electrical and Roofing Sub-Contractors that the General Contractor proposes to use on this Project from the list of pre-qualified sub-contractors contained herein.

1.12.3. General Contractors shall ensure they carry in their bid sub-contractors with whom they can execute a subcontract agreement. This requirement specifically pertains to trade union compatibility. Additional costs will not be considered for failure to comply with this requirement.

1.12.4. General Contractors are required to submit, on *Section 002200 - Supplementary Information Form,* a list of Sub-Contractors. The Bidder shall name in this list the Sub-Contractors proposed to perform the Work under the Contract. Ensure that only prequalified or subcontractors listed in individual specifications sections, if any, are listed. No substitutions to these lists shall be made without the written approval of the Consultants.

1.12.5. The selection of all Sub-Contractors must be acceptable to the Board and to the Consultants. If the required substitution of a Sub-Contractor affects the sub-tender price, an adjustment will be made in the amount of the General Contract by the amount only of the difference in sub-tenders, without additional overhead or profit to the General Contractor.

1.12.6. If the Bidder proposes to do Work with persons directly employed by him and not sub-contract then the Bidder shall insert the words "*Contractor*" ***provided*** that the Bidder can submit proof that his forces have had extensive experience in this field.

1.12.7. Sub-Contractors shall be actually engaged as their own recognized business, in the line of Work required by the specifications and shall carry out themselves the Work which they are awarded by subcontract. They shall not be permitted to re-subcontract their Work or portions thereof, to other contractors. THIS INCLUDES SHOP DRAWINGS.

1.13. COMPLETION DATE

1.13.1. Tenders must include all costs involved in having the Contract “Substantially Complete" by the date specified in *Form of Tender.*

1.13.2. Construction must start immediately upon signing of the contract. Work must continue during all adverse weather conditions as necessary to ensure completion by dates listed in the HDSB RFT front end documents.

1.14. OCCUPANCY REQUIREMENTS

1.14.1. The building(s) shall be deemed to be ready for occupancy when the Contract meets the requirements of OAA/OGCA Document 100, Construction Lien Act (latest amendments) and occupancy approval of all Authorities Having Jurisdiction.

1.14.2. The date of Substantial Completion shall be deemed the date by which the Contractor has achieved the level of completion for full legal occupancy of all areas by the owner.

1.15. BID BOND, PERFORMANCE BOND, LABOUR & MATERIAL BOND/MAINTENANCE BOND

1.15.1. Each tender shall be accompanied by a Bid Bond and Agreement to Bond in the most recent form approved by the Canadian Construction Association from a Surety Company, acceptable to the Board in the amount of **10% of the Bid Price** together with an Agreement to Bond. Tenders not accompanied by a Bid Bond and Agreement to Bond will be declared informal.

1.15.2. This Bid Bond shall be forfeited if the Bidder declines to enter into a formal contract in the amount tendered, or as adjusted according to the separate prices included in the tender, and to furnish, when called upon to do so, a Performance Bond. This Bid Bond shall be accompanied by an Agreement from the Surety Company that a 50% Performance Bond and a 50% Labour and Material Payment Bond will be issued to the Bidder if he is awarded the Contract. The cost of the Bonds shall be included in the amount of the Tender.

1.15.3. Retention and use of the Bid Bond, as outlined above, shall not be deemed a penalty, but a consideration to the Board for inviting and considering the Tender and as part payment for sustained damages and costs incurred by the Board, which shall be deemed to be the difference between the bid price of this Bidder and the bid price of the next lowest Bidder acceptable to the Board.

1.15.4. A Performance Bond, equal to 50% of the Contract Price, shall be furnished through a Surety Company or Insurance Company approved by the Consultant and the Board according to terms and conditions acceptable to the Board and the Consultant.

1.15.5. Labour and Material Payment Bond, equal to 50% of the Contract Price is to be provided within ten (10) Working Days upon request, stating that Board will not be held responsible if payment to Sub-Contractors, as certified due by the Consultant, is not made by the General Contractor when due.

1.15.6. On completion of the Work, the Performance Bond shall remain in force as a MAINTENANCE BOND for a period of one year from the date of acceptance of the building by the Board. It shall form a *Guarantee of Workmanship and Materials* for the one year period.

1.15.7. The Bidder to whom the contract is awarded must properly sign the contract and furnish a satisfactory Performance Bond, Labour and Material Payment Bond, Insurance Certificate and Workers' Compensation Board Certificate within ten (10) Working Days of acceptance of the Tender by the Board, or forfeit the Bid Bond.

1.16. PREQUALIFIED CONTRACTORS AND SUB-CONTRACTORS

1.16.1. Tenders will only be accepted from the following General Contractors:

.1 Bromac Construction Inc.
.2 Everstrong Construction Ltd.
.3 Gen-Pro
.4 Golden Gate Contracting
.5 PM Contracting
.6 Pre-Eng Contracting Ltd.
.7 Remo Construction
.8 Struct-Con Construction
.9 TRP Construction
.10 Tambro Construction Ltd.

1.16.2. Tenders will only be accepted with Mechanical, Electrical and Roofing Contractors listed from the Halton District School Board's list of Pre-Approved Sub-Contractors.

1.16.3. In addition, refer to specific specification sections for prequalified products or suppliers for some individual sections. Ensure names of ONLY the prequalified manufacturers or suppliers are listed on the Bid Documents that form the base bid price.

1.17. COMPLETION OF THE SUPPLEMENTARY INFORMATION FORM

1.17.1. Accurate completion of the Supplementary Information Form is a mandatory requirement for all contractors to make a complete Tender submission.

1.17.2. All bidders are to note that due to the requirement to submit the Supplementary Bid Form on the day following the Bid Submission, advance preparation to complete the information and in particular, the Alternate and Itemized Prices, is advisable.

1.17.3. Bidders must recognise that that accurate completion of the Alternate Prices

1.18. MECHANICAL AND ELECTRICAL SUPPLEMENTARY BID SUBMISSIONS

1.18.1. *Section 15001-'Mechanical Supplementary Tender Form'* and *Section 16001-'Electrical Supplementary Tender Form'* shall be signed, executed, only by the each respective sub-contractor Listed on the Stipulated Price Bid Form of the THREE LOW BID General Contractors. These shall be delivered to the three low bid General Contractors for submission by the three low bid General Contractors in accordance with the terms stated in article 1.7 above.

1.19. BIDDERS

1.19.1. Persons or firms submitting tender proposals shall be actually engaged as their recognized business in the lines of Work required by the specifications, and shall be able to refer to Work of a similar character which has been satisfactorily performed by them.

1.20. FAIR WAGE AND LABOUR

1.20.1. Rate of wages, hours and conditions of Work shall be in accordance with Provincial Codes and as generally recognized and accepted in the locality. Building mechanics and labourers resident in the district are to be employed where suitable.

1.20.2. Labour forces employed on the site may have compatible affiliation with any labour organization. Union contract itself is not a prerequisite.

1.21. DISCREPANCIES AND OMISSIONS

1.21.1. Bidders, including Sub-Contractors, finding specified items unavailable, finding discrepancies in, or omissions from, the drawings or specifications or other contract documents, or having any doubt as to the intent or meaning of any part thereof, shall at once notify the Consultant, who will issue a Bulletin to all Bidders in explanation of the inquiry if necessary.

1.21.2. All definitions, Addenda, explanations, corrections or additional information will be issued by the Consultant during the time of bidding in the form of typewritten Bulletins and such Bulletins will be available to all Bidders. These shall become part of the Contract Documents and must be shown on *Section 002110 - Stipulated Price Bid Form* as having been received.

1.21.3. NO ORAL INSTRUCTIONS WILL BE VALID.

1.22. BIDDING ASSUMPTIONS

1.22.1. All bids submitted, including bids by Sub-Contractors, are assumed to be based upon the complete set of Contract Documents. No alterations in prices for items of Work will be considered if it is determined by the Consultants, or the General Contractor, that bids were not based on the complete set of documents (e.g. bids based upon Specifications but not on drawings and vice-versa).

1.23. ERRORS IN TENDER

1.23.1. The Board shall not entertain requests for gratuitous payments arising from errors alleged to have been made in a Tender that the Board has accepted.

1.24. INQUIRY AND INSTRUCTION

1.24.1 All questions related to this Tender must be submitted in writing in the on-line bidding system.

1.25. EXAMINATION OF SITE

1.25.1. Before tendering, the Bidder shall examine the site, and examine and understand the Geotechnical Investigation Report, the scope of previous rough grading and understand and be aware of said materials as may be included in those documents and this specification. The Bidder shall ascertain the extent and nature of the materials it may be necessary to remove or fill to reach or provide the depths, levels and grades required. The Bidder must determine that all of his/her calculations are made in accordance with the drawings and specifications and the Soils Reports.

1.25.2. Proposals shall include the cost imposed by existing conditions and limitations of site and the accepted proposal shall be held to have included such costs. NO ALLOWANCE WILL BE MADE FOR FAILURE TO EXAMINE THE EXISTING SITE.

1.25.3. The levels and other information shown on the drawings are furnished in good faith for the guidance of the General Contractor. This information, however, shall in no way relieve the General Contractor of the responsibility of ascertaining to his/her own satisfaction the nature of all conditions at the site.

1.26. BUILDING PERMIT AND OTHER PERMITS REQUIRED

1.26.1. The Building Permit has been applied for and the Permit cost shall be paid for by the Owner. The permit may be provided for construction in phases as partial conditional permit(s).

1.26.2. The General Contractor must, however, pay all other necessary fees, deposits and charges related to Municipal, Regional, Provincial and Federal Requirements or permits except as outlined below. The General Contractor is responsible for determining the amounts of these permits, fees, etc.

1.27. CONTRACT DOCUMENTS

1.27.1. The Contract shall be subject to the **Canadian Standard Construction Document CCDC – 2 2020 for Stipulated Price Contract** and all Supplementary Conditions and Contract Documents as prepared by the Consultants. Successful bidder must sign a contract within ten (10) Working Days of notification of award. ***The Contractor shall not be entitled to any payment until the Contract is signed.***

1.27.2. All Contractors will be held to have examined and made themselves familiar with the various articles of these Standard Documents and shall be as binding for all sections of the following specifications as though written in full therein.

1.28. INSURANCE COVERAGE ON EXISTING SCHOOLS VACATED DURING CONSTRUCTION

1.28.1. This article is not applicable to this project.

1.29. FINAL ACCEPTANCE

1.29.1. It must be clearly understood that final acceptance of this Contract is subject to approvals of the Board and other Authorities and these may delay final approval. There will be no adjustments in the tendered price for a period outlined in the tender documents, from receipt of tenders due to delays resulting from obtaining necessary approvals.

1.30. ONTARIO HARMONIZED SALES TAX

1.30.1. The tender amount does not include HST, but shall include all other applicable sales and excise taxes, custom duties, freight, exchange and all other charges in effect and known to come into effect during the construction of the building described in this Contract.

1.30.2. The successful Tenderer must provide his H.S.T. Registration Number and each request for payment must show this number.

1.31. LONG DELIVERY BUILDING COMPONENTS

1.31.1. Contractor will identify long delivery items after contract award. It is not anticipated that there are building components requiring pre-order by the owner for this project.

END OF SECTION

1. SUPPLEMENTARY INFORMATION FORM

1.1. SUBMISSION REQUIREMENTS

Note that this **Supplementary Information Form** is to be submitted by the
THREE LOW BIDDERS to
the Architect admin@hossackarch.com and
School Board chatelaina@hdsb.ca

WITHIN TWENTY-FOUR (24) HOURS FOLLOWING THE CLOSE OF GENERAL TENDERS,
OR THE NEXT BUSINESS DAY.

1.2. TENDER BREAKDOWN

1.2.1. Cash Allowance

1.2.1.1 The value of the Cash Allowance included in the Tender Amount:

$ **700,000.00** _____ (***excluding* H.S.T.**)

1.2.2. Contingency Allowance

1.2.3.1 The value of the Contingency Allowance included in the Tender Amount:

$ **400,000.00** _____ (***excluding* H.S.T.**)

1.2.3. **Building Construction - School:**

1.2.3.1. The **school** building construction including all of the Work of all trades, the supply and installation of all specified equipment, base bid supply and installation, but excludes the cost of Mechanical, Electrical and Site Work identified. below.

$ _____ (***excluding* H.S.T.**)

1.2.4. **Building Construction – Childcare Facility:**

1.2.4.1. The **childcare** building construction including all of the Work of all trades, the supply and installation of all specified equipment, base bid supply and installation, but excludes the cost of Mechanical, Electrical and Site Work identified. below.

$ _____ (***excluding* H.S.T.**)

1.2.5. **Site Services:**

1.2.5.1. Cost of all Mechanical and Electrical Site services; i.e. site drainage, sewers, water mains, and underground Mechanical & Electrical services outside the Building.

$ _____ (***excluding* H.S.T.**)

1.2.6. **Site Work:**

1.2.6.1. Cost of all Site Work (excluding Site Services referenced in 1.2.5 above and childcare site work noted below); i.e. rough and finish grading, landscaping, asphalt and concrete paving, including temporary and permanent fencing and hoarding.

$ _____ (***excluding* H.S.T.**)

1.2.7. **Childcare Outdoor Play Area - Site Work:**

1.2.7.1. Cost of all Site Work required within the fenced childcare outdoor play area; i.e. fencing, asphalt, mulch, seating logs, stepped posts, trees etc...

$ _____ (***excluding* H.S.T.**)

1.2.8. **Mechanical Bid** (excludes Mechanical Site Services)

Name of Pre-Qualified Mechanical Sub-Contractor: _____

$ _____ (***excluding* H.S.T.**)

1.2.9. **Electrical Bid** (excludes exterior underground electrical site services)

Name of Pre-Qualified Electrical Sub-Contractor: _____

$ _____ (***excluding* H.S.T.**)

1.2.10. The total of items 1.2.1 through 1.2.9. shall equal the Tender Amount shown on the Stipulated Price Bid Form.

1.3. SUPPLEMENTARY LIST OF SUB-CONTRACTORS

1.3.1. We, the Bidder, propose to have the following Subcontractors perform the Work on this project and these are an integral part of this Tender.

1.3.2. We confirm that we shall not substitute other Subcontractors for any of the Subcontractors listed below. Any such substitution shall be subject to the Consultants' and Board's approval.

1.3.3. Where we propose to do the Work ourselves, we so note by inserting the word, "*Contractor*".

1.3.4. We confirm that we have investigated their reliability, bonding abilities where required, and competence to carry out the Work as specified. We agree that no changes to this list will be made without the express written approval of the Board.

1.3.5. We confirm that if more than one name is given for a specific sub-trade, the Board has the right to select the preferred trade without any adjustment to the Contract Amount.

1.4. WORK DIVISION

1.4.1. We the Bidder confirm that the division of Work among all the subcontractors and suppliers/installers is our responsibility and we covenant that neither the Consultants nor the Board, will be requested to act as an arbiter to establish subcontract limits between Sections or Division of Work.

SPECIFICATION SECTION/SUB-TRADE	NAME OF SUBCONTRACTOR
03 30 00 Concrete Slab on Grade	
03 41 00 Precast Structural Concrete	
04 21 13 Block Unit Masonry	
04 22 00 Veneer Unit Masonry	
05 12 23 Structural Steel Supply	
05 12 23 Structural Steel Installation	
05 50 00 Metal Fabrications	
06 40 00 Architectural Millwork	
07 21 13 Board Insulation	
07 27 10 Air Barrier	
07 41 43 Aluminum Composite Panels	
07 55 12 Roofing *(Pre-Qualified)*	
07 62 03 Sheet Metal Flashing & Trim	
08 11 14 Metal Doors and Frames	
08 44 13 Aluminum Curtain Wall & Doors	
08 50 50 Aluminum Windows	
09 30 13 Porcelain Floor Tile	

09 21 16 Gypsum Board System _____

09 51 13 Acoustic Panel Ceilings _____

09 65 16 Resilient Sheet Flooring/Base _____

09 65 19 Resilient Tile Flooring/Base _____

09 91 22 Painting _____

10 11 25 Chalkboards and Tackboards _____

10 21 14 Toilet Partitions _____

10 22 27 Folding Panel Partition _____

10 28 10 Washroom Accessories _____

11 52 00 Gymnasium Equipment _____

11 52 00 Gymnasium Divider Curtain _____

31 23 13 Rough Grading _____

31 23 10 Excavation and Backfilling _____

32 12 17 Asphalt Paving _____

32 31 13 Chain Link Fences and Gates _____

33 05 50 Mechanical Site Services _____

32 92 21 Topsoil and Fine Grading _____

32 92 21 Sodding _____

32 93 10 Landscaping _____

1.5. LABOUR RATES

1.5.1 The following (net HST) labour rates shall apply to all changes in the Work.

Trade of Labour Classification	Rate per Hour
Site Foreman	$_____
General Labourer	$_____
Carpenter	$_____
Carpenter Labourer	$_____
Other _____	$_____

(Insert applicable trades and rates per hour)

1.6. ALTERNATE, SEPARATE AND ITEMIZED PRICES

We the undersigned, have completed any Separate, Itemized and Alternate prices requested by the Architects, and any Contractor proposed Alternate Prices. We agree to the following:

1.6.1. All prices submitted take into consideration and allow for changes and adjustments in other Work as may be necessary, to provide a finished and functional result, unless specifically indicated otherwise.

1.6.2. **Alternate (In Lieu of) Prices** are for Work that is not included in the Tender Price requested by the Architect and identified in this *Supplementary Information Form* or submitted by the Tenderer as an attachment to this *Supplementary Information Form*, but which may be substituted by the Board for Work which is included. (No price listed shall mean no change in the cost.)

1.6.3. **Separate Prices** are for Work that is not included in the Tender Price listed in this *Supplementary Information Form,* but which may be added by the Board for the price quoted on the attachment(s).

1.6.4. **Itemized Prices** are for Work that is included in the Tender Price to be supplied by the Tenderer, supplied as for information to the Board for the purposes stated.

1.6.5. The Board reserves the right to accept or reject any of the prices proposed on the Supplementary Information Form or as attachment(s) to this Form.

1.6.6. **None of the prices listed below or on the attachment(s) include HST**.

1.7.7 All Alternate prices must be completed or the Bidder's Tender may not be considered.

1.7. **ALTERNATE PRICES** (Not included in the Tendered Amount, not incl. HST)

1.7.1. **Alternate Price No. 1: Sod to Synthetic Grass Surfacing**: "The total amount to be added to or deducted from the Tendered Amount to substitute 'Synthetic grass surfacing (artificial turf) and associated sub-base and drainage' in lieu of the specified natural sod, in the area noted as on drawing **SKA-1 'Partial Site Plan for Alternate Price Information for Synthetic Grass'** located in specification Binder C.":

Add: $_____ Deduct: $_____

1.7.2. **Alternate Price No. 2: Roof area to Roof Patio adjacent Library 209** : "The total amount to be added to or deducted from the Tendered Amount to substitute an inverted roof, pavers and exterior glass guardrail in lieu of the standard roofing in the area adjacent Library 209 between gridlines '2' & '7', as shown on drawing **SKA-2 'Library Roof Patio for Alternate Price Information'** located in specification Binder C.":

Add: $_____ Deduct: $_____

1.7.3. **General Contractor's Proposed Alternates**:

1.7.3.1. We, the General Contractor propose, for the Board's consideration, possible alternates to specified materials or products by indicating the alternate and the sum to be added to, or deducted from, the Stipulated Price. We acknowledge that the Board is under no obligation to consider or accept such proposed alternates.

Description of Alternate Product or Method of installation proposed as a deduction/addition to the Contract:

1.) _____

_____

Add: _____ Deduct: _____

2.)_____

_____

Add: _____ Deduct: _____

1.8. **SEPARATE PRICES** (Not included in the Tendered Amount, not incl. HST)

1.8.1. **Not applicable**.

1.9. ITEMIZED PRICES (Included in the Tendered Amount, not incl. HST)

1.9.1. **Not Applicable**.

1.10. SIGNATURE OF SUPPLEMENTARY INFORMATION FORM

We are submitting this *Supplementary Information Form* under a Corporate Seal as a Limited Company, or witnessed as an individual or partnership and in accordance with ***Instructions to Bidders.***

NAME OF BIDDER _____

PRINT NAME OF SIGNING OFFICER _____

PRINT TITLE OF SIGNING OFFICER _____

SIGNATURE OF AUTHORIZED SIGNING OFFICER _____

DATED AT_____ THIS _____ DAY OF _____2026

1.14 BIDDERS CHECKLIST – ENVELOPE SUBMISSION

1.14.1 We declare the following items are required in accordance with the Bid Documents for the Supplementary Information Form Submission, as follows:

☐ Stipulate Price Breakdown	☐ Alternate Prices (if applicable)
☐ Subcontractor Names	☐ Separate Prices (if applicable)
☐ Labour Rates	☐ Itemized Prices (if applicable)

Bidder shall check off ☐ items to verify that documents and or information have been attached and or included in the submission.

END OF SUPPLEMENTARY INFORMATION FORM

Part 1 General

1.0 SECTION INCLUDES

1.1 Precedence
1.2 Contract
1.3 Relations of Trades
1.4 Additional Drawings
1.5 Existing Site Conditions
1.6 Temporary Construction Fencing
1.7 Contractor Parking
1.8 Bylaws, Permits and Approvals
1.9 Organization
1.10 Seismic Design Requirements
1.11 Canadian Products and Local Labour
1.12 Materials and Workmanship
1.13 Quality Control
1.14 Overtime
1.15 Protection of Other Work
1.16 Fastenings
1.17 Supply and Install
1.18 Occupation Before Completion
1.19 General Requirements
1.20 Coordination
1.21 Access to the Project
1.22 Subtrade Awards
1.23 Safety Data Sheets
1.24 Regulating Documents
1.25 General Contractor's Responsibilities
1.26 Manufacturers' Instructions
1.27 Air and Vapour Seal
1.28 Fire Safety
1.29 Construction Safety
1.30 Independent Tests and Inspections
1.31 Periodic Cleaning
1.32 Temporary Protection
1.33 Completion
1.34 Guarantees
1.35 Contingency Allowance
1.36 Cash Allowances
1.37 Allowances Carried in Divisions 15 and 16
1.38 Schedule of Allowances
1.39 Polychlorinated Biphenyl (PCB)
1.40 Use of Consultant's Digital Drawings
1.41 Building Dimensions
1.42 Setting of the Work & Required Surveys
1.43 Layout of Work
1.44 Documents Required: Start, During & Close Out.

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1.1 PRECEDENCE

.1 This Section contains Articles prepared which represent the Board standards and policies. In all cases this Section is intended to be read in conjunction with and to coordinate with all other Sections. In the case of discrepancy between this Section and other Sections to more stringent Articles of any applicable Section shall apply.

1.2 CONTRACT

.1 Construct the Work under a single, lump sum, Stipulated Contract. The form of Contract is the CCDC2-2020 plus Supplementary Conditions attached to these specifications

.2 Contract includes the construction of a new three storey school, Milton #13 Public School, plus adjoining Child Care facility, site work, plus coordination. Location of the work is 1345 Trudeau Drive, Milton, Ontario

.3 Project Occupancy Requirements

.1 It is the requirement of this Contract that the school, which is to be contracted and completed under the terms of this contract, be Substantially Complete and fit for full legal occupancy as outlined in the School Board's RFT documents. Contractor to provide temporary utilities, winter heating, frost breaking and inclement weather protection per Section 01 51 00 as required to ensure completion date deliver.

.4 Cautionary Note

.1 Bidders, both General Contractors and Subcontractors, are cautioned that they should not submit bids or tenders if they are unsure of their ability to comply with the above stated construction/occupancy schedule and requirements, provide overtime work as necessary and/or are unwilling to be bound by the schedule and Provisions described in these documents.

1.3 RELATIONS OF TRADES

.1 The Contract Specifications have been generally divided into trade sections for the purpose of ready reference.

.2 The Contractor is responsible for coordinating all trades. He is solely responsible for determining the lines of demarcation between Contractor and/or trades. Neither the Consultant nor the Board, assume any responsibility for any such determination or for any dispute arising concerning it. No extras will be considered due to any such dispute concerning either labour or materials.

.3 Specifications and drawings form an integral part of the Contract Documents. Any subject or item omitted from one, but which is mentioned or reasonably implied in the other, shall be considered as properly and sufficiently specified and will be part of the Work.

1.4 ADDITIONAL DRAWINGS

.1 Consultant may furnish additional drawings to assist proper execution of the Work. These drawings will be issued for clarification only. Such drawings, however, shall have the

same meaning and intent as if they were included with plans referred to in the Contract Documents.

1.5 EXISTING SITE CONDITIONS

.1 Site area within the property lines only has previously been rough graded with fill by the developer. Refer to Drawings for additional grading, removals, new driveways and service connections and reinstatement for areas beyond property lines and coordinate Permits requirements with Section 00 21 13 – Instructions to Bidders.

.2 At the outset of the contract and before any other work begins, the contractor shall review grades on site to confirm compliance with the contract documents. Failure to do so at this initial stage shall eliminate the contractor's right to make claim regarding incorrect grades or site surface conditions at any later stage for the work.

.3 Contractor is responsible to quantify all on-site material to achieve design grades and is responsible for the importation or exportation of material from the site as required.

.4 Ascertaining the specific site and building conditions as they relate to the project is the responsibility of the contractor. Notwithstanding this overriding responsibility the consultant has made every effort to properly represent existing site conditions as they are evident at the time of tender.

.5 The Contractor shall assume the work site based on the existing conditions as shown on the drawings and visible on the job site at the time of the closing of the tender. All excavation, stockpiling, removal, importing and/or grading of soils is to be included in the work of this Contract. Refer to site plan drawings. The contractor shall also refer to the recommendations of the soils investigation records which are included for information, and report any discrepancies to the consultant prior to submitting a tender.

.6 Inspection of the site during the tender period is mandatory for all Contractors. In addition, refer to Section 00 21 13 Instructions to Bidders for the time of a MANDATORY conducted contractors' site tour.

.7 Minor adjustments to the level of sodded areas, berms, etc., may be permitted, to the prior approval of the Consultant and owner. It must be stressed that it will be the contractor's responsibility to negotiate and obtain approval for any such changes with the Authorities having Jurisdiction over lot grading approvals for this project. Completion delays due to such approvals shall not be entertained.

1.6 TEMPORARY CONSTRUCTION FENCING

.1 A temporary perimeter chain link construction fence and siltation fencing shall be erected by the awarded contractor in advance of work and is to be maintained for the duration of the work until such time as new fences, if any as shown, are installed. Provide lockable truck access gates and man gates and maintenance of the entire fence as part of the work of this contract.

.2 Ensure for the duration of the contract that surrounding the work site, the construction fencing, siltation fencing and man and truck gates, are provided and maintained. This

fence shall be locked when no work is in progress, and located as shown on the site plan drawing.

.3 The Board insists that the installation of this construction fencing be accomplished as the first task of the General Contractor when he moves onto the site.

.4 In addition, should the sodded play areas not be completed a minimum of 6 weeks prior to school occupancy, the contractor shall be responsible for the erection and maintenance of a temporary, leased, perimeter "Mod-U-Lock" fence around the sodded areas for a minimum of 6 months from sod being laid, at no additional cost to the owner. Refer also to Section 01 56 00.

1.7 CONTRACTOR PARKING

.1 Refer to section 01 52 00 Construction Facilities.

1.8 BYLAWS, PERMITS AND APPROVALS

.1 Nothing indicated on the Drawings or Specifications is intended to be in conflict with any law, by-law or regulation of Municipal, Provincial, or similar Authority Having Jurisdiction.

.2 Work of this Contract must conform with such laws, by-laws and/or regulations. Any required variation to, or deviation from, the drawings and specifications, shall be performed in accordance with the CCDC-2 Contract and Supplementary Conditions to the CCDC -2 contained in these specifications.

.3 Furnish inspection certificates and/or permits as may be applicable as evidence that the installed Work conforms with laws, by-laws and regulations of Authorities Having Jurisdiction.

.4 Each subtrade shall obtain and pay for all permits and licenses required by Municipal, Provincial, or other authorities having Jurisdiction, particular to their trade.

.5 It is the final responsibility of the General Contractor to obtain all the required approvals and permits and include in his Total Stipulated Price, the cost of such approvals, permits and fees. The only exception is the Building Permit and the Site Servicing permit, which will be applied for by the Consultant and paid for by the Board. It is the contractor's responsibility include in the base tender amount any additional permit or connection fees not specifically identified in the Cash Allowance, and to provide any deposits or securities required by Authorities Having Jurisdiction.

.6 Any revisions or deviations to Contract Documents required by any Authorities Having Jurisdiction must be reviewed by the Consultants before implementation.

1.9 ORGANIZATION

.1 Organize the Work of each section as required for satisfactory and expeditious completion of the Work. Take field dimensions required for the Work. Fabricate and install work to suit field dimensions and conditions.

□

.2 If applicable, take into account existing work to ensure best arrangements of components in available space. Contact the Consultant prior to commencing Work in critical locations and interface with other Contractors' Work.

.3 Provide all forms, templates, anchors, sleeves, inserts and accessories required to be installed in the Work. Set in place, or instruct the applicable subtrade as to their location. Pay costs of extra work, if required, as a result of a failure to comply with these requirements at the proper time.

.4 Before starting his work and from time to time as the work progresses, each Subcontractor shall examine the work and materials installed by the other Subcontractors insofar as it effects his own work, and the General Contractor shall promptly notify the Consultant IN WRITING, if any condition exists that will prevent any Subcontractor from giving a satisfactory result in his own work.

.5 Should any Subcontractor start his own work without such notification, it shall be construed as an acceptance by him of all preceding work and as a waiver of all claims or questions as to its suitability for receiving his work.

1.10 SEISMIC DESIGN REQUIREMENTS

.1 This project requires adherence to seismic design requirements as stipulated in the current Ontario Building Code (OBC), Div. B, Part 4. The General Contractor shall be responsible to coordinate all disciplines to ensure compliance with these requirements for all applicable building components.

.2 All disciplines including Mechanical & Electrical shall make reference to individual specification section and the seismic lateral load table on Drawing S01 which outlines components requiring compliance with seismic design.

.3 As a minimum standard, design for all connections to meet seismic forces shall be included in base bid whether specifically stated in specific specification sections or not.

.4 Shop drawings shall clearly include seismic design compliance calculations for all building components within scope of the current Ontario Building Code (OBC), Div. B, Part 4 requirements.

.5 Refer to Structural Drawing for a table of applicable building components and Section 13 05 41 – 'Seismic Restraint for Non-structural Components'.

1.11 CANADIAN PRODUCTS AND LOCAL LABOUR

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

□

1.12 MATERIALS AND WORKMANSHIP

.1 All materials shall be new and the best of their respective kinds, where a specific grade or brand is not indicated. Pre-packaged materials shall be delivered and stored in unopened containers.

.2 All work performed under this Contract shall be done by mechanics skilled in their respective trades. They shall make use of such templates, jigs or special tools as may be required for the operation involved.

.3 The acceptance of any materials or workmanship shall not be a bar to their subsequent rejection, if found defective.

.4 Adequate, dry storage facilities shall be provided and all stored materials shall be protected from damage and theft.

.5 All Contractors will do Work in accordance with the best industry practice of the type of work specified, unless the Contract Documents stipulate more precise requirements, in which case, the more precise requirements shall govern.

.6 Do Work in a neat, plumb & square manner. Ensure that various work components are properly installed, forming tight joints and appropriately aligned junctions, edges and surfaces, free of warps, twists, waves, or other such irregularities.

.7 Wherever indicated on the drawings or specifications, or in the manufacturers' / suppliers' written instructions, arrange to have manufacturers' / installer's representatives inspect the Work which incorporates their materials, products or items.

.8 Do not permit materials to come in contact with other materials such conditions may result in corrosion, staining, discolouration or deterioration of the completed Work. Provide compatible, durable separators where such contact is unavoidable.

.9 The design of the Work is based on the full interaction of its component parts. No provisions have been made for conditions occurring during construction. Ensure that no part of the Work is subjected to a load which will endanger its safety or which might cause permanent deformation.

.10 Conceal pipes, ducts, conduit, wiring and other such items requiring concealment preferably in, wall or ceiling construction of all finished areas. If in doubt as to method of concealment, or intent of the Contract Documents in this regard, request clarification from the Consultant before proceeding with the Work.

.11 Lay out mechanical and electrical work well in advance of concrete placement and furring installation to allow for proper concealment. Test and inspect Work before applying pipe covering and before it is concealed.

.12 Provide and maintain control lines and levels required for the Work. Lay out the Work in accordance with these lines and levels and dimensions indicated on the drawings.

.13 Verify lines, levels and dimensions and report any errors or inconsistencies on the drawings to the Consultants.

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.14 Final responsibility of satisfactory completion of all the Work, however, lies with the General Contractor.

1.13 QUALITY CONTROL

.1 Refer also to Section 01 45 00.

.2 The Consultants and authorized Board staff shall have access to all areas of the Work, including any off site construction facilities.

.3 The General Contractor shall give timely notice requesting inspection if Work is designated for special tests, inspections, or approvals by the Consultants, or any other authorized Board staff or testing and Inspection Company.

.4 If the General Contract covers, or permits to be covered Work that has been designated as outlined above, he shall uncover such work, have the inspections and tests satisfactorily completed and make good such work at no additional cost to the Board.

.5 The Consultants or the authorized Board Staff may order any part of the Work to be examined, if such Work is suspected not to be according to the Contract Documents. If, upon examination, such work is found not to be in accordance with the Contract Documents, then the General Contractor shall correct such Work and pay for cost of examinations and correction. If such Work is found to be in full accordance with the Contract Documents, the Board shall pay for the cost of examination and making good.

.6 If defects are revealed during inspection and/or testing, the appointed agency may request additional inspection and/or testing to ascertain the full degree of defects. The General Contractor shall correct the defects and irregularities as reported by the inspection and/or testing agency, at no additional cost to the Board and the General Contractor shall pay all associated costs for retesting and reinspection.

.7 The General Contractor shall provide any tools, materials or equipment that may be required by the inspection and/or testing agencies in retesting the Work (*e.g.* Video camera rental to reinspect incorrectly installed sewer lines.)

.8 The employment of inspection and/or testing agencies does not, in any way, affect the General Contractor's responsibility to perform the Work in strict accordance with the Contract Documents.

.9 The General Contractor shall remove all defective work, whether the result of poor workmanship by him or his subtrades, use of defective or damaged products, whether or not incorporated into the Work and any Work that has been rejected by the Consultants or authorized Board Staff as failing to conform to the Contract Documents. Replacement and execution of the affected Work shall be done in full accordance with the Contract Documents, making good other trades' work damaged by such removals or replacements at no additional charge to the Board.

.10 If, in the opinion of the Consultant and/or the authorized Board Staff, it is not expeditious to correct the defective Work, or Work not performed in accordance with the Contract Documents, the Board, may, at its sole discretion, deduct from the Contract Price, the

difference in value between the work performed and that required by the Contract Documents, the amounts of which shall be determined by the Consultant.

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

As required by ss. 24(4) of O. Reg 137/15, all new playground equipment and installation must meet current CSA standards, where applicable. Compliance with the CSA Standard must be verified in writing, by an independent certified third-party inspector, and a copy must be submitted to the ministry before the playground is used by children. This inspection of the playground equipment located within the Kindergarten and Childcare outdoor play areas is part of the project Cash Allowance (Inspections & Testing).

1.14 OVERTIME AND OVERTIME SCHEDULING

.1 The General Contractor must include in his Total Stipulated Tender Price, all costs for overtime work which may be necessary to complete the various portions of the Work, in accordance with the Completion Dates specified in the *Stipulated Price Bid Form.* The Board shall not entertain requests for any payments in connection with overtime work that may be required by the General Contractor, or any of his subtrades, in order to comply with the above referenced dates.

.2 Similarly, it is the Contractor's responsibility to ensure, prior to the close of tenders that all subtrades will meet the requirements for overtime, as required, with no additional costs to the owner, in order to meet the Completion Dates specified in the Form of Tender.

.3 The contractor shall recognize the critical importance that the schedule for full occupancy must be met by the dates stated in the *Stipulated Price Bid Form*. Note that local by-laws may be enforced restricting morning and evening and Sunday work hours.

.4 Note that at no time will the Board entertain additional charges or claims from the General Contractor or his subcontractors for premium, overtime or after–hours work.

.5 Only claims for scope changes or conditions beyond the control of the Contractor may be submitted for review by the Consultants and must be submitted and accepted in advance of the work taking place and at the outset of the condition or scope change arising. No claims additional charges or delays will be accepted if not reviewed and formally accepted in advance.

.6 Notwithstanding sentence 5 above, for any work that remains incomplete after school occupancy by students and staff, all access and work shall be restricted to after hours only: i.e.: after 4:00 p.m. and before 7:00 a.m. No additional costs for overtime or after hours work shall apply.

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1.15 PROTECTION OF OTHER WORK

.1 Each trade shall avoid damage to other trades and shall take all measures necessary and provide all masking and materials necessary, to provide adequate protection.

.2 Each Subcontractor shall be held responsible for all damage to work installed by others that is caused by this work or by anyone employed by him.

.3 Patching and repairing of damaged work shall be done by the Contractor who installed the work, as directed by the Consultant, but the cost of same, shall be paid for by the Contractor who is responsible for the damage.

1.16 FASTENINGS

.1 All fastenings must be permanent, of same metal, or compatible with any metals with which they are in contact, of adequate size and spacing, to ensure permanent anchorage against load or shear.

.2 Exposed fastenings must be evenly spaced, neatly laid out and must not mar surfaces of prefinished materials.

.3 No ram-setting or similar techniques will be permitted, without prior written approval of the Consultant.

1.17 SUPPLY AND INSTALL

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

1.18 OCCUPATION BEFORE COMPLETION

.1 If the General Contractor, for any reason, does not have the Project completed by the specified completion date and the Board, of necessity, is forced to occupy any part of the building before the whole of the Work is completed, the Contractor will not be entitled to any indemnity for interference with his operation.

1.19 GENERAL REQUIREMENTS

.1 All Contractors shall examine carefully all drawings and specifications to inform themselves fully of all conditions and limitations pertaining to the work of the contract.

.2 All Contractors shall co-operate and co-ordinate their work for the proper completion of the work, including co-ordination of delivery dates and commencement of subtrades work.

.3 The responsibility and costs for all work, including temporary structures, shoring, shoring design (if applicable) and erection shall at all times rest with the General Contractor and his Subcontractors. The Consultant will review construction methods and shop drawings for general arrangements only. The method of obtaining the results contemplated by the Contract Documents shall be determined by the General Contractor.

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.4 The undertaking of period site review by the Consultant or Board Representative shall not be construed as supervision of actual construction, nor make them responsible for providing a safe place for work, visit, use, access, travel, or occupancy of the Consultant's or Board's employees or agents.

.5 The General Contractor shall be fully responsible for coordinating and expediting the work of all Subcontractors and shall employ the necessary and qualified personnel to provide the required quality of labour and materials and to prevent delays in the progress of the project. Each trade shall be afforded all reasonable opportunities for the installation of its work and for the storage and handling of its materials.

1.20 COORDINATION

.1 The General Contractor shall coordinate all work and preparation on which subsequent work depends to facilitate mutual progress, and to prevent any conflict.

.2 The General Contractor shall ensure that each trade makes known, for the information of the General Contractor and other trades, the environmental and surface conditions required for the execution of its work; and that each trade makes known the sequence of others' work required for installation of its work.

.3 The General Contractor shall ensure that each trade, before commencing work, knows the requirements for subsequent work and that each trade is assisted in the execution of its preparatory work by trades whose work depends upon it.

.4 The General Contractor shall ensure that shop and layout drawings, templates, and all information necessary for the location and installation of materials, openings, inserts, anchors, accessories, fastenings, connections and access panels are provided by each trade whose work requires cooperative location and installation by other trades and that such information is communicated to the applicable installer.

.5 The General Contractor shall ensure that delivery of materials supplied by one trade to be installed by another is well before the installation begins.

.6 The General Contractor shall inform all trades that giving installation information in error, or too late to incorporate in the work, shall be responsible for any extra work caused thereby, unless impractical and where required, cutting shall be done by each respective trade, and patching shall be done by the general contractor.

1.21 ACCESS TO THE PROJECT

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

.2 The General Contractor shall cooperate fully with any and all Board commissioned Contractors.

1.22 SUBTRADE AWARDS

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

1.23 SAFETY DATA SHEETS

.1 The General Contractor shall ensure that the following material and safety data sheets are submitted prior to commencing installation and application of at least the following:

- .1 Lead-free solder
- .2 Resilient flooring
- .3 Painting and finishing
- .4 Fertilizers
- .5 Glues and adhesives
- .6 Pesticides
- .7 Herbicides
- .8 Any other product which may give off air borne particles after installation.
- .9 Sealants and caulking

.2 The General Contractor and all of his Subcontractors must note that specifically, Asbestos and Asbestos containing materials solder for piping containing lead, and Painting & Coatings containing lead and/or mercury must be excluded from any part of the Work.

.3 Contractor The General must submit Certificates of Compliance, prior to the application for Substantial performance, for each of the following items:

- .1 An affidavit relative to the use of Lead-free solder for all domestic water lines, regardless of location.
- .2 Products for which Material Safety Data Sheets have been submitted and accepted.
- .3 Other Work/Products identified in the Contract Documents as requiring a Certificate of Compliance.

.4 Each Certificate of Compliance must indicate names and addresses of the project, the Board, the date of Issue, produce description including name, number, manufacturer, with a statement verifying that the Work/Product installed meets specified requirements and, if applicable, complies with the submitted and accepted Material Safety Data Sheets.

.5 Each Certificate of Compliance must be issued on the trade's letterhead, properly executed, under whose work the respective Work/Product has been provided.

.6 Each Certificate of Compliance must be endorsed by the General Contractor with his authorized stamp/signature.

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.7 The Completion Security Account will not be paid to the Contractor without submission of all required affidavits and requested material and safety data sheets.

1.24 REGULATING DOCUMENTS

.1 The General Contractor and all of his Subcontractors, Suppliers/Installers etc., must conform to the latest editions in force at the time of tender of each and all of the following: Ontario Building Code, Canadian Electrical Code (CEC), The Occupational Health and Safety Act, Ontario, the National Fire Code, the local Municipal Fire Code, and all other applicable Codes and Building By-Laws. All must also conform to the requirements of the Authorities Having Jurisdiction, such as Public Utilities. Where required under the Occupational Health and Safety Act, engage a Professional Engineer to design hoarding, scaffolding and shoring, formwork and falsework for concrete.

.2 Contract forms, codes, standards and manuals referred to in these specifications are the latest published editions at the date of close of tenders. The General Contractor and all of his Subcontractors, Suppliers/Installers must meet or exceed the requirements of specified standards.

.3 Provide, on site, copies of documents referred to in the Specification for joint use of Contractor and Consultant.

1.25 GENERAL CONTRACTOR'S RESPONSIBILITIES

.1 The list of General Contractor's responsibilities identified below is by no means comprehensive, nor is it in any priority or critical order. It is here, merely to identify the most often forgotten or ignored responsibilities of the General Contractor and is reproduced only as a reminder. The Consultants and the Board advise the General Contractor that it is he who is responsible for all aspects and facets of the Project, from start to completion, from compliance with Occupational Health and Safety regulations to compliance with all codes and statutes.

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

.2 All equipment shall be in safe operating condition and appropriate to the task.

.3 Only competent personnel will be permitted on site. During the site introduction, *only the Consultant* will determine who is competent. The General Contractor will cause to remove from the site any persons not observing or complying with safety requirements.

.4 The General Contractor shall comply with, and shall ensure that all of his Subcontractors, Suppliers, Installers etc., comply with all Federal, Provincial and Municipal Safety Codes and Regulations and the Occupational Health and Safety Act.

.5 The General Contractor shall supply competent personnel to implement his safety program and ensure that all Subcontractors comply with the Board's standards, and those of the Occupational Health and Safety Act.

.6 The Board will provide periodic monitoring to ensure that safety requirements are met, and that safety records are properly kept and maintained. Continued

disregard for safety standards can cause the Contract to be canceled and the General Contractor removed from the site.

.7 The Board may hire Commissioners to perform inspections of building systems at the closing stages of the work of this contract. If so contracted and identified in the *Instructions to Bidders*, the General Contractor shall cooperate with and coordinate the work of the Board's Commissioners on site.

.8 The General Contractor will report to the Board and Jurisdictional Authorities any accident or incident involving personnel and/or property of the Contractor, Board, or Public, arising from the General Contractor's or any of his Subcontractors' execution of the work.

.9 The General Contractor will include all provisions of this contract in any agreement with Subcontractors, and hold them equally responsible for safe work performance.

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

1.26 MANUFACTURERS' INSTRUCTIONS

.1 Unless otherwise specified, the General Contractor and all his Subcontractors shall comply with manufacturer's latest printed instructions for materials and installation methods.

.2 The General Contractor shall notify the Consultant in writing of any conflict between the Specifications and Manufacturer's Instructions and have same clarified.

1.27 AIR AND VAPOUR SEAL

.1 The General Contractor shall ensure that exterior walls, windows, floor and roof surfaces provide an air-tight and vapour-tight membrane to prevent problems due to building vapour migration.

.2 In general, the air/vapour barrier must be achieved on the interior side of the thermal insulation.

1.28 FIRE SAFETY

.1 The General Contractor and all of his Subcontractors must comply with requirements of standard for Building Construction Operations DFC No. 301-1975, issued by Dominion Fire Commissioner.

.2 The appropriate clauses of the Ontario Building Code relating to fire protection shall be strictly followed.

.3 The General Contractor shall provide and maintain free access to temporary or permanent fire hydrants acceptable to local fire department.

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1.29 CONSTRUCTION SAFETY

.1 The General Contractor and all his trades must observe and enforce construction safety measures required by Canadian Construction Safety Code, Workplace Safety & Insurance Board, and Municipal statutes. In particular, the Ontario Construction Safety Act, the regulations of the Ontario Department of Labour and Ontario Hydro Safety Requirements shall be strictly enforced. In event of conflict between any provisions of above authorities the most stringent provisions will apply.

.2 The General Contractor is reminded, once again, that it is he who is responsible for Occupational Health and Safety on this Project. The items listed below are only guidelines of the Board's expectations in this regard and not to be construed to be comprehensive or total in nature.

.3 The Board will take every reasonable precaution to prevent injury or illness to students, employees and the public, participating in Board activities, or performing their duties. This shall be accomplished by providing and maintaining a safe, health working environment by providing the education necessary to perform these activities or duties safely.

.4 The Board is vitally interested in the health and safety of all Contractors and their workers performing work for the Board. Cooperation and support of the General Contractor in the protection of workers from injury or occupational disease is a major, continuing object of the Board. To achieve these goals, the Board, in concert with the Contractors, will endeavor to make every effort to ensure that the Contractors provide a work site which is a safe and healthy work environment. The Board insists that all Contractors and their workers are dedicated to the continuing objective of reducing risk and injury.

.5 The General Contractor covenants and agrees to comply with all statutory and other obligations, including, without limitation, the provisions of the Occupational Health and Safety Act (Ontario) and all Regulations thereto, and all amending and successor legislation, including without limitation, Bill 208 (the "Act") in connection with all work performed by either the Contractor, Subcontractors, or any Other Contractor on, or in connection with, the Project.

.6 Without limiting the foregoing, for the purposes of this Contract, the General Contractor agrees that **he** shall be the "constructor" of the Project within the meaning of the Act, and as such, shall assume all the obligations and responsibilities, and observe all construction safety requirements and procedures, and duties of inspection imposed by the Act on the "constructor", as therein defined, for all work and services performed by the General Contractor, Subcontractors and Other Contractors on or in connection with the Project.

.7 The General Contractor further covenants and agrees that the Board and its existing and former officers, trustees, employees and agents, and their respective heirs, executors, administrators, successors and assigns (hereinafter collectively referred to as the "Board") shall be released from any obligations or liabilities otherwise imposed on the Board, or on any of them, pursuant to the Act in connection with the Project, and that the General Contractor shall assume all liability and responsibility in connection with same.

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.8 The General Contractor agrees to save harmless and indemnify the Board from any losses, damages, costs and expenses of any kind, or nature whatsoever, including all legal expenses, and all defense costs and related expert or consulting fees, incurred by the Board, or any of them, arising in connection with the failure, default, or inability of the General Contractor of the Board, or any of them, to comply with any of the aforementioned statutory, or other legal requirements, or arising in connection with any breach by the General Contractor of any of its covenants, agreements and obligations under this Contract.

.9 The General Contractor shall inform and instruct Other Contractors that they, while performing work on this project, are under the authority of the Contractor. Other Contractors are to discuss and co-ordinate with, and follow instructions from, the General Contractor on all matters of site access, vehicles, deliveries, storage, temporary facilities, coordination with the work of other subcontractors, work methods, scheduling, labour conditions, construction safety, environmental protection, security and all other matters which relate to the safe and proper execution of construction work.

.10 The General Contractor shall ensure that all supervisory personnel on job site are fully aware of the procedures and requirements outlined above and comply with all requirements specified.

.11 All Contractors are responsible to ensure that all machinery and/or equipment are/is safe and that the workers perform their tasks in compliance with established safe work practices or procedures. Workers must receive adequate training in their specific work tasks to protect their health and safety.

.12 The General Contractor shall be responsible for all persons and companies performing work, including Other Contractors, on this project, at all times, up to and including, the date of Substantial Performance of the Work. Authority for coordination and instructions relating to all matters which relate to the safe and proper execution of construction work shall rest with the General Contractor. The Contract Price must include the General Contractor's fees for the coordination and supervision of the work of all Other Contractors.

.13 In addition to the responsibility of all contractors as outlined above, Subcontractors will be held accountable for the health and safety of workers under their supervision.

.14 Every worker must protect his/her own health and safety by working in compliance with the law and with safe work practices and procedures established by the authorities having jurisdiction.

.15 All sections of the Occupational Health and Safety Act for Industrial Establishments, latest edition, and the Occupational Health and Safety Act for Construction projects, latest edition, shall be enforced, by the General Contractor, in their entirety, throughout the duration of the construction project.

.16 The General Contractor shall provide the Consultant with the telephone number where the General Contractor or his representative can be reached at any time, day or night, for the duration of the contract.

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.17 Where an accident, explosion, or fire causes a person injury at the work place, and the worker is disabled from performing the usual task, the General Contractor shall prepare a written notice and shall forward same to the Ministry of Labour within four days of the occurrence with a copy to the Board's Representative, who shall copy and inform the Board's Supervisor of Health and Safety and/or the Board's Joint Health and Safety Committee, containing such information and particulars as may be described.

.18 Where a person is killed or critically injured from any cause at the work place, the General Contractor shall immediately call the Ministry of Labour. A written notice from the General Contractor shall be given to the Ministry of Labour within forty-eight hours after the occurrence, containing such information and particulars as may be prescribed, with copies to the Architect and the Board's Representative.

.19 The General Contractor is advised that the accident scene is under the jurisdiction of the Ministry of Labour and no wreckage, articles, etc., shall be interfered with, disturbed, destroyed, altered or carried away at the scene, or connected with the occurrence, until the Ministry of Labour has given permission.

1.30 INDEPENDENT TESTS AND INSPECTIONS

.1 The Contractor shall appoint inspection firms as directed by the Consultant and make payments from the cash allowances specified in Division noted, except for the following, which shall be included in the contract:

.1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.

.2 Inspection and testing performed exclusively for Contractor's convenience.

.3 Testing, adjustment and balancing of mechanical and electrical equipment and systems.

.4 Mill tests and certificates of compliance.

.5 Re-testing as already described in *Quality Control* of this Section.

.2 The Consultant will authorize payment of inspection services from specified cash allowances.

.3 The General Contractor shall furnish labour and facilities to:

.1 Provide access to work to be inspected and tested.

.2 Facilitate inspections and tests.

.3 Make good work disturbed by inspection and test.

.4 Pour concrete test cylinders and store as directed by Inspection Firm.

.4 The General Contractor shall notify Inspection Firms sufficiently in advance of operations to allow for assignment of laboratory personnel and scheduling of test.

.5 Where materials are specified to be tested, the General Contractor shall deliver representative samples in required quantity to testing laboratory.

1.31 PERIODIC CLEANING

.1 Refer also to Section 01 74 11.

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.2 As part of the Tender, the General Contractor shall provide all necessary garbage bins through the duration of the project. The General Contractor shall ensure that the following is accomplished:

.1 Keep all areas of the Work clean and orderly, free from accumulation of dirt, debris, garbage, oily rags, excess material, or such other trash items. Remove such items for all areas of the Work on a daily basis.

.2 Vacuum and/or broom interior building areas when ready to receive painting and other finishes. Continue cleaning on an "as needed" basis until the building is ready for inspection and takeover.

.3 Schedule cleaning operations so that resulting dust and other contaminants do not affect wet, newly painted surfaces.

.4 In preparation for Substantial Performance and Occupancy, conduct inspections of all exposed interior and exterior surfaces.

.5 Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from all exposed interior and exterior finishes, including glass and other polished surfaces.

.6 Remove all protective film from switch plates and hardware, particular kick plates.

.7 Clean lighting reflectors, lenses and other lighting surfaces.

.8 Broom clean paved surfaces and rake clean other disturbed surfaces in the area of the Work, to remove site debris caused by the Work of this Contract. Inspect for damages and make good.

.9 Remove debris and surplus materials from the roof areas and accessible concealed spaces.

.10 Replace heating, ventilation and/or air conditioning filters <u>through the entire building</u> to the extent that they supply or return from the work areas, whether or not, the units were operated during construction operations.

.11 Refer to "cleaning" sections of the specifications for additional specific periodic and final clean up requirements.

.3 The General Contractor must note the Board insists that tiled (VCT) and sheet good floors (vinyl or linoleum) be broom swept only. Wet mopping and waxing/polishing will be done by the Board's Caretaking Staff.

.4 Do not provide sealants and waxes on terrazzo, ceramic and other hard surfaced floors without reviewing products and methods of application with the Board's Caretaking Staff. Failure to comply with this requirement will result in the contractor stripping these floors in their entirety.

.5 The contractor shall also ensure that the appropriate measures including a stone mud mat are installed and maintained at all construction entrances, to avoid contamination of City roads and sewers. It is the Contractor's responsibility and not the Board's to ensure that site entrances and roadways in front of the site are maintained in clean condition acceptable to the municipality or Subdivision Engineer, as the case may be for un-assumed subdivisions.

1.32 TEMPORARY PROTECTION

.1 Refer also to Articles 1.6, in this Section.

.2 The General Contractor to provide temporary barricades, screens or barriers as directed by the Consultant and/or authorized Board Representative, for the safety of persons, or for dividing the Work from portion or portions of the building or site that may be required for use by the school, or others.

.3 Properly protect the Work from any damage by the elements. In cold weather cover all exterior openings in the work areas likely to cause water damage.

.4 During off hours and/or stages of suspended operations for whatever reasons, the General Contractor must assume all responsibility for protection against the elements, theft and/or vandalism. This applies to all work in progress and to any materials, products, tools, equipment, or other such items left at the work site.

.5 Properly protect floors and roofs from any damage. Take special precautions when moving heavy loads or equipment over floors and roofs.

.6 The General Contractor must keep floors free of oils, grease or other such materials likely to discolour them and/or affect bonding of applied surfaces.

.7 The General Contractor must ensure that no part of the Work is loaded greater than it was designed for, when completed. Make any temporary support as strong as the permanent support. Place no load on concrete structure until it has sufficient strength to safely bear such load.

.8 Protect glass and other finishes against heat, slab and weld splatters, using appropriate protective shields and covers.

.9 The General Contractor must provide and maintain, in good working order, appropriately labeled ULC fire extinguishers, to the approval of Authorities Having Jurisdiction.

.10 The General Contractor must provide a minimum of two safety helmets on site at all times for the use of the Consultant and any other Board authorized visitors to the site. It is the General Contractor's responsibility to make certain that any such visitors wear the protective headgear and any other safety gear which may be necessary at that particular time of construction.

1.33 COMPLETION

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

.2 Refer to the pertinent sections of the Specifications for requirements with respect to submission of *Record Documents, Maintenance Materials, Special Tools* and *Spare Parts.*

1.34 GUARANTEES

.1 The following is a summary of the guarantees (in number of years) required by the contract. Refer to individual specifications sections for additional information on warrantees. In the event an extended warranty is listed in the specific Section, that section will have precedence over this list. If no extended warranty is listed, this list will govern:

.1	Entire Building, General Contract	1
.2	Paving	2
.3	Finish Carpentry - Architectural Woodwork	2
.4	Sprayed-In-Place Urethane Insulation	2
.5	Precast Structural Concrete	5
.6	Caulking	2
.7	Aluminum Composite Metal Panels	5
.8	Aluminum Windows & Window Walls (manufacturer's)	5
.9	Glazed Sealed Units	10
.10	Finish Hardware	3
	(auto operators & hardware warranty to be from one supplier)	
.11	Panic Devices and Door Closers	5
.12	Acoustic Ceilings	2
.13	Built Up Roofing (installation)	2
.14	Built Up Roofing (manufacturer's)	10
.15	Sheet Metal Flashing and Siding	5
.16	Concrete Floors	3
.17	Ceramic Tile	3
.18	Painting (OPCA warranty)	2

.2 The guarantee period shall start on the date of issue of the Certificate of Substantial Performance of the Contract by the Consultant.

1.35 CONTINGENCY ALLOWANCE

.1 Include in the Tender Amount a Contingency Allowance in the amount identified in the front end contract documents.

.2 Expend Contingency Allowance as directed by the Consultant, in writing, in accordance with the CCDC-2 2020 Contract and Supplementary Conditions.

.3 Contractor's charges for expenses and profit on Contingency Allowance expenditure shall not be included in Contract Price. CCDC-2 2020 Contract and Supplementary Conditions for percentages of mark-ups.

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.4 Such charges shall be added to the net trade cost of each expenditure from the Contingency Allowance at the percentage rates noted in the Supplementary Conditions to the CCDC-2-2020.

.5 *Changes to the Work shall be added to, or deducted from, the Contingency Allowance, not from the Board approved Contract. The Contract shall be adjusted by Board approval, only once - at the end of the Project.* Credit the Contract with any unused portion of the Contingency Allowance only in the final payment statement.

1.36 CASH ALLOWANCES

.1 Include in the Contract Price, a stipulated sum Cash Allowance in the amount identified in the front end contract documents.

.2 Cash Allowances, unless otherwise specified, cover the net cost to the General Contractor of services, products, construction, machinery and equipment, freight, handling, unloading, storage installation and other authorized expenses incurred in performing the Work.

.3 The Contract Price, *and not the Cash Allowance*, includes the General Contractor's profit and coordination costs in connection with all Cash Allowance expenditures.

.4 The Contract Price will be adjusted by written order by the Consultant to provide for an excess or deficit to each Cash Allowance. Any unused portions of these allowances shall be returned to the Board on the conclusion of the Contract.

.5 A schedule shall be prepared jointly by the Consultant and the General Contractor to show when items called for under Cash Allowances, so that the progress of the Work is not delayed.

.6 Exclusive of Deposits, which are the contractor's sole responsibility to provide as required of Authorities Having Jurisdiction, the following is a summary of the scope Cash Allowances to be included in the contract:

.7 Expend both Cash Allowances as directed by the Consultant in writing. Allowances will be adjusted to actual cost with no adjustment to Contractor's charges. Cash expenditure must identify the H.S.T. separately.

.8 **Cash Allowance - General**

.1 Outdoor basketball poles and backstops

.2 Street Light Standard, Electrical Pole or buried unknown services relocation within the municipal right of way (if any), except those specifically noted to be relocated as part of the contract.

.3 Window Coverings (manual only)(electric operated included in base-bid)

.4 Music Equipment Storage

.5 Gymnasium and Sensory Room Crash Pads

.6 Stage Rigging, Drapery and Stage Lighting (other than items shown on electrical documents)

.7 Library Projector screen and projector

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.8 Interior Signage (supply and install)

.9 Exterior school name, address signage and HDSB logo
(structural framing for canopy signage to be included in base-bid).
('AD215 Job Site Sign' is to be in base-bid, not Cash Allowance)

.10 Local Utility and Hydro Service Connection Fees

.11 Incoming Gas Service

.12 Incoming fibre optic/cable service by Utility Company

.13 Additional fire route signage (as requested by authorities)

.14 Monitoring well decommissioning

.15 Commissioning Agent (Mechanical)

.16 Completion Site Survey by OLS

.17 All Inspections and Testing (requested by Consultants, Owner or Authorities)

.18 Preparation of digital Architectural and Structural as-built drawings

.19 'Integrated Life Safety Systems Testing' of all related systems to be completed one-year after Substantial Performance.

1.37 ALLOWANCES CARRIED IN DIVISIONS 15 AND 16

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

1.38 SCHEDULE OF ALLOWANCES

.1 Material Allowances shall include the following:

.1 Net cost of Material

.2 Applicable taxes and duties

.3 Delivery to site

.2 For Material Allowance, the contract shall include:

.1 Handling at site, including unloading, uncrating, storage and hoisting

.2 Protection from elements, from damage

.3 Labour, installation and finishing

.4 Other expenses required to do cash allowance work (i.e. contract co-ordination)

.5 Overhead and profit

.3 Material and Installation Allowances shall include the following:

.1 Net cost of material

.2 Applicable taxes and duties

.3 Deliver to site

.4 Handling at site, including unloading, uncrating, storage and hoisting

.5 Labour, installation and finishing

1.39 POLYCHLORINATED BIPHENYL (PCB)

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

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1.40 USE OF CONSULTANTS'S DIGITAL DRAWINGS

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

1.41 BUILDING DIMENSIONS

.1 Ensure that all necessary job dimensions are taken and all trades are co-coordinated for the proper execution of the work. Assume complete responsibility for the accuracy and completeness of such dimensions, and for co-ordination.

.2 Verify that all work, as it proceeds, is executed in accordance with dimensions and positions indicated which maintain levels and clearances to adjacent work, as set out by requirements of the drawings, and ensure that work installed in error is rectified before construction resumes.

.3 Check and verify all dimensions referring to the work and the interfacing of all services. Verify all dimensions, with the trade concerned when pertaining to the work of other trades. Be responsible to see that Subcontractors for various trades co-operate for the proper performance of the Work.

.4 Avoid scaling directly from the drawings. If there is ambiguity or lack of information, immediately inform the Consultant. Be responsible for any change through the disregarding of this clause.

.5 All details and measurements of any work which is to fit or to conform with work installed shall be taken at the building.

.6 Advise Consultant of discrepancies and if there are omissions on drawings, including layout of items which affect aesthetics, or which interfere with services, equipment or surfaces. DO NOT PROCEED without direction from the Consultant.

.7 Prepare interference drawings AND SUBMIT AS SHOP DRAWINGS IN ADVANCE OF PRODUCTION to properly co-ordinate the work in all ceiling spaces and where necessary. Coordinate these drawings with all Divisions. Refer also to Section 013300.

1.42 SETTING OF WORK AND REQUIRED SURVEYS

.1 As part of the base tender amount, provide and pay for the services of a Land Surveyor acceptable to the Consultant, registered in the Province of Ontario to establish the property boundaries and the location of the building addition.

.2 Lay out building lines for the work and provide substantial stakes, batterboards or monuments to preserve lines and levels.

.3 Verify on the site all grades, lines, levels, dimensions and location of hydrants, existing structures, manholes, overhead and buried utilities, existing trees, roadways, sidewalks and the like, shown on the drawings, and report omissions, errors, or inconsistencies, before commencing work.

□

.4 Upon completion of layout work and before commencement of any excavation, give ample notification to allow for inspection of lines and levels. Such inspection does not in any way mitigate the Contractor's responsibility for accuracy of layout.

.5 Provide the consultant with a Surveyor's Certificate describing the location of all perimeter foundation walls relative to property lines before construction proceeds on those walls.

1.43 LAYOUT OF WORK

.1 Layout work with respect to the work of all trades. Arrange mechanical and electrical work such as piping, ducts, conduits, panels, equipment and the like to suit the architectural and structural details.

.2 Alterations necessary due to conflict and interference between trades, to be executed at no cost to the Owner unless notification is given in writing before Tender Closing Date.

1.44 DOCUMENTS REQUIRED AT START, DURING & CLOSE-OUT OF CONSTRUCTION

.1 At Commencement of Contract

.1 Supply Performance Bond and Labour and Material Bond, in accordance with Section 00 21 13, Instructions to Bidders.

.2 Supply Public Liability and Property Damage Insurance Certificates, also Builder's Risk and Boiler Insurance as required of the Contract.

.3 Supply Certificates of good standing from WSIB for the General Contractor and all Subcontractors.

.4 Supply a complete Contract Sum Breakdown of all subtrades or parts of work and general expense items for approval by all consultants. Include Mechanical and Electrical Breakdowns for review and acceptance by Consultants.

.5 Supply a competent detailed Construction Schedule that has been reviewed and approved by major subtrades. Identify critical milestone dates.

.6 Supply Cash Flow schedule of monthly progress payments in coordination with the Construction Schedule and plot as 'S' curve chart.

.7 Supply Schedule of Shop Drawing Submissions and identify list of long-lead items.

.8 Apply for and post and supply a copy of Notice of Project.

.9 Supply a copy of Health & Safety policy as well as post at the job site.

.10 Supply Shoring Designs of all load bearing areas if any required of the construction sequence or if required by the Structural Engineer.

.11 Supply interference drawings for all areas requested by the Architect, Mechanical Engineer or Electrical Engineer.

.2 During Construction

.1 Maintain as-built record drawings in clean condition.

.2 Organize regular Trade Coordination meetings.

.3 Organize separate, regular Owner and Consultant Job Meetings in accordance with Section 012200.

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.4 Maintain a copy of up to date records on site including, but not limited to Permit Sets, Contract Documents updated with all addenda, all Changes and Supplementary Instructions issued by Consultants.

.3 Monthly with Each Progress Payment Application

.1 Supply Monthly Progress Reports and Construction Schedule in accordance with Section 012200.

.2 Adjust Allowances, as required.

.3 Current WSIB Form

.4 Confirm that payments are being made to subcontractors and suppliers by submission of original copies of the current versions of Statutory Declarations with the second and subsequent Progress Payment Application. Include both Statutory Declarations Form CCDC-9A for the General Contractor and CCDC-9B from subcontractors with each monthly Progress Payment Application. No payment will be made for unincorporated material on the site, unless Bill of Sale in proper format is provided.

.4 Prior to Substantial Completion

.1 Provide detailed Completion Schedule a minimum of 90 days prior to Substantial Completion. Schedule to illustrate all trades and sequences required for completion and legal occupancy. Issue to Consultants and upon acceptance, to all trades.

.2 Coordinate Completion Schedule with Building Commissioner at least 60 days prior to substantial completion or as directed by Consultant.

.3 Prior and as a requirement of owner acceptance of Substantial Completion of the work the following to be observed, executed and submitted:

.1 DEFICIENCIES ARE LISTED: prior to Substantial Completion, the contractor shall prepare a room by room deficiency list in electronic format on an MS Excel spreadsheet provided by the Consultant. Contractor shall print and review on site with consultants at a site meeting and post on each room or area. This list will be acted upon by all trades and coordinated and updated weekly as a minimum by the General Contractor to ensure all deficiencies are addressed by the date required for Total Performance. Confirm in writing to the Architect when and on what dates each deficiency has been completed in a satisfactory manner. The Consultant's site review will be final approval.

.2 Acceptable preliminary submissions of all Mechanical and Electrical Operations and Maintenance Manuals have been reviewed by Consultants.

.3 Acceptable preliminary submissions of all Warranty and Shop Drawing Records have been reviewed by Consultants.

.4 All final clean-up to have been executed, as specified in Section 01 74 11.

.5 Complete preliminary balancing and provide preliminary Balancing Reports.

.4 Failure to comply with these requirements shall have amounts withheld on Progress Payments and delay issuance of Certificate of Substantial Completion.

.5 Note that Prior to the Release of Holdback, a similar Progress Claim is required, and must include current Statutory Declaration Forms CCDC-9A for the General Contractor and CCDC-9B from subcontractors updated to refer to the Previous Certificate of Payment.

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.5 Upon Completion (Refer also to 01 78 00 Close-Out Submittals)

.1 Upon completion of work before the Final Certificate of Payment is issued, the following to be observed, executed and submitted:

.2 DEFICIENCIES ARE COMPLETE. Confirm in writing to the Architect when and on what dates each deficiency has been completed in a satisfactory manner. The Consultant's site review will be final approval.

.3 Finishing Hardware, Inspection and Verification. Note requirements for qualified installation and inspection in Section 08 71 10- Door Hardware. Inspection only is paid for from Cash Allowances.

.4 Organize a Final Inspection tour at which to be present: the Owner's authorized representative; the Architectural, Structural, Mechanical and Electrical Consultants, and their supervisory personnel, if any; the Contractor and his superintendent.

.5 Where the above procedure is impossible or where any deficiencies remain outstanding, the Owner's representative and the Consultant concerned, to inspect and accept the affected work and/or material upon notification by the Contractor, that all deficiencies involving this Consultant have been made good.

.6 A complete release of all liens arising out of this Contract, other than his own. If a subcontractor or supplier refuses to furnish a release of such a lien, furnish a bond satisfactory to the Owner to indemnify him against any claim under such a lien.

.7 Certificates of good standing from the WSIB, for the General Contractor and all Subcontractors.

.8 All reference records, as specified, under Section 01 78 00.

.9 Certificate of Inspection from Mechanical and Electrical Engineers.

.10 Copies of all Lists of Deficiencies with each Deficiency verified when complete by only this project's job Superintendent. The Final List of Deficiencies to be signed, completed by all concerned, if accepted.

.11 Statement of Completion from General Contractor.

.12 Final adjustment of all Allowances.

.13 Certificates required by Provincial, Municipal and other authorities having jurisdiction. Including signed Building Permit.

.14 Final Balancing Reports showing completed adjustments

.15 Digital copy of Site Services, Architectural, Structural, Mechanical and Electrical and 2 sets As-Built Drawings.

.16 As-Built Survey by O.L.S. (2 copies and digital copy on USB) – paid from Cash Allowance. Survey to include detailed spot elevations and include elevations at tops of all CB's & MH's, all invert elevations (engage private locate firm as required), elevations at bottoms of curbs, elevations at all corners of building. Digital copy of Survey must be georeferenced to NAD83/ UTM zone 17N.

.17 Final copies of all Maintenance Manuals.

Part 2 Products

2.1 NOT USED

.1 Not used.

□

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

□

Part 1 General

1.1 PROJECT MEETINGS FOR COORDINATION

.1 In consultation with the Consultant not later than the second week of construction, arrange for site meetings weekly or every 2 weeks as appropriate to the stage of construction, for project coordination. Such meetings shall fall at the same time each week the meeting is scheduled.

.2 Responsible representatives of the Contractor's and Subcontractor's office and field forces and suppliers shall be obliged to attend.

.3 Inform the Owner, Consultant, and those others whose attendance is obligatory, of the date of each meeting, in sufficient time to ensure their attendance.

.4 Provide physical space for meetings, prepare an agenda, chair and record the minutes of each meeting. Relevant information must be made available to all concerned, in order that problems to be discussed may be expeditiously resolved. Identify "action by: _____".

.5 Within three days after each meeting, distribute two copies of the minutes to each invited person and regular distribution list to be issued by the consultant.

1.2 PRECONSTRUCTION MEETING

.1 Within 5 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.

.2 Include in the agenda the following:

.1 Appointment of official representative of participants in the Work.
.2 Site Safety and Security
.3 Scheduling of Work. Schedule to include a detailed breakdown of mechanical and electrical works.
.4 Interference with ongoing business.
.5 Work by other Contractors.
.6 Schedule of submission of shop drawings and samples.
.7 Requirements for temporary facilities, site sign, offices, storage sheds utilities.
.8 Delivery schedule of specified equipment and identification of long-lead or other critical items.
.9 Site security.
.10 Procedures for Contemplated change notices, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
.11 Record drawings.
.12 Maintenance manuals.
.13 Take-over procedures, acceptance, warranties.

□

.14 Monthly progress claims, administrative procedures, photographs, holdbacks.

.15 Appointments of inspection and testing agencies or firms.

.16 Insurances, transcript of policies.

.17 Schedule for progress meetings.

1.3 PROJECT MEETINGS FOR PROGRESS OF WORK

.1 Conduct progress meetings in accordance with the schedule and/or decisions made at Preconstruction meeting.

.2 Inform the Owner, Consultant, project consultants, Subcontractors and suppliers and those whose attendance is obligatory, of the date of the meeting, in sufficient time to ensure their attendance.

.3 Include in the agenda the following:

.1 Site Safety and security record or incidents.

.2 Review, approval of minutes of previous meeting.

.3 Review of Work progress since previous meeting.

.4 Field observations, problems, conflicts.

.5 Problems which impede construction schedule.

.6 Review of off-site fabrication delivery schedules.

.7 Corrective measures and procedures to regain projected schedule.

.8 Revisions to construction schedule.

.9 Progress during succeeding work period as a “two-week look ahead”.

.10 Review submittal schedules: expedite as required.

.11 Maintenance of quality standards.

.12 Pending changes and substitutions.

.13 Review proposed changes for effect on construction schedule and on completion date.

.14 Other business.

1.4 PROGRESS RECORDS

.1 Maintain a permanent written record on the site of the progress of the work using standard OGCA form. This record shall be available to the Consultant at the site, and a copy shall be furnished to same on request. The record shall contain:

.1 Daily weather conditions, including maximum and minimum temperatures.

.2 Dates of the commencement and completion of stage or portion of the work of each trade in each area of the project.

.3 Conditions encountered during excavation.

.4 Dates of erection and removal of formwork, in each area of the project.

.5 Dates of pouring the concrete in each area of the project, with quantity and Particulars of the concrete.

.6 Work force on project daily per trade and active hours.

.7 Visits to site by personnel of Consultant, Jurisdictional Authorities and testing companies.

1.5 PROGRESS REPORTS

.1 Submit to the Consultant, Monthly Progress Reports consisting of a concise narrative and a marked-up summary schedule showing physical percentage complete by item and in total. These progress calculations must agree with the Progress Payment Claims. masonry; mechanical, finishing trades and the like. Include with this submission the digital schedule referenced below

1.6 DIGITAL PROJECT SCHEDULES

.1 At the outset of the project, General Contractor to provide and maintain a digital project schedule including Milestone Dates and listing all trades.

.2 Update and issue to Consultant in hard copy and electronic copy not less than monthly and at each Progress Draw. To be issued in format compatible with Microsoft Project program.

.3 At 70% completion, or 16 weeks prior to Substantial Completion, whichever comes first, Project develop a detailed Completion Schedule outlining final coordination and sequences to completion.

1.7 DOCUMENTS REQUIRED AT PROJECT START, DURING CONSTRYCTION AND CLOSE OUT

.1 Refer to Section 01 11 00 – Summary of Work, article 1.44.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

□

Part 1 General

1.1 SECTION INCLUDES

.1 Shop drawings and product data.

.2 Samples and mock ups.

1.2 SHOP DRAWINGS

.1 Submit to Architect, for review, shop drawings, product data and samples specified.

.2 Until submission is reviewed, work involving relevant product must not proceed.

1.3 RELATED SECTIONS

.1 Section 05 50 00 – Metal Fabrications

.2 Section 13 05 41 - Seismic Restraint for Non-structural Components.

1.4 REFERENCES

.1 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2 - 2020, Stipulated Price Contract.

1.5 SHOP DRAWINGS AND PRODUCT DATA

.1 Refer to CCDC 2 General Conditions.

.2 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.

.3 Drawings to be originals prepared by Contractor, Subcontractor, Supplier or Distributor, which illustrate appropriate portion of work; showing fabrication, layout, setting or erection details as specified in appropriate Sections.

.4 Identify details by reference to sheet and detail numbers shown on Contract Drawings.

.5 Maximum sheet size 606 x 909 mm.

.6 Reproductions for submissions: opaque diazo prints.

1.6 PROJECT DATA

.1 Certain specification Sections specify that manufacturer's standard schematic drawings, catalogue sheets, diagrams schedules, performance charts, illustrations and other standard descriptive data will be accepted in lieu of shop drawings.

.2 Above will only be accepted if they conform to following:

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.1 Delete information which is not applicable to project.

.2 Supplement standard information to provide additional information applicable to project.

.3 Show dimensions and clearances required.

.4 Show performance characteristics and capacities.

.5 Show wiring diagrams (when requested) and controls.

1.7 COORDINATION OF SUBMISSIONS

.1 Review shop drawings, product data and samples prior to submission.

.2 Verify:

.1 Field measurements.

.2 Field construction criteria.

.3 Catalogue numbers and similar data.

.3 Co-ordinate each submission with requirement of work and Contract documents. Individual shop drawings will not be reviewed until all related drawings are available.

.4 Contractor's responsibility for errors and omissions in submission is not relieved by Architect's review of submittals.

.5 Contractor's responsibility for deviations in submission from requirements of Contract documents is not relieved by Architect's review of submission, unless Architect gives written acceptance of specified deviations.

.6 Notify Architect, in writing at time of submission, of deviations from requirements of Contract documents.

.7 After Architect's review, distribute copies.

1.8 SUBMISSION REQUIREMENTS

.1 Schedule submissions at least fourteen (14) days before dates that reviewed submissions will be required to be returned.

.2 Submit one reproducible transparency, plus six (6) opaque diazo copies of shop drawings, product data to Architect for review.

.3 Accompany submissions with transmittal letter, in duplicate, containing:

.1 Date.

.2 Project title and number.

.3 Contractor's name and address.

.4 Number of each shop drawing, product data and sample submitted.

.5 Other pertinent data.

.4 Submissions must include:

.1 Date and revision dates.

.2 Project title and number.

.3 Name of:

.1 Contractor.

.2 Subcontractor.

.3 Supplier.

.4 Manufacturer.

.5 Separate detailer when pertinent.

.5 Identification of product or material:

.1 Relation to adjacent structure or materials.

.2 Field dimensions, clearly identified as such.

.3 Specification Section number.

.4 Applicable standards, such as CSA or CGSB numbers.

.5 Contractor's stamp, initialed or signed, certifying review of submission, verification of field measurements and compliance with Contract documents

1.9 INTERFERENCE DRAWINGS

.1 Prepare interference drawings for all work in confined space: all typical ceiling space conditions and atypical conditions. Coordinate with all trades.

.2 Submit as shop drawings in advance of fabrication or installation of components. Site conditions requiring corrections, due to failure to provide interference drawings as required will be corrected at no additional cost to the owner.

.3 Ceiling heights and bulkheads will not be revised during construction due to failure to prepare interference drawings.

1.10 SEISMIC DESIGN SUBMITTALS

.1 Shop drawings shall clearly include seismic design compliance calculations for all building components within scope of the current Ontario Building Code (OBC), Div. B, Part 4 requirements.

.2 Refer to Structural Drawing S-1 for a table of applicable building components and Section 13 05 41 – ‘Seismic Restraint for Non-Structural Components’.

1.11 SHORING DESIGN DRAWINGS

.1 If required as part of this project, or due to construction sequence, it is the contractor’s responsibility to provide in advance of any work requiring shoring, detailed Shoring design drawings bearing the seal of a Professional engineer registered in the Province of Ontario and also a Method Statement describing the work sequence.

.2 Submit to the Consultants as shop drawings in advance of the work.

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1.12 SHOP DRAWINGS BEARING THE SEAL OF A PROFESSIONAL ENGINEERS

.1 In addition to any the similar requirements for shop drawings of any mechanical or electrical systems, Shop Drawings for all structural components or components required to perform in conjunction with other structural or building envelope components, cladding and the like shall bear the seal of a professional engineer licensed in the Province of Ontario.

.2 In addition, all components to be attached to or suspended from the walls and ceiling areas shall also bear the seal of a professional engineer licensed in the Province of Ontario. This shall include but not be limited to the following:

.1 Stage drapery and rigging
.2 Stage lighting system
.3 Gymnasium equipment such as basketball backstops
.4 Projection screen supports
.5 Gymnasium curtain structural connections
.6 Stair guardrails and handrails
.7 Steel Ladders, rungs & guardrails
.8 Bent plate & channel at library mezzanine framing and curtain wall

1.13 LIST OF SAMPLE OR MOCK-UP SUBMITALS

.1 At the outset of the project the contractor shall prepare a comprehensive list of all shop drawings, sample submissions and mock ups required.

.2 For assistance only, the following samples and mock up items to be provided are included but not limited to the list following (note this is not exclusive of data sheets and shop drawings):

.1	04 21 13	Concrete and Brick Masonry	samples, mock-up (2m x 2m)
.2	04 21 13	Masonry Accessories	samples
.3	04 22 00	Concrete Masonry	samples
.4	06 40 00	Architectural Woodwork	samples (300mm x 300mm)
.5	06 47 00	Plastic Laminates	samples
.6	07 11 13	Bituminous Waterproofing	mock-up (3m x 2m)
.7	07 18 00	Traffic Coatings	samples
.8	07 21 13	Board Insulation	samples
.9	07 27 10	Air Barriers	samples
.10	07 41 43	Aluminum Composite Panels	samples, mock-up (3m x 2m)
.11	07 81 00	Applied Fireproofing	samples (300mm x 300mm)
.12	07 84 00	Firestopping	samples (300mm x 300mm)
.13	07 92 10	Joint Sealing	samples and mock up
.14	08 44 13	Glazed Aluminum Curtain Walls	samples, mock-up
.15	08 71 10	Finish Hardware	samples
.16	08 80 50	Glazing	samples (300 x 300)
.17	09 30 13	Ceramic Tiling	samples
.18	09 51 13	Acoustical Panel Ceilings	samples (300 x 300)
.19	09 65 19	Resilient Tile Flooring	samples
.20	09 68 00	Carpeting	samples (225 x 225)
.21	09 84 10	Acoustic Wall Treatment	samples (300 x 300)

□

.22	09 91 22	Painting	draw downs, mock-up
.23	10 11 25	Manufacturer Specialties	samples
.24	10 14 10	Exterior Building Panel Signage	samples
.25	10 21 20	Laminated Plastic Toilet Partitions	samples
.26	10 22 27	Folding Panel Partitions	samples
.27	31 23 10	Excavating, Trenching and Backfilling	samples
.28	32 12 17	Asphalt Paving	samples
.29	32 13 10	Unit Paving on Sand Bed	samples
.30	32 31 13	Chain Link Fences and Gates	samples
.31	32 91 21	Imported Topsoil	test reports and samples

1.14 SUBMISSIONS TO INSPECTION AGENCIES

.1 Note that Millwork shop drawings are to be submitted to AWMAC as part of the Guarantee Inspection program.

.2 Note that Paint formulations specified are to be submitted to the OPCA with set up documentation upon award of Contract.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

□

Part 1 General

1.1 SECTION INCLUDES

.1 Health and safety considerations required to ensure due diligence towards health and safety on construction sites, and meets the requirements laid out Occupational Health and Safety - Construction.

1.2 RELATED SECTIONS

.1 These specifications apply to all divisions of this project specification. It is the responsibility of the Contractor to apply these provisions wherever practical within specification limits to all products and services used on this project.

.2 Recognized that currently specified materials and methods may conflict with the basic intention of this section. Where reasonable alternate materials and methods exist that are not specified here, and that do not compromise quality or create additional cost for the Owner, notify the Consultant of such alternate materials or methods. Do not proceed to use alternate materials or methods to those specified without the express approval of the Consultant.

.3 Elsewhere, apply the provisions of this section to all work. Exceptions can only be made when signed off by the Consultant. Suitability of all products used is the responsibility of the Contractor.

1.3 REFERENCES

.1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS).

.1 Material Safety Data Sheets (MSDS).

.3 Province of Ontario

.1 Occupational Health and Safety Act and Regulations for Construction Projects, R.S.O. [1990 June 2002].

1.4 COMPLIANCE SPECIFICATION

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

1.5 BEYOND COMPLIANCE SPECIFICATION

.1 These specifications apply in addition to all applicable health, safety and environmental compliance regulations. They are incorporated here to reflect the Owner’s intention to develop a specification which maximizes environmentally “friendly” materials and methods wherever possible within current technical and budget limitations.

□

.2 Beyond compliance specifications recognize that performance well beyond the minimum regulatory standard is often desirable, possible and affordable, often with no cost or low cost options. It also recognizes that application methods or protocols may be as important as the material specified. Therefore these specifications cover both material and methods.

.3 The primary goal of beyond compliance specification is to reduce the use of products or methods which have negative health and environmental impacts both during and after construction. These considerations may include full life cycle impacts, associated with raw materials, manufacturing, transport, deconstruction and their eventual fate.

.4 These specifications will specifically address primary categories of readily identifiable products, ingredients and methods.

.5 These provisions apply to both indoor and outdoor applications equally.

1.6 EXCEPTIONS

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

1.7 PRODUCTS OR SUBSTANCES TO BE AVOIDED OR LIMITED IN USE

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

1.8 VOLATILE ORGANIC COMPOUNDS

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

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

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

□

1.9 CHLORINATED SUBSTANCES

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

1.10 PLASTICIZERS

.1 Plasticizers which off-gas (low molecular weight) should be avoided.

1.11 MAN MADE MINERAL FIBRES

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

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

1.12 RADIATION

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

1.13 BIOCIDES

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

1.14 HEAVY METALS

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

1.15 ALUMINUM

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

1.16 OZONE DEPLETING SUBSTANCES

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

1.17 GREENHOUSE GASES

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

1.18 BITUMINOUS (Tar) PRODUCTS

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

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1.19 CHEMICAL COMPOUNDS

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

1.20 ADHESIVES

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

1.21 COMPOSITE PRODUCTS

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

1.22 CLEANERS AND SOLVENTS

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

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

□

Part 1 General

1.1 FIRES

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

1.2 DISPOSAL OF WASTES

.1 Do not bury rubbish and waste materials on site.

.2 Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.

1.3 DRAINAGE

.1 Refer also to Section 31 23 10.

.2 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.

.3 Do not pump water containing suspended materials into waterways, sewer or drainage systems.

.4 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

1.4 SITE CLEARING AND PLANT PROTECTION

.1 Protect trees and plants on site and adjacent properties where indicated.

.2 Wrap in burlap, trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 2 m.

.3 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.

.4 Restrict tree removal to areas indicated or designated by Engineer.

1.5 POLLUTION CONTROL

.1 Maintain temporary erosion and pollution control features installed under previous contract and to be provided new under this contract and as requested by local Municipal and Regional Authorities.

.2 Install, maintain, restore, replace sediment control fence as required by Municipal and Regional authorities. The fence shall be in accordance with Municipal standards.

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3. Install, maintain, restore, replace roadside catchbasin sediment protection at all street catch basin in accordance with Municipal standards.

.3 Install, maintain, restore, replace catchbasin sediment barrier immediately after installation of catch basins on the property in accordance with Municipal Standards.

.4 A temporary mud mat has been installed under the previous grading contract and remains for removal under this contract. As part of this contract, include in the tender amount the supplementary stone required for maintenance and the removal of the mud mat consisting of 30m x 5m x 0.45m clear stone at any construction entrance. This is required whether or not such mud mat is shown on drawings or remains evident on site.

.5 Control emissions from equipment and plant to local authorities emission requirements.

.6 Prevent sandblasting and other extraneous materials from contaminating air beyond application area, by providing temporary enclosures.

.7 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

□

Part 1 General

1.1 SECTION INCLUDES

.1 Inspection and testing, administrative and enforcement requirements.

.2 Tests and mix designs.

.3 Mock-ups.

.4 Mill tests.

.5 Equipment and system adjust and balance.

1.2 PRECEDENCE

.1 For Federal Government projects, Division 1 Sections take precedence over technical specification sections in other Divisions of this Project Manual.

1.3 RELATED SECTIONS

.1 Section 1 33 00 - Submittal Procedures.

.2 Section 01 78 00 - Closeout Submittals.

.3 Section 01 11 00, article 1.12 – Quality Control

1.4 REFERENCES

.1 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2- 2020 Stipulated Price Contract.

1.5 INSPECTION

.1 General: Materials and workmanship shall be subject to inspection at any time. Cooperate in permitting access for inspection to all places where work is being done or stock is being stored.

.2 Owner's quality control inspection and testing is specified in the technical sections and will be paid from Cash Allowance except as otherwise specified. Contractor to be responsible to pay for inspections and retesting to verify acceptability of work requiring correction.

.3 Allow Consultant 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.

.4 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Consultant instructions, or law of Place of Work.

□

.5 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.

.6 Consultant may order any part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction.

1.6 ACCESS TO WORK

.1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.

.2 Co-operate to provide reasonable facilities for such access.

1.7 PROCEDURES

.1 Notify appropriate agency Consultant in advance of requirement for tests, in order that attendance arrangements can be made.

.2 Submit samples and/or 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 REJECTED WORK

.1 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.

1.9 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.

.3 Allow sufficient time for testing, evaluation, alterations and retesting so as not to interrupt the Progress Schedule for the Project.

.4 The Consultant may require testing of connections and special prefabricated inserts, as part of the work of this Section.

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1.10 MOCK-UPS

.1 Refer to partial list of mock ups in Section 01 33 00 - Submittal Procedures

.2 Prepare mock-ups for Work specifically requested in specifications. Include for Work of all Sections required to provide mock-ups.

.3 Construct in all locations acceptable to Consultant.

.4 Prepare mock-ups for Consultant's review with reasonable promptness and in an orderly sequence, so as not to cause any delay in Work.

.5 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.

.6 If requested, Consultant will assist in preparing a schedule fixing dates for preparation.

.7 Remove mock-up at conclusion of Work or when acceptable to Consultant.

.8 Mock-ups may remain as part of Work only if previously agreed to by consultant and accepted as acceptable quality upon completion..

.9 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed and when.

1.11 MILL TESTS

.1 Submit mill test certificates as required of specification Sections.

1.12 EQUIPMENT AND SYSTEMS

.1 Submit adjustment and balancing reports for mechanical, electrical and building equipment systems.

1.13 SEALANTS

.1 Refer also to Section 07 92 10.

.2 Sealants used for the various building envelope assemblies shall be selected from those specified in the respective assembly Section, and shall be coordinated with the sealant being provided under other building envelope Sections. Preferably, one sealant by the same manufacturer shall be used throughout. If different sealants are selected, from those specified, it is the responsibility of the respective Section to ensure compatibility between selected sealant, substrates, and sealants of other Sections which come in contact with the selected sealant.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

□

Part 1 General

1.1 SECTION INCLUDES

.1 Temporary utilities.

1.2 RELATED SECTIONS

.1 Section 01 52 00 - Construction Facilities.

.2 Section 01 56 00 – Temporary Barriers and Enclosures.

1.3 INSTALLATION AND REMOVAL

.1 Provide temporary utilities controls in order to execute work expeditiously.

.2 Remove from site all such work after use.

1.4 DEWATERING

.1 Refer also to Sections 31 23 10 and 01 35 43.

.2 Provide temporary drainage and pumping facilities to keep excavations and site free from standing water.

1.5 WATER SUPPLY

.1 Arrange, pay for and maintain temporary water supply in accordance with governing regulations and ordinances. Provide for water as require whether available in the vicinity of the site or not.

1.6 TEMPORARY HEATING AND VENTILATION

.1 Pay for cost of temporary heat and ventilation used during construction, including costs of installation, fuel, operation, maintenance and removal of equipment. Use of direct-fired heaters discharging waste products into work areas will not be permitted unless prior approvals given by the Architect.

.2 Furnish and install 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 for storage, installation, curing of materials.
- .5 Provide adequate ventilation to meet health regulations for safe working environment.

.3 Maintain minimum temperature of 10 degrees C or higher where specified as soon as finishing work is commenced and maintained until acceptance of structure by Engineer.

□

.4 Ventilating:

.1 Prevent hazardous 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 inharmful 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 elements.

.5 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.

.6 The Architect may permit the use of permanent system providing agreement can be reached on:

.1 Conditions of use, special equipment, protection and maintenance.

.2 Guarantees will not be affected.

.3 Approval of the Owner.

7. Refer to Section 011100, item 1.30. ‘Periodic Cleaning’ for replacement of filters at time of final acceptance of work.

8. Contractor is to provide all temporary utilities, winter heating, frost breaking and inclement weather protection as required to ensure completion date delivery.

1.7 TEMPORARY COMMUNICATION FACILITIES

.1 For duration of contract until final permanent lines are installed, provide and pay for temporary telephone and fax hook up, lines and equipment necessary for own use and use of Consultant.

.2 Immediately upon award of contract, arrange for temporary Bell telephone line to be connected to the site trailer for purposes of providing functional communication equipment listed above.

□

1.8 FIRE PROTECTION

.1 Provide and maintain temporary fire protection equipment during performance of Work required by [insurance companies having jurisdiction] [and] governing codes, regulations and bylaws.

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

1.9 POWER

.1 During the tender period, determine if power will be available in the vicinity of the project site. If no power is deemed available, include costs for generation of power required to carry out the work for the duration required to complete the Project. The Board will not consider payment of generated power.

.2 It is expected that power may not be available to the project site at the onset of the project. The contractor is to include costs for the generation of power, or arrange for the provision of temporary power as required to carry out the work for the duration required to complete the Project

.3 Arrange, pay for and maintain temporary electrical power supply in accordance with governing regulations and ordinances.

.4 Install temporary facilities for power such as pole lines and underground cables to approval of local power supply authority.

.5 Electrical power and lighting systems installed under this Contract may be used for construction requirements with prior approval of Architect, provided that guarantees are not affected. Make good damage. Replace lamps which have been used over period of three (3) months.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

□

Part 1 General

1.1 SECTION INCLUDES

.1 Construction aids.

.2 Office and sheds.

.3 Parking.

.4 Project identification – refer to AD Drawings for jobsite sign.

1.2 RELATED SECTIONS

.1 Section 01 51 00 - Temporary Utilities.

.2 Section 01 56 00 - Temporary Barriers and Enclosures.

1.3 REFERENCES

.1 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2-2020 Stipulated Price Contract.

.2 Canadian General Standards Board (CGSB)

.1 CGSB 1-GP-189M-84, Primer, Alkyd, Wood, Exterior.
.2 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.

.3 Canadian Standards Association (CSA International)

.1 CAN3-A23.1-/A23.2-94, Concrete Materials and Methods for Concrete Construction/Method of Test for Concrete.
.2 CSA-0121-M1978, Douglas Fir Plywood.
.3 CAN/CSA-Z321-96, Signs and Symbols for the Occupational Environment.

1.4 INSTALLATION AND REMOVAL

.1 Provide construction facilities in order to execute work expeditiously.

.2 Remove from site all such work after use.

1.5 SCAFFOLDING

.1 All necessary scaffolding shall be provided and constructed according to all by-laws and safety regulations. It shall be removed promptly and completely when no longer required.

.2 As required by Ministry or Labour, design of scaffolding or hoarding shall be by a Professional Engineer.

□

1.6 ACCESS

.1 Provide and maintain adequate access to project site.

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

.3 The General Contractor shall cooperate fully with any and all Board commissioned Contractors.

1.7 HOISTING

.1 Provide, operate and maintain hoists & cranes required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for use thereof.

.2 Hoists & cranes shall be operated by qualified operator.

1.8 ELEVATORS

.1 Permanent elevators may not be used by construction personnel for transporting of materials unless coordinated with the Architect or Structural Engineer.

.2 Provide protective coverings for finish surfaces of cars and entrances.

1.9 SITE STORAGE/LOADING

.1 Provide adequate weather tight sheds with raised floors, for storage of materials, tools and equipment which are subject to damage by weather.

1.10 CONSTRUCTION PARKING

.1 Provide, on site, sufficient temporary parking.

1.11 OFFICES

.1 Provide office heated to 22 degrees Celsius, lighted 750 Lx and ventilated, of sufficient size to accommodate site meetings and furnished with drawing lay down table, telephone, and facsimile machine. Pay telephone not acceptable.

.2 Maintain in clean condition.

.3 Provide and maintain in clean condition: two separate plans layout tables, minimum 1200 x 1800 mm each. One table shall be used by the General Contractor and subcontractors at their discretion. The second shall be provided for use by subcontractors and by the consultant or Inspection and Testing Companies during site visits or project meetings.

1.12 EQUIPMENT, TOOL AND MATERIALS STORAGE

.1 Provide and maintain, in a clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.

.2 Locate materials not required to be stored in weatherproof sheds on site in a manner to cause least interference with work activities.

1.13 SANITARY FACILITIES

.1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.

.2 Post notices and take such precautions, as required, by local health authorities. Keep area and premises in sanitary condition.

.3 When permanent water and drain connections are completed, provide temporary water closets and urinals complete with temporary enclosures, inside building. Permanent facilities may be used on approval or Architect.

1.14 JOBSITE SIGN

.1 Supply and erect a sign (W.P. Plywood Signboard) as shown on AD Detail Sheets

.2 Construct plumb and level in neat wood framework and securely anchored in ground by posts to withstand wind pressure of 160 km/h.

.3 Provide shop drawing of layout.

.4 Supply of painted sign only shall be paid from Cash Allowance. Contractor is responsible for supply and installation of support framing and foundation connection on the site.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

□

Part 1 General

1.1 SECTION INCLUDES

.1 Barriers.

.2 Traffic Controls.

.3 Fire Routes.

1.2 RELATED SECTIONS

.1 Section 01 51 00 - Temporary Utilities.

.2 Section 01 52 00 - Construction Facilities.

.3 Section 01 11 00 - Summary of Work.

1.3 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CGSB 1.189M- [84], Primer, Alkyd, Wood, Exterior.
.2 CGSB 1.59- [97], Alkyd Exterior Gloss Enamel.

.2 Canadian Standards Association (CSA International)

.1 CSA-O121- [M1978], Douglas Fir Plywood.

1.4 INSTALLATION AND REMOVAL

.1 Provide temporary controls in order to execute Work expeditiously.

.2 Remove from site all such work after use.

1.5 SITE ENCLOSURES

.1 Refer to Section 01 11 00- Summary of Work, article 1.6 ‘Construction Fencing’ for clarification of existing fence on site.’ Maintain fences in good repair.

2. Maintain siltation control fencing as part of site enclosure, as indicated in Section 01 35 43, and/or required Municipal or Regional authorities. Maintain/restore/replace siltation control fencing as directed throughout the construction period to ensure proper function.

1.6 WEATHER ENCLOSURES

.1 Provide temporary weathertight enclosures protection for exterior openings until permanently enclosed.

.2 Erect enclosures to allow access for installation of materials and working inside enclosure.

□

.3 Design enclosures to withstand wind pressure.

.4 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.

1.7 DUST TIGHT SCREENS

.1 Provide dust tight screens or insulated partitions as required 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.

1.8 ACCESS TO SITE

.1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work.

1.9 PUBLIC TRAFFIC FLOW

.1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect the public.

1.10 FIRE ROUTES

.1 Maintain access to property including overhead clearances for use by emergency response vehicles.

1.11 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.

1.12 PROTECTION OF BUILDING FINISHES

.1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.

.2 Provide necessary screens, covers, and hoardings.

.3 Confirm with Consultant locations and installation schedule 5 days prior to installation.

.4 Be responsible for damage incurred due to lack of or improper protection.

1.13 TEMPORARY FENCING TO SODDED AREAS

1. Following the installation of sod to the playfield areas, supply and install temporary, leased Modular (Mod U Lok) 1800 high chain link fencing. Stake with iron “T’s” at minimum 2400 o.c. and maintain for a minimum of 6 weeks while sod is maintained as part of this contract

and is deemed established. Refer to Section 32 92 23 – Sodding and 01 11 00 – Summary of Work.

2. Remove fencing at end of 6 week period.

3. Cost of this temporary fencing shall to be included Tender Price if sod is not installed a minimum of 6 weeks prior to occupancy.

4. If sodding is delayed such that the 6 week period is not completed prior to the end of the sod growing season, Contractor shall be responsible to maintain fence on site, at no additional cost to the owner, until the Spring and the consultant has deemed the sod roots have "knit" and is ready for student play activities.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 EXECUTION

3.1 NOT USED

.1 Not Used

END OF SECTION

□

Part 1 General

1.1 SECTION INCLUDES

.1 Requirements and limitations for cutting and patching the Work.

.2 The responsibilities of this section includes but is not limited to the following item(s), including all related labour and materials necessary to successfully complete the installation of same as detailed on the Drawings.

.3 The cutting, removal and disposal and patching of masonry wall sections in locations of all new electrical panels and for all mechanical ducts passing through masonry walls or walls of any other construction not automatically accommodated in new work by the mason.

.4 The cutting, removal and patching of all penetrations required for mechanical and electrical services through floors, ceilings and walls.

.5 The supply and installation of a Portland cement based leveling skim coat as required to provide an acceptable surface for the installation of new VCT tile to any rooms as described on drawings to receive such flooring.

.6 All other work not listed in other Sections, but detailed on the Drawings.

1.2 RELATED SECTIONS

.1 Section 01 11 00 - Summary of Work.

.2 Section 04 21 13- Brick Masonry

.3 Section 01 33 00 - Submittal Procedures.

.4 Section 08 11 14- Metal Doors and Frames

.5 Section 08 71 15 – Finish Hardware

.6 Section 09 91 22- Painting

.7 Section 09 21 16- Gypsum Board Assemblies

.8 Section 09 51 13- Acoustic Panel Ceilings

.9 Section 10 11 25- Manufactured Specialties

.10 Mechanical and Electrical Sections.

.11 Individual product Sections: cutting and patching incidental to work of section. Advance notification to other sections required.

□

1.3 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 elements.
- .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 Statement on 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.

1.4 MATERIALS

.1 Required for original installation.

.2 Change in Materials: Submit request for substitution in accordance with Section 01 33 00 - Submittal Procedures.

.3 Concrete lintel block, reinforcing steel and concrete fill for openings if required at new penetrations in walls or steel lintels as may be permitted by consultant.

.4 Portland Cement based Concrete Patching Compound compatible with new slab, precast concrete slabs or other flooring to make good a smooth, suitable surface to accept the direct application of new VCT or resilient sheet flooring.

.5 Portland Cement based Concrete for new floor openings or floor leveling, or patching of floor openings.

.6 All other materials not listed in other Sections, but detailed on the Drawings.

1.5 EXECUTION

.1 The Trades requiring cuts, holes or sleeves for their work shall locate them.

.2 Do not cut, drill or sleeve load-bearing members without obtaining prior written approval from the Consultant for each condition.

.3 Cut holes carefully, leaving holes no longer than required, with clean, true and smooth edges.

□

.4 Fit items to the tolerances established by industry 'Best Practice' standard for applicable type of work.

.5 Make patches undetectable in the finished work. All other work not listed in other Sections, but detailed on the Drawings, is to be done in a professional manner and to the industry 'Best Practice' standard for the described work.

.6 Execute cutting, fitting, and patching including excavation and fill if required, to complete Work.

.7 Fit several parts together, to integrate with other Work.

.8 Uncover Work to install ill-timed Work.

.9 Remove and replace defective and non-conforming Work.

.10 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.

.11 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.

.12 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.

.13 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.

.14 Restore work with new products in accordance with requirements of Contract Documents.

.15 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

.16 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material, full thickness of the construction element.

.17 Refinish surfaces to match adjacent finishes: For continuous surfaces refinish to nearest intersection; for an assembly, refinish entire unit.

.18 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

Part 2 Products

2.1 NOT USED

.1 Not Used.

□

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

□

General

.1 SECTION INCLUDES

.1 Progressive cleaning.

.2 Final cleaning.

.2 RELATED SECTION

.1 Section 01 77 00 - Closeout Procedures.

.2 Section 01 11 00 – Summary of Work.

.3 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2-2020, Stipulated Price Contract.

.4 GENERAL CLEANINESS DURING CONSTRUCTION

.1 Refer also to Section 01 11 10, item 1.30 ‘Periodic Cleaning’ and coordinate with this Section.

.2 Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.

.3 Store volatile wastes in covered metal containers, and remove from premises daily.

.4 Prevent accumulation of wastes which create hazardous conditions.

.5 Provide adequate ventilation during use of volatile or noxious substances.

.6 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

.7 Provide on-site dump containers for collection of waste materials, and rubbish.

.8 Remove waste materials, and rubbish from site.

.9 Vacuum clean interior building areas when ready to receive finish painting, and continue vacuum cleaning on an as-needed basis until building is ready for substantial completion or occupancy.

.10 Schedule cleaning operations so that resulting dust and other contaminants will not fall on wet, newly painted surfaces.

□

.5 FINAL CLEANING

.1 At completion of Work, remove waste materials, rubbish, tools, equipment, machinery, and surplus materials, and clean all surfaces exposed to view; leave project clean and ready for occupancy.

.2 Employ experienced, professional cleaners, for final cleaning.

.3 Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from all sight-exposed interior and exterior finished surfaces; polish resilient and ceramic surfaces so designated to shine finish. Vacuum carpet.

.4 Clean and polish glass and mirrors.

.5 Repair, patch and touch-up marred surfaces to specified finish, to match adjacent surfaces.

.6 Broom-clean paved surfaces; rake clean other surfaces of grounds.

.7 Clean exposed ductwork, and structure.

.8 Replace filters.

.9 Clean bulbs and lamps and replace those burned out.

.10 Clean diffusers and grilles.

.11 Clean sinks, faucets, and water closets and controls.

.12 Remove snow and ice from access to building, if applicable.

.13 Maintain cleaning until project, or portion thereof, is occupied by Owner.

Products

.1 NOT USED

.1 Not Used.

Execution

.1 NOT USED

.1 Not Used.

END OF SECTION

□

Part 1 General

1.1 REFERENCES

.1 Section 01 11 00 - Summary of Work, article 1.44.

.2 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2 - 2020, Stipulated Price Contract.

1.2 INSPECTION AND DECLARATION

.1 Refer to Section 01 11 00 – Summary of Work, article 1.44 for a detailed list of requirements.

.2 Contractor's Inspection: Contractor and Subcontractors: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.

.1 Notify Consultant in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.

.3 Consultant's Inspection: Consultant and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor to correct Work accordingly.

.4 Completion: submit written certificate that following have been performed:

.1 Work has been completed and inspected for compliance with Contract Documents.

.2 Defects have been corrected and deficiencies have been completed.

.3 Equipment and systems have been tested, adjusted and balanced and are fully operational.

.4 Certificates required by Fire Commissioner and Utility companies have been submitted.

.5 Operation of systems has been demonstrated to Owner's personnel.

.6 Work is complete and ready for final inspection.

.5 Final Inspection: when items noted above are completed, request final inspection of Work by Owner, Consultant and Contractor If Work is deemed incomplete by Owner and Consultant, complete outstanding items and request re-inspection.

.6 Declaration of Substantial Performance: when Owner and Consultant consider deficiencies and defects have been corrected and it appears requirements of Contract have been substantially performed, make application for certificate of Substantial Performance.

.7 Commencement of Lien and Warranty Periods: date of Owner's acceptance of submitted declaration of Substantial Performance shall be date for commencement for warranty period and commencement of lien period unless required otherwise by lien statute of Place of Work.

.8 Final Payment: when Owner and Consultant consider final deficiencies and defects have been corrected and it appears requirements of Contract have been totally performed, make application for final payment. If Work is deemed incomplete by Owner and Consultant, complete outstanding items and request re-inspection.

.9 Payment of Holdback: after issuance of Certificate of Substantial Performance of Work, submit an application for payment of holdback amount in accordance with CCDC 2-2020.

1.3 CLEANING

.1 In accordance with Section 01 74 11 – Cleaning.

.2 Remove waste and surplus materials, rubbish and construction facilities from the site immediately following completion of work and prior to final inspection.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 As-built, samples, and specifications.

.2 Equipment and systems.

.3 Product data, materials and finishes, and related information.

.4 Operation and maintenance data.

.5 Spare parts, special tools and maintenance materials.

.6 Warranties and bonds.

.7 Final site survey.

1.2 RELATED SECTIONS

.1 Section 01 45 00 - Quality Control.

.2 Section 01 77 00 - Closeout Procedures.

.3 Section 01 78 10 - Guarantee/Warrantee Form

.4 Section 01 91 00 - Commissioning.

.5 Mechanical Division: Commissioning

.6 Section 01 11 00 Summary of Work, article 1.43.

1.3 SUBMISSION

.1 Submit one copy of completed project operation and maintenance volumes and as-built drawings in final form 15 days prior to substantial performance. For equipment put into use with Owner’s permission during construction, submit Operating and Maintenance Manuals within 10 days after start-up. For items of Work delayed materially beyond date of Substantial Performance, provide updated submittal within 10 days after acceptance, listing date of acceptance as start of warranty period.

.2 Prepare instructions and data using personnel experienced in maintenance and operation of described products.

.3 Copy will be returned after inspection with Consultant's comments.

.4 Revise content of documents as required prior to final submittal.

□

.5 Submit 2 copies of revised volumes of data in final form within 10 days after final inspection.

.6 For contract drawings (architectural, site services, landscaping, structural, mechanical, and electrical)**,** transfer neatly as-built notations onto second and third set and submit all three sets. Cost of only the transfer of these as-built sets into digital format is paid from Cash Allowance. Completion of digital as-built to the Consultant is a mandatory requirement of Total Completion of the Contract.

.7 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.

.8 If requested, furnish evidence as to type, source and quality of products provided.

.9 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.

.10 Pay costs of transportation.

1.4 FORMAT

.1 Organize data in the form of an instructional manual.

.2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf [219 x 279] mm with spine and face pockets.

.3 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.

.4 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.

.5 Arrange content under Section numbers and sequence of Table of Contents.

.6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

.7 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

1.5 CONTENTS - EACH VOLUME

.1 Table of Contents: provide title of project;

.1 date of submission; names,

.2 Addresses, and telephone numbers of Consultant and Contractor with name of responsible parties;

.3 Schedule of products and systems, indexed to content of volume.

.2 For each product or system:

□

.1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

.3 Product Data: mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.

.4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

.5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

1.6 AS-BUILTS AND SAMPLES

.1 In addition to requirements in Sections 00 21 13 Instructions to Bidders, 01 11 00 Summary of Work and CCDC Contract terms, maintain at the site for Owner one record copy of:

.1 Contract Drawings.
.2 Specifications.
.3 Addenda.
.4 Change Orders and other modifications to the Contract.
.5 Reviewed shop drawings, product data, and samples.
.6 Field test records.
.7 Inspection certificates.
.8 Manufacturer's certificates.

.2 Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.

.3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.

.4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.

.5 Keep record documents and samples available for inspection by Consultant.

1.7 RECORDING ACTUAL SITE CONDITIONS

.1 Record information on set of black line opaque drawings, and in copy of Project Manual, provided by Consultant.

.2 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.

.3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.

□

.4 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:

.1 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 manufacturer's certifications, inspection certifications, and field test records, required by individual specifications sections.

1.8 DIGITAL AS-BUILT DRAWINGS

.1 Retain the services of a CAD drafting company acceptable to the Consultant.

.2 Transfer to digital file all information recorded on As-Built drawings. Layering of information as per Consultant’s instructions.

.3 The Consultant will provide CAD file of contract documents.

.4 The cost for preparing digital As-Built drawings will be deducted from the Cash Allowances.

1.9 EQUIPMENT AND SYSTEMS

.1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

.2 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 Contractor's 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 Mechanical Sections.

.15 Additional requirements: As specified in individual specification sections.

1.10 MATERIALS AND FINISHES

.1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured products.

.2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.3 Moisture-protection and Weather-exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.4 Additional Requirements: as specified in individual specifications sections.

1.11 MAINTENANCE MATERIALS

.1 On completion of project, submit to Architect two (2) copies of Operations Data and Maintenance Manual in English, made up as follows:

.1 Bind data in vinyl hard covered, 3 ring loose leaf binder for 215 x 280 mm size paper.

.2 Enclose title sheet, labeled "Operation Data and Maintenance Manual", project name, date and list of contents.

□

.3 Organize contents into applicable sections of work to parallel project's specification break-down. Mark each section by labeled tabs protected with celluloid covers fastened to hard paper dividing sheets.

.2 Include following information, plus data specified.

.1 Maintenance instruction for finished surface and materials.

.2 Copy of hardware and paint schedules.

.3 Description, operation and maintenance instructions for equipment and systems, including complete list of equipment and parts list. Indicate nameplate information such as make, size, capacity, serial number.

.4 Names, addresses and phone numbers of sub-contractors and suppliers.

.5 Guarantees, Warranties and bonds showing:

.1 Name and address of project.

.2 Guarantee commencement date (date of Final Certificate of Completion).

.3 Duration of guarantee.

.4 Clear indication of what is being guaranteed and what remedial action will be taken under guarantee.

.5 Signature and seal of Contractor.

.6 Additional material used in project listed under various Sections showing name of manufacturer and source of supply.

.3 Neatly type lists and notes. Use clear drawings, diagrams or manufacturers' literature.

.4 Include one complete set of final shop drawings (bound separately) indicating corrections and changes made during fabrication and installation.

1.12 STORAGE, HANDLING AND PROTECTION

.1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.

.2 Store in original and undamaged condition with manufacturer's seal and labels intact.

.3 Store components subject to damage from weather in weatherproof enclosures.

.4 Store paints and freezable materials in a heated and ventilated room.

.5 Remove and replace damaged products at own expense and to satisfaction of Consultant.

1.13 WARRANTIES AND BONDS

.1 Refer to Section 00 21 13 'Instructions to Bidders' for bonding requirements for this project, both at the time of tender submission and throughout the duration of the construction period.

.2 Refer to CCDC-2 2020 Contract for Warranty requirements and conditions for the standard warranty which is required for the work of this contract.

□

.3 Extended warranties are required to be issued by manufacturers, fabricators, suppliers and/or installers, sometimes jointly, due to their unique position in the construction process and their ability to guarantee a particular section of work. Refer to individual requirements of extended warranties requested as well as Section 01 11 00 article 1.33.

.4 Unless specifically noted otherwise, all extended warranties shall commence on the date of Substantial Performance of the Work as certified by the Consultant.

.5 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.

.6 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal. Use Guarantee/Warranty Form as provided in Section 017810 Sample Guarantee/Warranty Form, whenever standard preprinted trade or manufacturer's Guarantee/Warranty forms are not available. Provide written form for each warranty specified in Section 01 11 00 Summary of Work, Article 1.33.

.7 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work.

.8 Date at beginning of time of warranty start shall be Date of Substantial Performance.

.9 Verify that documents are in proper form, contain full information, and are notarized.

.10 Co-execute submittals when required.

.11 Retain warranties and bonds until time specified for submittal.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

1. GENERAL

1. To be made out on the letterhead of Guarantor or Warrantor which usually is a Subcontractor.

2. This format is to be used only when standard preprinted trade or manufacturer's forms are not available. Preprinted forms are to include all elements of information shown on this sample or as a minimum.

3. Comply with Requirements for Guarantee/Warranty as specified in Section 01 78 10, Closeout Submittals.

To: HALTON DISTRICT SCHOOL BOARD
J.W. Singleton Centre
2050 Guelph Line
Burlington, Ontario
L7R 3Z2

Date: _____

SECTION _____

TITLE _____

GUARANTEE/WARRANTY TO:

OWNER	The Halton District School Board
PROJECT	Milton #13 Public School 1345 Trudeau Drive Milton, Ontario
ARCHITECT	Hossack Architecture
REFERENCE	(to specifications or drawings)
TIME	Period of Guarantee/Warranty:_____ years
GUARANTEE/ WARRANTY	Starting Date: Substantial Performance as certified by Consultant Date: _____

(Description of Guarantee/Warranty)

_____

_____

_____

Upon written notification from the Owner or the Consultant that the above work is defective any repair or replacement work required shall be to the Consultant's satisfaction at no cost to the Owner.

This guarantee shall not apply to defects caused by the work of others, maltreatment of materials, negligence or Acts of God.

SUBCONTRACTOR

_____ _____
Signature Date

Authorized Signing Officer:

_____
(Name Printed)

_____
Title

Name of Firm: _____

Address: _____

Telephone Number _____

CONTRACTOR

_____ _____
Signature Date

Authorized Signing Officer:

_____ _____
(Name Printed)

_____
Title

Name of Firm: _____ SEAL

Address: _____

Telephone Number _____

END OF SECTION

Part 1 General

1.1 QUALITY ASSURANCE

.1 This Section includes parameters for the general design and performance for the work of Sections which comprise the building envelope including but not limited to, masonry cavity walls, metal cladding, soffits, windows, entrances and roofing.

.2 Performance of the building envelope shall be guaranteed by the Contractor.

1.2 DESIGN

.1 General: Design and engineer as required, fabricate, erect, and/or install building envelope in compliance with the Ontario Building Code, other regulations and requirements of authorities having jurisdiction.

.2 Take into account construction tolerance limitations, creepage, deflection and other movements of the structure.

.3 Accommodate, by means of expansion and contraction provisions, any movement in the building envelope assemblies themselves and between the assemblies and the building structure. Allow for expansion and contraction of components caused by ambient temperature range, surface temperature variation of components, wind, seismic forces, structural deflection and racking; without causing misalignment of joints, breakage of joints and air/vapour barriers, water and air penetration through the assembly, glass breakage, or other defects detrimental to appearance or performance.

.4 Method of attachment to the structure shall take into account site peculiarities so that site and air vibrations or normal temperature movements of the building do not loosen, weaken and/or fracture the connection between building envelope assembly components and the structure or between the components themselves.

.5 Reinforce building envelope assembly components, as required, so that the members can safely sustain design loads.

.6 Assemble and secure assemblies in manner which will keep stresses on sealants within the sealant manufacturer's recommended maximum performance levels.

.7 Rain Screen Principle: Except where detailed otherwise, construct building envelope assemblies based on the "Rain Screen" principle as advocated by the National Research Council of Canada. All voids between the assembly components as well as those between components and the structure shall have:

.1 Gaskets, baffles, overlaps, seals and compartmentalization as required providing a barrier "Rain Screen" to effectively prevent excessive rain water entry into any of the building envelope cavities but to allow pressure equalization of cavity air spaces.

.2 air barriers and seals are required to prevent entry of interior building air into building envelope cavities, and exterior air into the building. Air barriers and seals shall be able to withstand wind design pressures.

.3 such provisions in the form of openings between cavities and the building exterior of sufficient cross sections to provide adequate pressure equalization. All openings shall be effectively baffled against direct rain water entry. Air spaces shall be baffled and compartmentalized to prevent chimney effect within the air spaces vertically and horizontally.

.4 Thermal separators, isolators and seals placed to eliminate contact between interior humid air and a cold surface or structural component to prevent condensation and ice build-up on such surfaces during cold weather.

1.3 WATER, VAPOUR AND MOISTURE

.1 Comply with the design and performance requirements specified in the building code, and as specified herein, including the following principles:

.2 Drain to the exterior face of the assembly, any water entering at joints and any condensation occurring within the building envelope assembly.

.3 Design, fabricate and install the assembly to be watertight to the interior under the interior and exterior design conditions in combination with movements occurring due to loads imposed.

.4 At design conditions no water penetration to the building interior side of the assembly shall occur.

.5 The requirements for an air barrier and a vapour barrier are intended to be provided at the same plane in the building envelope design unless otherwise indicated or specified. In such cases, the Drawings and Specifications refer to "air/vapour barrier". The definition of the air/vapour barrier for the purpose of these Specifications is "a continuous membrane including joints of membrane between components and to adjacent construction which prevents or retards penetration of moisture laden air and the diffusion of water vapour through it".

.6 The maximum water vapour transmission of all components forming the vapour barrier shall be (1.72 ng/Pa x s x sq.m.) (0.3 Imperial Perms) unless specified otherwise.

.7 At design conditions no condensation shall occur on room side surfaces.

.8 Sound: Provide completed installations free from vibrations, wind whistles and noise due to thermal and structural movement and wind pressure.

.9 Seismic: Fabricate and erect cladding assemblies to prevent damage due to earthquake forces as required by The Ontario Building Code. Also refer to *Section 01 11 00 – ‘Summary of Work, article 1.10, Seismic Design Requirements’*.

□

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

□

PART 1 - GENERAL

1.1 General Requirements

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

1.2 Work in Other Sections

.1 Related Work Specified in Other Sections

Section 03 20 00	:	Concrete Reinforcement
Section 03 30 00	:	Cast-in-Place Concrete
Division 31	:	Earthwork

1.3 Reference Standards

CSA-A23.1-19: Concrete Materials and Methods of Concrete Construction
CSA-A23.2-19: Test Methods and Standard Practices for Concrete
CSA S269.1-16 (R2021): Falsework and Formwork for Construction Purposes

1.4 Co-ordination

.1 Install anchors, sleeves, bolts, inserts, drains, expansion joint components and other items supplied under other sections of the specifications required to be built into, anchored to, or passing through concrete work, in co-ordination with the other trades.

.2 Supply templates for setting all anchorages required for the buildings and shelters.

1.5 Design of Formwork

.1 Assume full responsibility for the complete structural design and construction of formwork including shoring and bracing to resist vertical and horizontal loads due to the weight of wet concrete, self weight of forms, wind, fluid pressure of concrete, and other forces arising from equipment used in placing the concrete.

1.6 Waste Management and Disposal

.1 Place materials defined as hazardous or toxic waste in designated containers.

.2 Ensure emptied containers are sealed and stored safely for disposal away from children.

.3 Use sealers, form release and stripping agents that are non-toxic, biodegradable and have zero or low VOC's.

PART 2 - PRODUCTS

2.1 **Materials**

.1 Formwork Lumber: Plywood and wood formwork materials to CAN/CSA-A23.1/A23.2. Formwork materials used on site shall be new and acceptable to the Consultant, prior to erection. Panels shall be fabricated for use as form panels, finished one side, with sealed edges and a minimum thickness of 19mm. Panels shall be smooth and free from defects which would show up on concrete surfaces exposed to view.

.2 Formwork Liner: Plastic laminate, vinyl, polyethylene, neoprene or approved products new and acceptable to the Consultant to provide the surface texture and forms required for the design as shown.

.3 Form Coating: Formaseal as manufactured by Master Builders for wood forms and as recommended by manufacturer for form liner.

.4 Form stripping agent: CPD colourless non-staining odourless or as recommended by manufacturer of form liner.

.5 Joint Tape: non staining, water impermeable, self releasing, where required.

.6 Form ties: removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm dia. in concrete surface, and not leaving metal closer than 25 mm to the surface of the concrete for walls. Snap tie length shall suit wall thickness as noted on drawings.

.7 Tie Hole Plugs: 25mm dia. tapered PVC hole plugs to be provided on all exposed walls.

.8 Form Ties/Supports: External clamping devices to retain form tight, uniform and easily removable around all columns.

PART 3 - EXECUTION

3.1 Erection

.1 Verify lines, levels and column centres before proceeding with formwork and ensure dimensions agree with drawings.

.2 Construct forms to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CAN/CSA-A23.1-19, and to produce acceptable finish where exposed.

.3 Construct falsework in accordance with CSA S269.1-19.

.4 Obtain approval from soils testing engineer for bearing surfaces prior to erection of forms.

.5 Obtain Consultant's approval for use of earth forms.

.6 Hand trim sides and bottoms and remove loose earth from earth forms before placing

concrete.

.7 Align form joints and make watertight. Keep form joints to minimum.

.8 Use (25) mm chamfer strips on external corners of beams, joints, columns, walls etc., exposed to view.

.9 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.

.10 Provide blocking and anchorage for hollow metal frames set to be cast into forms.

.11 Clean formwork in accordance with CAN/CSA-A23.1-19 before placing concrete.

.12 Forms shall remain in place for a minimum duration of 48 hours for footings, curbs, etc. and all other non-self-supporting structural components.

.13 Forms shall remain in place for a minimum of 72 hours for all columns.

.14 Re-use of formwork and falsework subject to requirements of CAN/CSA-A23.1-19.

.15 Be responsible for the safety of the structure, both before and after the removal of forms, until the concrete has reached its specified 28 day strength.

.16 When forms are stripped during the curing period, cure and protect the exposed concrete in accordance with Section 03 30 00.

.17 Movement and displacement of formwork during construction, variations in excess of specified tolerances and marked and disfigured surfaces that cannot be repaired by specified methods will be considered defective work performed by this Section.

.18 Reconstruct defective formwork and replace concrete and reinforcement placed in defective formwork at no additional cost to the Owner.

END OF SECTION 03 10 00

PART 1 - GENERAL

1.1 General Requirements

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

1.2 Work in Other Sections

.1 Related Work Specified in Other Sections

Section 03 10 00	:	Concrete Formwork & Accessories
Section 03 30 00	:	Cast-in-Place Concrete

1.3 Reference Standards

CSA-A23.1-19: Concrete Materials and Methods of Concrete Construction
CSA-A23.2-19: Test Methods and Standard Practices for Concrete
CSA A23.3-19: Design of Concrete Structures
CSA G30.18-09 (R2019): Carbon Steel Bars for Concrete Reinforcement
ACI 315-2004 (SP66): Detailing Manual 2014
ACI 315R-04: Manual of Structural and Placing Drawings for Reinforced Concrete Structures
CSA-W186-M1990 (R2016): Welding of Reinforcing Bars in Reinforced Concrete Construction

1.4 Shop Drawings

.1 Submit shop drawings in accordance with Section 01 30 00.

.2 Indicate bar sizes, spacing, location and quantities of reinforcement, mesh, mechanical splices, chairs, spacers and hangers with identifying code marks to permit correct placement without reference to structural drawings; (to Reinforcing Steel Manual of Standard Practice - Metric Supplement 2004 by Reinforcing Steel Institute of Ontario).

.3 Detail placement of reinforcing where special conditions occur.

.4 Design and detail lap lengths and bar development lengths to CSA-A23.3, unless otherwise indicated.

1.5 Substitutes

.1 Substitution of different size bars permitted only upon written approval of the Consultant.

PART 2 - PRODUCTS

2.1 Materials

.1 Reinforcing Steel: billet steel, deformed bars to CAN/CSA G30.18-09 epoxy coated, unless indicated otherwise. Use Grade 400R bars for all reinforcing unless noted otherwise, to sizes as shown on the drawings.

.2 Welded Wire Fabrics: Where no reinforcement is shown, provide 152 x 152 MW 18.7 x MW 18.7 (6" x 6" x 6/6) welded wire fabric at 37mm (1½ ") below the finished surface of slabs on grade or walks, or toppings 62mm (2½") in thickness or greater. Lap ends and sides of fabric in accordance with requirements of CSA Standard CAN/CSA-A23.1, but in any event, not less than 300mm (12").

PART 3 – EXECUTION

3.1 Fabrication

.1 Fabricate reinforcing in accordance with CSA-A23.1.

.2 Obtain Consultant's approval for locations of reinforcement splices other than shown on steel placing drawings.

.3 Ship bundles of bar reinforcement, clearly identified in accordance with bar list.

3.2 Storage of Reinforcing

.1 Reinforcing shall be stored off the ground to keep it free from dirt and to maintain its fabricated form.

3.3 Field Bending

.1 Do not field bend reinforcement except where indicated or authorized by the Consultant.

.2 When field bending is authorized, bend without heat, applying a slow and steady pressure.

.3 Replace bars which develop cracks or splits.

3.4 Placing

.1 Place reinforcing steel as indicated on reviewed shop drawings and in accordance with CSA-A23.1.

.2 Obtain Engineer's approval of reinforcing steel and position.

.3 Locate reinforcing bars to provide proper concrete cover. Reinforcing cover will be carefully inspected by the Consultant, and reinforcing with inadequate cover will not be acceptable.

.4 Fold all the wires behind bars, away from form faces.

.5 Modify bars on site to accommodate box-outs, inserts, etc., as directed by the Consultant.

3.5 Field Cutting of Reinforcing

.1 Field cut reinforcing bars only where permitted by the Consultant.

END OF SECTION 03 20 00

PART 1 - GENERAL

1.1 General Requirements

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

1.2 Work in Other Sections

.1 Related Work Specified in Other Sections

Section 03 10 00	:	Concrete Formwork & Accessories
Section 03 20 00	:	Concrete Reinforcing
Section 04 20 00	:	Unit Masonry
Section 05 10 00	:	Structural Metal Framing
Section 05 50 00	:	Miscellaneous Metal
Section 06 10 11	:	Rough Carpentry
Division 15	:	Mechanical
Division 16	:	Electrical
Division 31	:	Earthwork
Division 33	:	Utilities

1.3 Reference Standards

CSA-A23.1-19 – Concrete Materials and Methods of Concrete Construction
CSA A23.2-19 – Test Methods and Standard Practices for Concrete
CSA G30.18-09 (R2019): Carbon steel bars for concrete reinforcement
ASTM A820/A820M-16, Standard Specification for Steel Fibres for Fibre Reinforced Concrete

1.4 Samples

.1 At least (3) weeks prior to commencing work, inform the Consultant of the proposed mix design and proposed source of ready mixed concrete.

.2 A sample of the finishes shall be prepared and remain as the minimum acceptable standard for the project.

1.5 Certificates

.1 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA-A23.1.

.2 Provide certification that mix proportions selected will produce concrete of specified quality and yield and that strength will comply with CSA-A23.1.

1.6 Quality Assurance

.1 The Contractor shall employ an independent inspection and testing company to carry out all testing and inspection as required. The Consultant will appoint the inspection and testing company. The cost of inspection and testing shall be paid by the Contractor, out of the Cash Allowance carried for this testing under Division 1.

.2 Samples and methods of moulding shall conform to the requirements of CSA-A23.2.

.3 Additional testing shall be made if there is a distinct change in job conditions or if required by the Consultant or the authority having jurisdiction.

.4 Compression tests shall be performed in accordance with CSA-A23.2 and good practice.

.5 Failure to meet strength requirements will result in rejection of materials, strengthening or replacement of those portions that failed to develop the specified strength.

.6 Concrete slump shall be tested at time that cylinders are cast and at such other times deemed necessary.

.7 The addition of water and admixtures on the site is hereby prohibited and unacceptable for the project.

1.7 **Submittals**

.1 Submit shop drawings in accordance with Section 01 30 00 Submittals.

1.8 **Waste Management And Disposal**

.1 Designate a cleaning area for tools to limit water use and runoff.

.2 Carefully coordinate the specified concrete work with weather conditions.

.3 Ensure emptied containers are sealed and stored safely for disposal away from children.

.4 Prevent plasticizers, water-reducing agents and air-entraining agents from entering drinking water supplies or streams. Using appropriate safety precautions, collect liquid or solidify liquid with an inert, non-combustible material and remove for disposal. Dispose of all waste in accordance with applicable local, provincial and national regulations.

.5 Choose least harmful, appropriate cleaning method which will perform adequately.

PART 2 – PRODUCTS

2.1 **Materials**

.1 Formwork: As specified in Section 03 10 00.

.2 Formwork Lumber:

.1 Plywood and wood formwork materials to CSA-A23.1. Formwork materials brought on site shall be new.

.2 Panels shall be fabricated for use as form panels, finished one side with form coating, with sealed edges and a minimum thickness of 17mm.

.3 Panels shall be smooth and free from defects which would show up on concrete surfaces exposed to view.

.4 Form Coating: Formaseal, as manufactured by Sternson Construction Products.

.5 Joint Tape: Non-staining, water impermeable, self-releasing.

.6 Form Ties: Removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25mm diameter in concrete surface, and not leaving metal closer than 25mm to the surface of the concrete.

.7 Tie Hole Plugs: 25mm dia. tapered P.V.C. hole plugs.

.8 Reinforcing Steel: As specified in Section 03 20 00.

.9 Reinforcing Steel: Billet steel, grade 400R, deformed bars to CAN/CSA-G30.18-09 to sizes shown on structural drawings. Where none is shown, provide 15M bars at 300mm centres as minimum steel.

.10 Wire Mesh: Welded Wire Fabric to sizes and locations shown on drawings. Where none is shown, provide 152x152xMW18.7xMW18.7 W.W.F. one layer as minimum.

.11 Water: to CSA-A23.1.

.12 Aggregates: To CSA-A23.1. Coarse aggregates to be normal density. Use blend of 10mm and 20mm for coloured patterned concrete slabs.

.13 Colour Admixtures: Integral coloured pigments to C-979-86. Two (2) colours to be selected by Consultants from manufacturer's standard range.

.14 Non-Shrink Grout: Sternson M-Bed Superflow or approved equal.

.15 Floor Hardener: Surflex TR trap rock hardener, shake on, by Euclid Chemical Company. Application rate of 5kg/m^2 (1.0 lb/ft^2).

.16 Interior Cure and Seal Compound: Interior slabs shall be W. R. Meadows "Intex". No resin-based compounds will be accepted.

.17 Exterior Cure and Seal Compound: Exterior concrete slabs and gutters shall be W. R. Meadows "Sealtight CS-309".

.18 Expansion Joint Filler: Shall be Sealtight asphalt expansion joint filler, W. R. Meadows.

.19 Joint and Sawcut Filler: Shall be Loadflex by Sika or Jointflex by CPD.

.20 Joint Tape: Shall be Sealtight Gusset Tape by W. R. Meadows.

.21 Premoulded Membrane: Shall be Sealtight 7100-312 (PMPC), W. R. Meadows.

2.2 **Concrete Mixes**

.1 Proportion normal density concrete in accordance with CSA A23.1, to give following properties for concrete in footings, interior foundation walls, interior piers, interior slabs-on-grade, and any other unspecified concrete:

.1 Cement: Type GU Portland cement, minimum 325 kg/m^3

.2 Maximum 25% slag cement content

.3 Minimum compressive strength at 28 days: 25 MPa type N

.4 Nominal size of coarse aggregate: 20 mm.

.5 Slump at time and point of discharge: 50 to 100 mm.

.6 Air content: 0 to 3%.

.2 Proportion normal density concrete in accordance with CSA-A23.1, to give following properties: for concrete in exterior slabs-on-grade and sidewalks:

.1 Cement: Type GU Portland cement, minimum 325 kg/m^3

.2 Maximum 25% slag cement content

.3 Minimum compressive strength at 28 days: 32 MPa type C2.

.4 Nominal size of coarse aggregate: 20 mm.

.5 Slump at time and point of discharge: 60 to 100 mm.

.6 Air content: 5 - 8% maximum.

.3 Proportion normal density concrete in accordance with CSA-A23.1, to give following properties: for concrete in precast concrete toppings and composite deck toppings:

.1 Cement: Type GU Portland cement, minimum 275 kg/m^3

.2 Maximum 25% slag cement content

.3 Minimum compressive strength at 28 days: 25 MPa type N.

.4 Nominal size of coarse aggregate: 10 mm.

.5 Slump at time and point of discharge: 60 to 100 mm.

.6 Air content: 0 - 3% maximum.

.4 Proportion normal density concrete in accordance with CSA-A23.1, to give following properties: for concrete in exterior piers:

.1 Cement: Type GU Portland cement, minimum 275 kg/m^3

.2 Maximum 25% slag cement content

.3 Minimum compressive strength at 28 days: 32 MPa type F2.

.4 Class of exposure: C-2.

.5 Nominal size of coarse aggregate: 20 mm.

.6 Slump at time and point of discharge: 60 to 100 mm.

.7 Air content: 5 to 8%.

.5 Proportion normal density concrete in accordance with CSA-A23.1, to give following properties: for concrete in grouted masonry blocks:

.1 Cement: Type GU Portland cement, minimum 275 kg/m^3

.2 Maximum 25% slag cement content

.3 Minimum compressive strength at 28 days: 20 MPa type N.

.4 Nominal size of coarse aggregate: 10 mm.

.5 Slump at time and point of discharge: 50 to 100 mm.

.6 Air content: 0 - 3% maximum.

.6 Proportion normal density concrete in accordance with CSA-A23.1 to give following properties: for concrete fill.

.1 Cement: Type GU Portland cement, minimum 250 kg/m^3

.2 Maximum 25% slag cement content

.3 Minimum compressive strength at 28 days: 10 MPa type N.

.4 Nominal size of coarse aggregate: 20 mm.

.5 Slump at time and point of discharge: 100 mm.

.6 Air content: 0 - 4% maximum.

.7 Do not change job mix formula without prior approval of the Consultant.

.8 In addition to 28 day strength tests, 7 days test may be carried out. If average strength at 7 days is less then 70% of specified 28 day strength, check mix at once and adjust to ensure required

strength is obtained.

PART 3 - EXECUTION

3.1 Workmanship

.1 All concrete shall be as set forth in CSA-A23.1 and shall be composed of cement, fine and coarse aggregates and water.

.2 Concrete shall be delivered and discharged within 1½ hours after the introduction of the mixing water at the batch plant.

.3 Mixing, placing, compaction, curing, hot and cold weather protection shall conform to CSA-A23.1. Use power vibrators in sufficient number and in location and duration to the Consultant's complete satisfaction as required.

.4 Obtain the Consultant's approval before placing concrete. Provide 24 hour notice prior to placing of concrete.

.5 Pumping of concrete is permitted only after approval of equipment and mix.

.6 Ensure reinforcement and inserts are not disturbed during concrete placement in order to maintain proper coverage.

.7 Prior to placing of concrete obtain the Consultant's approval of proposed method for protection of concrete during placing and curing in adverse weather.

.8 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

.9 Do not place load upon new concrete until authorized by the Consultant.

3.2 Formwork

.1 Verify lines, levels and column centres before proceeding with formwork and ensure dimensions agree with drawings.

.2 Construct forms to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1.

.3 Align form joints and make watertight. Keep form joints to minimum.

.4 Use 25mm chamfer strips on all vertical and horizontal corners of exterior retaining walls as indicated on drawings.

.5 All surfaces of formwork which face concrete, which will be exposed to view are to be coated with protective form coating to minimize transfer of wood grain to finished concrete.

.6 Clean formwork in accordance with CSA-A23.1 before placing concrete.

.7 Re-use of formwork is subject to requirements of CSA-A23.1.

.8 When forms are stripped during the curing period, cure and protect the exposed concrete.

.9 Movement and displacement of formwork during construction, variations in excess of specified tolerances and marked and disfigured surfaces that cannot be repaired by specified methods will be considered defective work performed by this Section.

.10 Reconstruct defective formwork and replace concrete and reinforcement placed in defective formwork at no additional cost to the Owner.

3.3 **Inserts**

.1 Co-ordinate and verify that the Electrical Contractor has set all ducts, boxes and other inserts and openings as indicated or specified elsewhere. Sleeves and openings greater than 100 x 100 mm not indicated on structural or civil drawings must be approved by the Consultant.

.2 Co-ordinate and verify that the Mechanical Contractor has set all floor drains, cleanouts, trench drains to provide a smooth, flush appearance with the **'FINISHED FLOOR SURFACE'** and to ensure a positive and uniform slope towards the drains.

.3 Do not eliminate or displace reinforcement to accommodate inserts or hardware. If inserts cannot be located as specified, obtain approval of all modifications from the Consultant before placing of concrete.

.4 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete. With the Consultant's approval, grout anchor bolts in preformed holes or holes drilled after concrete has set. Formed holes to be at least 100 mm in diameter. Drilled holes to be minimum 25 mm larger in diameter than bolts used. Protect anchor bolt holes from water accumulations. Set bolts and fill holes with non-shrink grout or epoxy (as noted on drawings).

.5 Set hollow metal frames, plumbed, squared and braced with blocking in locations shown on drawings.

3.4 **Grouting**

.1 Grout underside of steel column bearing plates with non-shrinking grout to manufacturer's instructions. Place grout to cover steel shims left in place.

3.5 **Finishing**

.1 Finish all concrete surfaces in accordance with architectural and flooring requirements.

3.6 **Expansion Control**

.1 Expansion Joints: Install expansion joint material between slabs on grade and masonry walls, for interior slabs and at max. 6000mm spacing for exterior slabs and curbs, and between slabs on grade and concrete curbs.

.2 Control Joints: Sawcut control joints at a maximum spacing of 3000mm in each direction and where noted on drawings. Cut joints within 24 hours of placing and to a depth as detailed on

drawings.

3.7 **Precast Concrete Slab Toppings**

.1 Install structurally bonded 50 ± thick precast slab toppings as detailed on structural drawings.

.2 Bond concrete topping to precast concrete slabs via latex modified bonding agent installed in strict compliance with manufacturer's recommendations.

.3 Finish concrete toppings true, level, and smooth via power float and power trowel unless indicated otherwise.

.4 Provide depressions and roughened surfaces in designated areas as required to accommodate special floor finishes.

3.8 **Water/Vapour Control**

.1 Butt joints tight together and tight to foundation wall. Seal all joints with gusset tape including foundation wall junctions.

.2 Protect during placing of concrete to ensure the integrity of the barrier is maintained. Repair immediately any penetrations or areas damaged in accordance with the manufacturer's recommendations.

3.9 **Curing and Protection**

.1 Cure and protect newly finished slabs and steps in accordance with CSA A23.1.

.2 Coat exterior slabs, curbs with curing compound and leave for 30 days. Apply sealer after curing period has expired.

.3 Cure finished concrete surfaces in a manner which will leave the surface with a uniform appearance and with a minimum of discolouration after drying. Ensure that curing compounds are compatible with adhesives for finishes to be applied later.

.4 For all concrete slabs that are to remain exposed, curing compound is to be applied at a rate required for use as a sealer/hardener, in accordance with the manufacturer's instructions.

3.10 **Field Quality Control**

.1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by the Consultant in accordance with CSA-A23.1.

.2 The Consultant will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.

.3 Inspection or testing by Consultant will not augment or replace contractor quality control nor relieve him of his contractual responsibility.

3.11 **Tolerances**

.1 Cast-in-Place concrete shall be constructed within the dimensional tolerances specified in CSA-A23.1, as specified elsewhere in this section. Concrete floor slabs shall be constructed as moderately flat slabs and within the tolerances listed below.

.2 Conform in line, level and plumbness to the following tolerances. These are maximum values.

.3 Variation from vertical, in lines and surfaces of walls piers:

:	In height of 3m (10')	-	6mm (1/4")

.4 Variation from level or from grades shown in floors grade:

:	In any 3m (10')	-	3mm (1/8")
:	In any bay up to 6m (20')	-	6mm (1/4")
:	In any 12m (40')	-	12mm (1/2")

.5 Variation from straight or from correct position in walls:

:	In length up to 6m (20')	-	12mm (1/2")
:	In any 12m (40')	-	12mm (1/2")

.6 Variation in size and location of sleeves, floor open and the like and in location of bolts, inserts and fastenings:

:		-	6mm (1/4")

.7 Variation in location of bolts, inserts, sleeves and fastenings when in group:

:		-	3mm (1/8")

.8 Variation in cross-section of slabs, walls and piers:

:	Maximum oversize	-	12mm (1/2")
:	Maximum undersize	-	6mm (1/4")

.9 There shall be no variations from required level at junction of walls and floors.

.10 Where drains occur, floors shall be properly and uniformly sloped to allow complete drainage of the area.

3.12 **Duct Bank (Interior)**

.1 Excavate to elevations shown and form duct bank as shown on electrical drawings.

.2 Place reinforcing steel as shown. Electrical Contractor to place ducts.

.3 Place coloured concrete and finish top surface with wood float.

3.13 **Defective Concrete**

.1 Concrete is defective when:

.1 Containing visible honeycombing or embedded debris.

.2 Concrete damaged by freezing or which is unsatisfactory due to placement at too high a temperature.

.3 Average 28 day strength of any three consecutive strength tests is less than specified minimum 28 day strength.

.4 Any 28 day strength test result in less than 88% of specified minimum 28 day strength.

.5 Cracking occurs in locations other than at control and construction joints.

.6 Curing is not carried out strictly according to the specifications.

.2 Remove and reconstruct in entirety any defective concrete footing, slabs, walls as directed by the Consultant.

Cold Weather Protection

.1 Refer to CSA Standards CSA-A23.1 and CSA-A23.2 Provisions and Publications. Include for tarped heated enclosures - no non-freeze additives such as calcium will be tolerated on this project.

END OF SECTION 03 30 00

Part 1 General

1.1 SECTION INCLUDES

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

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 51 00 - Temporary Utilities.

.3 Section 03 33 00 – Cast-in-Place Concrete.

1.3 REFERENCE STANDARDS

.1 Health Canada - Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.2 CSA-A23.1-09: Concrete Materials and Methods of Concrete Construction

1.4 SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section [02 61 33 - Hazardous Materials].

.1 WHMIS MSDS acceptable to Human Resources Development Canada-Labour and Health Canada for concrete floor hardeners.

.2 Indicate VOC content.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal [paper] [plastic] [polystyrene] [corrugated cardboard] packaging material [in appropriate on-site bins] for recycling.

.3 Dispose of unused chemical additive materials at an official hazardous materials collections site approved by Consultant.

.4 Unused chemical additive materials must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

.5 Fold up metal banding, flatten and place in designated area for recycling.

□

.6 Dispose of unused chemical additive materials at an official hazardous materials collections site approved by Consultant.

1.6 ENVIRONMENTAL REQUIREMENTS

.1 Temporary lighting

.1 Minimum 1200 W light source, placed 2.5 m above floor surface, for each 40 m^2 of floor being finished.

.2 Electrical power

.1 Sufficient electrical power to operate equipment normally used during construction.

.3 Work area

.1 Water tight protection against rain and detrimental weather conditions.

.4 Temperature

.1 Maintain ambient temperature of not less than [10] degrees C from [7] days before installation to at least 48 hours after completion of Work and maintain relative humidity not higher than 40% during same period.

.2 Maintain substrate temperature at [10] degrees C minimum.

.5 Moisture:

.1 Ensure concrete substrate is within moisture limits prescribed by [flooring] manufacturer.

.6 Safety:

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.

.7 Ventilation:

.1 Ventilate area of work as directed by Consultant by use of approved portable supply and exhaust fans.

.2 Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities.

.3 Provide continuous ventilation during and after coating application.

.4 Sufficient to prevent carbon monoxide or high levels of carbon dioxide and other injurious gases from affecting concrete.

1.7 SCOPE OF WORK

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

Part 2 Products

2.1 FLOOR HARDENER

.1 Where concrete curing agent/sealer/hardener is specified on drawings, provide Shur-Seal as manufactured by Paul M. Wolff Co. Inc. (714) 974-0630, Sure Hard manufactured by Dayton Superior's Canada ltd or Liqui-Hard by W.R. Meadows.

Part 3 Execution

3.1 EXAMINATION

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

3.2 INSTALLATION

.1 On freshly painted concrete surfaces, no additional surface preparation will be required.

.2 On areas where forms are recently removed, remove all form oil and breaking compound residue to assure penetration of the product into the surface.

.3 When applying near windows, mask the glass.

.4 Avoid contact with plant life, glass, aluminum, and other finished surfaces. Where contact occurs, immediately wipe with a damp cloth or flush with water.

.5 Avoid contact with asphaltic concrete.

.6 On previously sealed existing concrete floors, completely strip floor of sealers and contaminants prior to application. Apply as for freshly painted surfaces.

3.3 APPLICATION REQUIREMENTS

.1 Two applications are required. The first application at 200 ft□/gallon as the curing agent at the time of concrete placement. The second application at 400 ft□/gallon as final coat after final cleaning of the concrete.

3.4 APPLICATION

.1 Curing Application:

.1 Application should be made immediately following the final concrete finishing operation as soon as the concrete is firm enough to work on. This will help prevent temperature and hairline cracking.

.2 Application shall be made with low pressure spray. All concrete surfaces shall be kept wet for 30-45 minutes.

.3 After this period, when the treated surfaces become slippery under foot, lightly sprinkle the surfaces with water to aid penetration.

□

3.5 FINISH APPLICATION

.1 Apply sealer with low pressure sprayer at 400 ft^2/gallon coverage rate.

.2 Lambs wool or fine bristle broom the sealer evenly across the concrete surface. Do not allow pudding.

.3 Allow sealer to dry into the surface after 30 minutes.

.4 Keep standing water off concrete surface for 30 days. Do not wet scrub for 30 days.

END OF SECTION

□

PART 1 - GENERAL

1.1 General Requirements

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

1.2 Work in Other Sections

.1 Related Work Specified in Other Sections

Section 03 10 00	:	Concrete Formwork & Accessories
Section 03 30 00	:	Cast-in-Place Concrete
Section 04 20 00	:	Unit Masonry
Section 05 10 00	:	Structural Steel Framing
Section 07 84 00	:	Fire Stopping
Section 07 92 10	:	Joint Sealing
Section 09 65 16	:	Resilient Sheet Flooring
Section 09 68 00	:	Carpeting
Section 09 91 22	:	Painting

1.3 Qualification

.1 The work of this Section shall be carried out by an established concrete precasting company having a proven record of satisfactory workmanship for a period of at least 5 years prior to this contract and approved by the Consultant.

1.4 Scope of Work

.1 Supply all materials, labour and service to provide acceptable finished precast concrete floors, where indicated on the structural drawings.

1.5 Reference Standards

.1 Perform work of this Section to meet specified requirements of C.S.A. Standard CSA-A23.1-19, Concrete Materials and Methods of Concrete Construction.

.2 Additionally perform work of this Section to meet specified requirements of CSA-A23.4-19, Prestressed Concrete.

.3 Concrete shall have a minimum compressive strength of 25 MPa at transfer and 40 MPa at 28 days.

.4 Precast slabs shall be manufactured by an extrusion process using smooth rigid steel forms and cut to length as required on the project.

1.6 **System Description**

.1 Structural Requirements: Fabricate slabs to support dead loads, and live loads as indicated on Drawings, with maximum deflections of

: 1/360 of the span where ceilings are suspended from the slabs.

: 1/240 of the span where ceilings are not suspended from the slabs.

.2 Tolerances: Ensure that subfloor surfaces under finish flooring are levelled by filling compound or other means to within 3.2mm under a 3m long straightedge and within a maximum variation of 1.5mm in any running 300mm.

.3 Designer Qualifications: Design and supervise fabrication of precast concrete slabs specified in this Section by professional engineers licensed to practice at the place of building.

1.7 **Requirements of Regulatory Agencies**

.1 Fabricate precast concrete slabs that are validated by ULI, ULC or NRC tests for fire-protection or fire-resistance ratings in complete accordance with the test design specification. Precast concrete slabs provided otherwise, and which require a fire rating, will be approved only on presentation of affidavits that it is acceptable to the authorities having jurisdiction.

1.8 **Inspection Services**

.1 Submit affidavits that precast concrete slabs have been fabricated to meet requirements of the Specifications. Include copies of mill tests of reinforcement incorporated, and compression test results of tests made for each 38 cu.m, or part, of concrete.

1.9 **Submittals**

.1 Design Data: Submit, with shop drawings, calculations pertaining to the design of slabs including reinforcement, anchorage, connections and estimated camber, and in the same manner as for shop drawings.

.2 Submit shop and erection drawings.

.3 Include documentation of manufacturing procedures including means of checking strand slippage, concrete strength at time of detensioning, and methods used to determine slippage and concrete strength.

.4 Affix the seal of the engineer, signed and dated, who is responsible for structural analysis and design of concrete slabs on each shop drawing and supporting document.

.5 Affidavits: Submit affidavits as specified in this Section for products, if requested.

.6 Production Reports: Submit test reports of strand slippage with a performance evaluation of each slab.

1.10 **Delivery, Storage and Handling**

.1 Handle, transport and store precast concrete slabs as required by specified reference standards, and by use of methods devised or approved, or both, by fabricator to prevent staining, soiling and damage.

.2 Store precast concrete slabs to clear ground or other bearing surfaces, to prevent overstress, warp, twist, accumulation of water and snow in depressions and holes, and to afford free movement of air on all sides of each unit.

1.11 **Site Conditions**

.1 Environmental Requirements: Grout in anchorage and joints, and patch concrete, only when air and surface temperatures exceed 4 deg. C and will remain so until grout has cured.

PART 2 - PRODUCTS

2.1 **Materials**

.1 Incorporate materials to meet specified requirements of CSA-A23.4-16, and as required to meet specified performance.

.2 Reinforcement:

.1 Mild Steel Bars: Billet steel to meet specified requirements of CAN/CSA-G30.18-09 (R2019).

.2 Prestressing Tendons: Uncoated, 7 wire strand, high tensile steel to meet specified requirements of CSA G279-1975 (R1998).

.3 Water: Verify that no salts are present that will cause efflorescence.

.4 Bearing Pads: 3.2mm thick tempered hardboard, smooth on each side, to meet specified requirements of CGSB Specification 11-GP-3M, Type 2.

.5 Grout: Cement grout consisting of one part portland cement mixed with 2½ parts sand and sufficient water for placing and hydration.

.6 Sealant: To suit manufacturer's standards.

.7 Core Insulation: Rigid polystyrene to meet specified requirements of CGSB 41-GP-14a Type 4.

.8 Levelling Topping: Shall be cementitious based, minimum 3 mm in thick over the entire floor area (gypsum based products are not acceptable). The finish shall be smooth so as to prevent the telegraphing of finish through the floor covering.

.9 Bonding Agent: Latex modified bonding agent. W.R. Meadows Intralok or similar.

PART 3 - EXECUTION

3.1 Examination

.1 Verify, before delivery of materials to site, that construction to receive precast slabs is located correctly and at proper levels.

.2 Ensure that bearings are clean, smooth and level, and provision has been made for proper anchorage.

.3 Defective concrete slab installation caused by unsatisfactory construction previously completed will be considered the responsibility of this Section.

3.2 Preparation

.1 Take particular care to protect finished surfaces that are exposed to view from mortar droppings and smears.

.2 Protect visible edges of slabs that are exposed to possible damage.

.3 Protect slabs from damage from welding by use of non-combustible shielding.

3.3 Fabrication

.1 Fabricate slabs:

.1 To meet specified requirements of reference standards for fabrication and manufacturer's certification.

.2 To ensure that finished dimensions are within specified tolerances.

.3 To meet or exceed performance requirements.

.4 With concrete consolidated through full cross-section of slabs to provide full bond with reinforcement, and surfaces free of cold joints and honeycombing.

.5 With cambers incorporated.

.6 To include closure slabs of special widths to suit Project conditions.

.7 With surfaces of a uniform appearance where exposed to view, and with no visible seams.

.8 With raked finish where topping is to exceed 25 mm.

.2 Concrete:

.1 Of mix designed by fabricator to meet requirements of Specifications.

.2 Normal weight, with compressive strength of 40 MPa at 28 days.

.3 Reinforcement:

.1 Cover reinforcement with concrete to a thickness required by jurisdictional authorities to provide fire protection.

.2 Minimum strength of concrete at detensioning shall be 25 MPa.

.3 Record strand slippage.

.4 Curing: Cure slabs by normal curing process.

.5 Finishing: Provide smooth finishes as approved by the Consultant for carpet and vinyl tile floor finishes and for painting of ceiling.

.6 Provide cast-in plates and anchorages as noted on the drawings.

3.4 **Installation**

.1 Install slabs with uniform joint widths, and units aligned straight, plumb, level and square. Cumulative dimensional error in position of slabs will not be allowed.

.2 Install bearings and set slabs on them dry.

.3 Coordinate the location of holes through slabs with consultant drawings, and cut holes through slabs to ensure that no damage is caused to slabs or reinforcement.

.4 Supply information required for installation of anchors, supports, inserts and similar accessories that are required by this Section and are installed by other Sections. Assist or supervise, or both, in their installation.

.5 Install and grout in anchorage.

.6 Drypack completely under the edges of slab (full length) above and between beams, walls, etc.

.7 Do not grout one cell of the core throughout the length of the slab installation, to provide for installation of electrical, telephone and data services.

.8 Fill joints and keys between slabs completely with grout. Saturate surfaces of joints and keys with water before grouting.

.9 Apply topping of concrete over each floor area to provide a level smooth substrate for installation of finish flooring within tolerances as per CSA-A23.4 and as specified in Section 03 30 00.

.10 Do not install chipped, cracked, blemished, stained or otherwise defective units.

.11 Caulk between abutting slabs and at joints between slabs and adjoining construction to meet specified requirements in applicable sections of this specification.

3.5 Adjustment and Cleaning

.1 Patch holes and damaged surfaces where exposed to view with concrete to match adjacent area. Use bonding agent to ensure bond. Finish patches to match precisely the colour and texture of adjacent area. Remove and repatch areas that do not match.

.2 Co-ordinate location and size of holes with applicable sub-trades. Repair oversized, misaligned and incorrect openings in a manner acceptable to the Consultant.

.3 Clean surfaces of slabs exposed to view after joint treatment is complete. Use fibre brushes, water and mild cleaning agents only as recommended by precast fabricator. Remove deposits of foreign material, dirt, soil and stains. Do not use tools which will damage finish surfaces. Rinse thoroughly with clean water after cleaning.

.4 Protect adjoining surfaces from damage during cleaning.

END OF SECTION 03 40 00

PART 1 - GENERAL

1.1 General Requirements

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

1.2 Work in Other Sections

.1 Related Work Specified in Other Sections

Section 03 30 00	:	Cast-in-Place Concrete
Section 04 20 00	:	Unit Masonry
Section 05 10 00	:	Structural Metal Framing
Section 05 30 00	:	Metal Decking
Section 05 50 00	:	Miscellaneous Metal
Section 06 10 11	:	Rough Carpentry
Section 07 21 13	:	Board Insulation
Section 07 21 19	:	Foamed-in-Place Insulation
Section 08 11 14	:	Metal Doors & Frames
Section 09 22 16	:	Non-Structural Metal Framing
Section 09 21 16	:	Gypsum Board Assemblies
Section 09 84 10	:	Acoustic Wall Treatment
Section 09 91 22	:	Painting
Section 14 21 23	:	Hydraulic Passenger Elevators
Division 15	:	Mechanical
Division 16	:	Electrical

1.3 Reference Standard

.1 Do masonry mortar and grout work in accordance with CSA A179-14 (R2019) and CSA-A82.56-94 except where specified otherwise.

.2 All masonry mortar and grout work shall be carried out in accordance with CSA A179-14 (R2019) mortar and grout for unit masonry and CSA A82.56-94 aggregate for masonry mortar.

ASTM C270-89: Standard Specification for Mortar for Unit Masonry.

CSA A371-14 (R2019): Masonry Construction for Buildings.

CSA S304-14 (R2019): Masonry Design for Buildings (Limit States Design).

CAN/CSA A179-14 (R2019): Mortar and Grout for Unit Masonry

1.4 Qualifications

.1 Execute work of this section only by a Contractor who has adequate equipment and skilled tradesmen to perform it expeditiously and is known to have been responsible for satisfactory installations similar to that specified during a period of at least five (5) years.

1.5 **Submittals**

.1 Submit affidavit from an inspection company that all materials conform to the requirements of the specification.

1.6 **Delivery, Storage and Handling**

.1 Store all materials protected against moisture, freezing and excess heat and to prevent contamination by foreign materials.

PART 2 - PRODUCTS

2.1 **Materials**

.1 General: Ensure that water and aggregates used are all from same source and will meet required strengths. Batch mortar and grouts are acceptable provided source is approved prior to commencement of work.

.2 Mortar and grout: Types M, N, S and O to CSA A179-94

.3 Colour: To match brick used. As manufactured by Harcross Pigments.

.4 Masonry Cement – CAN/CSA-A8, Type H.

.1 Portland Cement – CAN/CSA-A3001, Normal

.2 Hydrated Lime - CSA A82.43.

.3 Sand Aggregate CSA A82.56.

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

.5 Mortar - Shall be grey dirt resistant and conform to the following:-

Loadbearing	:	Type S and M
Non-Loadbearing	:	Type N and S

.5 Dirt resistant additives: aluminum tristearate, calcium stearate or ammonium stearate.

.6 Use aggregate passing 1.18 mm sieve where 6 mm thick joints are indicated.

2.2 **Material Source**

.1 Use same brands of materials and source of aggregate for entire project.

2.3 **Mortar Types**

.1 Mortar for exterior masonry:

.1 Loadbearing: Type S and M.

.2 Non-loadbearing: Type N and S.

2.4 **Dirt-Resistant Mortar**

.1 For dirt-resistant mortar add aluminum tristearate, calcium stearate, or ammonium stearate to mortar in amount of 3% of weight of Portland cement.

.2 Use dirt-resistant mortar for all masonry work for the project.

2.5 **Grout**

.1 Non-shrink Grout: to CSA A179-14 Table 3 by Embeco by Master Builders, In-Pakt by C.C. Chemicals, or M-Bed Superflow by Sternson.

.2 Concrete grout for reinforced masonry shall consist of one part Portland cement and three parts sand with water to provide a minimum compressive strength of 10MPa at 28 days. Maximum aggregate size shall be 10mm. Slump for the grout shall be 200 to 250mm.

PART 3 - EXECUTION

3.1 Mixing

.1 Mix mortar to consistency required for working.

.2 Mix grout to semi-fluid consistency.

.3 Incorporate colour and admixtures into mixes in accordance with manufacturer's instructions. Use clean mixer for coloured mortar.

.4 Prehydrate pointing mortar by mixing ingredients dry, then mix again adding just enough water to produce damp unworkable mix that will retain its form when pressed into ball. Allow to stand for not less than 1 hour nor more than 2 hour then remix with sufficient water to produce mortar of proper consistency for pointing.

3.2 Installation

.1 Grout fully all pockets in concrete foundation walls where structural components installed, under bearing plates at piers and elsewhere as noted on drawings.

.2 Grout solid all reinforcing installed in concrete block walls.

.3 Protect all mortar and grout installed from freezing or from excessive heat which will prevent bonding or decrease the required compressive strength.

END OF SECTION 04 10 00

PART 1 - GENERAL

1.1 General Requirements

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

1.2 Work in Other Sections

.1 Related Work Specified in Other Sections

Section 03 30 00	:	Cast-in-Place Concrete
Section 04 10 00	:	Mortar & Grout
Section 05 10 00	:	Structural Metal Framing
Section 05 50 00	:	Miscellaneous Metal
Division 7	:	Thermal and Moisture Protection
Division 8	:	Openings
Division 31	:	Earthwork

.2 Products Supplied Under Work of Other Sections

and Installed Under Work of This Sections

Section 07 21 13	:	Board Insulation
Section 08 11 14	:	Metal Doors & Frames

1.3 Qualifications

.1 Execute work of this section only by a contractor who has adequate equipment and skilled tradesmen to perform it expeditiously and is known to have been responsible for satisfactory installations similar to that specified during a period of at least five years.

1.4 Reference Standards

CAN/CSA-A5/A8/A362-93 - Blended Hydraulic Cement
CAN/CSA-A165 SERIES-14 (R2019) - Concrete Block Masonry Units
CAN/CSA A82:14 (R2018), ASTM C216-10 – Fired Masonry Brick Made from Clay or Shale
CSA A371-14 (R2019) – Masonry Construction for Buildings
CSA S304.14 (R2019) – Design of Masonry Structures
CSA-A23.1:19 - Concrete Materials and Methods of Concrete Construction

.1 Install flashings in masonry as follows:

.1 Install flashings under exterior masonry bearing on foundation wall.

1.5 Supervision

.1 Work of this Section shall be executed under the continuous supervision and direction of a competent foreman for each class of work.

.2 One thoroughly experienced, reliable and competent tradesman shall be in charge of mortar mixing.

.3 Ensure that all items required to be built into masonry walls by all other trades are known and co-ordinated prior to commencement of work.

.4 Consult the approved shop drawings for all sections of the specifications to determine the exact location of items to be built into masonry.

1.6 **Submittals**

.1 Submit for approval clearly labelled samples of masonry materials to be used in the work. Submit for approval any alternative materials if requested by the Consultant.

.2 Provide a mock-up sample, 1200mm HIGH by 1800mm LONG, for each of the following items, prior to commencing work:-

: exterior brick
: interior brick

1.7 **Defects Defined**

.1 In addition to non-compliance with specified requirements or other contract requirements, the following will be considered defect:

.1 Shrinkage in individual units and erected walls.

.2 Spalling, efflorescence, cracking or chipping of units.

.3 Poor colour or texture blending of units.

.4 Surface deterioration dusting.

.5 Discolouration, crumbling and similar deterioration of mortar, grout.

.6 Failure of built-in items to remain anchored.

1.8 **Storage of Materials**

.1 Store cementitious material in accordance with CAN/CSA-A5/A8/A362. Store aggregates in accordance with CSA-A23.1. Stack masonry units to avoid chipping. Manufacturer's seals and labels shall be intact. Refer to cold weather protection Article 3.6 for requirements of preheating masonry materials prior to building in.

1.9 **Wind Bracing**

.1 Brace walls during construction until the structure provides sufficient lateral support. **This is a mandatory requirement**.

1.10 **Protection**

.1 Cover top of completed and partially completed masonry walls not protected by permanent work. Use waterproof coverings draped 600 mm (min.) down each side of wall and securely anchored.

PART 2 - PRODUCTS

2.1 **Materials**

.1 General: Use only materials specified herein.

.2 Masonry Cement: As specified in Section 04 10 00.

.3 Portland Cement: As specified in Section 04 10 00.

.4 Hydrated Lime: As specified in Section 04 10 00.

.5 Sand aggregate CSA A82.56: As specified in Section 04 10 00.

.6 Water: Verify that water used contains no salts to cause efflorescence.

.7 Concrete Masonry Units:

.1 Bubble cured units or Autoclaved units to meet requirements of CSA-A165 Series 14.

.2 Type H/15/C/M lightweight block.

.3 Size Metric

.4 Special Shapes - Supply corner block, "L" shape block, bullnose block, header block, lintel block and the like as shown on the drawings, or as required.

.8 Acoustical Concrete Masonry Units to CSA-A165-14, purpose made with slots to provide the acoustical characteristics specified:

.1 Size and extent as shown on the drawings.

.2 Reinforcing patterns as shown on the structural drawings.

.3 Type H/15.0 A/M normal weight block.

.4 Incombustible fibrous cavity filler.

.5 Richvale York Block ‘Acoustade’.

.9 Insulation: As specified in Section 07 22 00.

.10 Glass Fibre Board: Glass fibre insulation, semi-rigid board, density of 20.8 kg/m^3 (1.3

lbs./cu.ft.).

.11 Bellows for Control and Expansion Joint: Bituminous membrane type compatible with wall membrane.

.12 Dampproof/Thru-Wall Flashing: Fibre reinforced membrane, coated one side with 0.61 kg/m^2 (2 oz./sq.ft.) copper, to meet quality standard of Copper-Bar by Gummed Papers Limited or Bituminous reinforced membrane manufactured by Monsey Bakor Inc.

.13 Asphalt Emulsions: As specified in CGSB 37-GP-2M.

.14 Air Barrier Membrane: As specified in Section 07 22 00.

.15 Brick Vents: Flexible PVC offset "T" shape with vertical leg slotted to allow passage of air, for installation in vertical joints, to meet quality standard of GOODCO brick vent.

.16 Wall Reinforcing: As shown on Structural drawings.

.17 Cavity Wallbonding Box Tie: 4.76mm (3/16") galvanized high tensile steel wire, truss type reinforcing with box ties @ 400 o/c in two sections to form a hook and eye, Blok-Lok Limited or equivalent by Dur-O-Wal Limited.

.18 Flexible Anchor: To suit conditions and to allow for differential movement between the structure and masonry work. Typically: 4.76 mm (3/16") diameter steel, galvanized, bent into an equilateral triangular shape with its apex flexibly secured to structure, and with its two legs terminating in 25 mm (1") inward bent hooks extending a minimum of 100 mm (4") into masonry anchored.

.19 Wall Ties: 22 gauge galvanized corrugated steel.

.20 Stud Anchors: 14 gauge, hot-dipped galvanized steel plate anchors with 4.76mm (3/16") diameter galvanized steel wire ties for cavity wall.

.21 Bond Anchor: 4.76 mm (3/16") diameter steel galvanized with 50 mm (2") end bent 90°.

.22 Galvanizing: To specified requirements of ASTM Specification A153, Class B.3 coatings, for all bolts and hardware, ASTM Specification A116, Class 3 coating, for masonry ties other than above.

.23 Cleaner: Vanatrol as manufactured by C.P.D., Ratio 6:1 unless otherwise noted by brick/mortar/grout manufacturer. (MURIATIC ACID NOT ACCEPTED).

PART 3 - EXECUTION

3.1 General Workmanship

.1 Employ properly qualified masons for laying up masonry units.

.2 Distribute exposed masonry units of varying colours, tones and textures evenly over wall surface to avoid patches and streaks and to produce a pleasing appearance.

.3 Gaining to meet spandrels, etc., leaving courses uneven or with visibly thicker mortar joints will not be acceptable. Any such work must be removed and rebuilt to approval of Consultant.

.4 Construct masonry evenly in maximum lifts of 1200 mm per working day. Rake back ends of unfinished walls; do not tooth and bond new masonry.

.5 Chases, fixtures, outlets must be built - not cut. Co-ordinate with Mechanical and Electrical.

.6 Install aluminium and hollow metal door frames by building in lugs and filling voids with mortar. Keep frames free of mortar stains. Protect as required.

.7 Chipped or blemished units may be used where concealed. Chipped, cracked or broken units are considered deficiencies where exposed to file and shall be removed and replaced.

.8 Build masonry with accurately plumbed faces, truly horizontal bed joints and accurately aligned vertical joints.

.9 Notwithstanding current trade practices in this regard, fill all vertical collar and bed joints through the entire wall thickness solidly with mortar.

.10 Cut masonry neatly with a carborundum saw where it comes in contact with the structure and where else required and build tightly against the structure except where expansion control and deflection joints are required. Build masonry up and neatly fit to all openings, and all anchors for frames for such openings shall be built securely into joints.

.11 Do all cutting, fitting and patching in masonry work to receive work of other trades. Install items supplied by other trades to be built into masonry walls, plumb, level, rigid and secure. Build in all miscellaneous metal work, loose lintels, bearing plates, sleeves, anchor bolts, wood nailer and all other items which require building into the masonry. Set access doors with front face flush with final wall finish. Locate such fittings precisely as directed.

3.2 **Lintels**

.1 Set loose lintels supplied under Section 05 10 00 for bridging openings in masonry.

.2 Bridge openings not exceeding 450 mm in width with 6 mm mild steel plate lintels bearing 100 mm on each side of opening. Width of plate shall be wall thickness less 25 mm. Joint at lintel to be dry packed. Provide minimum brick vents per lintel at 800 o/c.

.3 Install concrete block lintels where indicated on drawings. Fill with 25 MPa concrete and reinforce as shown. Temporarily support until concrete is cured.

3.3 **Structural Bearing**

.1 Install bearing pads in all load bearing walls to receive structural components by:

: Two courses of solid masonry units at least 400mm (16") in upper course and 800mm (32") long in lower course or by lintel blocks at least 800mm (32") long filled with 25MPa (3600 psi) concrete and reinforced with two 10mm (3/8")

diameter bars, in bearing course only.

: Co-ordinate this work with fixing devices provided under the work of Section 05 10 00.

3.4 **Dampproof Course/Thru-Wall Flashings**

.1 Install bituminous membrane on walls and partitions rising from footings below grade and in locations indicated on Drawings. Lap and seal all joints. Install thru-wall flashings at all lintels, grade junctions and roof junctions and in locations indicated on the drawings. Lap and seal all joints.

3.5 **Control Joints**

.1 Control joints shall be located at maximum spacings of 4800 to 6000 centres and be located as shown on the drawings.

3.6 **Cold Weather Protection**

.1 Refer to the Ontario Masonry Contractor's Association's provision and publications. Include for tarped heated enclosures, heated mortar mixing pans - no non-freeze additives such as calcium will be tolerated on this project.

3.7 **Bonding**

.1 Lay face brick and concrete block units coursing in running bond pattern. Lay soldier and header coursing. Corbel brick piers and friezes as shown on drawings.

.2 Lay brick coursing to course every second block course. Course soldier coursing to course on three stretcher courses.

.3 Construct quoins, header courses and soldier and corbelling to protrude 25mm.

.4 Lay stone in random pattern. Dry pack solid all stone.

.5 Cut brick to provide opening dimensions shown only as necessary. Cut ends are not to be exposed.

.6 Anchor brick to back-up at 400 o/c vertical and horizontal maximum with ties.

3.8 **Joints**

.1 Ensure cavity width is maintained and keep free of droppings. Back trowel to prevent build-up of mortar.

.2 Rake brick joints to size and depth in accordance with recommended trade practices.

.3 Keep control joints, expansion joints and air spaces free from mortar and droppings.

.4 Construct Control Joints in locations shown. **DO NOT SAW CUT**. Sealing to be carried out in conformance with Section 07900. Install bellows to maintain membrane air barrier

integrity. Keep joints free of mortar droppings.

.5 Make joints of uniform thickness with vertical joints plumbed over each other. Do not butter corners of units, allow mortar scrapings in joints excessively or shift and tap units after mortar has initially set.

.6 For solid masonry units completely fill with mortar both bed and vertical joints.

.7 For hollow masonry units ensure that mortar covers all available bearing surfaces fully and fills vertical joints, except for weep and vent holes.

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

.9 Form tooled concave joints for concrete block walls wherever exposed to view, whether behind cabinets, fitments, and wall accessories, or not. When mortar has become "thumbprint" hard by a tool having a minimum 500mm long bearing surface to avoid uneven depressions. Clean off burrs with trowel or burlap.

.10 Rake out joints at juncture of interior and exterior walls with columns, at intersections of walls and partitions where joint reinforcement is installed, and at other caulked joints.

.11 Form reglets required for metal flashing in masonry.

.12 Flush-in solidly with mortar between cavity filler strips and interior face of brick veneer.

.13 Cut joints off flush where treatment is not otherwise specified. No mortar shall protrude from joints on wall surfaces to which insulation will be applied.

.14 Install insulation using adhesive recommended by the manufacturer. Insulation is to be tight fitting with no joints.

3.9 **Laying Masonry**

.1 Stop off horizontal runs of walls by racking back a half unit in each horizontal course: do not tooth.

.2 Wet clay and shale masonry units before placing. Do not wet concrete units. Wet faces of work in place before laying new work. Units shall not have water adhering to their surfaces when laid; but shall be wet only to ensure that complete hydration takes place, during hot drying weather, and when unit absorption rates are greater than 0.025 oz/sq.in./ minute, so that the initial rate of absorption does not exceed above rate when laid.

.3 Distribute masonry units of varying colours and textures to avoid spotty appearance over wall surfaces exposed to review. Do not use units which contrast too greatly with overall range.

.4 Use chipped and blemished units only where concealed. Do not use defective or broken units. Do not lay concrete units that will appear smooth or slick where exposed to view, whether painted or not.

.5 Brace walls and piers continuously during construction until structure provides support.

.6 Extend all walls to construction above except where otherwise noted on Drawings. Leave deflection space over non-load bearing walls as specified later.

.7 Cope, cut and split concrete masonry units with power-driven abrasive discs. Cut units wherever electrical outlets, grilles, and pipes occur. Allow 4 mm minimum clearance around items which are incorporated in walls.

.8 Lay hollow concrete masonry units so that effective shells rest and align one over the other. If they do not in bond courses, use solid bonding units.

.9 Install solid masonry units at all locations required for fixing of handrails, metal partitions and accessories of all description.

.10 Flush smooth with mortar masonry surfaces that flashings rest against to ensure that they are not punctured.

.11 Install brick vents at 600 mm (24") o.c. in vertical joints of masonry courses that rest on dampproofing and thruwall flashing and at top of masonry wall at steel lintels.

.12 Locate bearings and piers as indicated on Drawings; provide solid masonry units at bearings. Grout under bearing plates installed on masonry with non-shrink grout.

.13 Co-operate at all times with persons carrying out the work of Section 07220, Cavity Wall Insulation.

.14 Keep cavity spaces free of mortar in cavity walls.

.15 Build, do not cut, chases. Do not incorporate chases in walls of 200mm (8") thick or less, nor locate them within 500mm (20") of lateral support provided for wall, nor exceed one-third of wall thickness for chase depth. Provide lintels over chases that exceed 500mm (20") in width and that are more than one-third of wall thickness in depth. Locate adjoining chases with a minimum clear distance between them of four times wall thickness.

3.10 **Masonry Reinforcing**

.1 Reinforce all masonry walls using joint reinforcement in horizontal joints.

.2 Place joint reinforcement continuously in horizontal joints. Lap a minimum of 150mm (6") at splices.

.3 Reinforcing Schedule

: Inner Wythe of Cavity Walls (Non Load Bearing): Heavy duty joint reinforcement every second course between bonding ties.

: Load-Bearing Exterior and Interior Walls: Heavy duty joint reinforcement every block course.

: Non-Load-Bearing Partitions: Standard joint reinforcement every second course with additional course over all openings carried at least 800 mm (32") beyond jambs.

: Refer to Structural Drawings for size and placement of vertical reinforcing steel.

.4 Do not reinforce face veneers.

.5 Where changes in wall thicknesses occur extend horizontal reinforcement 500 mm (20") beyond on each side. Carry reinforcement all around every course in masonry cover to structural steel.

.6 Do not carry reinforcement through control or expansion joints.

.7 Wherever walls and partitions intersect one another, or each other, continue reinforcement through. Do not carry it through where lateral support anchors are installed, or intersection occurs at a solid pier.

3.11 **Masonry Anchorage and Support**

.1 Anchor masonry construction to ensure its stability and to withstand loads imposed by intended use and by natural elements.

.2 Anchor masonry construction at structural steel work with flexible anchor every 400mm (16") in height. Weld flexible tab section of anchor to structural steel.

.3 Unless indicated or specified otherwise, space anchors at a maximum of 600mm (24") vertically and 800mm (32") horizontally.

.4 Wall Anchorage:

: For Non-Load-Bearing Partitions: Anchor partitions that abut or intersect other walls or partitions by corrugated galvanized wall ties spaced at not more than every third course apart vertically or by joint reinforcement.

: For Load-Bearing Exterior and Interior Walls: Anchor walls that face or abut other load-bearing walls or solid masonry piers by toothing, or blocking, with 100 mm (4") minimum and 200 mm (8") maximum offsets into which strap anchors are set at a maximum spacing of 800 mm (32") vertically. Use lateral support anchors, but with 75 mm (3") hooks. Extend anchors a minimum of 450 mm (18") into masonry at both sides of intersection. Where this is not possible, install cross pins in lieu of hooks to provide equivalent anchorage. At corners, provide true bonding of at least 50% of the units of one wall imbedded in the other. Provide for caulked joints at intersecting walls as part of the work of Section 07 90 00.

.5 Lateral Support: shall be provided for masonry walls and partitions as indicated on Drawings, specified, and required by jurisdictional authorities; perpendicular to wall faces; and either horizontally or vertically to wall panel edges. Provide lateral support for interior walls and partitions.

: Horizontally: by wedging masonry against structure, by clips or dowel plates specified in Section 05 50 00 at a maximum spacing of 1800mm (6'-0") o.c. where concealed in the final work or by continuous cover angles where exposed.

: Vertically: at junction with poured-in-place concrete by corrugated metal veneer anchors spaced at not more than every third course apart, one for every 4" or part thereof of masonry wall thickness, securely fastened to concrete by an approved method.

.6 Deflection Space:

: Provide a deflection space between tops of non-load-bearing walls and partitions and structures to prevent transference of structural loads to masonry.

: Fill deflection space with Type AF100 glass fibre board compressed to 50% of original thickness to completely fill space.

: Fill voids in accordance with Section 07950 for assemblies requiring a fire resistance rating:

: Deflection space shall be 1" unless otherwise designated on Drawings.

: Co-ordinate work with installation of lateral support specified in Section 05500.

3.12 **Dampproof Flashing**

.1 Install dampproof flashing continuously through exterior masonry walls, under sills and elsewhere as indicated on Drawings. Lap joints 150 mm (6").

.2 Flush up surfaces to receive dampproof flashing with mortar, and install flashing. Ensure that no coarse aggregate or other protrusions will pierce flashing, and protect it until work resumes.

.3 Through-wall flashings shall be dressed through full thickness of exterior wythe, across airspace and turn-up at least 150 mm (6") against inner wythe applied with approved adhesive. Install flashings prior to application of cavity wall insulation to details as shown on Drawings.

.4 When mortar bed for flashing has set resume laying of masonry.

.5 Where flashing is exposed to view or must bridge air-space without support, use sheet metal flashings provided and installed as part of the work of Section 07560. Install sheet metal flashings after dampproof flashings but prior to others.

3.13 **Mechanical Louvres, Grilles, Unit Ventilators**

.1 Construct openings in wall to accommodate sizes and details required by mechanical trades.

.2 Seal completely around penetrations to prevent air infiltration.

3.14 **Patching**

.1 Patch masonry walls damaged by installation of work specified under other Sections, and which have been rejected as defective or otherwise damaged.

3.15 **Pointing and Cleaning**

.1 Point all holes in mortar joints and in concrete masonry unit faces.

.2 Cut out defective mortar joints and repoint.

.3 Wash down and brush brick and grout/mortar to remove mortar laitance and stains. Use specified cleaners only. Consult with brick/block/grout and mortar supplier for solution strength and recommendations.

.4 Clean concrete masonry units with brushes and as otherwise recommended by the supplier to remove mortar and stains.

.5 Do not use wire brushes for cleaning.

.6 Should specified cleaning methods be insufficient, proceed with other methods only with approval of the Consultant.

.7 Protect adjacent materials and work from damage while cleaning.

END OF SECTION 04 20 00

Part 1 General

1.1 RELATED SECTIONS

.1 This section to be read in conjunction with Section 04 22 00 for Execution Requirements

.2 Section 01 33 00 – Submittal Procedures

.3 Section 03 30 00 – Cast-in-Place Concrete

.4 Section 05 12 23 – Structural Steel for Buildings

.5 Section 03 41 00 – Plant- Precast Structural Concrete

.6 Section 04 20 00 – Unit Masonry

.7 Section 07 21 13 – Board Insulation

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM).

.1 ASTM C126-99, Standard Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units.

.2 Brick Industry Association (BIA).

.1 Technical Note No. 20-2000, Cleaning Brick Masonry.

.3 Canadian Standards Association (CSA International).

.1 CAN/CSA A82-06: Fired Masonry Brick Made from Clay or Shale
.2 CAN/CSA-A165 SERIES-04 (R2009): Concrete Block Masonry Units
.3 CSA-A371-04 (R2009): Masonry Construction for Buildings
.4 CAN/CSA-A3001: Portland Cement
.5 CSA-A8-M88: Masonry Cement
.6 CSA S304.1-04: Design of Masonry Structures

1.3 SUBMITTALS

.1 Product Data.

.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.

.2 Manufacturer's Instructions.

.1 Submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

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

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.2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.3 For clay units, in addition to requirements set out in referenced CSA and ASTM Standards include data indicating initial rate of absorption for units proposed for use.

1.5 PRODUCT DELIVERY STORAGE AND HANDLING

.1 Ensure that materials are delivered to job site in dry condition.

.2 Except where wetting of units is specified, keep materials dry until use.

.3 Store under waterproof cover on pallets or plank platforms held off ground by means of plank or timber skids.

1.6 COLD WEATHER REQUIREMENTS

.1 Supplement Clause 5.15.2 of CSA A371 with the following

.1 Maintain temperature of mortar between 5°C and 50°C until used.

1.7 HOT WEATHER REQUIREMENTS

.1 As per Clause 6.7.4 of CSA A37.

1.8 PROTECTION

.1 Until completed and protected by flashings or other permanent construction, keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain. Use waterproof coverings draped 600 mm (min.) down each side of wall and securely anchored.

.2 Protect masonry and other work from marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.

.3 Provide temporary bracing of masonry work during and after erection until permanent lateral support is in place.

1.9 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site for recycling in accordance with Waste Management Plan.

1.10 JOB MOCK UP

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

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Part 2 Products

2.1 MANUFACTURED UNITS

.1 Clay Brick Veneer Units:

.1 All units: 57 mm x 90 mm x 290 mm (HxDxL) Norman in a smooth finish as manufactured by:

.1 Brampton Brick, Brampton, ON, tel. (800) 462-7425.

.2 Canada Brick (prev. Meridian Brick), tel. (800) 263-6229

.3 I.X.L. Building Products, Mississauga, ON L5T 2C9 (905) 565-0886

.2 **Masonry Veneer 'A'** (Colour **– Dark Grey**)**:**

.1 Brampton Brick 'Sioux City Brick' – Colour EBONITE SMOOTH

.2 Canada Brick 'Canada Architectural Series' - Colour IRONSTONE

.3 I.X.L. - Hebron - Colour OPUS

.4 Thames Valley Brick & Tile – Colour MANGANESE IRONSPOT *(Velour)*

.3 All units are to be manufactured from single continuous run to ensure minimum colour and texture variations.

.4 Hollow core units may be used. Provide solid units where required for corners and edges.

.5 Install in a one-third lapped running bond pattern.

.2 Concrete Brick Veneer Units:

.1 All units: 90 mm x 90 mm x 390 mm (HxDxL) in a smooth finish as manufactured by:

.1 Brampton Brick, Brampton, ON, tel. (800) 462-7425.

.2 Day & Campbell, Hamilton, ON, tel.: (905) 385-5315

.3 Richvale York Block Inc., Toronto, tel (877) 792-5625

.2 **Masonry Veneer 'B'** (Colour **- Light Grey-White**)**:**

.1 Brampton Brick 'Finesse Series – Colour POLAR WHITE *(Suave)*

.2 Day & Campbell 'Modern Masonry Architectural' – Colour CAMEO WHITE #200 *(Honed)*

.3 Richvale York 'Cambridge Series' – Colour WELLINGTON *(Ground)*

.3 All units are to be manufactured from single continuous run to ensure minimum colour and texture variations.

.4 Provide solid units where required for corners and edges.

.3 Pre-cast Concrete Sills (Colour – Natural Grey):

.1 All units: 90 mm x 140 mm x 5380 mm (HxDxL) and 90 mm x 140 mm x 1800 mm (HxDxL) as illustrated on drawings and manufactured by:

.4 Brampton Brick, Brampton, ON, tel. (800) 462-7425.

.5 Day & Campbell, Hamilton, ON, tel.: (905) 385-5315

.6 Richvale York Block Inc., Toronto, tel (877) 792-5625

.2 Locations: at all locations shown on drawings.

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.2 Portland Cement:

.1 To CAN/CSA-A3001.

.3 Masonry Cement:

.1 To CAN/CSA A8.

.4 Hydrated Lime:

.1 To ASTMC207-74.

.5 Aggregate:

.1 To CSA A82.56-M1976.

.6 Water:

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

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

.8 Bolts and Anchors: To CAN3-A370.

.9 Mortar:

.1 Generally: Use materials only as specified in CSA A179. Ensure that weather and aggregate used in mortar, other than in walls buried in earth, will not cause efflorescence.

.2 Bonding Agent**:** Acrylic latex type by Sternson Limited, W.R. Meadows or Thoro Building Products. Use for all mortar except clay brick.

.3 Mixes: Mix mortars as specified in CSA A179 using the Proportion Specification. Add bonding agent in accordance with manufacturer's instructions.

.4 Mortar Types:

.1 For masonry walls in contact with earth and bedding for bearing plates and lintels: Mortar Type "S".

.2 For load-bearing walls: Mortar Type "S".

.3 For clay brick: Mortar Type "N" (1:1:6) premixed "Betomix 1-1-6" Type "S" portland cement hydrated lime as supplied by Daubois Inc., Jiffy Mortar Systems. Mix on site with sand and water.

.4 For all other (non-structural) masonry walls, use regular Type "N" mortar.

.5 Colouring Additive: A mineral-oxide pigment, harmless to mortar set and strength, shall be provided. Colour shall be one (1) colour per masonry unit type, as selected by the Consultant. Dark grey bricks to have dark grey mortar colour additive.

.6 Grout: To CSA A179 Table 3.

.10 Mortar Dropping Control Device: "Mortar Net" manufactured by Mortar Net USA (Telephone: 1-800-664-6638).

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.11 Weepholes**:** 90 mm x 90 mm x 10 mm purpose made PVC, designed to drain cavities and with mesh to prevent insects from entering. Colour to be chosen by Architect from manufacturer's full range.

.12 Date Stone: Date stone to be 390 x 390 x 90 deep solid limestone. Font: Technic Lite, 100mm high. Beveled edges. Polish finish. Location to be determined by Architect.

.13 Veneer Ties: Fero slotted block tie (Type II) c/w V-Tie manufactured from 4.76 mm diameter wire conforming to CSA Standard G30.3, hot dipped galvanized to ASTM A153.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 WORKMANSHIP

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

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

3.3 TOLERANCES

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

3.4 EXPOSED MASONRY

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

.2 Parging on the face of exposed masonry units will be rejected.

3.5 JOINTING

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

3.6 WEEPHOLES

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

3.7 JOINING OF WORK

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

3.8 CUTTING

.1 Cut out neatly for electrical switches, outlet boxes, and other recessed or built-in objects.

.2 Make cuts straight, clean, and free from uneven edges. Use masonry saw where necessary.

3.9 BUILDING-IN

.1 Build in items required to be built into masonry by other trades.

.2 Prevent displacement of built-in items during construction. Check for plumbness, alignment, and correctness of position, as work progresses.

.3 Brace door jambs to maintain plumbness. Fill door frame with concrete.

3.10 WETTING OF UNITS

.1 Except during winter, wet units having an initial rate of absorption exceeding 1g/min/100mm2; wet to uniform degree of saturation, to 24 hours before laying, and do not lay until surface is dry.

.2 Similarly, wet tops of walls built of units qualifying for wetting, when recommencing work on such walls.

3.11 SUPPORT OF LOADS

.1 Except where drawing requirements are more stringent, comply with Clause 6.3 of CSA S304.1.

.2 Where concrete fill is used in lieu of solid units, use minimum 25 MPa concrete to Section 03 30 00.

.3 Install building paper below voids to be filled with concrete; keep paper 25 mm back from faces of units.

3.12 PROVISION FOR MOVEMENT

.1 Leave 5 mm space below shelf angles.

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

3.13 LINTELS

.1 Install steel lintels above windows, doors and all mechanical and electrical as shown on structural drawings. Centre over opening width.

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.2 Install loose steel lintels supplied by Section 05 12 23. Centre lintel over opening width. Minimum 150 mm solid bearing each end.

.3 Lintels over 2000 mm span to be complete with bearing plate and anchors each end.

.4 Bridge openings less than 450 mm wide with 6 mm thick mild steel plate lintels, bearing minimum 100 mm on each side of opening and set on dry pack grout. Width of plate to be equal to the wall thickness less 25 mm.

.5 Install precast concrete lintels supplied under Section 03 30 00.

3.14 CONTROL AND EXPANSION JOINTS

.1 Except as noted following, control joints required at maximum of 6000 mm o.c. in continuous walls having no openings, intersections or column locations. Refer to elevations for locations on exterior walls and advise Consultant of variances prior to executing the work. Control joints are not shown for clarity on the drawings for interior walls. If in doubt, request assistance from the Consultant.

.2 At doorway locations, unless indicated otherwise on elevation drawings, use one side of doorway beyond lintel. Use building paper to prevent that end of lintel to bond.

.3 Use standard block with concrete filled end core to form key. Line one side of core with building paper before filling core to prevent bonding. Complete vertical separation, full height and thickness of wall are required.

.4 Stop masonry reinforcing at each side of the joints. Caulking specified in Section 07 92 10 – Joint Sealers.

.5 At expansion joints in brick and veneer, install Rapid Expansion joint DA 2015, to leave vertical joint free of mortar to allow for horizontal expansion.

3.15 INSPECTION & TESTING

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

3.16 CLEANING

.1 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.

.2 On a weekly basis and at completion of work remove all debris, cut blocks and bricks, and mortar droppings.

.3 Power wash or brush exterior masonry surfaces at completion of work.

.1 Soft, clean cloths.

.4 Clean concrete brick masonry as work progresses.

.1 Allow mortar droppings on masonry to partially dry then remove by means of trowel, followed by rubbing lightly with small piece of veneer and finally by brushing.

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

END OF SECTION

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PART 1 - GENERAL

1.1 General Requirements

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

1.2 Work In Other Sections

.1 Related Work Specified in Other Sections

Section 03 30 00	:	Cast-in-Place Concrete
Section 03 40 00	:	Precast Hollow Core Slabs
Section 04 20 00	:	Unit Masonry
Section 05 30 00	:	Metal Decking
Section 05 50 00	:	Miscellaneous Metal
Section 07 81 00	:	Applied Fireproofing
Section 08 11 14	:	Metal Doors and Frames
Section 09 91 22	:	Painting

.2 Products Supplied Under Work of this Section

and Installed Under Work of Other Sections

Section 03 30 00	:	To install anchor bolts and loose bearings plates

1.3 Reference Standards

CSA S16-19: Design of Steel Structures
CSA W59-18: Welded Steel Construction (Metal Arc Welding)
CSA G40.20-13 (R2018): General Requirements for Rolled or Welded Structural Quality Steel
CSA G40.21-13 (R2018): Structural Quality Steel
CSA W48-14: Filler Metals and Allied Materials for Metal Arc Welding
CAN/CSA G164-18: Hot Dip Galvanizing of Irregularly Shaped Articles
ASTM F3125/F3125M-15a: Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength

The Ontario Building Code, (O. Reg. 332/12)

.1 Do structural steel work in accordance with CAN/CSA-S16.14 latest edition except where specified otherwise.

.2 Do welding in accordance with CSA W59-13 except where specified otherwise.

.3 All work shall conform to National Building Code and any other Provincial or local application, provided that, in any case or conflict or discrepancy, the more stringent requirements shall apply and govern.

.4 CAN/CSA-S16.1 latest edition, "Limited States Design of Steel Structures" shall be the basis for design and construction of all structural steel on this project.

1.4 **Source Quality Control**

.1 Submit 2 certified copies of mill reports covering chemical and physical properties of steel used in this work.

.2 Submit affidavits from the manufacturer or fabricator that materials supplied comply with this Specification.

.3 At least one-third of the joists are to be fabricated and ready for delivery prior to calling the inspection company, thus limiting the number of visits required to three (3). All deficiencies are to be corrected prior to delivery.

.4 The Owner will appoint an independent inspection and testing company to ensure that the Work of this Section is performed in accordance with the Specifications. The cost of all inspections/testing shall be paid for from the cash allowance allocated for this in Section 01 45 23 - Allowances.

1.5 **Design of Details and Connections**

.1 Design details and connections in accordance with requirements of CAN/CSA-S16, latest edition, to resist forces, moments and shears indicated.

.2 For non-standard connections, submit sketches and design calculations stamped and signed by qualified professional Engineer registered in the Province of Ontario.

.3 For standard connections, select details from CISC Handbook of Steel Construction to ensure structural adequacy.

.4 Submit shop fabrication details stamped and signed by a qualified professional licensed in the Province of Ontario.

1.6 **Shop Drawings**

.1 Submit shop drawings in accordance with Section 01 33 00 Submittals.

.2 Indicate shop and erection details including cuts, copes, connections, holes, bolts and welds. Indicate welds by welding symbols defined in CSA-W59-18.

.3 Submit copy of erection drawings to the Consultant for review and reference.

.4 Submit a copy of stamped shop drawings for the cold formed steel, including all connections.

.5 Submit all weld procedures pertinent to the work prior to or along with the first submission of shop drawings, for subsequent review and acceptance by the Consultant.

1.7 **Storage and Handling**

.1 Handle all materials with the necessary care to prevent damage to fittings, finishes and alignments.

.2 Materials damaged due to faulty storage or handling shall be repaired or replaced, without additional expense to the Owner, all to the satisfaction of the Consultant.

.3 Replace promptly all items verified as received in a damaged condition.

1.8 **Examination**

.1 Examine surfaces with which Work is to be anchored or connected.

.2 Report to the Consultant, all unsatisfactory conditions likely to prevent or prejudice the proper installation of the work.

.3 Commencement of Work implies unconditional acceptance of substrate and surface and condition to which all members are to be anchored and secured.

1.9 **Quantity of Items**

.1 Where a component, device, item or part of material is referred to in the singular number, such reference shall mean as many as are required to complete the work

PART 2 - PRODUCTS

2.1 **Materials**

.1 Structural steel: to CAN/CSA-G40.21 Grade 350W for rolled sections and plates, Grade 350W for Hollow Structural sections.

.2 Anchor bolts: to CAN/CSA-G40.21, Grade 300W.

.3 Bolts, nuts and washers: to ASTM A325M.

.4 Welding materials: to CSA W48 Series.

.5 Shop paint primer: to CGSB 1-GP-40M. Refer to Formulas in Section 09900.

.6 Hot dip galvanizing: galvanize steel, where indicated, to CAN/CSA G164, minimum zinc coating of 600 g/m^2.

.7 Cold Formed Steel: to CSA S136

.8 Lintels: As required to complete all work as part of this project. Steel Lintels shall be approved over all openings including mechanical, electrical and architectural drawings and as shown on the drawings.

PART 3 - EXECUTION

3.1 Inspection and Co-ordination

.1 The Contractor shall field check all dimensions and elevations affecting his trade at the site. All discrepancies shall be reported to the Consultant before proceeding with the work.

.2 The Contractor shall report in writing all defects in the work prepared under other sections of the Specifications which will affect the work of this Section. Commencement of the work will imply acceptance of previously prepared work.

.3 Verify all requirements and dimensions of existing, proceeding and following Work before commencing fabrication.

3.2 Fabrication

.1 Fabricate structural steel, as indicated, in accordance with CAN/CSA-S16.1 and in accordance only with reviewed and stamped shop drawings.

.2 Supply fastenings, anchors and accessories required for fabrication and erection of Work. Make exposed metal fastenings and accessories of same material, texture, colour and finish as base metal on which they occur unless otherwise shown or specified. Keep exposed fastenings to absolute minimum and inconspicuous, spacing them evenly and setting them out neatly. Make fastenings of permanent type.

.3 Beams shall be rolled sections, combined as noted. Beam connections shall be standard double angle clip type, developing full strength of all the members.

.4 Clean all steel members by scraping, wire brushing or other effective means to remove loose mill scale, rust, oil or other foreign matter. Surfaces shall be thoroughly dry before painting.

.5 Apply one (1) shop coat of paint, conforming to CGSB 1-GP-40D primer, to all surfaces except surfaces to be in contact with or encased in concrete and surfaces and edges to be field welded or high tension bolted.

.6 Apply two (2) shop coats of paint, conforming to CGSB 1-GP-40D primer to all surfaces which will be inaccessible after assembling. Touch up all bolts, welds and surfaces of connecting members damaged during construction.

.7 All steel exposed to weather including steel lintels in exterior walls shall be hot dip galvanized.

.8 All members shall be assembled true and without twists or open joints. Shop connections shall be welded.

.9 High tensile bolted connections, where used, shall be in accordance with CAN/CSA-S16 latest edition. Holes shall be accurately spaced and of size to allow insertion of bolts of 1.5 mm (1/16") diameter less than hole diameter.

.10 Welding shall be executed so as to avoid damage or distortion to the work. Welds on exterior work shall be continuous to provide proper weathering; all welds on exposed finished work shall be ground smooth.

.11 There shall be no burning of holes in members in the shop or field without the permission of the Consultant. If consent is given, burned members shall be finished to an acceptable appearance.

.12 Mark materials in accordance with CAN/CSA-G40. Do not use die stamping. If steel is to be left in unpainted condition, place marking at locations not visible from exterior after erection. Shop mark bearing assemblies and splices for fit and match.

3.3 **Erection**

.1 Erect structural steel as indicated in accordance with CAN/CSA-S16 latest edition and in accordance with shop drawings.

.2 Continuously seal members by continuous welds where indicated. Grind smooth.

.3 Obtain written permission of the Consultant prior to field cutting or altering of structural members.

.4 Touch up shop primer to bolts, rivets, welds and burned or scratched surfaces at completion of erection.

.5 Erection of structural steel on site shall be properly co-ordinated by the Contractor with the work of all other trades. Co-ordinate the work to incorporate all electrical appurtenances, and protect same from damage during erection.

.6 Bolted assemblies for base connections shall not be tightened until at least 72 hours after the grout pad has been placed.

.7 All bolts shall be tightened by using a suitable torque wrench, torquing as required in CAN/CSA-S16 latest edition.

.8 Damaged work will not be accepted on site. Damaged work arriving on site will be returned to the shop for repair and/or refinishing.

.9 All temporary supports shall be attached to the work in such a manner so as not to mar the surface on the finished section.

.10 All steel shall be set accurately to the lines and elevations shown on the Drawings.

.11 Assume full responsibility for the correct plumbing, alignment and setting of all members; set all guys, braces, etc., necessary to maintain the structure during erection, and until such time as the work of other trades is in place.

3.4 **Open Web Steel Joists**

.1 Minimum bearing, unless otherwise detailed, shall be 63.5mm (2½") on steel and 100mm (4") on concrete or masonry. Where joists span from one side only they shall bear directly over centre of beam unless otherwise shown. Open web steel joists and their design shall conform to CAN/CSA-S16 latest edition.

.2 Shoes are to be designed so that the allowable bearing pressure on the supporting material is not exceeded.

.3 Provide bridging in accordance with CAN/CSA S16 latest edition.

.4 Extend and if necessary, deepen top chords of joists with cantilevered ends to carry the specified loading indicated or implied.

END OF SECTION 05 10 00

PART 1 – GENERAL

1.1 General Requirements

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

1.2 Work in Other Sections

Related Work Specified in Other Sections

Section 05 10 00	:	Structural Metal Framing
Section 05 50 00	:	Miscellaneous Metal
Section 06 10 00	:	Rough Carpentry
Division 7	:	Thermal and Moisture Protection

1.3 Reference Standards

CSA S136S1:19: North American Specification for the Design of Cold-Formed Steel Structural Members.
CSA W59-13: Welded Steel Construction (Metal Arc Welding)
CSA W47.1:09 (R2019): Certification of Companies for Fusion Welding of Steel
CSA W48-18: Filler Metals and Allied Materials for Metal Arc Welding

.1 Work of this section shall conform to CSA-S136-16 and to meet the specified requirements of the Canadian Sheet Steel Building Institute "Standard for Steel Roof Deck" and "Standard for Steel Floor Deck".

.2 Welding shall meet requirements of CSA-W59-13 and undertaken to meet requirements of CSA-W47.1:09 (R2019) and CSA-W55.3-08 (R2018)

1.4 Design Criteria

.1 Metal deck shall be of suitable design and thickness to safely support the indicated live and dead loading over the spans shown without exceeding the maximum working stress of 143.8 MPa.

.2 Deflection under live load only shall be not more than 1/240th of span for roof units, and 1/360th for floor units.

.3 Metal roof deck and composite concrete slab sections shall have a depth not less than 38mm (1½").

.4 Metal deck units shall span over three or more supports except where structural steel layout does not permit.

1.5 Qualifications

Execute the work of this Section only by a Subcontractor who has adequate plant, equipment and skilled tradesmen, and is known to have been responsible for satisfactory work similar to that specified during a period of at least five years.

1.6 **Shop Drawings**

Submit shop drawings in accordance with Section 01 33 00 Submittals.

1.7 **Product Handling**

.1 Deliver materials as required for erection. If storage becomes necessary stack bundles of steel deck on wood blocking clear of ground and tilted slightly so as to avoid water lying on the material. Storage area to be as close to the building as is practical.

.2 Protect deck against damage. Damaged materials shall be replaced by this Contractor without extra cost to the Owner.

.3 Protect the work of other trades from damage during erection, welding, and cutting operations, and make good any such damage where caused.

PART 2 - PRODUCTS

2.1 **Materials**

.1 Metal roof deck shall be fabricated from galvalume coated steel. Heavy AZ180 for deck surfaces within the arena portions and standard AZ150 for the remainder of the steel deck conforming to ASTM A792/A792M-10(2015).

.2 Metal roof deck for all roof areas except noted below shall be fabricated from zinc-coated steel conforming to A.S.T.M. designation A446-G5T Grade 'A' minimum steel, with a minimum decimal core thickness of 0.76 mm and a zinc coating class of G90.

.3 Incombustible, non-hygroscopic glass fibre insulation, with a density of 1.1 lbs. per cubic foot, shaped to completely fill all flutes on the top side of acoustic deck.

.4 Metal deck shall be manufactured by Robertson, Vic-West, or Canadian Metal Rolling Mills.

2.2 **Floor Deck Accessories**

.1 Cover plates shall be of the same material gauge as decking or of greater thickness, if required. Closures shall be tight to prevent leakage of concrete. Form to match deck contour, minimum 6 inches wide.

.2 Column flashing shall be provided to close spaces between floor units and columns, weld in place.

.3 End closures shall be provided to close open ends of cells at columns, walls and openings in floors.

.4 Closures shall be provided for closing voids between cells over partitions that are perpendicular to direction of cells. Closures may be rubber or steel metal. Closures above fire-resistant partitions shall be sheet metal at both sides of partition. Fibrous glass insulation shall fill spaces between pair of closures.

.5 Provide angles and other steel members not designated as structural steel or miscellaneous metal work, but which are required for a complete and rigid deck installation.

PART 3 - EXECUTION

3.1 Installation

.1 The metal roof units shall be placed on the supporting steel framework and adjusted to final position before being permanently fastened. Each unit shall be brought to proper bearing on the supporting structure. The roof units shall be placed in straight alignment for the entire length of run of cells and with close registration of the cells of one unit with those of abutting units.

.2 Align deck end to end to provide accurate fit with corresponding sections, with sections parallel, level and straight. All laps over supporting members shall be uniform and a minimum of 100 mm length, countersunk to provide proper nesting for deck thickness greater than 1.5 mm. Touch up all welds and fasteners with paint.

.3 Deck units shall be securely fastened to the steel framework at the ends of the units and at intermediate supports by welds not less than 20 mm diameter, spaced not more than 300 mm along the steel frame or in other manner approved by the Consultant. Where two units abut, each unit shall be welded to the steel frame. Welds shall be free of sharp points or edges.

.4 All welds for roof deck shall be made so that the finished deck surface is capable of sustaining an upward force of 1.44 kN/m^2.

.5 The side laps of adjacent units shall be fastened between supports by clinching at intervals not exceeding 600 mm, or by 25 mm long welds at intervals not exceeding 1 m.

.6 Damaged, bent or dished sheets shall be rejected and removed from the site.

.7 Install closures running parallel to flutes of deck to stiffen deck at roof edges.

3.2 Openings

.1 For openings 150 mm to 450 mm in diameter or square, provide not less than 50 mm x 50 mm x 6 mm angle reinforcing to frame across holes in direction perpendicular to flutes, and weld at least two flutes on each set of holes.

.2 Do not cut openings until final sizes have been verified on shop drawings or until steel framing provided under other sections of work is in place.

.3 For openings larger than 450mm in diameter or square, refer to Structural, Mechanical and Architectural drawings for sizes and locations.

3.3 Touch Up and Replacement

.1 Touch up adjacent primed surfaces burned, scratched or otherwise damaged during erection with prime paint to match shop coat, when erection is completed.

.2 Paint over bare areas on galvanized surfaces and welds with zinc rich paint.

.3 Replace dented, punctured or weld perforated deck where exposed to view.

END OF SECTION 05 30 00

PART 1 - GENERAL

1.1 General Requirements

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

1.2 Work In Other Sections

.1 Related Work Specified in Other Sections

Section 03 30 00	:	Cast-In-Place Concrete
Section 03 40 00	:	Precast Hollow Core Slabs
Section 04 20 00	:	Unit Masonry
Section 05 10 00	:	Structural Metal Framing
Section 05 30 00	:	Metal Decking
Section 05 50 00	:	Miscellaneous Metal
Section 06 40 00	:	Architectural Woodwork
Division 7	:	Thermal and Moisture Protection
Division 8	:	Openings
Section 09 21 16	:	Gypsum Board Assemblies
Section 09 51 13	:	Acoustic Panel Ceilings
Section 09 84 10	:	Acoustical Wall Treatment
Division 15	:	Mechanical
Division 16	:	Electrical

1.3 Scope of Work

.1 Work of this Section shall include the supply and installation of all load bearing and non - load bearing steel studs including all fasteners, bridging and bracing.

1.4 Qualifications

.1 Execute Work of this Section only by a Subcontractor who has adequate plant, equipment and skilled tradesmen to perform it expeditiously, and is known to have been responsible for satisfactory applications similar to that specified during a period of at least five (5) years.

1.5 Product Handling

.1 Package all materials and store off the ground and covered until ready for use.

1.6 Submittals

.1 Submit Shop Drawings to Consultant for approval prior to erection of all load bearing steel studs in accordance with Section 01 33 00 - Submittals.

PART 2 - PRODUCTS

2.1 **Materials**

.1 Load-bearing, Wind-Loaded and Non-loadbearing Channels: to ASTM C645-81, 3_" (92mm) and/or 4" (102.0mm) stud size, roll formed from electrogalvanized steel sheet, for screw attachment of composite building panel. Knock-out service holes at 460mm centres. Deflection for 25 p.s.f. horizontal load to be limited to $^{L}/360$mm. Refer to Structural Drawings for extent of loadbearing steel stud walls. Include all bridging necessary for the heights shown.

.2 Floor and ceiling tracks: to ASTM C645-81, in widths to suit stud sizes, 38mm flange height.

.3 Furring channels: to CSA A82.30-M1980, 38mm and 19mm.

PART 3 - EXECUTION

3.1 **Erection**

.1 Align partition tracks at floor, steel deck and framing, and ceilings, and secure at 600mm o.c. maximum.

.2 Place studs vertically at 600mm o.c. and not more than 50mm from abutting walls, and at each side of openings and corners. Position studs in tracks at floor and ceiling. Cross brace steel studs as required to provide rigid installation to manufacturer's instructions.

.3 Erect metal studding to tolerance of 3mm in 3000mm.

.4 Attach studs to bottom track and ceiling track using screws. Secure and brace back to structure as required to prevent movement.

.5 Attach gypsum board and/or exterior sheathing where noted, securely with tight fitting joints.

.6 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.

.7 Erect track at head of door opening to accommodate intermediate studs. Secure track to studs at each end. Install intermediate studs above opening in same manner and spacing as wall studs.

.8 Install wood blocking securely anchored to studs for anchorage of fixtures, accessories, brackets, etc. as shown on drawings.

END OF SECTION 05 40 10

PART 1 - GENERAL

General Requirements

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

Work in Other Sections

Related Work Specified in Other Sections

Section 03 30 00	:	Cast-in-Place Concrete
Section 04 20 00	:	Unit Masonry
Section 05 10 00	:	Structural Metal Framing
Section 06 10 11	:	Rough Carpentry
Section 06 40 00	:	Architectural Woodwork
Section 07 21 13	:	Board Insulation
Division 8	:	Openings
Section 09 91 22	:	Painting

Products Supplied Under Work of This Section
and Installed Under Work of Other Sections

Section 03 30 00	:	To install anchors, bolts and inserts
Section 04 20 00	:	To install anchors, bolts and inserts
Section 06 10 11	:	To install items included in work of this Section as specified

1.1 **Reference Standards**

CSA S16-14 (R2019): Design of Steel Structures
CSA W59-13: Welded Steel Construction (Metal Arc Welding)
G40.20-13 (R2018): General Requirements for Rolled or Welded Structural Quality Steel
G40.21-13 (R2018): Structural Quality Steel
CSA W47.1:19 Certification of Companies for Fusion Welding of Steel
W48-18: Filler Metals and Allied Materials for Metal Arc Welding
CAN/CSA G164-18: Hot Dip Galvanizing of Irregularly Shaped Articles
The Ontario Building Code, (O. Reg. 350/12)

1.2 **Qualifications**

.1 Execute the work of this Section only by a Subcontractor who has adequate plant, equipment and skilled tradesmen, and is known to have been responsible for satisfactory work similar to that specified during a period of at least five years.

1.3 **Shop Drawings**

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittals.
.2 Indicate connections, details, dimensions, and all other data as required to accommodate installation.

1.4 **Product Handling**

.1 Deliver materials as required for erection. If storage becomes necessary stack materials on wood blocking clear of ground and tilted slightly so as to avoid water lying on the material. Storage area to be as close to the building as is practical. Protect finished surfaces from damage or rust.

.2 Damaged materials shall be replaced by this Contractor without extra cost to the Owner.

PART 2 - PRODUCTS

2.1 **Materials**

.1 Steel Sections and Plates: to CAN/CSA-G40.21, Grade 350W.

.2 Hollow Structural Sections: to CAN/CSA-G40.21 Grade 350W.

.3 Welded Wire Fabric: WWF 50 x 50 x MW11.1 x MW11.1.

.4 Welding Materials: to CSA W48 Series.

.5 Hot rolled structural steel shapes: to CAN/CSA-G40.21, Grade 350W.

.6 Galvanizing: hot dipped galvanizing with zinc coating 600 g/m^2 to CAN/CSA-G164-M92.

.7 Stainless Steel: bars and rods to ASI Type 316, No. 4 finish.

.8 Anchors: strap type or approved self-drilling type minimum 3 per member.

.9 Fasteners: as shown on drawings and as required for secure anchorage.

PART 3 - EXECUTION

3.1 **Fabrication**

.1 The jointing in built-up sections shall be made with hairline joints in the least conspicuous location and manner. All work shall be assembled in the most substantial manner and reinforced where necessary with similar fastenings. All screws shall be countersunk unless otherwise noted.

.2 Provide positive anchorage to the building structure by means of through bolts, welding, or approved inserts cast into the building structure.

.3 Apply a coat of primer to all interior ferrous metals before leaving the factory unless noted otherwise. Touch up any galvanized surfaces damaged after erection with galvafroid paint as approved by the Consultant.

.4 All items shall be fabricated, finished and assembled in the shop as much as possible, consistent with the size and shipping problems. Assembly on the job shall be kept to a minimum.

.5 All welds, unless noted specifically otherwise, are to be continuous where exposed and ground smooth.

3.2 **Schedule of Fabrication**

.1 Generally: Ensure that all Drawings and Specification Sections, including those for architectural, structural, mechanical and electrical work, are consulted to establish the limits of work included in this Section.

.2 Columns, Plates and Anchor Bolts:

: Steel of sizes shown on structural drawings, details.
: Finish: prime painted.

.3 Lintels:

: As required to complete all work as part of this project. Steel lintels shall be provided over all openings including Mechanical, Electrical and Architectural Drawings and as shown on the drawings.

: Steel of sizes shown on Lintel Schedule, Structural Drawings.

: Provide concealed angle clips welded to lintels and anchored with bolts at lintel supports.

: Finish: Prime paint for interior and galvanized for exterior locations.

: Finish: Prime paint for interior and prime painted for exterior locations.

: These items refer to components which are not normally supplied by the manufacturer but required to secure the Miscellaneous Specialty items.

.4 Miscellaneous Channels and Clip Angles:

: Provide all miscellaneous fastenings required, including supports, anchor bolts and other items as required and indicated to complete all work as part of this project.

.5 Lateral Support:

: Install deflection space and lateral support for non-load-bearing masonry walls and partitions in accordance with specified requirements of CSA-A371-94 and CSA-S304.1-94.

: Angles to be per details on the structural drawings.

: Finish: Prime paint.

.6 Fixed Steel Bollards:
: Schedule 40 steel pipe, quantity, sizes and lengths as detailed on the drawings.

3.3 Erection

.1 Erect work in accordance with shop drawings and in co-ordination with trades whose work relates to this Section.

.2 Erect work plumb, straight, square and accurately fitted with tight joints at intersections.

.3 Where possible install work in one continuous piece.

.4 Anchor all components to structure, walls, floors as required with weld or other methods of anchorage approved by the Consultant.

3.4 Touch-up and Replacement

.1 Touch up adjacent primed surfaces burned, scratched or otherwise damaged during erection with prime paint, to match shopcoat, or galvafroid for galvanized when erection is completed.

.2 Paint over bare areas on galvanized surfaces and welds with zinc rich paint.

.3 Replace damaged or unacceptable materials indicated by the Consultants.

END OF SECTION 05 50 00

Part 1 General

1.1 RELATED SECTIONS

.1 Section 03 10 00 – Concrete Forms and Accessories.

.2 Section 08 11 14- Steel Doors and Frames.

.3 Section 07 50 13 – Common Work Results for Roofing*

.4 Section 07 50 16 – Rough Carpentry for Roofing *coordinate responsibilities with this Section and Work Division Table in Section 07 50 13.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA B111-[1974(R1998)], Wire Nails, Spikes and Staples.
.2 CAN/CSA-G164-[M92(R1998)], Hot Dip Galvanizing of Irregularly Shaped Articles.
.3 CSA O121-[M1978(R1998)], Douglas Fir Plywood.
.4 CAN/CSA-O141-[91(R1999)], Softwood Lumber.
.5 CSA O151-[M1978(R1998)], Canadian Softwood Plywood.
.6 CAN/CSA-O325.0-[92(R1998)], Construction Sheathing.

.2 National Lumber Grades Authority (NLGA)

.1 Standard Grading Rules for Canadian Lumber [2000].

1.3 QUALITY ASSURANCE

.1 Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.2 Plywood identification: by grade mark in accordance with applicable CSA standards.

.3 Plywood, OSB and wood based composite panel construction sheathing identification: by grademark in accordance with applicable CSA standards.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.2 Divert unused wood materials from landfill to recycling, reuse, composting facility approved by Consultant.

.3 Do not dispose of preservative treated wood through incineration.

.4 Do not dispose of preservative treated wood with materials destined for recycling or reuse.

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.5 Dispose of treated wood, end pieces, wood scraps and sawdust at sanitary landfill approved by Consultant.

.6 Dispose of unused wood preservative material at official hazardous material collections site approved by Consultant.

.7 Do not dispose of unused preservative material into sewer system, into streams, lakes, onto ground or in other locations where they will pose health or environmental hazard.

Part 2 Products

2.1 LUMBER MATERIAL

.1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% or less in accordance with following standards:

.1 CAN/CSA-O141.

.2 NLGA Standard Grading Rules for Canadian Lumber.

.2 Furring, blocking, nailing strips, grounds, rough bucks, cants, curbs, fascia backing and sleepers:

.1 Douglas fir Graded 122-C, construction or No. 2 Pine, pressure treated in accordance with CSA 080M.

.2 Board sizes: "Standard" or better grade.

.3 Dimension sizes: "Standard" light framing or better grade.

.4 Post and timbers sizes: "Standard" or better grade.

2.2 PANEL MATERIALS

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

2.3 ACCESSORIES

.1 Nails, spikes, staples, screws, bolts anchors lag screws, special fastening devices and supports required for erection of all carpentry components: to CSA B111. Use galvanized components where exposed to exterior atmosphere.

2.4 FINISHES

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

Part 3 Execution

3.1 GENERAL

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

3.2 PREPARATION

.1 Do all wood framing in accordance with the Ontario Building Code and Can3-086M-1983.

.2 Machine dressed work shall be slow fed using sharp cutters and finished members shall be free from drag, feathers, slivers or roughness of any kind.

.3 Frame materials with tight joints rigidly held in place.

.4 Design construction methods for expansion and contraction of the materials.

.5 Erect work plumb, level, square and to required lines.

.6 Be responsible for methods of construction for ensuring that materials are rigidly and securely attached and will not be loosened by the work of other trades.

3.3 FURRING AND BLOCKING

.1 Supply and install furring and blocking, required.

.2 Align and plumb faces of furring and blocking to tolerance of 1:600.

3.4 ROUGH BUCKS AND NAILERS

.1 Install wood bucks and nailers, as indicated, including wood bucks and linings around frames for doors and windows.

.2 Except where indicated, otherwise, use material at least 38 mm thick secured with 9 mm bolts located within 300 mm from ends of members and uniformly spaced at 1200 mm between.

.3 Countersink bolts where necessary to provide clearance for other work.

3.5 ROOF FASCIAS, CANTS, NAILERS CURBS

.1 Install wood cants, fascia backing, nailers, curbs and other wood supports for roofing, sheet metal fork, roof mounted equipment.

.2 Secure with galvanized 9 mm bolts, where indicated, galvanized nails elsewhere. Locate fastenings within 300 mm from ends and uniformly spaced between. Space bolts at 1200 mm and nails at 600 mm centres, except where indicated otherwise.

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.3 Staple vapour retardant sheet strip to underside of nailers before installation. Apply strip continuous with 200 mm overlap at joints, free of wrinkles and tears, with at least 200 mm exposed for overlap on roof deck.

.4 Install wood nailers for roof hoppers, dressed, tapered and recessed slightly below top surface of roof insulation.

3.6 SUPPORTS FOR MECHANICAL UNITS

.1 Performed by Section 07 50 16. Refer to Section 07 50 13 for work division.

3.7 PRESSURE TREATED WOOD

.1 Use wood pressure treated in accordance with CSA 080M for all wood members in contact with exterior walls and roofs.

.2 Re-treat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation.

3.8 GARBAGE ENCLOSURE DOORS

.1 Supply and install 38 mm x 140 mm pressure treated wood slats to front of garbage enclosure doors.

.2 Fasten each slat to steel frames with 2 screws at top, bottom and at diagonal bracing.

3.9 INSTALLATION OF HOLLOW METAL FRAMES

.1 Set frames plumb and square in their exact location and at correct elevation. Firmly block and brace to prevent shifting. Shim up where required to ensure proper alignment dimensions from finished floor to head of frame. Install temporary wood spreaders at mid-height.

.2 Where pressed steel frames are installed in concrete walls, secure frames to concrete using lead expansion shields and anchor bolts through pipe sleeves. Perform drilling of concrete as required. Fill recessed bolt heads flush to frame face with approved metal filler and sand smooth.

.3 Install fire rated door frames in accordance with requirements of National Fire Code Volume 4, produced by The National Fire Protection Association (NFPA 80).

3.10 GENERAL

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

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3.11 ERECTION

.1 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.

.2 Countersink bolts where necessary to provide clearance for other work.

3.12 SCHEDULES

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

END OF SECTION

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Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 06 10 11 – Rough Carpentry.

.3 Section 06 47 00 – Plastic Laminates.

.4 Section 08 80 50 – Glazing.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI A208.1-[99], Particleboard.

.2 ANSI A208.2-[94], Medium Density Fiberboard (MDF).

.2 American Society for Testing and Materials (ASTM)

.1 ASTM E1333-[96], Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates From Wood Products Using a Large Chamber.

.2 ASTM D2832-[92(R1999)], Standard Guide for Determining Volatile and Non-volatile Content of Paint and Related Coatings.

.3 ASTM D5116-[97], Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products.

.3 Architectural Woodwork Manufacturers Association of Canada (AWMAC)

.1 AWMAC Quality Standards for Architectural Woodwork.

.4 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-71.20-[M88], Adhesive, Contact, Brushable.

.5 Canadian Standards Association (CSA)

.1 CSA B111-[74(R1998)], Wire Nails, Spikes and Staples.

.2 CSA O112.4-[M1977(R1999)], Standards for Wood Adhesives.

.3 CSA O112.5-Series-M-[1977(R1999)], Urea Resin Adhesives for Wood (Room- and High-Temperature Curing).

.4 CSA O112.7-Series M-[1977(R1999)], Resorcinol and Phenol-Resorcinol Resin Adhesives for Wood (Room- and Intermediate-Temperature Curing).

.5 CSA O115-[M1982(R2001)], Hardwood and Decorative Plywood.

.6 CSA O121-[M89(R1998)], Douglas Fir Plywood.

.7 CAN/CSA O141-[91R1999], Softwood Lumber.

.8 CSA O151-[M1978(R1998)], Softwood Plywood.

.9 CSA O153-[M1980(R1998)], Poplar Plywood.

□

.10 CSA Z760-[94], Life Cycle Assessment.

.6 Environmental Choice Program (EPC)

.1 ECP-44-[92], Adhesives.

.2 ECP-45-[92], Sealants and Caulking Compounds.

.3 ECP-76-[98], Surface Coatings.

.7 International Organization for Standardization (ISO)

.1 ISO 14040-[97], Environmental Management-Life Cycle Assessment - Principles and Framework.

.2 ISO 14041-[98], Environmental Management-Life Cycle Assessment - Goal and Scope Definition and Inventory Analysis.

.8 National Electrical Manufacturers Association (NEMA)

.1 NEMA LD-3-[95].

.9 National Hardwood Lumber Association (NHLA)

.1 Rules for the Measurement and Inspection of Hardwood and Cypress [, January 1996].

.10 National Lumber Grades Authority (NLGA)

.1 Standard Grading Rules for Canadian Lumber [, 2000].

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate details of construction, profiles, jointing, fastening and other related details.

.1 Scales: profiles full size, details 1/2 full size.

.3 Indicate materials, thicknesses, finishes and hardware.

1.4 SAMPLES

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit duplicate samples: sample size 300 x 300 mm samples of each type of paneling laminate, melamine and each type of solid wood or plywood to receive stain or natural finish.

.3 Submit a typical prototype unit representative of the work of this section.

1.5 QUALIFICATION

.1 Millwork manufacturer to have not less than 5 years proven first class experience in institutional millwork, shall be a member of AWMAC or shall be able to provide a maintenance bond as specified.

□

1.6 GUARANTEE

.1 This architectural woodworker shall furnish the owner with a two (2) year AWMAC Guarantee Certificate, or an equivalent maintenance bond, to the full value of the architectural woodwork sub-contract, certifying that the architectural woodwork has been manufactured and/or installed in accordance with the standards incorporated in the AWMAC Quality Standards Manual, (edition in effect at time of tender). Those providing the maintenance bond, instead of the Guarantee Certificate, to submit a letter from their insurer stating that they will provide the bond. A copy of this letter to be attached to their tenders. The Guarantee shall cover replacing and/or refinishing to make good any defects in architectural woodwork due to faulty workmanship or defective materials supplied by this architectural woodworker, which appear during a two (2) year period following the date of substantial completion of the project.

1.7 INSPECTION

.1 Architectural woodwork shall be manufactured and/or installed to the specified AWMAC Quality Standards and may be subject to an inspection at the plant and site by ainspector. Such inspection costs shall be paid from Cash Allowances. Shop drawings shall be submitted for review or approval before any work is commenced. Any work which does not meet AWMAC Quality Standards, as specified, shall be replaced by this architectural woodworker, at no additional cost to the owner and to the satisfaction of the consultant and the inspector.

1.8 DELIVERY, STORAGE, AND HANDLING

.1 Protect millwork against dampness and damage during and after delivery.

.2 Store millwork in ventilated areas, protected from extreme changes of temperature or humidity.

Part 2 Products

2.1 MATERIALS

.1 Softwood lumber: unless specified otherwise, S4S, moisture content 10 % or less for interior work in accordance with following standards:

.1 CAN/CSA-O141.

.2 NLGA Standard Grading Rules for Canadian Lumber.

.3 AWMAC premium grade, moisture content as specified.

.2 Hardwood lumber: moisture content 10% or less for interior work in accordance with following standards:

.1 National Hardwood Lumber Association (NHLA).

.2 AWMAC premium grade, moisture content as specified.

.3 Species: to be Maple unless otherwise noted.

□

.3 Hardwood plywood: to CSA O115, of thickness indicated, rotary cut face veneer, birch plywood, veneer core, No. 1 grade. Select veneers to provide book match veneer strips to be 240 mm wide minimum.

.1 Species: to be Birch, unless otherwise noted.

.4 Nails and staples: to CSA B111, galvanized for exterior work, interior high-humidity areas and for treated lumber; plain finish elsewhere. Use spiral thread nails except where specified elsewhere.

.5 Particle Board core: to CAN3-0188.1-M78, Grade R, 720 kg/m3 density in thicknesses indicated.

.6 Plywood core for shelving: to CSA 0120.

2.2 PLASTIC LAMINATE

.1 Refer to Section 06 47 00.

2.3 MELAMINE FACED PARTICLEBOARD

.1 To CAN3-0.188.1-M78, Grade "R" particleboard sanded faces, 13 mm, 16 mm, and 19 mm thickness, faced with laminated plastic. Melamine resin impregnated cover sheet with coloured and/or pattern paper inner layer. Thermally fuse to rigid particleboard substrate. Melamine faces shall be 8 mil thickness. Wood grain pattern to be chosen by Consultant from manufacturer's full range.

.1 Acceptable Material: Melamine faced particleboard as manufactured by Flakeboard, Formica or Arborite Division of Domtar Construction Materials Ltd., are of acceptable quality but colour/pattern requires approval prior to confirmation of full acceptance.

2.4 EDGE BANDING

.1 Solid polyvinyl chloride (PVC), 3 mm thickness x full width of panel edge, colour/pattern to match finished face of melamine panel or as selected by Consultant. All exposed edges of banding to be radiused to 2 mm radius after installation on panels. Submit sample of edge-banded panel with radiused edges to Consultant for approval prior to fabrication of architectural woodwork.

.1 Acceptable Material: Solid PVC edging as manufactured by "Woodtape" Edge-Banding.

.2 Acceptable Material: Solid PVC edging as manufactured by "Complast Inc."

.3 Provide solid hardwood edging, and plastic laminate edging where specified on AD drawings.

2.5 CABINET HARDWARE

.1 Furnish and install all hardware to custom casework as follows:

.1 Cupboard Doors - 19 mm thick.:

.1 Hinges 200 Series 110° Salice

	.2	Roller Catches	807N 2G (SgDr) Onward
	.3	Door Pulls	CBH235-3 1/2" C32D
	.4	Cupboard Locks	CB 250 or 255 double door dead bolt by Hafele (to eliminate use of elbow catches)

.2 Drawers - 19 mm thick.:

.1	Drawer Slides	"Accuride Slide" 3832-2G full extension with ball bearing rollers, 100lb. capacity
.2	Drawer Pulls	CBH235-3 1/2" C32D
.3	Drawer Locks	8703 - 14a National

.3 Shelving:

(Note: AD drawings may graphically represent and note holes for adjustable shelving, however, pilaster strips and shelf clips are to be used):

.1	Pilaster strips	KV255 Zinc Knape & Vogt
.2	Shelf Clips	KV256 Zinc Knape & Vogt

.4 Teacher's Closet Doors - 35 mm thick.:

.1	Hinges	F179 76x76 Stanley C15
.2	Roller Catches	504N Onward C26
.3	Surface bolt	043-4 X Angle Strike C15
.4	Teacher's Closet Locks	supplied and installed under Section 08 71 10 & 08 71 15.

.5 Closet Rods and Flanges

.1	Rods:	chrome finish, Ø 33 mm.
.2	Flanges:	chrome finish, closed flanges at both ends of rods.

.6 Shelf and Rod — Steel, white enamel, model No. 1797, manufactured by Hager.

.7 Display Case:

.1 Pilaster Strips: Brush Finish
.2 Shelf Brackets: Brush Finish
.3 Aluminum sliding track, top and bottom to accommodate sliding glass doors
.4 Lock sets and all required hardware for sliding glass door display system
.5 Glazing: 12mm tempered glass for shelves. 8mm tempered glass for sliding doors. Glazing to display cases to be provided by Section 08 80 50 and installed by the Section 06 40 00.

.8 Counter Brackets:

.1 Teacher's Workroom Counter & Computer Room Counter (750mm counter depth) Support Bracket
Model: Hafele Hebgo Bracket, model no. 287-44-489, 150 kg capacity per pair, grey powder coat, refer to AD 600 series.

.2 Library Workroom Counter (635mm counter depth) Support Bracket
Model: Hafele Hebgo Bracket, model no. 287-45-477, 150 kg capacity per pair, grey powder coat, refer to AD 600 series.

.3 Copier Workroom #110 Counter (400mm counter depth) Support Bracket
Model: Hafele Hebgo Bracket, model no. 287-44-443, 150 kg capacity per pair, grey powder coat, refer to AD 600 series.

□

.10 Safety Release Coat Hook:

.1 High strength polycarbonate coat hook with safety release weight under downward pressure to not exceed 12 kg (26 lbs.)

.2 Supply all suitable mounting hardware for a vandal proof, secure installation using stainless steel sleeve bolts on partition doors or panels. Do not supply standard Robertson or Phillips head screws.

.3 Colours: 2 premium colours from manufacturer's complete range.

.4 Acceptable Materials: "Henkel Hook" as manufactured/distributed by Henkel Diversified Inc, London ON, Tel. (519) 641-5872.

.5 Locations: to all Childcare and Kindergarten 'Cubbies'; (two per individual cubbie as shown on AD drawings in Binder C) and Teachers Closets. Hooks for these areas noted above are to be supplied by this section. All other areas, (washroom and change rooms) safety hooks are to be supplied by Section 10 11 25.

.6 Samples: submit test data and samples for review as specified in Section 013330 – Submittal Procedures.

.11 Bench Support Brackets:

.1 Bench support brackets to be Hafele Hebgo bracket. Model to be coordinated by millwork contractor based on size and load capacity of 150 kg per 600mm.

.12 Heavy Duty Lock Castors:

.1 Swivel Castors with brake, 2" x 2-1/2" (40kg): Part 00K21.21, as distributed by Lee Valley Tools, 1-800-267-8767, www.leevalley.com, or approved alternate.

.2 Quantity: Quantity and Location as described on AD drawings.

.13 Grommets:

.1 Cable grommets: round, one-piece chrome polished '429.94.258' by Hafele or approved alternative.

.2 Quantity: Quantity and Location as described on AD drawings.

.2 This section shall also include accessories such as rubber door silencers (2 per drawer or door), and other items necessary for the completion of the millwork.

.3 Cabinet Keying: Key all cabinet and drawer locks alike for the entire school, except teachers" closets.

2.6 MELAMINE CLAD CABINETWORK

Casework shall be melamine clad unless otherwise specified within this section and/or AD Drawings.

.1 All cabinet frames whether for base, wall or tall floor standing cases, shall be fabricated so each is a self-contained module. Front side top and bottom, exterior and interior surfaces shall be finished allowing future relocation of any module, into any bench arrangement, without need of any additional finishing.

□

.2 Gables and panels shall be fabricated from 19 mm thick melamine surfaced panels with a P.V.C. edging applied to exposed edges.

.3 Bottoms shall be fabricated utilizing the same materials and edge finish as gables. Front edge will be edged with P.V.C. edging. All other edges will be thoroughly sealed and moisture proofed prior to attachment to gables.

.4 Rails shall be fabricated and machined to join the gables and form a rigid cabinet frame.

.5 Tops (applies to wall and tall units only) shall be fabricated utilizing the same material and edge finish as gables. Front edge will be edged with P.V.C. edging.

.6 Toe kick rail shall have a 100 mm x 19 mm section, machined to receive four screw nails for attachment to bottom front edge of gables. Cabinet base shall be plywood attached to melamine cabinet separately, insuring the melamine particle core gables do not come in contact with the floor.

.7 Backs in base cupboards shall be fabricated from a 13 mm hardboard.

.8 Backs in wall and tall cabinets shall be fabricated from 13 mm thick melamine surfaced panels securely glued and screw nailed into the check out provided in the backs of gables, tops, and bottoms.

.9 Shelves shall be fabricated from 19 mm melamine faced particle board with PVC edging. All shelves shall be adjustable at 13 mm increments and each will be supported by a shelf support resting in four pilaster strips attached to the gables.

.10 Doors shall be fabricated from 19 mm thick melamine surfaced panels. All four edges shall be P.V.C. edging.

.11 Drawer fronts shall be fabricated utilizing the same material and edge finish as doors. All four edges shall P.V.C. edging. Fronts will be secured to drawer bodies with five screw nails through the front of the drawer body into the core of the drawer front.

.12 Drawer bodies shall consist of box construction fabricated from 13 mm birch plywood with solid birch edge, front, sides and back with a 13 mm hardboard bottom dadoed and glued into box members. Joint front, sides and back with carefully fitted glued and tenoned joints. Alternately, Blum Metabox drawer body and side can be used.

.13 35 mm thick doors shall be solid core with plastic laminate both sides and on all four edges, color and grain to match melamine.

.14 Solid hardwood glazed door fronts and frames shall receive lacquer finish. Glazing shall be 3mm tempered clear glass.

.15 Finish:

.1 Melamine surfaced panels shall be finished both sides in the same colours, patterns, and grain as selected by the Consultant.

.2 Solid hardwood glazed doors and drawer bodies shall be sanded, then sealer coated, and sanded with two finish coats of catalytic type acid resistant varnish.

□

2.7 PLASTIC LAMINATE on PLYWOOD cabinetwork

Refer to AD drawings (binder C) for locations

.1 Plastic Laminate factory glued to plywood core, thickness as shown or specified.

.2 Plastic laminate graphics to be book matched or run in same direction where applicable. All exposed finished casework, drawer, cupboard and door fronts shall have vertical grain orientation.

.3 Use solid hardwood for exposed edges, typical for Library/Learning Commons millwork. Casework in Library / Learning Commons to be plastic laminate on plywood cabinetwork as indicated in this section and AD Drawings.

.4 Case bodies: ¾" plywood, finish with plastic laminate factory adhered. Typical for gables and panels

.6 Backs: ¼" plywood, finished with plastic laminate. Backs in wall and tall cabinets shall be securely glued and screw nailed into the check out provided in the backs of gables, tops, and bottoms.

.7 Shelving: ¾" plywood, finish with plastic laminate factory adhered. All shelves shall be adjustable at 13mm increments and each will be supported by a shelf support resting in four pilaster strips attached to the gables.

.8 Drawers:

- .1 ¾" plywood, finish with plastic laminate. All four edges shall have plastic laminate edging. Fronts will be secured to drawer bodies with five screw nails through the front of the drawer body into the core of the drawer front.
- .2 Drawer box including front, back and sides shall consist of box construction, carefully fitted glued and tenoned joints.
- .3 Drawer bottom to be ¼" plywood, plastic laminate finished, dadoed and glued into box members.

.9 Casework doors: ¾" plywood, plastic laminate finished with plastic laminate to all four sides. Locks to be provided as indicated on details.

.10 All cabinet frames whether for base, wall or tall floor standing cases, shall be fabricated so each is a self-contained module. Front side top and bottom, exterior and interior surfaces shall be finished allowing future relocation of any module, into any bench arrangement, without need of any additional finishing.

.11 Rails shall be fabricated and machined to join the gables and form a rigid cabinet frame.

.12 Tops (applied to wall and tall units only) shall be fabricated utilizing the same material and edge finish as gables.

.13 Toe kick rail (behind rubber or ceramic base, as applicable) shall have a 4" x 3/4" section, waterproof fir plywood, machined to receive four screw nails for attachment to bottom front edge of gables. Cabinet base shall be plywood attached to cabinet separately, insuring the plastic laminate plywood gables do not come in contact with the floor.

2.8 SHOP FABRICATION

.1 Shop install cabinet hardware.

.2 Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes and other fixtures.

.3 Shop assemble work for delivery to site in size easily handled and to insure passage through building openings.

□

2.9 BENCHES

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

.2 Bench support brackets to be Hafele Hebgo bracket. Model to be coordinated by millwork contractor based on size and load capacity of 150 kg per 600mm.

2.10 SLATWALL

.1 Maple, birch or white oak (with clear coat) veneered slatwall panels, with metal inserts

.2 Standard slatwall panel sizes 1219 mm x 2438 mm (4'x8') x 19mm (3/4") thick.

.3 Grooves 150mm (6") OC (industry standard) to accept standard industry slatwall accessories.

.4 To be used in various locations in millwork (ADs in Binder C) and applied to walls per Interior Elevations.

2.11 PLASTIC LAMINATED TOPS

.1 Coordinate with Section 06 47 00.

.2 19 mm thick particle board core with post-forming grade plastic laminate finish bonded with resorginal formaldehyde resin glue to a particleboard core. All countertop front face to return vertically 35 mm ± . All front and backsplash edges to be rounded.

.3 Underside to receive a backing sheet, sanded one side and bonded same as surfacing material.

.4 Exposed edges to be finished with same material as used for the top.

.5 Drip grooves to be cut into underside of the top where exposed edges occur.

.6 Splash backs, curbs and curb shelves are to be of similar construction as the tops.

.7 At all wall termination, provide backsplash return.

2.12 INTERIOR SIGNAGE PANELS (ISP)

.1 Noted ‘ISP’ on drawings.

- .1 Plastic laminate on 16mm particle board.
- .2 600mm wide by 2200mm high.
- .3 Location: adjacent doors where indicated on floor plans.
- .4 Solid white acrylic numbers and ‘KINDER’ to be applied to the millwork panels. Coordinate room names and numbers with consultant.

□

2.13 MOULDING AND TRIMS

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

2.14 FABRICATION

.1 Set nails and countersink screws apply wood filler to indentations, sand smooth and leave ready to receive finish.

.2 Shop install cabinet hardware for doors, shelves and drawers. Recess shelf standards unless noted otherwise.

.3 Shelving to cabinetwork to be adjustable unless otherwise noted.

.4 Provide cut-outs for plumbing fixtures, inserts, appliances, outlet boxes and other fixtures.

.5 Shop assemble work for delivery to site in size easily handled and to ensure passage through building openings.

.6 Obtain governing dimensions before fabricating items which are to accommodate or abut appliances, equipment and other materials.

.7 Ensure adjacent parts of continuous laminate work match in colour and pattern.

.8 Form shaped profiles and bends as indicated, using postforming grade laminate to laminate manufacturer's instructions.

.9 Use straight self-edging laminate strip for flatwork to cover exposed edge of core material. Chamfer exposed edges uniformly at approximately 20 degrees. Do not mitre laminate edges.

.10 Apply laminate backing sheet to reverse side of core of plastic laminate work.

.11 Apply laminated plastic liner sheet where indicated.

2.15 SCIENCE CLASS UPPER CABINETS

.1 6 mm tempered Glazing to upper cabinet units in science classroom to be provided to Millworker by Section 08 80 50.

2.16 SCIENCE CLASSROOM COUNTERTOPS

.1 .Cast Epoxy Resin Countertops:

- .1 Chemical and abrasion resistant, 25 mm thick cast epoxy resins and inert products, cast flat, with a uniform low-sheen black surface.
- .2 Backsplash curb: same material as top. Include end curb where top abuts end wall.
- .3 Fabricate countertop and backsplash sections in as long a length as practicable.
- .4 Cut holes for fittings, accessories, and equipment.

□

.5 Round or chamfer exposed edges and corners of cutouts.

.2 Location: Science Classroom

.3 Colour: Black

2.17 DISPLAY CASES

.1 Display Cases: Provide and install appropriate hinges, keyed locks and wood/glass shelf supports required for all display cases as described on drawings. Glazing to be provided by section 08 80 50. Refer to Section 08 80 50.

.2 Display/Trophy Case Finish:

.1 Linseed oil, Forbo Tackboard surfacing to interior of all display cabinets where felt or tackboard is indicated: supplied by Architectural School Products or equivalent product by other manufacturer approved by the Consultant. Colour to be selected by Architect.

2.18 DISPLAY AND BENCH CUSHIONS:

.1 Cushions to be marine grade vinyl by Spradling, or approved alternate, wrapping 75mm high density foam with a 13mm dacron wrap, as described on AD drawings.

2.19 STAGE CHAIR DOLLIES

.1 Stage Chair Dollies: Provide and install stage front fascia white oak panels and trim edging and wood chair dolly fronts as shown on Drawing A21 fabricated from 38mm thick quarter sawn white oak veneer plywood, complete with two hand holes cut at top of front, typical for all doors. Coordinate installation with miscellaneous metals fabricator at shop drawings. Refer to plans and details for approximate size (to be confirmed on site prior to fabrication). Refer to Drawing A23 for number of doors required.

2.20 INSTALLATION

.1 Do architectural woodwork to Quality Standards of the Architectural Woodwork Manufacturers Association of Canada (AWMAC), except where specified otherwise.

.2 Install prefinished millwork at locations shown on drawings. Position accurately, level, plumb straight.

.3 Set and secure all material and components in place, rigid, plumb and square.

.4 Provide heavy duty fixture attachments for wall mounted cabinets.

.5 Use draw bolts in countertop joints.

.6 At junction of plastic laminate counter back splash and adjacent wall finish, apply small bead of sealant.

.7 Apply water resistant building paper over wood framing members in contract with masonry or cementitious construction.

□

.8 After installation, fit and adjust operating hardware for wood and laminated plastic cabinet doors, drawers and shelves.

2.21 CLEANING

.1 Clean millwork, cabinet work, drawers and outside surfaces.

.2 Remove excess glue from surfaces.

2.22 PROTECTION

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

END OF SECTION

□

Part 1 General

1.1 RELATED SECTIONS

.1 Section 062000: Finish carpentry

.2 Section 064000:Architectural Woodwork

1.2 REFERENCES

.1 CAN/CGSB-71.20-M88 Adhesive, Contact, Brushable

.2 CAN3-A172-M79 High Pressure Paper Base, Decorative Laminates.

.3 CSA O112 Series-M1977(R2001) CSA Standards For Wood Adhesives.

.4 CSA O121-M1978(R2003) Douglas Fir Plywood.

.5 CSA O151-04 Canadian Softwood Plywood.

1.3 SAMPLES

.1 Submit duplicate samples of joints, edging, cutouts and postformed profiles in accordance with the General Conditions.

1.4 MAINTENCE DATA

.1 Provide maintenance data for laminated plastics work for incorporation into Operation and Maintenance Manual.

1.5 PRODUCT HANDLING

.1 Cover finished laminated plastic surfaces with heavy kraft paper or put in cartons during shipment. Protect installed laminated surfaces by approved means. Do not remove until immediately before final inspection.

.2 Do not store or install materials in areas where relative humidity is less than 25% or greater than 60% at 22 deg C.

Part 2 Products

2.1 GENERAL

.1 Products manufactured by one of the following companies are suggested for use on this project.

.1 Cyanamid Canada Inc., Montreal (Formica).
.2 Domtar Construction Materials, Arborite Division, LaSalle Quebec (Arborite).
.3 Wilsonart International, Temple, Texas (Wilsonart).

.4 Nevamar Corporation, Odenton Md.

.2 Allow for 8 colours of matte finish from manufacturer's full range. Final Selection of Plastic Laminate surface characteristics including colour, texture and pattern is to be made by the Consultant by means of a Colour Schedule to be issued at a later date. Use the following materials specifications as a base bid:

2.2 MATERIALS

.1 Laminated plastic for flatwork: to CAN3-A172, Grade GP, Type SD, 1.25mm (0.050") thick; based on solid colour range with velour finish. Acceptable products:

.1 Formica Laminate Grade 10.

.2 Nevamar H-5 General Purpose Grade.

.3 Wilsonart General Purpose HGS Type 107.

.2 Laminated plastic for postforming work: to CAN3-A172, Grade PF, Type S, 1.07mm (0.042") thick, based on solid colour range with velour finish. Acceptable products:

.1 Formica Laminate Grade 12.

.2 Nevamar HF-5 Horizontal Post Forming Grade.

.3 Wilsonart Postforming Type 350.

.3 Laminated plastic backing sheet: supplied by same manufacturer as facing sheet; not less than 0.508 mm (0.02") thick and same colour as face laminate. Sanded one side. Acceptable products:

.1 Formica Laminate Grade 20.

.4 Laminated plastic cabinet liner sheet material or for MCP Board or Cladboard material: supplied by same manufacturer as facing sheet, not less than 0.760 mm (0.028") thick, white colour. Acceptable products:

.1 Formica Laminate Grade 20.

.2 VF-3 Vertical Post Forming Grade by Nevamar.

.3 Wilsonart Vertical Surface Type 335.

.5 Plywood core: Douglas Fir Plywood to CSA-O121 or Canadian Softwood Plywood to CSA-O151 solid two sides, 19 mm (¾") thick.

.6 Particleboard core: to CAN3-O188.1, Grade R, sanded faces, of thickness indicated.

.7 Adhesive for laminated plastic: to be CSA approved and one of the following types as selected by the laminate manufacturer as being suitable for the application:

.1 Urea resin adhesive to CSA O112 Series.

.2 Contact adhesive to CAN/CGSB-71.20.

.3 Resorcinol resin adhesive to CSA O112.

.4 Polyvinyl adhesive to CSA O112.

.5 Two component epoxy thermosetting adhesive.

.8 Sealer: water resistant sealer or glue acceptable to laminate manufacturer.

.9 Sealant: of a type recommended by the laminate manufacturer and in accordance with Section 079210 - Joint Sealers; colour to be selected by the Consultant.

.10 Draw bolts and splines: as recommended by fabricator.

.11 Apply laminate backing sheet to reverse side of core of plastic laminate work.

.12 Apply laminated plastic liner sheet to interior of cabinetry, including all exposed surfaces such as gable ends, doors and drawers, and where otherwise indicated.

Part 3 Execution

3.1 INSTALLATION

.1 Install work plumb, true and square, neatly scribed to adjoining surfaces.

.2 Make allowances around perimeter where fixed objects pass through or project into laminated plastic work to permit normal movement without restriction.

.3 Use draw bolts and splines in countertop joints. Maximum spacing 450 mm (18") oc, 75 mm (3") from edge. Make flush hairline joints.

.4 Provide cutouts for inserts, grilles, appliances, outlet boxes and other penetrations. Round internal corners, chamfer edges and seal exposed core.

.5 At junction of laminated plastic counter back splash and adjacent wall finish, apply small bead of sealant.

.6 Where laminated plastic is site applied, adhere laminated plastic over entire surface. Make corners with hairline joints. Use full sized laminate sheets. Make joints only where indicated or approved. Slightly bevel arises. Cap exposed edges with anodized aluminum extrusions.

.7 For site application, offset joints in plastic laminate facing from joints in core.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

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

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 51 00 - Temporary Utilities.

.3 Section 312310- Excavating, Trenching and Backfilling

.4 Section 033000- Cast- in-Place Concrete

.5 Section 042113- Masonry

1.3 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-37.2-[M88], Emulsified Asphalt, Mineral-Colloid Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.

.2 CAN/CGSB 37.3-[M89], Application of Emulsified Asphalts for Dampproofing or Waterproofing.

.3 CAN/CGSB 37.5-[M89], Cutback Asphalt Plastic Cement.

.4 CGSB 37-GP-6Ma-[83], Asphalt, Cutback, Unfilled, for Dampproofing.

.5 CGSB 37-GP-9Ma-[83], Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing.

.6 CGSB 37-GP-11M-[76(R1984)], Application of Cutback Asphalt Plastic Cement.

.7 CGSB 37-GP-12Ma-[84], Application of Unfilled Cutback Asphalt for Dampproofing.

.8 CGSB 37-GP-15M-[76(R1984)], Application of Asphalt Primer for Asphalt Roofing, Dampproofing and Waterproofing.

.9 CAN/CGSB 37.16-[M89], Filled, Cutback, Asphalt for Dampproofing and Waterproofing.

.10 CAN/CGSB 37.28-[M89], Reinforced Mineral Colloid Type, Emulsified Asphalt for Roof Coatings and for Waterproofing.

.11 CGSB 37-GP-36M-[76], Application of Filled Cutback Asphalts for Dampproofing and Waterproofing.

.12 CGSB 37-GP-37M-[77], Application of Hot Asphalt for Dampproofing or Waterproofing.

.2 Canadian Standards Association (CSA International)

.1 CSA A123.4-[98], Bitumen for Use in Construction of Built-Up Roof Coverings and Dampproofing and Waterproofing Systems.

.3 Health Canada

.1 Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.4 National Research Council Canada (NRC)/Institute for Research in Construction (IRC)

.1 Canadian Construction Materials Centre (CCMC)

1.4 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures .

.2 Submit product data sheets for bituminous dampproofing products. Including:

.1 Product characteristics.
.2 Performance criteria.
.3 Application methods.
.4 Limitations.

.3 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence, and cleaning procedures.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Provide and maintain dry, off-ground weatherproof storage.

.2 Store materials on supports to prevent deformation.

.3 Remove only in quantities required for same day use.

.4 Store materials in accordance with manufacturer's written instructions.

.5 Store solvent base liquids away from excessive heat and open flame.

.6 Store emulsion liquids at above freezing temperatures, free from contact with cold or frozen surfaces.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.2 Ensure emptied containers are sealed and stored safely.

.3 Fold up metal banding, flatten and place in designated area for recycling.

.4 Divert unused bituminous waterproofing, sealing compounds and asphalt primer materials from landfill to recycling facility approved by Consultant.

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1.7 PROJECT/SITE ENVIRONMENTAL REQUIREMENTS

.1 Temperature, relative humidity, moisture content.

.1 Apply waterproofing materials only when surfaces and ambient temperatures are within manufacturers' prescribed limits.

.2 Do not proceed with Work when wind chill effect would tend to set bitumen before proper curing takes place.

.3 Maintain air temperature and substrate temperature at dampproofing installation area above 5 degrees C for 24 hours before, during and 24 hours after installation.

.4 Do not apply dampproofing in wet weather.

.2 Safety: Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of asphalt, sealing compounds, primers and caulking materials.

.3 Ventilation:

.1 Ventilate area of Work as directed by Consultant by use of approved portable supply and exhaust fans.

.2 Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities.

.3 Provide continuous ventilation during and after waterproofing application. Run ventilation system 24 hours per day during installation; provide continuous ventilation for 7 days after completion of waterproofing installation.

1.8 QUALIFICATIONS AND QUALITY ASSURANCE

.1 Waterproofing shall be carried out by applicators skilled and with previous similar experience in this work in strict accordance with manufacturer's printed instructions. Submit proof of experience upon Consultant’s request.

.2 Manufacturer’s representative shall be called by the applicator to inspect the substrate prior to commencement of work.

.3 Manufacturer’s representative shall be retained by installer to provide technical assistance on a as-needed basis during course of installation of membrane.

1.9 EXTENDED WARRANTY

.1 Contractor performing the work of this Section, shall provide a full materials and labour warranty for 5 years from the date of Substantial Performance of the Contract.

.2 Contractor hereby warrants that the waterproofing membrane will stay in place and remain leakproof in accordance with the Contract, but for 5 years.

.3 Waterproofing membrane manufacturer shall provide a written warranty that the waterproofing membrane will remain in a watertight condition and will not leak as a result of faulty materials for a period of ten years.

□

Part 2 Products

2.1 MATERIALS

.1 Locations: Walls below grade in elevator pits and all foundations adjacent to sodded and planted areas.

.2 Primary Waterproofing Membrane for Vertical Foundation Walls: Cold applied elastomeric asphalt emulsion waterproofing membrane in compliance with CGSB 37.2 shall be Aqua-Bloc 720-38 Elastomeric Asphalt Emulsion Waterproofing Membrane as manufactured by Bakor, a one component waterproofing compound compatible with sheet waterproofing membranes and substrates, having the following characteristics, or Terra Shield WC 100, as manufactured by Poly-Tuff Systems International.

- .1 Elongation: 2000%,
- .2 Maximum VOC: 10 g/l
- .3 Water vapour permeance: 10 ng/Pa.m².s, ASTM E96,
- .4 Chemical resistance: Alkalis, calcium chloride, mild acid and salt solutions.

.3 Fabric Reinforcement for Cold Applied Waterproofing: Fabric reinforcement shall be 990-06 Yellow Jacket as supplied by Bakor, a glass reinforcement sheet capable of allowing the membrane to bleed through adequately to provide a monolithic reinforced membrane system.

.4 Prefabricated Drainage Board for Vertical Surfaces: Bakor DB 2000 Prefabricated Composite Drain Board, a polypropylene core board with polypropylene fabric attached, having the following physical properties:

- .1 Flow Rate: 223 L/min/m,
- .2 Compressive Strength: 11,000 psf,
- .3 Thickness: 10 mm

.5 Prefabricated Drainage Board Accessories

- .1 Securement Bars: Continuous 6mm x 20mm (1/4” x 3/4”) HDPE bar for screw attachment.
- .2 Moulding Strip: Continuous 90mm wide “Z” flashing strip to fit over exposed top edge of drain board.
- .3 Drain Board Plugs & Nails: HDPE pre-moulded washer to fit dimples c/w high strength, corrosion resistant concrete nails, UCAN AFH 37 or equal.
- .4 Termination Sealant: Polybitume 570-05 Polymer Modified Sealing Compound as manufactured by Bakor, a polymer modified sealing compound, compatible with sheet waterproofing membrane, substrate and insulation materials, complies with CGSB 37.29, remains flexible with ageing and chemically resistant to alkalis, calcium chloride, mild acid and salt solutions.
- .5 Approved alternate: Meeting the above specifications as manufactured by Tremco Inc., W.R. Meadows or Carlisle Coatings and Waterproofing.

Part 3 Execution

3.1 WORKMANSHIP

.1 Keep hot asphalt:

.1 Below its flash point.

.2 At or below its final blowing temperature.

.3 Within its equiviscous temperature range at place of application.

3.2 PREPARATION

.1 Before applying waterproofing:

.1 Seal exterior joints between foundation walls and footings, joints between concrete floor slab and foundation and around penetrations through waterproofing with sealing compound.

.2 Before commencing work, ensure environmental and site conditions are suitable for installation of waterproofing membrane.

.3 The substrate shall be clean and dry, free from surface water, ice, snow or frost, dust, dirt, oil, grease, curing compounds or any other foreign matter detrimental to the adhesion of the waterproofing membrane.

.4 Can be applied to damp or new green concrete. Ensure concrete is smooth and free from voids and honeycombing prior to application of waterproofing membrane.

.5 Voids, cracks, holes and other damages to horizontal or vertical surfaces shall be repaired before application of the membrane.

.6 Notify Consultant and Contractor in writing of unsuitable surfaces and working conditions. Commencement of work shall imply acceptance of surfaces and working conditions.

3.3 MOCK UP

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

.2 Notify Consultant and allow 24 hours for inspection by Consultant.

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

.1 Coat penetrations, such as brackets, clips, braces, etc. that are set into the concrete with a 2.3 mm (90 mil) coating of primary waterproofing membrane to the height of the wearing course and around projections to ensure a complete seal prior to coating the entire area.

.2 Penetrations subject to movement should be flashed with fabric reinforcement set into a minimum thickness of 2.3 mm (90 mil) of primary waterproofing membrane to required height on the wall and at least 100 mm (4”) on the slab, embed fabric reinforcement into wet coating followed by second coat.

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.3 To all cracks and cold joints less than 3 mm (1/8") apply a coat of primary waterproofing membrane at a minimum thickness of 2.3 mm (90 mil) and reinforce with fabric reinforcement.

.4 To all cracks greater than 3 mm (1/8"), prime area and install self-adhered flashing membrane. Overlap end joint of sheet a minimum 75 mm (3").

.5 At monolithic wall/slab junctures, apply primary waterproofing membrane at a minimum thickness of 2.3 mm (90 mil) to required height on the wall and at least 100 mm (4") on the slab and embed fabric reinforcement into wet primary waterproofing membrane followed by a second coat.

.6 At non-monolithic wall/slab junctures, prime area, trowel-in fillet bead to inside corners and install self-adhered flashing membrane sheet to the required height on the wall and at least 100 mm (4") on the slab. Lap primary waterproofing membrane over a minimum of 50 mm (2").

.7 At footing to foundation wall junctions apply a coat of primary waterproofing membrane at a minimum thickness of 2.3 mm (90 mil) and reinforce with fabric reinforcement followed by second coat.

3.5 WATERPROOFING MEMBRANE VERTICAL APPLICATION

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

.2 Apply second full and continuous coat of primary waterproofing membrane at 1.5 l/m^2 (3.6 gal./100$ft.^2$) and allow to cure.

3.6 WATERPROOFING MEMBRANE HORIZONTAL APPLICATION

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

.2 Apply second full and continuous coat of primary waterproofing membrane at 1.5 l/m^2 (3.6 gal./100$ft.^2$) and allow to cure.

3.7 INSTALLATION OF PROTECTION BOARDS

.1 Protection Boards shall be installed over the waterproofing membrane to prevent damage from materials used in backfilling.

.2 Allow waterproofing to cure dry and apply protection board adhesive in 12mm wide strips spaced at 450 mm o/c to cure waterproofing membrane. Immediately embed protection board and press into adhesive to ensure full contact.

.3 Do not backfill until adhesive has cure dried. Do not use excessive levels of adhesive.

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3.8 APPLICATION OF DRAINAGE BOARD VERTICAL

.1 Align and hang drainage up to foundation wall. Position bottom edge of drainage board to be in moderate contact with weeping tile system.

.2 Secure drainage board to foundation wall with nails and washers spaced 450 mm o/c horizontally. Install minimum of 2 rows staggered and spaced 150 mm apart and min 150 from top edge.

.3 Align and install termination strip along top edge with nails spaced 300 mm o/c and seal with termination sealant.

.4 Align and install moulding strip over completed top edge detail.

.5 Overlap end laps, pull back loose fabric to expose drain core and position core of second panel over the overlap flange of first panel.

.6 Bend drain board to create inside corners and cut board to create outside corners, provide 75 mm of extra fabric to wrap corner.

.7 Stagger or offset joints of drain board sheets.

.8 Place all subsequent sheets in an overlapping single fashion.

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

3.9 APPLICATION

.1 Do sealing work in accordance with CGSB 37-GP-11M except where specified otherwise.

.2 Do priming of surface in accordance with CGSB 37-GP-15M except where specified otherwise.

.3 Apply primer.

3.10 SCHEDULE

.1 Apply continuous, uniform coating to entire exterior faces of foundation walls from 50 mm below finished grade level to and including tops of foundation wall footings of foundation wall footings where described in Item 2.1.1. of this specification section.

.2 Apply continuous, uniform coating to exterior side of foundation walls enclosing rooms below finished grade. Include exterior portion of interior walls where floors in adjacent rooms are at different elevations.

.3 Apply two additional coats of dampproofing to vertical corners and construction joints for a minimum width of 230 mm on each side, and all around and for 230 mm along pipes passing through walls.

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3.11 CLEANING

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

END OF SECTION

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Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 04 21 13 – Masonry.

.3 Section 07 27 10 – Air Barriers.

.4 Section 07 55 00 – Roof insulation.

.5 Section 07 21 19 – Spray in Place Urethane Foam Insulation.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).

.1 ASTM E96-[00e1], Test Methods for Water Vapour Transmission of Materials.

.2 Canadian General Standards Board (CGSB).

.1 CGSB 71-GP-24M-[77(R1983)], Adhesive, Flexible, for Bonding Cellular polystyrene Insulation.

.3 Underwriters Laboratories of Canada (ULC).

.1 CAN/ULC-S604-[91], Type A Chimneys.

.2 CAN/ULC-S701-[01], Thermal Insulation, Polystrene, Boards and Pipe Coverings.

.4 Environmental Choice Program (EPC).

.1 CCD-016-[97], Thermal Insulation.

1.3 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOC's insulation products and adhesives.

.2 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

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

.2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.3 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material [n appropriate on-site bins for recycling.

Part 2 Products

2.1 INSULATION

.1 Extruded polystyrene (XPS): to CAN/ULC-S701.

.1 RSI 3.52/R20.
.2 Thickness: **100 mm** or as indicated on drawings.
.3 Edges: ship-lapped.
.4 For use at typical cavity wall construction and at miscellaneous detail locations calling for rigid insulation.
.5 Acceptable Material: "**Styrofoam Cavity-Mate**" as manufactured by Dow Chemical Canada Inc.
.6 Acceptable Material: "**Foamular C200**" as manufactured by Celfortec Inc. (Owen Corning).
.7 or approved equal.

.2 Extruded polystyrene (XPS): to CAN/ULC-S701.

.1 RSI 3.94/R 22.
.2 Thickness: **112 mm** (4.4") or as indicated on drawings.
.3 Edges: Ship lapped.
.4 For use on foundation wall construction" below through-wall flashing below slab on grade as shown typical foundation details,
.5 Acceptable Material: "**Styrofoam SM**" as manufactured by Dow Chemical Canada Inc.
.6 Acceptable Material: "**Foamular C300**" as manufactured by Celfortec Inc. (Owen Corning).

.3 Extruded polystyrene (XPS): to CAN/ULC-S701.

.1 RSI 2.65/R 15.
.2 Thickness: **75 mm** or as indicated on drawings.
.3 Edges: Ship lapped.

.4 For use under slab on grade as shown typical foundation details,

.5 Acceptable Material: "**Styrofoam SM**" as manufactured by Dow Chemical Canada Inc.

.6 Acceptable Material: "**Foamular C300**" as manufactured by Celfortec Inc. (Owen Corning).

2.2 ADHESIVE

.1 Adhesive (for polystyrene): to CGSB 71-GP-24.

.1 Bakor Air Bloc 21.

.2 Compatible with respective rigid insulation, air/vapour and waterproofing membranes and recommended by manufacturers of those products. Use Bakor 230-21 rigid insulation adhesive for rigid insulation in contact with Blueskin air vapour barrier.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 WORKMANSHIP

.1 Install insulation after building substrate materials are dry.

.2 Install insulation to maintain continuity of thermal protection to building elements and spaces.

.3 Fit insulation tight around electrical boxes, plumbing and heating pipes and ducts, around exterior doors and windows and other protrusions.

.4 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from sidewalls of CAN4-S604 type A chimneys and CAN/CGA-B149.1 and CAN/CGA-B149.2 [type B] [and] [L] vents.

.5 Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.

.6 Offset both vertical and horizontal joints in multiple layer applications.

.7 Do not enclose insulation until it has been inspected and approved by Consultant.

3.3 EXAMINATION

.1 Examine substrates and immediately inform Consultant in writing of defects.

.2 Prior to commencement of work ensure:

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

3.4 RIGID PERIMETER FOUNDATION INSULATION INSTALLATION

.1 Apply adhesive to polystyrene in accordance with manufacturer's recommendations.

.2 Apply adhesive to insulation board by spot method with daubs 40 mm diameter x 25 mm high at 200 mm o.c. each way

.3 Interior application: extend boards vertically below bottom of finish floor slab as indicated on drawings, installed on inside face of perimeter foundation walls.

.4 Exterior application: extend boards below finish grade as indicated on drawings. Install on exterior face of perimeter foundation wall with adhesive.

.5 Under slab application: extend boards as indicated on drawings. Lay boards on level compacted fill.

3.5 RIGID CAVITY WALL INSULATION INSTALLATION

.1 System Comprised of:

.1 Specified thickness of rigid ship-lapped insulation on Henry-Bakor Blueskin SA air/vapour barrier.

.2 Henry-Bakor Airbloc 21 adhesive to be applied to all sides of insulation and continuous layer to all insulation surfaces in contact with air/vapour barrier. Butter all sides and back to ensure full air barrier integrity. Apply adhesive to polystyrene in accordance with manufacturer's recommendations

.3 Butter Air Bloc 21 at all brick tie penetrations to ensure a complete seal

.4 Install plastic LOC-Wedges at masonry veneer ties to ensure securement to structural wythe or back up wall and in full contact with air/vapour barrier on wall surfaces.

3.6 CLEANING

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 04 21 13 - Masonry.

.2 Section 01 45 00 - Quality Control.

.3 Section 01 51 00 - Temporary Utilities.

.4 Section 07 21 13 – Board Insulation.

.5 Section 07 55 00 – Protected Membrane Roofing.

.6 Section 07 62 00 – Sheet Metal Flashing & Trim.

.7 Section 07 27 10 – Air Barriers.

1.2 APPROVED ALTERNATE

.1 In relation to Cavity Wall Insulation only, this spray foamed-in-place insulation may be used as an approved alternate. Note that base cavity wall insulation is rigid board as specified in Section 07 21 13 and shown on drawings

1.3 REFERENCES

.1 Canadian Urethane Foam Contractors' Association Inc. (CUFCA)

.2 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S101-[1989], Fire Endurance Tests of Building Construction and Materials.

.2 CAN/ULC-S102-[1988(R2000)], Surface Burning Characteristics of Building Materials and Assemblies.

.3 CAN/ULC-S705.1-[01], Standard for Thermal Insulation Spray Applied Rigid Foam, Medium Density, Material Specification.

.4 CAN/ULC-S705.2-[02], Standard for Thermal Insulation Spray Applied Rigid Foam, Medium Density, Installer's Responsibilities-Specification.

1.4 TEST REPORTS

.1 Submit test reports, verifying qualities of insulation meet or exceed requirements of this specification, in accordance with Section 01 45 00 - Quality Control.

.2 Submit test reports in accordance with CAN/ULC-S101 for fire endurance and CAN/ULC-S102 for surface burning characteristics.

1.5 QUALITY ASSURANCE

.1 Applicators to conform to CUFCA Quality Assurance Program.

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1.6 SAFETY REQUIREMENTS

.1 Protect workers as recommended by CAN/ULC-S705.2 and manufacturer's recommendations:

.1 Workers must wear [gloves] [respirators] [dust masks] [long sleeved clothing] [eye protection] [protective clothing] when applying foam insulation.

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

1.7 PROTECTION

.1 Ventilate area in accordance with Section 01 51 00 - Temporary Utilities.

.2 Ventilate area to receive insulation by introducing fresh air and exhausting air continuously during and [24] hour after application to maintain non-toxic, unpolluted, safe working conditions.

.3 Provide temporary enclosures to prevent spray and noxious vapours from contaminating air beyond application area.

.4 Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of insulation materials.

1.8 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling.

.3 Fold up metal banding, flatten and place in designated area for recycling.

.4 Dispose of waste foam daily in location designated by Consultant and decontaminate empty drums in accordance with foam manufacturer's instructions and CAN/ULC-S705.2.

.5 Divert metal drums from landfill to metal recycling facility as approved by Consultant and to CAN/ULC-S705.2.

1.9 ENVIRONMENTAL REQUIREMENTS

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

Part 2 Products

2.1 MATERIALS

.1 Insulation: spray polyurethane to CAN/ULC-S705.1.

.1 Density: 30.4 kg/m3 (1.9 lb/ft3) minimum.

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.2 Compressive Strength: >185 KPa (per ASTM D1622)

.3 Tensile Strength: > 330 KPa (per ASTM D1623)

.4 Air Barrier Classification:

.1 Type III (NRC) - permeance: 0.02 L/sec/m2 maximum at 75 Pa pressure differential.

.2 Air Barrier System Performance with leakage not exceeding 0.0054 l/m^2 @75 Pa pressure when tested in Accordance with CCMC Air Barrier System Requirements.

.3 All manufacturers/applicators shall submit test data reports prior to acceptance.

.5 Water Permeance: 125 ng/Pa.m2.s @25mm specimen thickness

.6 Submit manufacturer's Material Data Safety Sheets in accordance with and Sections 013300 – Submittal Procedures and 013530 – Health and Safety.

.7 Thickness: as required for thermal resistance indicated, or to match rigid board insulation thickness.

.8 Acceptable material: Products meeting these specifications by BASF Canada Inc: Walltite CMO1, Heatlok 0240, Heatlok Soya, Polar Foam 7300 and Polarfoam Soya, Elastochem Insulathane Extreme, Genyk Boreal Nature Elite, CertaSpray Closed Cell Foam by CertainTeed Canada and Icynene MDC200.

.9 Acceptable materials: products by other manufacturers meeting or exceeding these specifications as approved in writing by the Architect following specification, WMIS and test data submission.

.10 Installation shall only be by applicators specifically approved by the manufacturer/distributor.

.11 Blowing agents must have a GWP of 150 or lower per Environment Canada Regulations effective January 1, 2021.

.2 Primers: in accordance with manufacturer's recommendations for surface conditions.

.3 Sheet Air/Vapour Barrier Transition Membrane and Thru-Wall Flashing:

.1 Self adhering SBS modified bitumen membrane reinforced with non-woven fibrous glass:

.1 Thickness: minimum 1.45 mm

.2 Water Vapour Permeance: 0.05 perms max value. (2.8 ng/Pa.m2.s)

.3 Air Permeance: less than 0.01 l/m2 at 75 Pa pressure differentials.

.4 Adhesion: 7 day min. Peel adhesion at 5 deg. C :

.1 to primed Concrete: > 20 N/cm

.2 to selfedge: > 20 N/cm

.3 to primed plywood: > 25 N/cm

.4 to metal: > 30 N/cm

.5 Submit manufacturer's Material Data Safety Sheets in accordance with and Sections 01333 – Submittal Procedures and 013520 – Health and Safety.

.6 Acceptable Material: Blueskin SA by Bakor and Blueskin TW as thru-wall transition at masonry locations.

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.2 Overlap typically minimum 150 mm on all adjacent layers/materials or as detailed.

Part 3 Execution

3.1 APPLICATION

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

.2 Apply sprayed foam insulation in thickness as indicated.

3.2 WORKMANSHIP

.1 Certification

.1 Installation is to be only by certified CUFCA/NECA applicators and manufacturer of the product being applied. Applicator shall provide proof of both approvals.

.2 Examination

.1 Install insulation after building substrata materials are dry, thoroughly clean and capable of providing a firm, uniform bonding surface and temperatures are within the range recommended by product manufacturers.

.2 Verify that surfaces and conditions are suitable to accept work required in this section.

.3 Report, in writing, defects in surfaces or conditions which may adversely affect the performance of products installed under this section to the Consultant; prior to commencement of work.

.4 Do not commence work until defects have been corrected.

.3 Preparation-Sprayed Insulation:

.1 Mask and cover adjacent areas to protect from overspray.

.2 Apply primers for special conditions as required by foam manufacturer.

.3 Clean work area prior to commencing spray operations.

.4 Preparation-Peel & Stick Membrane:

.1 Prime all surfaces using Blueskin Primer by Bakor or primer specifically approved by membrane manufacturer. Allow primer to dry. Apply primer only to areas to receive membrane within the same working day, or reprime surfaces.

.5 Application-Sprayed Insulation:

.1 Apply insulation to clean surfaces in accordance with CAN/CGSB 51-39-92 and manufacturer's printed instructions. Use primer where recommended by manufacturer. Ensure full adhesion to transition membrane.

.2 Completely fill jambs of all hollow metal frames with insulation and ensure continuous contact with sheet membrane used at head of frames.

.6 Application-Peel & Stick membrane:

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.1 Ensure membrane widths capable of sealing to all door opens at heads of frames.

.2 Lap sides and ends a minimum of 100 mm or as per details. Ensure full adhesion as per details.

.3 Position membrane for alignment with release film in place. Roll back, remove release film and press firmly in place. Roll all areas and laps with a steel or polyurethane roller.

.4 Seal ends of membrane to substrate using Polybithume by Bakor. or product approved specifically by membrane manufacturer.

.7 Tolerance

.1 Maximum variation from required thickness for sprayed insulation: 6 mm.

.8 Firestopping

.1 Required in all cavity walls 25 mm air space or greater.

.2 Install firestopping at 20 m intervals maximum horizontally and 3 m maximum vertically, in accordance with OBC requirements and manufacturer's approved method of Roxul AFB and transition membrane protection.

.3 At wall extending more than 1 storey in height, install additional firestopping horizontally at intermediate floor elevation.

3.3 LOCATIONS

.1 Cavity Walls Above Grade: as an approved alternate to Rigid Cavity Installation.

.2 If used as alternate to rigid board insulation in wall cavity, provide mineral wool horizontal and vertical fire stopping to perimeter of building cavity as required by OBC Division B.

.3 If used as alternate to rigid board insulation in wall cavity, provide 450mm high band of rigid board insulation at the base of the wall cavity below the foamed in place insulation, to avoid sag and blocking of weep holes.

.4 On all structural steel in concealed locations exterior to insulation wall assemblies where steel penetrates through thermal barrier of wall forming a "cold bridge, whether shown on drawings or not.

.5 Concealed within Soffit Conditions: Refer to drawings.

.6 Jambs of Hollow Metal Frames: Refer to Section 081115 – Door Schedule.

.7 Behind Metal Siding/composite panels: Refer to Section 074143 – Aluminum Composite Panels.

.8 All other miscellaneous locations to ensure integrity of a continuous air/vapour barrier and insulation layer.

END OF SECTION

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Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation methods providing [primary] airvapour barrier materials and assemblies.

.2 Air/vapour barrier materials to provide continuous seal between components of building envelope and building penetrations.

1.2 RELATED SECTIONS

.1 Section 04 21 13 - Masonry.

.2 Section 07 51 12 – Built-Up Bituminous (BUR) Roofing.

.3 Section 07 46 13 – Preformed Metal Cladding Siding.

.4 Section 07 21 13 – Board Insulation

.5 Section 07 21 19 – Spray in Place Urethane Foam Insulation.

.6 Section 07 62 00 – Sheet Metal Flashing & Trim.

1.3 REFERENCES

.1 Canadian Construction Documents Committee

.1 CCDC 2 - Stipulated Price Contract.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-19.13M-[M87], Sealing Compound, One Component, Elastomeric Chemical Curing.

.2 CAN/CGSB-19.18M-[M87], Sealing Compound, One Component, Silicone Base Solvent Curing.

.3 CAN/CGSB-19.24M-[M90], Multi-Component, Chemical Curing Sealing Compound.

.4 CGSB 19-GP-14M-[76], Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing.

.3 NBCC 1995; Part 5 - Environmental Separation

.4 Sealant and Waterproofer's Institute - Sealant and Caulking Guide Specification.

1.4 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit manufacturer’s product data sheets in accordance with Section 01 33 00 - Submittal Procedures.

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.3 Submit manufacturer=s installation instructions in accordance with Section 01 33 00 - Submittal Procedures.

1.5 QUALITY ASSURANCE

.1 Perform Work in accordance with Sealant and Waterproofer's Institute - Sealant and Caulking Guide Specification requirements for materials and installation.

.2 Maintain one copy of documents on site.

1.6 QUALIFICATIONS

.1 Applicator: Company specializing in performing work of this section with documented experience with installation of air/vapour barrier systems. Completed installation must be approved by the material manufacturer. .

.2 Applicator: Company who is currently licensed by National Air Barrier Association or certifying organization must maintain their license throughout the duration of the project.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver, store and handle materials in accordance with manufacturer=s written instructions.

.3 Avoid spillage. Immediately notify Consultant if spillage occurs and start clean up procedures.

.4 Clean spills and leave area as it was prior to spill.

1.8 WASTE MANAGEMENT AND DISPOSAL

.1 Place materials defined as hazardous or toxic waste in designated containers.

.2 Ensure emptied containers are sealed and stored safely for disposal away from children.

1.9 PROJECT ENVIRONMENTAL REQUIREMENTS

.1 Do not install solvent curing sealants or vapour release adhesive materials in enclosed spaces without ventilation.

.2 Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities.

.3 Maintain temperature and humidity recommended by materials manufactures before, during and after installation.

1.10 SEQUENCING

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

Part 2 Products

2.1 SHEET MATERIALS

.1 Refer to technical data sheets for physical properties of product.

.2 Sheet Seal Type [1]: Self-Adhesive bitumen laminated to high-density polyethylene film, nominal total thickness of 1 to 4 mm as indicated.

.1 Acceptable material: Bakor Blueskin AG, adhesive grade membrane, use ‘peel and stick’ Blueskin where Air-Bloc 21 not present or equal Blueskin SA or TG or Soprema ‘Sopraseal Stick.’

.2 Sealant and Adhesive as recommended by Manufacturer.

.3 Transition membrane adhesive to be Bakor Air-Bloc 21.

.4 Air Barrier Membrane to be Bakor Air-Bloc 21.

2.2 SEALANTS

.1 Sealants in accordance with Section 07 92 10 - Joint Sealing.

.2 Primer: Recommended by sealant manufacturer and Appropriate to application.

.3 Substrate Cleaner: Non-corrosive type recommended by sealant manufacturer and compatible with adjacent materials.

2.3 ADHESIVES

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

2.4 ACCESSORIES

.1 Thinner and cleaner for As recommended by sheet material manufacturer.

.2 Stick-Clips: Perforated Galvanized steel anchors.

Part 3 Execution

3.1 EXAMINATION

.1 Verify that surfaces and conditions are ready to accept the Work of this section.

.2 Ensure all surfaces are clean, dry, sound, smooth, continuous and comply with air barrier manufacturer=s requirements.

.3 Report any unsatisfactory conditions to the [Engineer] [Consultant] in writing.

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.4 Do not start work until deficiencies have been corrected. Commencement of Work implies acceptance of conditions.

3.2 PREPARATION

.1 Remove loose or foreign matter which might impair adhesion of materials.

.2 Ensure all substrates are clean of oil or excess dust; all masonry joints struck flush, and open joints filled; and all concrete surfaces free of large voids, spalled areas or sharp protrusions.

.3 Ensure all substrates are free of surface moisture prior to application of self-adhesive membrane and primer.

.4 Ensure metal closures are free of sharp edges and burrs.

.5 Prime substrate surfaces to receive adhesive and sealants in accordance with manufacturer's instructions.

3.3 INSTALLATION

.1 Install materials strictly in accordance with manufacturer's instructions.

.2 Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

3.4 PROTECTION OF WORK

.1 Protect finished Work in accordance with Section 01 61 00 - Common Product Requirements.

.2 Do not permit adjacent work to damage work of this section.

.3 Ensure finished Work is protected from climatic conditions.

3.5 SCHEDULES

.1 Wall Air/Vapour Barrier Over Outer Surface of Inner Wythe of Masonry: Trowel seal Type F over masonry unit surface to a thickness of 6 mm, seal masonry anchor penetrations air tight.

.2 Wall Air/Vapour Barrier Over Exterior Surface of Gypsum Sheathing: Place sheet seal Type G over sheathing surfaces with Adhesive Type E. Seal with Type Y sealant.

.3 Window Frame Perimeter: Lap sheet seal Type H from wall air seal surface with 75 mm of full contact over firm bearing to window frame with 25 mm of full contact. Edge seal with Type Z sealant.

.4 Wall and Roof Junction: Lap sheet seal Type J from wall seal material with 150 mm of contact over firm bearing to roof air seal membrane with 100 mm of full contact. Seal with Type X sealant.

.5 Roof System Air/Vapour Barrier Over Steel Deck: Gypsum sheathing, taped joints, apply membrane air seal Type K over sheathing surfaces with Adhesive Type D; edge seal membrane with Type Y sealant

END OF SECTION

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Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 07 27 10 – Air Barriers.

.3 Section 07 21 13 – Board Insulation.

.4 Section 05 50 00 - Metal Fabrications.

.5 Section 07 44 56 – Composite Panels.

1.2 REFERENCES

.1 American Association (AA)

.1 DAF-45-[03], Designation System for Aluminium Finishes.

.2 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.3 American Society for Testing and Materials International, (ASTM)

.1 ASTM A653/A653M-[02a], Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM A792/A792M-[02], Specification for Steel Sheet, 55% Aluminium-Zinc Alloy-Coated by the Hot-Dip Process.

.3 ASTM D523-[89(1999)], Test Method for Specular Gloss.

.4 ASTM D822-[01], Standard Practice, For Conducting Test on Paint and Related Coatings and Materials Using Filtered Open-Flame Carbon-Arc Light and Water Exposure Apparatus.

.5 ASTM D2832-[92 (1999)], Guide for Determining Volatile and Nonvolatile Content of Paint and Related Coatings.

.4 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-93.1-[M85], Sheet, Aluminium Alloy, Prefinished, Residential.

.5 Canadian Standards Association (CSA International)

.1 CSA S136-[01], North American Specification for the Design of Cold-Formed Steel Structural Members.

.2 CSA S136.1-[01], Commentary on North American Specification for the Design of Cold-Formed Steel Structural Members.

.6 Environmental Choice Program (ECP)

.1 CCD-016-[97], Thermal Insulation.

.2 CCD-046[95], Adhesives.

.3 CCD-046-[95], Sealants and Caulking Compounds.

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1.3 SYSTEM DESCRIPTION

.1 Design Requirements:

.2 Design, fabricate and erect a pressure equalized wall panel system to meet the following requirements.

.1 Rain Penetration: prevent rain penetration through wall system. Design system based on “Rain Screen Principle” per the National Research Council. Incorporate means of draining to the exterior.

.2 Wind load: Design wall system to resist wind loads, positive and negative, expected in this geographical region (OBC climatic data, 100 years probability) without causing rattling, vibration or excessive deflection of panels, overstressing of fasteners, clips and other detrimental effects on system.

.3 Structural and thermal movement: Accommodate movement of supporting structural framing and movement caused by thermal expansion and contraction of system component parts without causing bowing, buckling, delamination, oil canning, failure of joint seals, excessive stress on fasteners or any other detrimental effects.

.3 Panel flatness tolerance: Fabricate panels not exceeding the following tolerances:

.1 Rises and falls across the panel, (local bumps and depressions) will not be accepted.

.2 1.5 mm in a concave/ convex direction, measured perpendicular to the normal plane.

.4 Panel removal: System/ procedure to allow removal of individual panels within wall system.

.5 Maximum deviation from vertical and horizontal alignment of erected panels: 6 mm in 6 m.

.6 Testing: Provide wall assembly that has been tested and certified to conform to the following criteria:

.1 Structural: Provide systems that have been tested in accordance with ASTM E330 at a design pressure of 60 psf and have been certified to be without permanent deformation or failures of structural members.

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.

.2 Shop Drawings:

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate elevations, profiles, dimensions an thickness of panels and joint details.

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.3 Indicate attachment clips, system extrusions, fastening, anchor and installation details.

.3 Samples:

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit duplicate 130 x 180 mm samples of wall system, representative of materials, finishes and colours.

.4 Production and Installation Schedule:

.1 Meeting the required schedules listed below will be required for approval of progress payments for design and fabrication.

.2 As part of base contract price, upon award of contract submit a detailed schedule with the shop drawing which outlines:

.1 submission timing of shop drawings

.2 fabrication timing from date of approved shop drawings

.3 building completion requirements for site measurements

.4 Duration of installation period

.5 dates required for installation program for work to be 100% complete by date of substantial completion

.3 Ensure the program for fabrication and installation is integrated into the General Contractor’s overall project schedule.

.4 As part of base contract price, attend site meetings commencing 6 weeks prior to installation and through installation period to confirm site progress and timing of completion.

.5 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

1.5 MAINTENANCE DATA

.1 Provide maintenance data for cleaning and maintenance of aluminum finishes for incorporation into manual.

.2 Protect panel face with a plastic film adhered to panel in accordance with panel manufacturer’s recommendation.

.3 Store components and materials in accordance with panel manufacturer’s recommendations.

1.6 MOCK UP

.1 Submit mock-up in accordance with Section 013330- Submittal Procedures.

.2 Erect mock-up panel approximately 3m long x 2m high in location as directed by architect.

.3 Mock-up panel shall include all components of the wall system including subgirt flashing. Mock up will NOT be incorporated into work once approved.

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.4 Remove mock up from site following installation and acceptance of panel system.

1.7 DURANAR PANEL FINISH WARRANTY

.1 Provide a manufacturer's written warranty: Furnish panel manufacturer's written warranty covering failure of factory-applied exterior finish on composite metal panels within the warranty period; warrant finish per ASTM D 4214 for chalk not in excess of 8 NBS units and fade not in excess of 5 NBS units. Warranty period for finish: 10 years after the date of Substantial Completion.

1.8 QUALITY ASSURANCE

.1 Installation crews engaged or provided by the approved supplier shall have proven experience specifically trained and qualified in this work (written proof of minimum of five (5) years employment or service with the panel manufacturer or similar manufacturer. Individuals are to be either employees of the manufacturer and/or workers approved by the manufacturer.

.2 Provide one (1) thoroughly experienced. reliable, qualified and competent foreman in charge of the work to be on site at all times when work is taking place. Individual to be designated in charge from start of activities on site until final deficiencies are complete. Foreman may only be changed by written approval *or request* of the Consultant or owner.

.3 Panel fabricator/supplier is to have adequate plant and skilled tradesmen and is known to have manufactured and installed panel systems for a minimum of five (5) years in the Province of Ontario

1.9 MATERIAL AND WORKMANSHIP WARRANTY

.1 Warranty against defects or deficiencies shall be for a period of one year from date of substantial completion.

1.10 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material [in appropriate on-site] bins for recycling.

.3 Divert unused metal materials from landfill to metal recycling facility approved by Consultant.

.4 Divert unused paint and joint sealer material from landfill to official hazardous material collections site approved by Consultant.

.5 Do not dispose of unused paint and joint sealer materials into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

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Part 2 Products

2.1 MATERIALS

.1 Aluminum Composite Material (ACP)

.1 Pre-formed aluminum composite panels in locations as indicated on drawings.

.2 Composition: Two sheets of aluminum sandwiching a core of extruded thermoplastic formed in a continuous process without the use of glues or adhesives between dissimilar materials. Bond integrity testing to adhere to ASTM D1781-76

.3 Aluminum face sheets: Aluminum alloy 3003, thickness: 0.51 mm

.4 Panel thickness: 4 mm

.5 Panel weight: 5.28 kg/sq.m.

.6 Tolerances:

.1 Panel bow: Maximum 0.8% of panel dimension (width or length).

.2 Panel Dimensions: Take site measurements before proceeding with production unless dimensions can be guaranteed by General Contractor.

.3 Panel lines, breaks and angles to be sharp and true; panel surfaces to be free from warp or buckle.

.7 Panel System: Dry joint SL-2000 with 12.5 mm wide panel joints using proprietary aluminum extrusions.

.8 Aluminum Composite to have a fire-resistant core, meeting OBC requirements for non-combustible materials.

.9 Acceptable materials and manufacturers:

.1 Alucobond Plus, Alpolic; Kanalco Ltd., Flynn Canada, Alcotex or others meeting the exact fire rated and compositional requirements of this specification and having colours and 'wood grain look' options to the satisfaction of the architect.

.2 Panel finishes: Duranar, three coat, coil-coated baked enamel finish containing Kynar 500 polyvinylidene fluoride resin, metallic finish as specified below.

.3 Panel Colours: Allow for 3 colours:

.1 **Aluminum Composite Panel Colour 1**: White. Exact colour to be selected by consultant from manufacturer's full colour range, including metallic series.

.1 **Aluminum Composite Panel Colour 2**: 'Wood Grain' pattern in light wood tone. Exact colour to be selected by consultant from manufacturer's full colour range.

.2 **Aluminum Composite Panel Colour 3**: Grey. Exact colour to be selected by consultant from manufacturer's full colour range, including metallic series.

.3 Locations: Wall panels, Canopies and Roof Fascias as noted on drawings.

.4 Contractor to submit triplicate samples of colours for review by Consultant prior to order and fabrication.

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.4 Panel and Wall Accessories

.1 Provide proprietary aluminum extrusions to manufacturer's standard profiles for a complete installation.

.2 Provide aluminum integrated roof parapet cap flashing where indicated on drawings.

.3 Fasteners: as recommended by panel manufacturer, concealed and non-corrosive.

.4 Extrusions and extrusion clips for attaching panels to the sub-structure: Purpose made aluminum.

.5 Extrusions shall be full length around panel perimeter for panel reinforcement and alignment. Intermittent clips are unacceptable.

.6 Joint filler strip: Same material and color as panels. Use of caulking at joints is not acceptable.

.7 Plastic shims, shall be used as thermal separator between extrusions and sub-girts.

.8 Sub-girts: To be manufactured from G-90 galvanized steel and shall be designed to accommodate expansion and contraction, dynamic movements and design load requirements.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 PREPARATION

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

3.3 INSTALLATION

.1 Wall Panel System:

.1 Before proceeding, examine work of other sections upon which this section depends.

.2 Sub-girts: Prior to installation of insulation air vapour barrier under Section 072710- Air Barriers erect subgirts fastened to masonry wall in accordance with system manufacture's installation instructions. Ensure that all penetrations through air/ vapor barrier are sealed.

.3 After installation of insulation/ air vapour barrier under Section 072710 – Air Barriers and Section 072113 – Board Insulation, erect panels and joint filler strip in accordance with manufacturer's details to meet specified design criteria and performance.

.4 Finished work shall be securely anchored, free of distortion, free of surface imperfections and uniform in colour.

.5 Use concealed fastenings only.

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.6 Install panels plumb, true, level and in alignment to established lines and elevations.

3.4 CONTROL/EXPANSION JOINTS

.1 Construct control and expansion joints where required or as indicated.

.2 Use cover sheets, of brake formed profile, of same material and finish as adjacent material.

.3 Use mechanical fasteners to secure sheet materials.

.4 Assemble and secure wall system to structural frame so stresses on sealants are within manufacturers' recommended limits.

3.5 FIELD QUALITY CONTROL

.1 Have manufacturer of products supplied under this Section review Work involved in handling, installation/application, protection and cleaning of its product[s], and submit written reports in acceptable format to verify compliance of Work with Contract.

.2 Manufacturer's field services: 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 Manufacturer to 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 Three times during progress of Work: at start up, at 25% and 70% complete.

.3 Upon completion of Work, after cleaning is carried out.

.4 Obtain reports within three days of review and submit.

3.6 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Wash down exposed interior and exterior surfaces using solution of mild domestic detergent in warm water, applied with soft clean wiping cloths. Wipe interior surfaces clean as part of final clean-up.

.3 Remove excess sealant with recommended solvent.

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

.5 Remove protective plastic film from panels.

.6 Repair and touch-up with colour matching high grade enamel minor surface damage.

.7 Replace damaged panels and components which cannot be satisfactorily repaired.

END OF SECTION

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SUMMARY OF WORK
Roof Installation

PART 1 GENERAL

1.1 GENERAL CONDITIONS

1.1.1 Conform to all sections in this document and to the requirements of the Canadian Roofing Contractors Association Roofing Manual Specifications as referred to herein.

1.1.2 Abide by all Federal, Provincial, Municipal and Local Laws or Codes, rules and regulations that in any way affect Work including all amendments up to the Project date. No plea of misunderstanding will be considered on account of ignorance thereof. Notify the Consultant immediately in writing of any provisions in Drawings, Specifications or Contract, which are contrary to or inconsistent with any law, rule or regulation.

1.1.3 Where documents differ, the most stringent interpretation will apply.

1.2 TYPE OF FACILITY

1.2.1 This Contract will be carried out on the premises of a new school/building.

1.2.2 Exercise appropriate care and keep construction noise and disruption to an absolute minimum and to the satisfaction of the Owner.

1.2.3 Take special precautions where alterations are required above and in all areas occupied by staff, or pedestrians.

1.3 NEW ROOF ASSEMBLIES:

.1 Supply and install the new roofing system comprised of the following (from the top down):

Roofs: All Roof Areas

(a) Floodcoat of asphalt & pea gravel
(b) 4-Plies of Type IV fiberglass felt in Type II Asphalt
(c) 1-Ply of No. 15 organic felt in Type II Asphalt
(d) 12.7mm (½") High density fiberboard in Type II Asphalt
(e) 2% Tapered insulation in Type II asphalt
(f) 1 Layer 76mm (3.0") polyisocyanurate insulation in Type II asphalt
(g) 1 Layer 76mm (3.0") polyisocyanurate insulation in Type II asphalt
(h) 2-Ply of No. 15 organic felt in Type II Asphalt
(i) Concrete deck (primed)/ Metal deck with 13mm sheathing secured (Refer to roof plan for loactions)
(j) All membrane flashings are to be 2-ply modified bituminous membranes, 1-ply modified bituminous membrane (base sheet) mopped in place with Type III asphalt and 1-ply granulated modified bituminous membrane (cap sheet) torched in place.

.2 Conform to Section 07 51 13 – Built-Up Asphalt Roofing

1.4 ADDITIONAL REQUIREMENTS

.1 Supply and install the new roofing components in accordance with the Contract Documents.

.2 Utilize a single source supplier of membrane and related primary materials.

.3 Provide the membrane manufacturer's warranty as specified. (2-year OIRCA & 10-year material)

.4 Dispose of all debris/waste in approved containers and transfer to an approved municipal and/or provincial disposal site(s).

.5 At locations of metal deck, refer to roof plan and drawings, secure 13mm sheathing with 8 fasteners per 1219 mm x 2438 mm (4'x8') board.

END OF SECTION 07 51 10

07 51 12 -Roofing Rough Carpentry

PART 1 GENERAL

1.1 GENERAL CONDITIONS

1.1.1 All conditions of the Contract and Divisions 00 and 01 apply to this section and to the requirements of the Canadian Roofing Contractors Association Roofing Manual Specifications as referred to herein.

1.1.2 Abide by all Federal, Provincial, Municipal and Local Laws or Codes, rules and regulations that in any way affect the work, including all amendments up to the project date.

1.1.3 All standards, regulations and specifications listed herein are the latest edition.

1.2 CO-ORDINATION

1.2.1 Co-ordinate work of this Section with work

.1 Section 07 51 10 Roofing Summary of Work

.2 Section 07 51 13 Built-Up Asphalt Roofing.

.3 Section 07 62 00 Sheet Metal Flashing and Trim.

.4 Section 07 92 00 Joint Sealants.

1.3 STANDARDS

1.3.1 ASTM INTERNATIONAL

.1 ASTM A123/A123M-[09], Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.2 ASTM A307, Carbon Steel Bolts & Studs.

.3 ASTM A653/A653M-[09a], Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealled) by Hot-Dip Process.

.4 ASTM D1761-[06], Standard Test Methods for Mechanical Fasteners in Wood.

.5 ASTM D5456-[10], Standard Specification for Evaluation of Structural Composite Lumber Products.

1.3.2 CANADIAN GENERAL STANDARDS BOARD (CGSB)

.1 CAN/CGSB-11.3-[M87], Hardboard.

.2 CAN/CGSB-51.32-[M77], Sheathing, Membrane, Breather Type.

.3 CAN/CGSB-51.34-[M86], Vapour Barrier, Polyethylene Sheet for Use in Building Construction and amendment.

.4 CAN/CGSB-71.26-[M88], Adhesive for Field-Gluing Plywood to Lumber Framing for Floor Systems.

1.3.3 CSA INTERNATIONAL

.1 CAN/CSA-A123.2-[03(R2008)], Asphalt Coated Roofing Sheets.

.2 CAN/CSA-A247-[M86(R1996)], Insulating Fibreboard.

.3 CSA B111-[1974(R2003)], Wire Nails, Spikes and Staples.

.4 CSA O112 Series-[M1977(R2006)], CSA Standards for Wood Adhesives.

.5 CSA O121-[08], Douglas Fir Plywood.

.6 CAN/CSA O122-[06], Structural Glued-Laminated Timber.

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.7 CSA O141-[05(R2009)], Softwood Lumber.

.8 CSA O151-[09], Canadian Softwood Plywood.

.9 CSA O153-[M1980(R2008)], Poplar Plywood.

.10 CSA O325-[07], Construction Sheathing.

.11 CSA O437 Series-[93(R2006)], Standards on OSB and Waferboard.

1.3.4 FOREST STEWARDSHIP COUNCIL (FSC)

.1 FSC-STD-01-001-[2004], FSC Principle and Criteria for Forest Stewardship.

.2 FSC-STD-20-002-[2004], Structure and Content of Forest Stewardship Standards V2-1.

.3 FSC Accredited Certified Bodies.

1.3.5 NATIONAL LUMBER GRADES AUTHORITY (NLGA)

.1 Standard Grading Rules for Canadian Lumber [2007].

1.3.6 UNDERWRITERS' LABORATORIES OF CANADA (ULC)

.1 CAN/ULC-S706-[09], Standard for Wood Fibre Insulating Boards for Buildings.

1.4 QUALITY ASSURANCE

1.4.1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

1.4.2 Plywood, particleboard, OSB and wood based composite panels in accordance with CSA and ANSI standards.

PART 2 PRODUCTS

2.1 COMPATIBILITY

2.1.1 Compatibility between materials is an essential requirement of the Contract.

2.2 WOOD

2.2.1 BLOCKING AND ROUGH FRAMING

.1 Grade No. 2, Northern Softwood in accordance with “Standard Grading Rules for Canadian Lumber” as issued by National Lumber Grades Authority (N.L.G.A.).

.2 Spruce, #1Softwood, conforming to CSA 0151.

.3 Wood Cants: 89mm x 89mm (3.5” x 3.5”, 2x4 nominal).

.4 Wood Blocking: 38mm x 38mm (1.5” x 1.5”, 2x2 nominal), 38mm x 89mm (1.5” x 3.5”, 2x4 nominal), 38mm x 140mm (1.5” x 5.5”, 2x6 nominal) 38 x 184mm (1.5” x 7.25”, 2x8 nominal), 38mm x 254mm (1.5” x 9.25”, 2x10 nominal)), 38mm x 286mm (1.5” x 11.25” (2x12 nominal).

2.2.2 PLYWOOD SHEATHING

.1 Exterior, Spruce #1, conforming to CSA 0151 or O121, exterior grade, G1S. Thickness of 13mm (1/2”) and/or 19mm (3/4”) as noted on the drawings.

2.3 FASTENERS

2.3.1 NAILS

.1 Ardox spiral, to CSA Standard B111, length to give 25mm (1") minimum penetration into the materials being fastened.

2.3.2 SCREWS

.1 Fasteners for wood: Galvanized steel wood screws with countersunk heads of size and length to

provide a minimum 38mm (1.5") penetration into the underlying member.

.2 Fasteners for steel substrates: Flat head, self-tapping steel screw with galvanized finish as supplied by Fastening House, or Approved Alternate. Length: to suit. Penetrate through the member a minimum of 19mm (3/4").

.3 Fasteners for masonry and concrete substrates: Tapcon fasteners with "Climaseal" corrosion resistant finish, as manufactured by Buildex/Red Head, or Approved Alternate. Screw to be of sufficient length to penetrate into the substrate a minimum of 38mm (1.5").

.4 Bolts, Washers and Nuts: to ASTM A307. Size as indicated on the Drawings. Hot dipped galvanized or an approved equivalent corrosion resistant finish.

PART 3 EXECUTION

3.1 GENERAL

3.1.1 All carpentry work is to comply with the best practices of trade and by skilled carpenters.

3.1.2 Provide carpentry alterations and comply with best trade practices. Anchor all wood blocking securely to the existing surfaces and to each other.

3.1.3 Make adjustments to the specified procedures caused by weather and site conditions only with the Owner's approval.

3.1.4 Maintain all equipment in good working order to ensure the control of roofing operations and the protection of the Work. Equipment and laying techniques are to meet the approval of the Consultant.

3.2 EXAMINATION

3.2.1 Ensure that existing wood blocking to be incorporated with the work is in good condition and is permanently and properly secured to the existing surfaces.

3.2.2 Inform the Consultant of any unacceptable conditions immediately upon discovery.

3.2.3 Proceed with installation only after the unacceptable conditions have been remedied.

3.2.4 Replace all damaged material and reseal masonry anchors as required to conform to the design intent herein described.

3.2.5 Remove all sharp edges that would otherwise damage materials that come in contact.

3.3 INSTALLATION

3.3.1 Cut, align, plumb, and secure the wood to conform to the full intent of the details. Shim the new wood assembly where required in order to obtain true to line levels.

3.3.2 Construct continuous members from pieces of the longest practical length. Treat all saw cuts with wood preservative.

3.3.3 Countersink bolts where necessary to provide clearance for other work.

3.3.4 Install spanning members with "crown-edge" up.

3.3.5 Install cant strips and blocking as indicated on the drawings, secured permanently to the structure trimmed and levelled to accommodate chamfers and slopes. Install to accommodate insulation, roofing and flashing materials.

3.3.6 Install continuous plywood sheathing, wood blockings, cants, studs, nailers and continuous shims where required and detailed on the Drawings and Details. Shims are to be of sufficient height to ensure a minimum two (2%) percent positive slope on all parapet, perimeter and dividing walls.

3.3.7 Install the roof sheathing in accordance with the requirements of the NBC (National Building Code).

3.3.8 Install furring and blocking as required to space-out and support facings, fascia, soffit, siding, and

other work as required.

3.3.9 Install furring to support siding applied vertically where sheathing is not suitable for direct nailing.

3.3.10 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.

3.3.11 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.

3.3.12 Use nailing disks for soft sheathing as recommended by sheathing manufacturer.

3.3.13 Fabricate sleepers, expansion joints, perimeters and walls as detailed. Maintain a minimum height of 305mm (12") above the finished roof surface for sleepers and curbs and where permitted at walls.

3.3.14 Securely the anchor wood blocking, cant strips, nailers and shims in place at 305mm (12") on centre in a staggered pattern. Fasten studs to the top and bottom plates with two screw fasteners. Fasten wood blocking, wood cant strips, nailers and shims to existing substrate with appropriate screw fasteners.

3.3.15 Fasten the plywood along the supported edges at a minimum of 152mm (6") on centre. Fasten to the framing members within the field of the plywood panel at a maximum of 406mm (16") on centre. Fasten the plywood to the framing and the existing substrate with the appropriate fasteners.

3.3.16 Re-fasten any loose existing wood blocking, cants, shims and plywood with screw fasteners where permitted to remain as part of the finished work and to the satisfaction of the Consultant.

3.3.17 Coordinate work to keep cutting and remedial work to a minimum. Fasteners are to be of size and spacing required to assure secure anchorage. Fastener spacing of the wood blocking to the substrate and to each other is not to exceed 305mm (12") o.c. unless otherwise accepted in writing by the Consultant.

3.3.18 Construct wood blocking as per details. Build-up all perimeter details to accommodate the height of the new roof assembly where required. Install wood blocking so that the new wood blocking extends a minimum of 76.2mm(3") above the finished roof surface. Install sloped wood blocking along the top of the perimeter sloping inward towards the roof. Build-up all unit curbs a minimum of 304.8mm(12") above the finished roof level to accommodate the height of the new roof assembly.

3.3.19 Offset blocking layers 304.8mm(12") and weave corners.

3.3.20 Assemble blocking using two staggered rows of nailing. Space nails in any row a maximum of 609.6mm(24") on centre. Within 2440mm(8') of outside corners, reduce maximum spacing to 304.8mm(12") on centre.

3.3.21 Install asphalt protection board along the perimeters/curbs/walls, from the top of the existing deck to the top edge of the wood blocking along the perimeters/curbs/walls. The asphalt protection board is to be secured 152.4mm(6") on centre horizontally with fasteners spaced no more than 304.8mm(12") on centre vertically.

3.4 MECHANICAL CURBS (UNLESS OTHERWISE PROVIDED)

3.4.1 All fans, HVAC, vents, skylight curbs etc. are to be box framed to a minimum height of 305mm (12") above the finished roof surface.

3.4.2 This includes all roof top openings except drains, electrical conduits, soil stacks, hot stacks and vent stacks.

3.4.3 38mm (1-1/2") thick lumber is to be used or as detailed. Widths as may be required to achieve design intent.

3.4.4 Disconnecting, extending, and reconnecting electrical services to fans, HVAC units etc. Is to be completed by a Mechanical Contractor.

3.4.5 Extending ductwork and vent pipes to new elevations, as required, is to be performed as part of this

Contract.

3.5 GAS LINE SUPPORTS

3.5.1 Install new adjustable supports at each pipe elbow, threaded joint, and where the pipe changes in direction, as well as approximately every 6’ as per the current CSA B149.1 guidelines, Table 6.2 for the distance of the gas line/conduit tray.

3.6 PROTECTION

3.6.1 Protect the installed products and components from damage during construction.

3.6.2 Repair damage to adjacent materials caused by rough carpentry installation.

3.7 CLEANING

3.7.1 Remove all surplus materials and debris resulting from the foregoing work daily as the Work proceeds and upon completion.

END OF SECTION 07 51 12

07 51 13 – Built-Up Asphalt Roofing

PART 1 GENERAL

1.1 GENERAL CONDITIONS

1.1.1 All conditions of Contract and Divisions 0 and 1 apply to this section and to requirements of Canadian Roofing Contractors Association Roofing Manual Specifications as referred to herein.

1.1.2 Abide by all Federal, Provincial, Municipal and Local Laws or Codes, rules and regulations that in any way affect work including all amendments up to project date.

1.2 SECTION INCLUDES

1.2.1 Roofs: All Roofs

Built-up asphalt roofing, pea gravel aggregate broadcast into hot asphalt top pour, 4-ply fibreglass felt, and 1-ply no. 15 organic felt mopped in place with asphalt, cant strips, fibreboard mopped in place, tapered insulation mopped in place, 1st layer of polyisocyanurate insulation mopped in place, 2nd layer of polyisocyanurate insulation mopped in place, and 2-ply no. 15 organic felt vapour retarder mopped in place to the concrete deck or over gypsum sheathing on metal deck. Membrane flashings to be 2-plies modified bituminous membranes, 1-ply modified bituminous membrane (base sheet) and 1-ply granulated modified bituminous membrane (cap sheet) torched in place.

1.3 CO-ORDINATION

1.3.1 Co-ordinate work of this Section with work of:

.1 Section 07 51 10 Roofing Summary of Work

.2 Section 07 51 12 Roofing Rough Carpentry.

.3 Section 07 62 00 Sheet Metal Flashing and Trim.

.4 Section 07 92 00 Joint Sealants.

1.4 STANDARDS

1.4.1 CAN/ULC S702: Standard for Thermal Insulation Mineral Fibre for Buildings.

1.4.2 CAN/CSA – A123.4 (R2008): Asphalt for Constructing Built-up Roof Coverings and Waterproofing Systems.

1.4.3 CAN/CSA O80 SERIES-08 – Wood Preservation.

1.4.4 CAN/CGSB 19.13-M87: Single Compound, One-Component, Elastomeric, Chemical Curing.

1.4.5 CGSB 37-GP-56M Amend: Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing.

1.4.6 CGSB 37-GP-64M: Mat Reinforcing, Fibrous Glass, for Membrane Waterproofing Systems and Built-up Roofing.

1.4.7 CGSB 37-GP-9MA: Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing.

1.4.8 ASTM C165-12: Standard Test Method for Measuring Compressive Properties of Thermal Insulations.

1.4.9 ASTM D6164/D6164M-11: Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements.

1.4.10 ASTM A653/A653-10: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.

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1.4.11 ASTM E84-12: Standard Test Method for Surface Burning Characteristics of Building Material

1.4.12 UL 790: Standard Test Methods for Fire Tests of Roof Coverings.

1.4.13 UL 1256: Fire Test of Roof Deck Constructions.

1.5 SYSTEM DESCRIPTION

1.5.1 Roofs: All Roofs

2 Built-up asphalt roofing, pea gravel aggregate broadcast into hot asphalt top pour, 4-ply fibreglass felt, and 1-ply no. 15 organic felt mopped in place with asphalt, cant strips, fibreboard mopped in place, tapered insulation mopped in place, 1st layer of polyisocyanurate insulation mopped in place, 2nd layer of polyisocyanurate insulation mopped in place, and 2-ply no. 15 organic felt vapour retarder mopped in place to the concrete deck or over gypsum sheathing on metal deck . Membrane flashings to be 2-plies modified bituminous membranes, 1-ply modified bituminous membrane (base sheet) and 1-ply granulated modified bituminous membrane (cap sheet) torched in place.

2.1 WARRANTIES

2.1.1 The Contractor will furnish the Owner and the Consultant with a standard 2-year Canadian Roofing Contractors Association labour warranty and the material manufacturer's 10-year standard warranty.

2.1.2 The Contractor will inspect the roofing project with the Consultant immediately after its completion and will correct any workmanship defects within a reasonable time period (30 days) at the Contractor's expense. Failure to correct the deficiencies and/or provide the required written warranty may cause final payments to be withheld until the situation is rectified.

2.1.3 Failure to provide full documentation will prevent issuance of the certificate of substantial completion and delay the release of the final payment and holdback.

2.1.4 The Owner must notify the Contractor and the Consultant in writing a minimum of thirty days before installation of any equipment or procedures that may damage or alter the roofing system. Failure to notify may void the warranty.

2.1.5 It is the responsibility of the Contractor to notify the membrane manufacturer before the Work begins to arrange on-site inspections by the manufacturer's printed procedures in order to obtain the manufacturer's warranty.

2.2 QUALIFICATIONS

2.2.1 The Contracting company must be an operating roofing company in business for a minimum of 5 years. The Contracting company must be a member in good standing of the CRCA (Canadian Roofing Contractors Association) and local provincial association.

2.2.2 All workers shall be thoroughly experienced in the particular class of Work in which they are employed. The Consultant reserves the right to reject any worker who, in his/her opinion, does not have the skills necessary to properly complete any job they are so assigned.

2.2.3 The Contractor must be acceptable to the materials manufacturer in order to provide the required warranties.

2.2.4 These requirements are required for any and all Sub Contractors.

2.2.5 Provided a competent supervisor to supervise all work.

2.2.6 Ensure that the quality of the work conforms to the best standard trade practices.

2.2.7 Ensure that torching operators continually carry identity verification together with verification of the membrane manufacturer's torching training certification.

2.3 QUALITY CONTROL

2.3.1 Forman

.1 Once the project has started, the roofing foreman cannot be replaced without the written permission of the Consultant.

2.3.2 Housekeeping

.1 The Contractor shall be responsible for maintaining all work areas in a neat and orderly manner. All ground areas shall be clean, neat and orderly at the end of each day's work. All materials and equipment (including kettle) stored on the ground must be placed on plywood to prevent damage to paved areas. If ballast materials must be placed on a grass surface, it must be placed on a protective covering sufficiently large enough to ensure that no ballast remains on the grass. Any and all landscaping damaged or destroyed shall be restored to its original condition by a landscape Contractor paid for by the Contractor.

.2 All roof top areas shall be clean, and materials properly stored at the end of each day's Work.

.3 If the Contractor does not comply with the requirements to keep the premises clean or does not take steps to correct any damage that may have occurred, a written notice will be issued to the Contractor. If immediate, satisfactory steps are not taken to correct the situation, it shall be the prerogative of the Owner to rectify the situation and charge the Contractor accordingly

2.3.3 Protection

.1 Existing roof areas and roof top equipment shall be completely protected throughout the course of this project. Protect roofing system in hoisting area by means of plywood sheets extending a minimum of ten feet beyond the Working area.

.2 Do not transport any materials across new roofing without first installing adequate plywood protection. Failure to adequately protect the roof may result in the rejection of that roof area.

2.3.4 Surface Condition

.1 The Contractor will ensure that all substrates are clean, dry, sound, smooth and free of dirt, debris, moisture, and other contamination before any materials are applied.

2.3.5 Replacement

.1 Any isolated areas that must be torn off and replaced will be built up to the height of the existing roof prior to the installation of the new roofing membrane system.

2.3.6 Damaged Materials

.1 If in the opinion of the Inspector, any materials, either in place or not yet applied, are deemed to have been damaged by moisture, traffic, or any other cause, the Contractor will repair and/or replace the damaged materials to the approval of the Inspector, and at no cost to the Owner.

2.3.7 Weather Conditions

.1 No materials are to be applied when the outside temperature is below 5 degrees Celsius unless written approval is obtained from the manufacturer's representative. No materials are to be applied when precipitation is imminent. No materials will be applied to damp, wet, of contaminated surfaces. No roofing is to be carried out during periods of high winds.

2.3.8 Phased Roofing

.1 All installed insulation must be covered with the specified membranes and membrane flashings the same day. **Phased roofing will not be accepted.**

2.3.9 Night Seals

.1 At the end of each working day, the incomplete installation shall be sealed along all edges to prevent water from entering the roofing system and structure. This temporary night seal must be removed before proceeding with the adjoining area.

2.3.10 Inspection

.1 Before leaving the roof at the end of a working day, inspect the project to ensure that all materials and equipment are covered and secured, no fire hazards are present, no drains are plugged, all openings are properly protected, and all night-seals are completed. Remove the ladder from the building. Secure the kettle area and ensure that the kettle temperature has been reduced to a safe temperature.

2.3.11 Materials & Equipment

.1 All surplus materials and equipment shall be removed from the site when they are no longer required to complete the remaining Work.

2.3.12 Good Roofing Practices

.1 Responsibility – The Contractor shall be responsible for all supervision and execution of the Work as defined in the Construction Documents. The Contractor shall be solely responsible for construction safety and compliance with all legislation, practices, rules and regulations.

.2 Standards – Unless otherwise noted in the specifications, Contractors will adhere to the principles, practices, and guidelines of the Canadian Roofing Contractors Association, and the Ontario Industrial Roofing Contractors Association.

.3 Manufacturers – When possible and practical, use materials supplied from a single manufacturer. All materials, equipment, accessories, etc. are to be applied and/or installed strictly in accordance with the manufacturer's written instructions. No deviations will be permitted without written approval from the manufacturer of that material, equipment, accessory, etc.

.4 Acceptance – The Contractor must verify that all materials can be installed to accommodate the building design, pertinent codes and regulations, and the manufacturer's current recommendations.

2.3.13 Review & Quality Assurance of the Work

.1 Conform to the Owner/Contractor Agreement.

(a) Co-operate with the Owner and their representative(s) to afford all facilities necessary to permit full inspection of the work and testing of materials prior to, during their use and during the warranty period. Act immediately on instructions given by the Consultant.

(b) If the Contractor covers or permits to be covered the 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.

(c) The Consultant will order part of the Work to be examined if the Work is suspected to be not in accordance with the Contract Documents. If, upon examination such work is found in accordance with the Contract Documents, correct such Work and pay the cost of the examination and correction.

.2 Undertaking and periodic inspections by the Owner, their agent, Consultant or Inspector is not to be construed as supervision of actual construction, nor make him responsible for providing a safe place for performance of work by contractors of contractor's employees or those of suppliers or sub-contractors or for access, visits, use, work, travel or occupancy by any person.

.3 Pre-Start Meeting – This meeting is deemed to be a site visit and shall be held before the start of

the project. The Contractor, the foreman for this project, and the Consultant will review the specifications, drawings and details. The site will be examined, and the condition of the grounds and the building will be noted. The Contractor will be responsible for any damage to the facilities resulting from the execution of this project.

.4 Notification – The Contractor shall provide the Consultant with forty-eight (48) hours written notice before commencing Work on this project. At the completion of any patching, flashing repair, or cleaning, and prior to any resurfacing and restoration work, the Contractor shall provide the Consultant with forty-eight (48) hours written notice to inspect the area before work proceeds. After the start date of this project, it shall be the responsibility of the Contractor to notify the Consultant before 8:00 a.m. each and every day, if no roofing personnel will be on site that day; for any reason, weather, labour, materials, strikes, etc., or any other delays. Failure to notify the Consultant will result in an invoice issued to the Contractor in the amount of three hundred and fifty dollars per occurrence. Payment of this invoice must be received by the Inspection Company before the holdback for this project will be released. Further, the Contractor shall send a written notification to the Consultant before 12:00 noon the same day, confirming that their employees will not be on site that day, and that the Consultant was notified before 8:00 a.m. This will serve as a permanent record and proof of notification.

.5 Core Samples – When directed by the Consultant, the Contractor shall cut not more than four(4) cores of approximately 200 square inches each from every newly constructed built-up roof system, and shall restore all such areas to sound and watertight condition. These procedures will be done at the Contractor's cost.

.6 Inspection – The Owner authorizes Tr-Tech Pinnacle Group Inc. to periodically visit the site in order to assist in ascertaining the extent to which the materials and procedures conform to the requirements of these specifications and to the published instructions of the material manufacturer.

.7 Leaks – If a roof leak occurs during the project and the inspector visits the site, the Contractor is required to reimburse the inspection company three hundred and fifty dollar per visit.

.8 Acceptance – The acceptability of the completed roofing Work will be based on its conformance to the written specifications and addenda. The Owner and/or his representative are not obligated to accept non-conforming work and such non-conforming work may be rejected. The rejected Work shall be promptly replaced or corrected in a manner and by methods approved by the Owner's representative. The Consultant will instruct the Contractor's foreman and Work crew on the proper methods of installation of the roofing system and will follow up on a regular basis to inspect the Work being done. Any deficiencies or deviations from the specified Work will be noted and reported to the Owner along with recommended corrective actions necessary. Acceptance of any Work in no way relieves the Contractor of his/her warranty obligations.

.9 Noncompliance – Non-compliance with the terms of this specification and ensuing contract can result in either the cancellation of the contractor or complete replacement of the defective areas at the Contractor's expense. In the event of cancellation, the Owner will not be obligated to compensate the Contractor for any work undertaken. Furthermore, all damages caused by water infiltration resulting from the failure of the Contractor to secure each day's Work in a watertight manner, will be corrected at the Contractor's expense. Included as damages will be all labour costs incurred by the Owner as a result of such water infiltration.

.10 Final Inspections – Final inspections are noted as site visits. Additional visits to re-inspect the project because of defective or incomplete work, or for any other reason may result in additional visits charged to the Contractor.

.11 Responsibility – The presence and activities of the Consultant shall in no way relieve the Contractor and/or Sub Contractor(s) of his/her contractual responsibilities. The Consultant <u>will not</u> act as a supervisor of any work force present on the site.

.12 Safety – Safety is the absolute responsibility of the Contractor. The Consultant is not responsible for, nor has control of safety procedures required for the Work as set forth by legislation, the facility, or accepted construction practices. However, if in the opinion of the Consultant, unsafe conditions, practices and procedures are present, the project may be shut down by order of the Consultant or the Owner until such conditions are corrected.

.13 Engineering Responsibility – Tri-Tech Pinnacle Group Inc. does not, nor do its representatives, practice engineering or architecture. We make no judgments on, and hereby disclaim any responsibility for the soundness of any roof deck or structural component of buildings upon which Work is carried out and recommend that the Owner obtain written certification from a structural engineer that the structure will support the proposed weight of any Work undertaken, including, but not limited to Replacement, Repair, Retrofit, Restoration, or Ballasted Roofing Systems or Equipment installations.

2.3.14 Procedures

.1 Notify the Consultant in advance of the requirements for tests, in order that attendance arrangements can be made.

.2 Submit sampled and/or materials required for testing, as specifically requested in the specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in the Work.

.3 Provide labour and facilities to obtain and handle sample material on site. Provide sufficient space to store and cure test samples.

2.3.15 Defective Work

.1 Conform to the Owner/Contractor Agreement

(a) Remove defective Work, whether the result of poor workmanship, use defective products or damage and whether incorporated in the Work or not, which has been rejected by the Consultant as failing to conform to the Contract Documents. Replace or re-execute in accordance with the Contract Documents.

(b) Make good other Contractor's work damaged by such removals or replacements promptly.

(c) If in the opinion of the Consultant it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, the Owner will deduct from the Contract Price the difference in value between Work performed and that called for by the Contract Documents, amount of which will be determined by the Consultant.

2.3.16 Quality of Work

.1 Execute the Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.

.2 Ensure that the Quality of the Work is of the highest standard, executed by workers experienced and skilled in the respective duties for which they are employed. Immediately notify the Consultant if the required Work is such as to make it impractical to produce the required results.

.3 Do not employ anyone unskilled in their required duties. The Consultant reserves the right to require dismissal from the site, workers deemed incompetent or careless.

.4 Decisions as to the standard or fitness of Quality of Work in cases of dispute rest solely with the Consultant, whose decision is final.

2.3.17 Coordination

.1 Ensure the co-operation of workers in laying out the Work. Maintain efficient and continuous supervision.

.2 Be responsible for the coordination and placement of openings, sleeves and accessories.

2.3.18 Concealment

.1 In finished areas, conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.

.2 Before installation, inform the Consultant if there is interference. Install as directed by the Consultant.

2.3.19 Remedial Work

.1 Perform remedial work required to repair or replace parts or portions of the Work identified as defective or unacceptable. Co-ordinate the adjacent affected Work as required.

.2 Perform remedial work by specialists familiar with the materials affected. Perform in a manner to neither damage nor put at risk any portion of the Work.

2.4 PRE-START MEETING

2.4.1 A pre-start meeting is to be scheduled one week prior to any work commencing. The roofing contractor, the consultant, the on-site contact and/or owner's representative should be present.

2.4.2 The following items will be discussed at the pre-start meeting:

.1 methods and procedures relating to the roof assembly installation

.2 on-site procedures

.3 on-site material storage

.4 the construction schedule

2.5 DELIVERY, STORAGE & HANDLING

GENERAL

2.5.1 Handle and store products in a manner to prevent damage, deterioration and soiling and in accordance with the manufacturer's instructions when applicable.

2.5.2 Store products subject to damage from weather and/or theft in lockable weatherproof enclosures.

2.5.3 All roofing membranes must be stored on end. Granular surfaces membranes will be stored selvage side up. Protect edges of roll goods.

2.5.4 Store cementitious products clear of earth or concrete floors, and away from walls.

2.5.5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.

2.5.6 Store sheet materials and lumber on flat, solid supports and keep clear of ground and/or roof surface. Slope to shed moisture.

2.5.7 Store and mix paints in a heated and ventilated room. Remove oily rags and other combustible debris from the site daily. Take every precaution necessary to prevent spontaneous combustion.

2.5.8 Remove and replace wet and otherwise damaged products at your own expense and to the satisfaction of the Consultant.

2.5.9 Touch-up damaged factory finished surfaces to the Consultant's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

2.5.10 Locate all materials not required to be stored in weatherproof sheds on site in a manner to cause the

least interference with work activities.

2.5.11 Confine work and operations of employees to those defined by the Contract Documents. Do not unreasonably encumber the premises with products.

2.5.12 Do not load or permit to load any part of the Work with weight or force that will endanger the Work. The contractor is fully responsible to ensure the structural loading of the roof is not excessive. Should doubt exist as to the structural capacity of the existing roofing structure, the Contractor will be held responsible for acquiring the opinion and direction from a Professional Structural Engineer, licensed to practice within the province of work at no additional cost to the Owner.

2.5.13 All materials shall be safely stored and protected against weather, vandalism, and theft. All materials will be adequately tarped with waterproof breathable coverings and secured with rope. Provide additional tarps to protect all materials from weather and be responsible at all times for the protection of the materials and the securement of the tarps.

2.5.14 No roofing materials are to be used as ballast to secure protection coverings. Any materials used in this manner will be marked with paint and rejected by the Consultant. These materials must be immediately removed from the job site. Any of these materials found incorporated into the applied roofing system will result in that portion of the Work being rejected.

2.5.15 Store all solvent based materials in well ventilated areas away from excessive heat or open flames.

PRODUCT STORAGE AND HANDLING REQUIREMNTS FOR HAZARDOUS MATERIALS

2.5.16 PROPANE CYLINDERS/GAS CYLINDERS

.1 Follow the supplier's instructions and comply with the Provincial and/or National Health and Safety Guidelines for Low-Slope Roofing when handling and storing gas cylinders.

.2 Transport gas cylinders in an upright position, properly secured. Store gas cylinders with valve closed and safety cap in place inside a locked storage area, at least 7.6m(25') from the kettle or tanker.

.3 Check the pressure regulator before using any gas cylinder and adjust it as required.

.4 Check hoses and couplings for cracks and cuts and replace them as required before using the cylinder.

PRODUCT STORAGE AND HANDLING REQUIREMENTS FOR TOXIC MATERIALS

2.5.17 Store volatile waste in covered metal containers and remove from the premises at the end of each working day.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Roof Membrane (Fibreglass Felts): inorganic, non-woven fibreglass mat, asphalt saturated, Type IV glass felts, meeting or exceeding the requirements of CSA A123.17 and ASTM D2178

2.1.2 Roof Membrane (Organic Felts): high-strength organic felt, asphalt saturated, perforated felt, meeting or exceeding the requirements of CSA A123.3 Type 1 and ASTM D226 Type I

2.1.3 Flashing Membrane (Modified Bituminous – Cap Sheet): Modified bituminous membranes, granulated top and thermo-fusible bottom surfaces, 250gm/sq.m., non-woven polyester reinforced, meeting or exceeding the requirements of CGSB 37.56-M and ASTM D6164 Type II

2.1.4 Flashing Membrane (Modified Bituminous – Base Sheet): Modified bituminous membranes, sanded top and bottom surface, 180gm/sq.m., polyester reinforced, meeting or exceeding the requirements of CGSB-37.56-M and ASTM 6164 for Type I

2.1.5 Asphalt Primer: Conforming to CGSB 37-GP-9Ma

2.1.6 Insulation (Base Layers): 76mm + 76mm (3.0" + 3.0") polyisocyanurate insulation (4'x4' boards). Type: closed cell polyisocyanurate foam roof board insulation with inorganic facers, meeting the requirements of CAN/ULC S704, Type 2 Class 3 materials.

2.1.7 Insulation (Tapered – Top Layer): Fully tapered asphalt impregnated fibreboard to provide a slope of 2.0%. The tapered insulation/layout is to be four-way slope to the drains with no crickets linking the drains. Crickets are to be used at all openings and/or mechanical curbs. Flat areas around the drains are not to exceed 50ft2. Meeting and exceeding the requirements of CAN/CSA-A247-M86 and CAN/ULC-S706.

Acceptable Products: Asphalt Impregnated Fibreboard by Posi-Slope Enterprises Inc.

2.1.8 Insulation Sump: Polyisocyanurate, pre-manufactured, one piece drain sump. Meeting the requirements of CAN/ULC S770. Drain sumps to be 8'x8'

Acceptable Products: Gemini Drain Sets by Atlas Roofing Corporation or Drain Sumps by Posi-Slope Enterprises Inc.

2.1.9 Cover Board: 12.7mm (0.5") high density fibreboard insulation (4'x4') boards, factory coated on one side, meeting or exceeding the requirements of CAN ULC-S706-09 Type II, Class 1

2.1.10 Vapour Retarder: High-strength organic felt, asphalt saturated, perforated felt, meeting or exceeding the requirements of CSA A123.3 Type 1 and ASTM D226 Type I

2.1.11 Asphalt: Type II conforming to CSA Std. A123.4M

Type III conforming to CSA Std. A123.4M

2.1.12 Pea Gravel: Clean, water washed, free from organic matter and fines. 9mm(3/8") aggregate.

2.1.13 Stripping Adhesive: One-part rubberized elastomer

2.1.14 Gypsum Board: 13mm(1/2") thick, 4'x8' boards, fastened in place as per manufacturer

2.2 ACCESSORIES

2.2.1 Wood Blocking, Plywood Sheathing: Construction grade; free from warping and visible decay; pressure-treated spruce, to CAN/CSA O80 SERIES-08.

2.2.2 Wood Fasteners: hot-dipped galvanized steel fasteners conforming to ASTM A153

2.2.3 Cant Strip: asphalt impregnated fibreboard cant strip.

2.2.4 Metal Flashing: 26 gauge pre-painted galvanized; Series 8000 baked enamel finish; colour to match existing, to ASTM A653/A653M-10. 24 gauge metal for all cleats and hook strips. Colour to be confirmed by the Owner.

2.2.5 Pitch Pan: Pre-manufactured type; 16 oz. copper, fully soldered, minimum 152.4 mm (6") high above finished roof level, complete with copper caps and sealant.

2.2.6 Pitch Pan Sealant: M-1 Structural sealant (pitch pan sealant) and 1-part pourable sealer (pitch pan pourable sealer) by ChemLink or Joint & Termination Sealant #9600 (pitch pan sealant) and Semi-Selfleveling Sealer #4500 (pitch pan pourable sealer) by Lucas

2.2.7 Self-Adhering Membrane (Perimeter Parapet): Self-adhering, self-sealing, composite membrane consisting of a high softening point with SBS rubberized asphalt compound.

2.2.8 Self-Adhering Membrane Adhesive (Perimeter Parapet): Rubber based adhesive for self-adhering membranes.

2.2.9 Sealant: single component; moisture cure; polyurethane sealant conforming to CAN/CGSB19.13M87.

2.2.10 Fasteners: 25mm square or round head, ring shanked galvanized or non-ferrous type, length as required to suit application.

2.2.11 Drains: Boxed Copper Retro Drain with Flange, with Dome, with Seal, with Stainless Steel Ballast Guards by Platinum Technologies Inc.

2.2.12 Control Flow Mechanism: by Platinum Technologies Inc.

2.2.13 Gooseneck Flashing: 30" Stainless Steel gooseneck 1.9" I.D. and spun aluminum base by Platinum Technologies Inc.

2.2.14 Tall Cones: all sizes (1.5" to 12"): by Platinum Technologies Inc.

2.2.15 Vent Stack: insulated aluminum vent stack with factory applied polyurethane foam insulation and vent stack cap by Platinum Technologies Inc.

2.2.16 Termination Bar: 10' Alum Term Bar – Item NO. – Term-10 (#90354) by Platinum Technologies Inc.

2.2.17 Gas Line Supports: SmartBlox as supplied by Platinum Technologies Inc.

2.2.18 Foam Gasket: EMSEAL MST Multi-Use Sealant Tape or EMSEAL UST Sealant Tape

Note: The Contractor must supply all primers, mastics, and membranes from a single source Manufacturer. No alternates will be accepted without written approval from the Consultant

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Supply and install perimeter safety warning as prescribed by the Provincial Occupational Health and Safety Code and all local codes before starting any other work.

3.1.2 It is the contractor's responsibility to obtain all required permits for this project and must carry this cost in his bid price.

3.1.3 The ground areas around the building are to be protected as much as possible. All disposal boxes must be placed on planks. The interior areas of the building, where the roofing contractor has access, are to be protected.

3.1.4 It is the responsibility of the roofing contractor to contact the Owner to mark the exact location of buried utilities.

3.1.5 Inspect the deck and report any deficiencies to the Owner's Representative. Do not apply any new roofing over deficiencies, other than temporary waterproofing, until all deficiencies have been corrected.

3.1.6 Phasing of the roof assembly is not acceptable. Therefore, the entire roof assembly from the vapour retarder to the flood coat and aggregate are to be installed on a daily basis.

3.1.7 All adjacent roof areas being used for storage/setup and travelled on, are to be fully protected with polystyrene and plywood. Roofing contractor is responsible for all costs relating to overhead protection, scaffolding, protection of adjacent roofs and any required permits.

3.2 ASPHALT PREPARATION

3.2.1 Prepare asphalt according to Manufacturer's instructions. If heating temperatures are not supplied on the containers or Bills of lading, for the asphalt on site, heat to no more than the temperatures listed below.

Mechanical Application	Mop Application
Type II 221 ^{0}C (+/- 15 ^{0}C) 450 ^{0}F (+/- 25 ^{0}F)	Type II 210 ^{0}C (+/- 15 ^{0}C) 410 ^{0}F (+/- 25 ^{0}F)
Type III 239 ^{0}C (+/- 15 ^{0}C) 462 ^{0}F (+/- 25 ^{0}F)	Type III 225 ^{0}C (+/- 15 ^{0}C) 437 ^{0}F (+/- 25 ^{0}F)

3.2.2 Maintain asphalt in tanker or kettle below its Final Blowing Temperature (FBT) of 260^{0}C (500^{0}F) as indicated on Bill of Lading or container. In cold weather insulate delivery pipes and transport bitumen in insulated carriers on the roof.

3.2.3 Bitumen shall not be heated to Flash Point or FBT for more than four (4) hours.

3.2.4 Apply asphalt at temperatures noted in the above table.

3.2.5 Ensure an accurate thermometer independent of the kettle thermometer or heat gun is used to monitor the asphalt temperature. Consultant may request a daily temperature Log.

3.2.6 Asphalt Quantities:

1. Insulation or cover board mopping: 1.0 kg/m2 (20 lbs. / 100 ft2)
2. Glass Ply Sheet interplay mopping: 1.2 kg/m2 (25 lbs. / 100 ft2)
3. Base Ply interplay mopping: 1.0 kg/m2 (20 lbs. / 100 ft2)
4. Glaze Coat: 0.49-0.73 kg/m2 (10-15 lbs. / 100 ft2)
5. Flood Coat (Top Pour): 2.9 kg/m2 (60 lbs. / 100 ft2)

3.3 VAPOUR RETARDER

3.3.1 Install 2-plies of No. 15 organic felt membrane fully hot mopped in place using Type II asphalt at a rate of 20-25lbs. per 100 sq.ft., over the concrete deck or sheathing board over metal deck.

3.3.2 Do not stand on the newly embedded felt to unroll the membrane. Do not walk on the membrane until the asphalt has set up. **Gang rolling of felts is not allowed.**

3.3.3 Ensure the felts lie flat, with no wrinkles, fishmouths, or blisters, and are well bonded. All surfaces of the membrane must be completely coated with asphalt. No areas of dry felt in contact with dry felt will be accepted.

3.3.4 No felts are to be left uncoated at days end for any reason.

3.4 INSULATION & COVER BOARD

3.4.1 Ensure the vapour retarder is clean, dry, continuous, and ready for insulation application.

3.4.2 Install first layer of insulation fully mopped in place in Type II asphalt at a rate of 20-25lbs. per 100sq.ft., over the vapour retarder. Ensure all insulation boards butted tight with no gaps between boards. Insulation is to be placed with all joints staggered a minimum of 609.6mm (2') per row, per layer.

3.4.3 Install second layer of insulation fully mopped in place in Type II asphalt at a rate of 20-25lbs. per 100sq.ft., over the first layer of insulation. Ensure all insulation boards butted tight with no gaps between boards. Insulation is to be placed with all joints staggered a minimum of 609.6mm (2') per row, per layer.

3.4.4 Install 2.0% tapered insulation fully mopped in place in Type II asphalt at a rate of 20-25lbs. per 100sq.ft., following the tapered insulation manufacturer's drawings.

3.4.5 No damaged or wet insulation will be accepted. All rejected materials will be marked and must be stored on site. They are not to be removed until the project is completed.

3.4.6 Install sloped prefabricated insulation 2438.4mm x 2438.4mm (8'x8') around all roof drains. Adjust the insulation thickness (top layer) to accommodate the sumps.

3.4.7 Install one layer 12.7mm(0.5") high density fibreboard cover board, in a full mopping of Type II asphalt, at a rate of not less than 20lbs. per 100 sq.ft. over the tapered insulation and carried over the drain sumps. Butt boards tightly together. Stagger all joints. Ensure that the joints of the tapered layer and the cover board are not directly over one another.

3.4.8 Do not apply more insulation & cover board than can be covered with membranes the same workday.

3.5 CANT STRIPS

3.5.1 Embed the cant strip into a full mopping of Type II asphalt at all horizontal to vertical transitions in the roof. Cant strip is to be continuous and butted tight.

3.5.2 No damaged or wet cant strip will be accepted. All rejected materials will be marked and must be stored on site. They are not to be removed until the project is completed.

3.6 MEMBRANE APPLICATION

3.6.1 Over the insulation, apply 5 plies (1-ply No. 15 organic felt membrane and 4-ply Type IV fibreglass felts) of membranes fully hot mopped in place using Type II asphalt.

3.6.2 Apply 1-ply of No. 15 organic felt membrane fully hot mopped in place using Type II asphalt at a rate of 20-25lbs. per 100 sq.ft., over the newly installed cover board.

3.6.3 Over the 1-ply, apply 4 plies of Type IV fibreglass felts fully hot mopped in place using Type II asphalt at a rate of 20 – 25 lbs. per 100 sq.ft. pre ply. Do not mop more than 3.048m(10') in front of the roll. Ensure a minimum 12.7mm (0.5") bleed-out of asphalt occurs along the side and end laps of each ply. All plies will be terminated at the top of the cant strip. The mini mop asphalt spreader is not to be used when installing fibreglass felts. A hand mop is to be used.

3.6.4 Do not stand on the newly embedded felt to unroll the membrane. Do not walk on the membrane until the asphalt has set up. **Gang rolling of felts is not allowed.**

3.6.5 **Phased roofing will not be accepted.** If one, or two, or three plies are applied for whatever reason, the contractor must remove these plies and apply a new 4 ply system on top at no additional cost to the owner.

3.6.6 All end laps in the field of the roof are to be staggered.

3.6.7 Ensure the felts lie flat, with no wrinkles, fishmouths, or blisters, and are will bonded. All surfaces of the membrane must be completely coated with asphalt. No areas of dry felt in contact with dry felt will be accepted.

3.6.8 No felts are to be left uncoated at days end for any reason.

3.7 GRAVEL

3.7.1 Apply a 60lb. per 100 square foot flood coat of Type II asphalt. While the asphalt is still hot, embed the new aggregate at a rate of 500 lbs. per 100 square feet.

3.7.2 Sweep loose gravel back 20' from all corners on the roof. Pour another floodcoat of Type II asphalt and embed another layer of new, washed aggregate into the hot asphalt.

3.7.3 Once the aggregate has been applied, no asphalt is to be visible.

3.8 NIGHT SEAL

3.8.1 Roofer is responsible to have all roofs closed-in and in a watertight condition at the end of each production day.

3.8.2 It is the Foreman's responsibility to thoroughly check this detail at the end of each day before leaving

the roof.

3.9 MEMBRANE FLASHINGS

3.9.1 Provide membrane flashings in accordance with membrane manufacturer's written installation guidelines. All flashing membranes are to be installed in 1-meter widths.

3.9.2 Install flashings to ensure the roof is watertight at the end of each working day.

3.9.3 Contractor is responsible to disconnect and reconnect any electrical conduit, cabling, and/or gas lines which are affecting the roof installation.

3.9.4 Membrane flashings will be comprised of 1 ply granulated modified bituminous cap sheet torched in place and 1 ply modified bituminous base sheet in Type III asphalt.

3.9.5 Flashing membranes are to be terminated 304.8mm (12") above the top of the cant strips at all locations.

3.9.6 Perimeter (Outside Perimeter):

.1 Raise the existing perimeter to accommodate the height of the new roof assembly, where required.

.2 Apply one coat of quick dry primer on all surfaces to receive modified bituminous membranes at a rate of 150 sq.ft. per gallon. Ensure that all surfaces are clean and dry before primer application.

.3 After the application of the 5 ply field membranes, apply 1-ply modified bituminous base sheet membrane flashings fully hot mopped in place using Type III asphalt, extending on the roof surface a minimum of 101.6mm(4") and extending over the top of the detail and down the outside face fully covering the wood blocking. The membrane shall be nailed every 457.2mm (18") on centre.

.4 Apply 1-ply granulated modified bituminous cap sheet membrane flashings torched in place extending a minimum of 101.6mm(4") beyond the modified bituminous membrane base sheet membrane flashings onto the roof surface and extending to the top of the perimeter. Ensure that the laps of the granulated modified bituminous cap sheet membrane flashings do not coincide with the laps of the modified bituminous base sheet membrane flashings.

.5 Continuously seal the top edge of the granulated cap sheet with elastomeric sealant. All seams and laps of the granulated cap sheet membrane are to be hot air welded.

.6 Fully cover the membrane flashings with new pre-painted metal flashings.

3.9.7 Equipment Curb Flashings:

.1 Build-up all unit curbs a minimum of 305mm (12") above the finished roof surface to accommodate the height of the new roof assembly where required.

.2 Temporarily disconnect each HVAC/fan unit, completely lift the unit off the curb and set it on the roof while flashing the curb. The curb is to be set on plywood to protection the roof membrane. Once the curb has been flashed, the unit is to be lifted off the roof and set back on the curb. Then once the unit has been reinstalled and reconnected it is to be tested to ensure it is working properly. The unit work must be performed only by qualified HVAC contractors. The roofing contractor is responsible for these costs in his bid price.

.3 Apply one coat of quick dry primer on all surfaces to receive modified bituminous membranes at a rate of 150 sq.ft. per gallon. Ensure that all surfaces are clean and dry before primer application.

.4 After the application of the field membranes, apply 1-ply modified bituminous base sheet membrane flashing fully hot mopped in place using Type III asphalt, extending on the roof surface

a minimum of 101.6mm (4") and extending over top of the curb.

.5 Apply 1-ply granulated modified bituminous cap sheet membrane flashing torched in place, extending a minimum of 101.6mm (4") beyond the modified bituminous base sheet membrane flashing onto the roof surface and extending over top of the curb.

.6 The granulated modified bituminous cap sheet membrane flashing is to be nailed every 152.4mm (6") on centre at the top of the curb.

.7 Fully cover the membrane flashings with new pre-painted metal flashings.

.8 Install new foam gasket over top of the metal flashings prior to reinstalling mechanical equipment/skylights. Ensure foam gasket is continuous, creating a permanent seal between the mechanical equipment/skylights and metal flashings.

3.9.8 Vent/Plumbing Stack:

.1 The stack jack flange is to be primed before installation. Paint all existing vent stacks using double "D" aluminum paint.

.2 All existing plumbing vent pipes are to be extended to suit, so that the inside portion of the cap is within the plumbing vent pipe. Stacks to be a minimum of 304.8mm (12") above the finished roof surface. All stacks are to be pre-insulated as listed in the Materials section. Mechanically fasten cap with 2 self-tapping stainless-steel screws.

.3 Secure a metal cone down to the concrete deck. The cone must extend up past the finished roof level a minimum of 50.8mm (2"). Install the roofing vapour retarder so that it extends above the insulation surface 50.8mm (2"). The insulation should butt up against the metal cone.

.4 Over the new field membranes, embed the flange of the stack in elastomeric sealant.

.5 Install modified bituminous base sheet membrane flashings and granulated modified bituminous cap sheet membrane flashings in Type III asphalt over the flange. The first ply shall be applied starting 38.1mm (1.5") away from the upright and extend a minimum of 101.6mm (4") beyond the flange. The second ply shall be applied tight to the upright and extend a minimum of 203.2mm (8") beyond the flange.

.6 Elastomeric sealant and granules are to be applied where the modified bituminous cap sheet membrane flashings meet the stack along the base.

.7 Install insulating sleeve. Mechanically fasten cap with 2 self-tapping stainless-steel metal screws.

3.9.9 Furnace Stack:

.1 Secure a metal cone down to the concrete deck. The cone must extend up past the finished roof level a minimum of 50.8mm (2"). Install the roofing vapour retarder so that it extends above the insulation surface 50.8mm (2"). The insulation should butt up against the metal cone.

.2 Over the new field membranes, embed the flange of the stack in elastomeric sealant.

.3 Install modified bituminous base sheet membrane flashings and granulated modified bituminous cap sheet membrane flashings in Type III asphalt over the flange. The first ply shall be applied starting 38.1mm (1.5") away from the upright and extend a minimum of 101.6mm (4") beyond the flange. The second ply shall be applied tight to the upright and extend a minimum of 203.2mm (8") beyond the flange.

.4 Replace any damaged rain collars and re-caulk all collars.

3.9.10 Pitch Pans:

.1 All pitch pans will be replaced. Pitch pans must be a minimum of 152.4mm (6") high (above the finished roof surface) with a 101.6mm (4") primed roof flange. The sides of the pan will be a

minimum of 50.8mm (2") from the projection. **Where possible use copper gooseneck instead of pitch pan.**

.2 Secure a metal cone down to the metal deck. The cone must extend up past the finished roof level a minimum of 50.8mm (2"). Install the roofing vapour retarder so that it extends above the insulation surface 50.8mm (2"). The insulation should butt up against the metal cone.

.3 Over the new field membranes, embed the flange of the stack in elastomeric sealant.

.4 Install modified bituminous base sheet membrane flashings and granulated modified bituminous cap sheet membrane flashings in Type III asphalt over the flange. The first ply shall be applied starting 38.1mm (1.5") away from the upright and extend a minimum of 101.6mm (4") beyond the flange. The second ply shall be applied tight to the upright and extend a minimum of 203.2mm (8") beyond the flange.

.5 Ensure the penetration and the inside walls of the new pitch pans are clean and free from any dirt or debris before applying sealant.

.6 Apply pitch pan sealant around the inside walls and base of the pitch pan. Apply pitch pan sealant around the roof projection.

.7 Fill all pitch pans using pourable sealant.

.8 Install new pitch pans as required at mechanical units and at other roof penetrations/projections, no conduits, satellite cables, or gas lines are to be carried through the curb flashings. The roofing contractor is responsible for the disconnection and reconnection, where required.

3.9.11 Roof Drains:

.1 Sump area around the drains 12.7mm (0.5") deep and centered equally over the drain in all directions. 8'x8' drain sumps are to be installed.

.2 Over the new field membranes, install new drain in a full bed of elastomeric sealant. Check the drainpipes on the underside of the deck to ensure the installation of the proper length of down-pipe. Ensure that the pipe does not impede the flow of water. Plug the drains temporarily while working around them.

.3 Apply 1 coat of primer to the flange.

.4 Install 1-ply modified bituminous base sheet membrane flashings extending a minimum of 457.2mm (18") from the centre of the drain into hot asphalt. Install 1-ply modified bituminous cap sheet membrane flashing extending a minimum of 152.4mm (6") beyond the first ply into hot asphalt.

.5 Apply 1 ply of modified bituminous base sheet membrane in hot asphalt that extends a minimum of 25.4mm (1" beyond the edge of the drain sump shoulder in each direction.

.6 Apply asphalt with a dipper and apply gravel into hot asphalt. If the plumbing connection, on the underside of the metal deck has been made **REMOVE THE PLUG.** Do not leave plugged overnight.

.7 The new metal strainer and control flow mechanism are to be installed immediately following the installation of the flashing membranes. Therefore, if the roof has 10 drain and only two drains have been flashed (that particular day), those two drains are to have the metal strainer, control flow mechanism installed at the end of that workday.

3.9.12 Scupper Drains:

1. Install new fully soldered copper scupper drain. The new scupper drains are to have a 152.4mm x 152.4mm (6"x6") tail piece to accept new 24-gauge pre-painted metal, open faced downpipes. Downpipes are to kick out from the wall a minimum of 304.8mm (12") and have a patio paver on polystyrene insulation installed at the base. New downpipes are to be 152.4mm x 152.4mm

(6"x6"). Scupper flanges are to be a minimum of 152.4mm (6") wide and extend onto the field of the roof and perimeter as per detail.

2. Construct wood blocking to allow for the new scupper to site approximately ¼" to ½" lower than the finished roof level and to allow the opening to be flashed in with modified bituminous membranes.
3. Apply one coat of quick dry primer on all surfaces to receive asphalt and membranes at a rate of 150 sq.ft. per gallon. Ensure that all surfaces are clean and dry before primer application.
4. The field membranes are to be extended directly into the scupper opening fully covering the wood blocking.
5. The new scupper drain is to be primed to accept asphalt and membranes. New scupper is to be set into a full bed of mastic.
6. Install 1-ply modified bituminous base sheet membrane flashing mopped in place over the flange, using Type III asphalt. The base sheet flashings are to extend a minimum of 152.4mm (6") beyond the flange of the scupper onto the field of the roof in all directions and be carried into the scupper. The granulated modified bituminous cap sheet field membranes are to be carried into the scupper over the modified bituminous base sheet flashings. All laps and seams in the modified bituminous cap sheet flashings are to be hot-air welded.
7. New metal flashings are to be installed fully covering the membrane flashings and picture framing the scupper along the outside perimeter of the roof.

3.9.13 Sleepers:

1. Build-up all sleepers a minimum of 305mm (12") above the finished roof level to accommodate the height if the new roof assembly where required. Wood blocking and cant strip to be pressure treated. Ensure positive drainage between sleepers, under the mechanical equipment.
2. If required, temporarily disconnect each HVAC/fan unit, completely lift the unit off the curb and set it on the roof while flashing the sleepers. The unit is to be set on plywood, protecting the roof membrane. Once the sleepers have been flashed, the unit is to be lifted off the roof and set back on the curb. Then once the unit has been reinstalled and reconnected it is to be tested to ensure it is working properly. The unit work must be performed only by qualified HVAC contractors. The roofing contractor is responsible for these costs in his bid price.
3. Apply one coat of quick dry primer on all surfaces to receive modified bituminous membranes at a rate of 150 sq.ft. per gallon. Ensure that all surfaces are clean and dry before primer application.
4. After the application of the field membranes, apply 1-ply modified bituminous base sheet membrane flashing fully mopped in place using Type III asphalt, extending on the roof surface a minimum of 101.6mm (4") and extending up and over the sleeper.
5. Apply 1-ply granulated modified bituminous cap sheet membrane flashings torched in place using Type III asphalt, extending a minimum of 101.6mm (4") beyond the 1st ply modified bituminous base sheet membrane flashings onto the roof surface and over top of the sleepers. Cap sheet membrane flashing sides laps to be staggered 101.6mm (4") from the modified bituminous base sheet membrane flashings side laps.
6. The granulated cap sheet membrane flashings are to be extended a minimum of 203.2mm (8") beyond the toe of the cant strip onto the field of the roof, on both side of the sleepers.
7. Fully cover the membrane flashings with new pre-painted metal flashings.

3.9.14 Doghouse Curb:

1. Build-up the doghouse curb to accommodate the height of the projections. Install gypsum board under the curb, leaving 6.35mm(1/4") gap between any conduit and pipes in the dog house.

2. Temporarily disconnect the equipment entering the doghouse, as required and as possible to complete the doghouse. Once the doghouse has been constructed/flashed, reconnect the equipment. Then once the equipment has been reinstalled and reconnected it is to be tested to ensure it is working properly. The unit work must be performed only by qualified contractors.
3. The field membranes are to be terminated at the top of the cant strip.
4. After the application of the field membranes, apply 1-ply modified bituminous base ply flashing membrane, mopped in place with Type III asphalt. Flashing membrane is to extend over top of the curb and down onto the field of the roof a minimum of 76.2mm(3") beyond the toe of the cant strip.
5. After the application of the modified bituminous base sheet flashing, apply 1-ply modified bituminous cap sheet flashing membrane adhered in Type III asphalt, extending a minimum of 76.2mm(3") beyond the modified bituminous base sheet flashing membranes onto the field of the roof and overtop of the curb. Ensure the laps of the 2nd ply do not coincide with the laps of the 1st ply.
6. The cap sheet flashing membrane is to be nailed every 152.4mm(6") on centre at the top of the curb.
7. Fill the doghouse with fire-resistant batt insulation. The insulation is to be kept approximately 76.2mm(3") from the top of the curb.
8. Apply M1 structural sealant around the inside walls, over the insulation and along the top, where the membrane flashings have been terminated. Apply M1 sealant on the pipes and conduit within the curb.
9. Install new pre-painted metal flashings fully covering the membrane flashing. The metal flashing is to have a minimum of 25.4mm(1") upstand to allow for the securement of the dog house.

3.9.15 Metal Siding:

1. Flashing membranes at inside walls, are to be terminated 304.8mm (12") above the top of the cant strip. Cut the existing metal siding to accommodate the height of the new membrane flashings and metal flashings to be installed. Install 6.35mm (1/4") asphalt recovery board over exposed substrate behind metal siding.
2. Where the membrane flashings and/or peel & stick membrane (existing) is found behind the detail, it is to be peeled up and protected during the new membrane flashing installation. Once the new membrane flashings have been installed, the existing membrane flashings are to be shingled over the new membrane flashings. Cut the existing membrane flashings and/or peel & membrane (existing) approximately 152.4mm (6") below the eave of the slope
3. Apply one coat of quick dry primer on all surfaces to receive asphalt and membranes at a rate of 150 sq.ft. per gallon. Ensure that all surfaces are clean and dry before primer application.
4. After the application of the 5-ply field membranes, apply 1 ply modified bituminous membrane base sheet flashings fully hot mopped in place with Type III asphalt, extending down onto the roof surface a minimum of 101.6mm (4") and extending up the wall.
5. Apply 1 ply of 180 g./sq.m. granulated modified bituminous cap sheet in Type III asphalt extending a minimum of 101.6mm (4") beyond the modified bituminous base sheet flashing membrane onto the roof surface. Cap sheet flashing membrane to be installed in 1-meter widths with 76.2mm (3") side laps.
6. A termination bar is to be installed through the flashing membranes, approximately 12.7mm (0.5") below the top of the granulated cap sheet flashing membranes. It is to be secured 152.4mm (6") on center.
7. Continuously seal the top edge of the granulated cap sheet with elastomeric sealant.

8. All seams and laps in the granulated cap sheet are to be hot-air welded.
9. Install new metal drip closure, to be tucked behind the existing metal siding and mechanically fastened in place, as per details. Fully cover the membrane flashings with new 26-gauge metal flashing. Metal flashings are to be tucked in behind the existing siding and secured in place.

3.11 GAS LINES

3.11.1 Wire brush all gas lines to remove surface rust.

3.11.2 Apply 2 coats of yellow rust inhibiting paint.

3.12 GAS LINE & CONDUIT SUPPORTS

3.12.1 Install new adjustable supports at each pipe elbow, threaded joint, and where the pipe changes in direction, as well as approximately every 6' as per the current CSA B149.1 guidelines, Table 6.2 for the distance of the gas line/conduit tray.

Pipe O.D. Diameter in Inches (mm)	Maximum Spacing for Pipe Supports Feet (Metres)
0.5" (12.7mm) or less	Horizontal 6 feet (2 metres)
0.75-1.0" (19 -25.4mm)	Horizontal 8 feet (2.5 metres)
3-4" (75-102mm)	Horizontal 15 feet (5 metres)
5-8" (127-204mm)	Horizontal 20 feet (6 metres)
10" or larger	Horizontal 25 feet (8 metres)
All pipe Sizes- Vertical	Every floor but not more than 125% of horizontal spacings.
Tubing- all sizes	Vertical & Horizontal 6 feet (2 metres)
Supports to be placed at all pipe unions, changes in directions (both sides) and at changes in elevation.	

3.13 SCUPPERS/CONDENSATE PIPES/ROOF ACCESS/MECHANICAL UNIT

3.13.1 Install new concrete patio pavers on 25.4mm (1") extruded polystyrene insulation. The extruded polystyrene insulation is to be cut 50.8mm (2") smaller (all the way around) than the concrete patio pavers. Therefore, if the concrete paver is 609.6mm x 609.6mm (24"x24") the extruded polystyrene insulation should be 508mm x 508mm (20"x20").

3.13.2 Install four concrete patio pavers on 25.4mm (1") extruded polystyrene insulation, in a square pattern at roof access points.

3.14 FINISH

3.14.1 Perform a daily clean up to collect all wrappings, empty containers, and any other debris from the project site.

3.14.2 Upon completion, all debris is to be disposed of in a legally acceptable manner.

3.14.3 Prior to the final inspection, the Contractor is to perform a pre-inspection to review all work and to verify that all flashings have been completed as well as the application of all caulking.

END OF SECTION 07 51 13

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07 62 00 - Sheet Metal Flashing & Trim

PART 1 GENERAL

1.1 GENERAL CONDITIONS

1.1.1 All conditions of the Contract and Divisions 0 and 1 apply to this section and to the requirements of the Canadian Roofing Contractors Association Roofing Manual Specifications as referred to herein.

1.1.2 Abide by all Federal, Provincial, Municipal and Local Laws or Codes, rules and regulations that in any way affect the work including all amendments up to the project date.

1.2 CO-ORDINATION

1.2.1 Co-ordinate the work of this Section with the work of:

.1 Section 07 51 10 Roofing Summary of Work

.2 Section 07 51 12 Roofing Rough Carpentry

.3 Section 07 51 13 Built-Up Asphalt Roofing

.4 Section 07 92 00 Joint Sealants

1.3 STANDARDS

1.3.1 THE ALUMINUM ASSOCIATION INC. (AAI)

.1 AAI-Aluminum Sheet Metal Work in Building Construction-[2002].

.2 AAI DAF45-[03], Designation System for Aluminum Finishes.

1.3.2 AMERICAN SOCIETY FOR TESTING AND MATERIALS INTERNATIONAL (ASTM)

.1 ASTM A167-[99(2004)], Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

.2 ASTM A240/A240M-[07e1], Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

.3 ASTM A606-[04], Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance.

.4 ASTM A653/A653M-[07], Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.

.5 ASTM A792/A792M-[06a], Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by Hot-Dip Process.

.6 ASTM B32-[04], Standard Specification for Solder Metal.

.7 ASTM B370-[03], Standard Specification for Copper Sheet and Strip for Building Construction.

.8 ASTM D523-[89(1999)], Standard Test Method for Specular Gloss.

.9 ASTM D822-[01(2006)], Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.

1.3.3 CANADIAN ROOFING CONTRACTORS ASSOCIATION (CRCA)

.1 Roofing Specifications Manual, latest edition.

1.3.4 CANADIAN GENERAL STANDARDS BOARD (CGSB)

.1 CAN/CGSB-37-GP-9M, Asphalt Primer.

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.2 CAN/CGSB-51.32-[M77], Sheathing, Membrane, Breather Type.

.3 CAN/CGSB-93.1-[M85], Sheet Aluminum Alloy, Prefinished, Residential.

.4 CAN/CGSB 93.3-M, Sheet, Steel, Galvanized Pre-finished Residential.

1.3.5 CANADIAN STANDARDS ASSOCIATION (CSA INTERNATIONAL)

.1 CSA A123.3-[05], Asphalt Saturated Organic Roofing Felt.

.2 AAMA/WDMA/CSA 101/I.S.2/A440-[2008], Standard/Specification for Windows, Doors, and Unit Skylights.

.3 CSA A123.22, Self-Adhering Polymer Modified Eave Protection

.4 CSA B111-[1974(R2003)], Wire Nails, Spikes and Staples.

1.3.6 GREEN SEAL ENVIRONMENTAL STANDARDS

.1 Standard GS-03-[93], Anti-Corrosive Paints.

.2 Standard GS-11-[97], Architectural Paints.

.3 Standard GS-36-[00], Commercial Adhesives.

1.3.7 HEALTH CANADA/WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM (WHMIS)

.1 Safety Data Sheets (SDS).

1.4 APPROVAL

1.4.1 Do not install any metal work until the membrane flashings have been inspected and accepted by the Owner's Representative. The colour is to be determined by the Owner.

1.4.2 In all cases and prior to the fabrication of the finished product, supply and install a sample for approval by the Owner's representative.

1.5 SCHEDULE

1.5.1 Schedule the work so that the membrane flashings are not left exposed for more than 30 days.

1.6 WARRANTY

1.6.1 Guarantee the metal flashing in conjunction with the membrane roofing for TWO (2) year. Submit on the same form as for the membrane roofing, CRCA Warranty.

1.7 QUALITY CONTROL

1.7.1 Quality control for Work of this Section is to be performed by the Consultant under the work of and as specified in Section 01 10 10 General Requirements.

1.7.2 Work of this Section is to be carried out by a specialist having a minimum of five (5) years of related experience.

1.7.3 Work is to be performed in accordance with the practices and details of SMACNA Architectural Manual – 6th Edition (Sheet Metal and Air Conditioning Contractors National Association Inc.), unless otherwise required in the Contract Documents.

2 PRODUCTS

2.1 COMPATIBILITY

2.1.1 Compatibility between roofing materials is an essential requirement of the Contract.

2.2 METAL COUNTERFLASHINGS

2.2.1 PREFINISHED STEEL METAL:

.1 Pre-painted galvanized steel, 0.46.35mm (26 ga.) core nominal thickness, Series 8000 with a baked enamel finish to ASTM A653.

.2 The finish is to be Dofasco Perspectra Series, Valspar WeatherX factory baked finish, or an approved alternate.

.3 The colour is to be approved by the Owner.

2.2.2 GALVANIZED STEEL:

.1 Galvanized sheet steel, Z275 (G90) zinc coating. Thickness as specified or shown on the Drawings.

2.2.3 HOOK, STARTER, LOCK STRIP / CLEAT:

.1 Fabricated from pre-finished steel, 0.56.35mm (24 ga.) core nominal thickness, Z275 (G90) zinc coating to ASTM A653. Width minimally 102mm (4”). Colour to match prefinished sheet metal where exposed. Starter strips are to be continuous.

2.2.4 COPPER:

.1 Copper to be 0.8mm (16 oz.) cold rolled to ASTM B370.

2.2.5 SOLDER & FLUX:

.1 Solder to be lead-free.

.2 Flux is a rosin, cut hydrochloric acid or commercial preparation suitable for materials to be soldered.

2.2.6 WEDGES:

.1 Rolled Plumber sheet lead.

2.2.7 ISOLATION COATING:

.1 Asphalt based back paint for application to sheet metal in contact with masonry. Use asphalt primer to ASTM D41.

2.2.8 PITCH PAN:

.1 Size as specified in the Summary of Work or as shown in the Detail. One piece pre-fabricated aluminium of fabricated from 26 ga. pre-painted steel or 16 oz. Copper.

2.2.9 PITCH PAN FILLER:

.1 One (1) or two (2) part elastomer such as ChemLink M-1 Sealant, Sopramastic SP-2 or approved alternate.

2.2.10 TOUCH-UP PAINT:

.1 As recommended by the prefinished sheet metal Manufacturer.

2.2.11 FASTENERS:

.1 Nails: Hot dipped galvanized steel flat head roofing nails of length and thickness to suit the application.

.2 Where exposed, use Hex Head screws with 12.7mm (1/2") dome and neoprene washers as supplied by Weather Guard, or equal.

.3 Fasteners for masonry and concrete: Tapcon fasteners with “Climaseal” corrosion resistant finish,

or an approved equivalent, of sufficient length to provide a minimum 38mm (1.5") penetration into the substrate.

.4 Expansion Fasteners: A tamper-proof nail drive anchor which has a body formed from Zamac alloy. Zamac Nail-in.

3 EXECUTION

3.1 GENERAL

3.1.1 Apply in accordance with the Drawings, Specifications and the requirements of the jurisdictional authorities and the Canadian Roofing Contractors Association's Roofing Manual.

3.1.2 Regard the Manufacturer's printed recommendations and Specifications as a minimum requirement for materials, methods and quality of Work not otherwise specified herein.

3.1.3 Make adjustments to the specified procedures caused by weather and site conditions only with the Owner's approval.

3.1.4 Maintain all the equipment in good working order to ensure control of roofing operations and protection of the Work. Equipment and laying techniques are to meet the approval of the Consultant.

3.2 FABRICATION

3.2.1 Shop fabricate the flashings and trims in accordance with the applicable requirements of SMACNA Architectural Manual and in accordance with the Contract Documents. Form sheet metal on a bending brake. Shaping, trimming and seaming on a bench.

3.2.2 Form sections square, true, and accurate to size, free from distortion, oil canning and other defects detrimental to the appearance and performance, and to the dimensions as indicated/required.

3.2.3 Fabricate the cap flashings, starter strips, and base counter flashings less than 304.8mm (12") in height in 2440mm (96") maximum lengths. Form the counter flashings between 304.8mm and 609.6.35mm (12" and 24") in height in 1219.2mm (48") maximum lengths.

3.2.4 Provide a counter flashing and an intermediate vertical flashing where the cap flashing is greater than 610 m (24") above the top of the roofing membrane. Form the vertical flashings in 1220 mm (48") maximum lengths.

3.2.5 Provide an "S-Lock" joint at all end joints and at all horizontal joints between the cap flashing and the vertical flashing and between the vertical flashing and the base counter flashing.

3.2.6 Hem all exposed edges at least 12.7mm (1/2") for appearance and stiffness.

3.2.7 Provide a horizontal stiffening "V" or "X" break on all face metal exceeding 228.6mm (9") in girth. Centre the V or X break in mid-span of the panel. Cross break the metal face flashing on all parapet flashings exceeding 457.2mm (18") in girth.

3.2.8 Mitre and form the standing seams at all corners. Make allowances for movement at the joints.

3.2.9 Apply an isolation coating to the metal surfaces to be embedded in concrete or mortar joints.

3.3 PITCH PAN FABRICATION / INSTALLATION

3.3.1 All boxes shall be minimum 254 mm (10.0") high above finished roof surface, with 125 mm (5.0") roof flange as approved by the Consultant. Make all seams continuous and soldered. Tapered rain collars to be included

3.3.2 Install new pitch pans where required and as shown on Drawings.

3.3.3 Apply asphalt primer on the underside of flange. Embed flange in a layer of mastic on to the built-up / modified roof membrane.

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3.3.4 BUR: Apply a minimum of two plies of No.15 asphalt perforated felts over the flange followed by one ply of glass fibre felts. The first ply is to extend a minimum of 150 mm (6") beyond the outside of the flange. Each additional ply shall extend a further 100 mm (4") beyond the underlying flashing ply.

3.3.5 Modified Bitumen: Flash in with one ply base sheet membrane to manufacturer's recommendations.

3.3.6 Fill the bottom two-thirds (2/3) of the pitch pan with polyurethane foam . Apply polyurethane pitch pocket sealant on the exposed interior face and fill the top third of the pitch pan with the pourable sealer. The pourable sealer is to extend 13 mm (1/2") above the pitch pan at the centre and cove it to shed water.

3.3.7 Once the sealant has cured, apply the specified storm collar and clamp to existing protrusion to provide complete protection over the pitch pan. Apply sealant if required.

3.4 SCUPPER FABRICATION AND INSTALLATION – IF REQUIRED

3.4.1 Fabricate scuppers from copper. Fabricate scuppers to suit a 102 mm (4") diameter down spout and in general accordance with CRCA standard flashing detail FL 9. Solder all joints in the scupper. Ensure flange is continuous by filling in outside corners.

3.4.2 Fabricate deck flange to provide a 152 mm (6") wide apron. Ensure flange is continuous by filling in outside corners. Apply isolation coating on deck flange. Provide a gravel stop soldered in place across scupper opening.

3.4.3 Provide copper or stainless steel strainers for outlet.

3.4.4 Install new scuppers at existing and/or new scupper locations, where applicable. Set pre-primed flange in a full bed of rubberized mastic for BUR and Modified bitumen membranes.

3.4.5 Install scuppers in general accordance with CRCA standard flashing detail FL. 9 or to Detail.

3.5 COPPER SLEEVE FABRICATION AND INSTALLATION- IF REQUIRED

3.5.1 Fabricate sleeve flashing for existing penetrations from copper.

3.5.2 Provide a two piece or split sleeve with a minimum height of 305 mm (12").

3.5.3 Fabricate deck flange to provide a 152 mm (6") wide apron. Ensure flange is continuous by filling in outside corners.

3.5.4 Fabricate sleeve and flange with flat lock joints suitable for field soldering.

3.5.5 Apply isolation coating on surface of penetration.

3.5.6 Install copper sleeve flashing around penetrations.

3.5.7 Close and solder all joints and seams. Clean copper on joint surfaces to receive solder with steel wool. Flux and fill joints with molten solder.

3.5.8 Wipe and wash clean all traces of acid from the flux immediately after the joints are made.

3.5.9 Install split storm collar in strict accordance with Manufacturer's recommendations. Apply silicone sealant, as specified in Section 07 92 00 - Joint Sealants, at joint between storm collar and gas line penetration.

3.5.10 Install rain collar with sealant bead.

3.6 SHEET METAL UNDERLAYMENT INSTALLATION- IF REQUIRED

3.6.1 Install self-adhesive bituminous membrane as per the Detail Drawings, according to Manufacturer's instructions.

3.6.2 Provide membrane underlayment beneath sheet metal flashings at all locations, except where membrane flashings are present.

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3.6.3 Ensure all surface areas are free from frost, dust, grease, oil, loose or spalled material.

3.6.4 Apply primer as per Manufacturer's printed instructions. Allow the primer to dry and install underlayment membrane on the same day as priming.

3.6.5 Proceed only when weather is favourable. Should installation be undertaken at temperature below 4°C (40°F), consult Manufacturer regarding special procedures.

3.6.6 Maintain the recommended minimum side lap and end lap as per the Manufacturer's printed instructions.

3.6.7 Roll the membrane underlayment immediately after placement to ensure continuous adhesion. The roller to be of the type and size recommended by the Manufacturer.

3.6.8 Ensure the continuity of the membrane underlayment is maintained at all penetrations and terminations. Apply membrane sealant as required to fill inaccessible gaps following the Manufacturer's instructions.

3.6.9 Do not cover the membrane underlayment until it is reviewed and approved by the *Consultant*.

3.7 TERMINATION BAR INSTALLATION

3.7.1 Provide continuous termination bar along top of membrane flashings where indicated on Drawings and at locations and where membrane flashings terminate at the base of a wall and no other means of mechanical securement is specified or indicated.

3.7.2 Install the termination bar 3 mm (⅛") below the top edge of the base flashing membrane and mechanically secure to the masonry wall using 38 mm (1½") 'Tapcon fasteners, or Zamac Nail-ins at 152 mm (6") o.c.

3.7.3 Seal the top of the termination bar with rubberized mastic or polyurethane based sealant.

3.8 METAL DRIP EDGE FLASHING INSTALLATION- IF REQUIRED

3.8.1 Install new pre-finished aluminum metal drip edge along eaves at area of work.

3.8.2 Metal is to extend onto perimeter wood substrate 52 mm (2") minimum. Fasten metal to wood substrate with roofing nails installed every 152 mm (6") on-centre, along edge. Nails are to be set in 25 mm (1") and parallel from edge of metal.

3.8.3 Metal drip flashings to be fabricated up to 3048 mm (10') lengths and overlapped at joints 76.2mm (3") minimum. Apply sealant within joints prior to securement.

3.9 SHEET METAL INSTALLATION

3.9.1 Install the cap flashings, counter flashings, starter strips, and other miscellaneous sheet metal Work in accordance with the Contract Documents.

3.9.2 Provide a continuous starter (hook) strip where detailed or required to present a true, non-waving, leading edge. Fasten the starter strip to the substrate at a minimum of 304.8mm (12") on centre in a "Z" pattern using roofing nails of at least 25.4mm (1") length.

3.9.3 Ensure the parapet cap flashings are installed with a minimum positive slope of 2% toward the roof area. The slope is to be provided by the installation of continuous wood shims, plywood or wood blockings as detailed in accordance with Section 00 61 00 – Rough Carpentry.

3.9.4 Install cross-broken flat stock metal to entire parapet wall over 304.8mm (12") in height.

3.9.5 Caulk all horizontal joints less than 1:100 slope (1%).

3.9.6 Join all sheet metal with evenly spaced flat lock seams 25.4mm (1") wide to allow for thermal movement.

3.9.7 Counter flash bituminous flashing membranes at roof joints, walls, perimeters, parapets and curbs. Flash

joints in metal flashings using S-locks and standing seams forming tight fit over hook strips. Construct internal and external mitres.

3.9.8 End joints where adjacent lengths of metal flashing meet to be made using an "S-lock" joint. This is to be executed by inserting the end of one length in a 25.4mm (1") deep "S" lock formed in the end of the adjacent length. The concealed portion of the "S" lock is to extend 25.4mm (1") outwards and is to be nailed to the substrate. Face nailing of joints will not be permitted.

3.9.9 Insert the top edge of the sheet metal flashing under the cap flashings to form weather tight junctions.

3.9.10 Turn the top edge of the flashings into recessed reglets or mortar joints a minimum of 25.4mm (1"). Fasten the sheet metal flashing into the reglet joint at a maximum spacing of 457.2mm (18") or more often if required.

3.9.11 Ensure all fasteners are located a minimum of 304.8mm (12″) above the surface of the roofing membrane, unless otherwise detailed.

3.9.12 Where detailed or required, saw cut existing/new reglets into the masonry surfaces to receive metal flashings. The reglet is to be a minimum 19.05mm wide x 13 mm deep (3/4" x 1/2").

3.9.13 Lock seam corners. Do not use pop rivets.

3.9.14 Install the sheet metal with concealed fasteners. Exposed fastening is permitted only upon the Consultant's approval.

3.9.15 Use lead plugs or an approved expansion shield and screw in place with rubber washers where metal is installed over concrete or masonry.

3.9.16 Do not secure metal work to cant strips.

3.9.17 Install sheet metal in a uniform manner, level, true to line, free of warp or distortions.

3.9.18 Install metal flashings under cap flashings and behind other claddings a minimum of 38mm (1.5") to form a weather tight junction.

3.9.19 All outside perimeter cap flashings are to completely cover all fascia, or otherwise extend a minimum of 76.2mm (3") below deck or wood blocking level.

3.9.20 Properly cover the area to be protected with the metal flashings lightly touching the gravel pour and firmly secured to prevent movement or stripping by the wind.

3.9.21 No irregular or badly fitted metal work will be accepted. Provide metal strips, cleats, as required.

3.9.22 Install self-adhering modified bituminous membrane over all exposed masonry, concrete or wood to be flashed with metal. Secure in place.

3.9.23 At walls or junctions, re-cut the reglet joint, wedge the flashings with lead wedge at 304.8mm (12") o.c. Turn top edge of flashing into reglet or mortar joint a minimum of 25.4mm (1").

3.10 SEALANTS

3.10.1 Apply sealant at the junction between the sheet metal counterflashing and the reglet joint in accordance with Section 07 92 00 – Joint Sealants.

3.11 CLEANING

3.11.1 Remove completely from surfaces and crevices the flux residue, other deposits, stains and protections and wash the visible metal left unpainted

END OF SECTION 07 62 00

Part 1 General

1.1 REFERENCES

.1 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S101, 1989.

.2 CAN/ULC-S102, 1988.

1.2 TEST REPORTS

.1 Submit product data including certified copies of test reports verifying fireproofing applied to substrate as constructed on project will meet or exceed requirements of Specification.

.2 Submit test results in accordance with CAN/ULC-S101 for fire endurance and CAN/ULC-S102 for surface burning characteristics.

.3 For assemblies not tested and rated, submit proposals based on related designs using accepted fireproofing design criteria.

1.3 SAMPLES

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit duplicate 300 x 300 mm size sample of exposed fireproofing for approval of texture and colour.

1.4 PROTECTION

.1 At outdoor temperatures less than 5EC, ensure that a 5EC air and substrate temperature is maintained during and for 24 hours after application. Ensure that natural ventilation to properly dry the fireproofing during and subsequent to its application is provided. In enclosed areas lacking openings for natural ventilation, ensure that interior air is circulated and exhausted to the outside.

.2 Provide temporary enclosures to prevent spray from contaminating air beyond application area.

.3 Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of fireproofing materials.

Part 2 Products

2.1 MATERIALS

.1 **Sprayed fireproofing**: ULC certified cementitious or fireproofing qualified for use in ULC Designs to provide 1 hour fire resistance rating to **all floor supporting structural**

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steel members. Contractor to state ULC Design compliance in data submissions in accordance with Section 01 33 00 – Submittals.

.1 Acceptable Material: "W.R. GRACE", Type MK-6.

.2 Acceptable Material: "CAFCO/ISOLATEK INTERNATIONAL" Type 300.

.3 Acceptable Material: AD Fire Protection systems, AD Type 5.

.2 Curing compound: type recommended by fireproofing manufacturer, qualified for use in ULC Designs specified.

.3 Primer: As required by ULC design where applicable, or as recommended by AD Fire Protection Systems.

.4 **Intumescent Paint Fireproofing** to be applied to all exposed columns, beams and members part of the floor supporting system, or as indicated. Intumescent fireproofing system to provide a fire resistance rating of 1 hour in accordance with ULC listed on drawings.

.1 All faces of exposed structural steel columns indicated to receive fireproofing to be painted prior to the installation of abutting walls and bulkheads.

.2 Interior Intumescent Fireproofing to be A/D Firefilm as manufactured by A/D Fire Protection Systems Inc., listed by Underwriters Laboratories and bearing ULC label on container, Carboline or approved equal.

.1 Provide decorative finish as approved by A/D Fire Protection Systems Inc.

.2 Primer: As recommended by AD Fire Protection Systems.

.3 Exterior Intumescent Fireproofing to be Thermo Lag E100-S as manufactured by Carboline, A/D Fire Protection Systems Inc., listed by Underwriters Laboratories and bearing ULC label on container, or approved equal.

.1 Provide exterior rated topcoat Carbomastic 94TL by A/D Fire Protection Systems Inc.

.2 Primer: Carboguard 893 SG by AD Fire Protection Systems.

.3 Locations: Exterior Columns supporting a rated floor assembly. Refer to drawings.

Part 3 Execution

3.1 PREPARATION

.1 Discuss fireproofing methods and final product with principal building inspector prior to application to ensure that finished installation will be acceptable. Record in writing all materials and methods to be employed to achieve final approval of installation.

.2 Contractor to prepare a mock-up of the fireproofing on site. Architect and GC to review to determine if level of finish is acceptable.

.3 Substrate shall be free of material, which would impair bond.

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.4 Verify that painted substrate [s] are compatible and have suitable bonding characteristics to receive fireproofing.

.5 Remove incompatible materials.

.6 Ensure that items required to penetrate fireproofing are placed before installation of fireproofing.

.7 Ensure that ducts, piping, equipment, or other items which would interfere with application of fireproofing are not positioned until fireproofing work is completed.

3.2 APPLICATION

.1 Apply bonding adhesive or primer to substrate if recommended by manufacturer.

.2 Apply fireproofing to correspond with tested assemblies, or acceptable calculation procedures to provide following fire resistance ratings.

.3 Apply fireproofing over substrate, building up to required thickness to cover substrate with monolithic blanket of uniform density and texture.

3.3 INSPECTION AND SITE TESTS

.1 Inspection and testing of fireproofing will be carried out by a third party agency designated by Consultant.

.2 Cost of testing will be paid from Cash Allowance specified in Section 011100 – Summary of Work, section 1.29.

.3 Arrange for final inspection of the work of this section by municipal building inspector.

3.4 PATCHING

.1 Patch damage to fireproofing caused by testing or by other trades before fireproofing is concealed, or if exposed, before final inspection.

3.5 LOCATIONS- SPRAYED FIREPROOFING

.1 Fireproofing is required on all structural steel supporting floor loads. Refer to structural drawings.

END OF SECTION

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Part 1 General

1.1 RELATED WORK

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

1.2 REFERENCES

.1 Underwriters Laboratories of Canada (ULC)

.1 ULC-S115-[1995], Fire Tests of Firestop Systems.

1.3 SAMPLES

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit duplicate 300 x 300 mm samples showing actual firestop material proposed for project.

1.4 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit manufacturer's product data for materials and prefabricated devices, providing descriptions are sufficient for identification at job site. Include manufacturer's printed instructions for installation.

1.5 WASTE MANAGEMENT AND DISPOSAL

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

1.6 SYSTEM DESCRIPTION

.1 Firestopping Materials: CAN4-S115M ASTM E814 to achieve a fire protection rating as noted on Drawings.

.2 It is the intent of this Section that in conjunction with Divisions 26 and 33 a competent, single source be responsible for the firestopping and smoke seals of the entire project.

1.7 QUALITY ASSURANCE

.1 Manufacturer: Company specializing in manufacturing products of this Section with minimum five years documented experience.

.2 Applicator: Approved, licensed and supervised by the manufacturer of firestopping materials. Company with minimum five years documented experience.

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.3 Product: Manufactured under ULC Follow-up Program. Each container or package shall bear ULC label.

1.8 REGULATORY REQUIREMENTS

.1 Conform to applicable code for fire protection ratings.

.2 Provide certificate of compliance for authority having jurisdiction indicating approval.

1.9 DELIVERY, STORAGE AND HANDLING

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

1.10 PROJECT AND SITE CONDITIONS

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

1.11 SEQUENCING AND SCHEDULING

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

Part 2 Products

2.1 MATERIALS

.1 A/D Firebarrier Firestop Systems, by A/D Fire Protection Systems Inc., capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of CAN4-S115 and not to exceed opening sizes for which they are intended.

.2 Mineral Wood Backing Insulation: ULC labeled, preformed non-combustible material (A/D Firebarrier Mineral Wool) by A/D Fire Protection Systems Inc.

.3 Retainers: Clips to support mineral wool.

.4 Firestopping Sealant: ULC labeled, single component silicone bases, A/D Silicone Firebarrier Sealant by A/D Fire Protection Systems Inc.

.5 Firestopping Seal: ULC labeled, single component water-base seal, A/D Firebarrier Seal by A/D Fire Protection Systems Inc.

.6 Firestopping Foam: ULC labeled, two components silicone foam, A/D Firebarrier RTV Foam by A/D Fire Protection Systems Inc.

.7 Firestopping Mortar: ULC labeled, non-combustible fibre reinforced, foamed cement mortar, A/D Firebarrier Mortar by A/D Fire Protection Systems Inc.

.8 Damming Material: In accordance with tested assembly being installed as applicable and as acceptable to authorities having jurisdiction.

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Part 3 Execution

3.1 PREPARATION

.1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials. Ensure that substrates and surfaces are clean, dry and frost free.

.2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.

.3 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour barrier.

.4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

.5 Verify that openings are ready to receive the Work of this Section.

.6 Confirm compatibility of surfaces to receive firestopping and smoke seal materials.

.7 Beginning of installation means acceptance of existing surfaces and substrate.

3.2 INSTALLATION

.1 Install fire stopping and smoke seal 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 unpenetrated 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.

.6 Apply in sufficient thickness to achieve rating to uniform density and texture.

.7 Protect installed material until cured or set.

3.3 INSPECTION

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

3.4 SCHEDULE

.1 Firestop and smoke seal at:

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.1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.

.2 Top of fire-resistance rated masonry and gypsum board partitions.

.3 Intersection of fire-resistance rated masonry and gypsum board partitions.

.4 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.

.5 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.

.6 Openings and sleeves installed for future use through fire separations.

.7 Around Mechanical and Electrical assemblies penetrating fire separations.

.8 Refer to Drawings for horizontal and vertical fire stop locations and for typical firestopping detail at cavity wall, for top of wall fire separation assembly and for fire separation locations.

3.5 CLEAN UP

.1 Remove excess materials and debris and clean adjacent surfaces immediately after application.

.2 Remove temporary dams after initial set of fire stopping and smoke seal materials.

END OF SECTION

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07 92 00 - Joint Sealants

PART 2 GENERAL

2.1 GENERAL CONDITIONS

2.1.1 All conditions of the Contract and Divisions 0 and 1 apply to this Section and to the requirements of the Canadian Roofing Contractors Association Roofing Manual Specifications as referred to herein.

2.1.2 Abide by all Federal, Provincial, Municipal and Local Laws or Codes, rules and regulations that in any way affect the Work including all amendments up to the Project date.

2.2 CO-ORDINATION

2.2.1 Co-ordinate work of this Section with work of:

.1 Section 07 51 10 Roofing Summary of Work

.2 Section 07 51 12 Roofing Rough Carpentry.

.3 Section 07 51 13 Built-Up Asphalt Roofing.

.4 Section 07 62 00 Sheet Metal Flashing and Trim.

2.3 REFERENCE STANDARDS

2.3.1 Sealant work, materials, products and accessories shall be in accordance with the most current applicable industry standards including but not limited to:

2.3.2 AMERICAN SOCIETY FOR TESTING AND MATERIALS INTERNATIONAL, (ASTM)

.1 ASTM C919:-Use of Sealants in Acoustical Applications.

.2 ASTM C920; Elastomeric Joint Sealants, Type S, grade NS.

.3 ASTM C1311; Solvent Release Sealants

2.3.3 DEPARTMENT OF JUSTICE CANADA (JUS)

.1 Canadian Environmental Protection Act, 1999 (CEPA).

2.3.4 GENERAL SERVICES ADMINISTRATION (GSA) - FEDERAL SPECIFICATIONS (FS)

.1 TT-S-00227E; Sealing Compound Elastomeric Type- Multi-Component, Class A, Type 2.

.2 TT-S-00230C; Sealing Compound elastomeric Type- Single component, Class A, Type 2.

2.3.5 HEALTH CANADA/WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM (WHMIS)

.1 Safety Data Sheets (SDS).

2.3.6 TRANSPORT CANADA (TC)

.1 Transportation of Dangerous Goods Act, 1992 (TDGA).

2.4 CLIMATE CONDITIONS

2.4.1 ENVIRONMENTAL LIMITATIONS

.1 Do not proceed with the installation of joint sealants under the following conditions:

(a) When ambient and substrate temperature conditions are outside the limits permitted by the joint sealant manufacturer.

(b) When joint substrates are wet.

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.2 Joint-Width Conditions:

(a) Do not proceed with the installation of joint sealants where the joint widths are less than those allowed by the joint sealant manufacturer for the applications indicated.

.3 Joint-Substrate Conditions:

(a) Do not proceed with the installation of joint sealants until contaminants capable of interfering with adhesion are removed from the joint substrates.

2.5 ENVIRONMENTAL REQUIREMENTS

2.5.1 Comply with the requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Safety Data Sheets (SDS) acceptable to Labour Canada.

2.5.2 Conform to the manufacturer's recommended temperatures, relative humidity, and substrate moisture content for the application and curing of sealants including special conditions governing use.

2.6 WARRANTY

2.6.1 Provide all applicable material and labour Warranties offered by the material Manufacturer for a minimum of two (2) years.

2.6.2 Defective joint sealant installation covered under Warranty is to include but not be limited to:

.1 joint leakage, hardening, craze cracking, crumbling, melting, bubbling, shrinkage, runs, sags, change of colour, loss of adhesion, loss of cohesion and staining of adjoining or adjacent material surfaces.

2.6.3 Carry out all replacement and repair Work during the Warranty period as directed by the Consultant and at no additional cost to the Owner.

2.7 QUALITY CONTROL

2.7.1 Quality control for Work of this Section is to be performed by the Consultant under the Work of and as specified in Section 01 10 10 General Requirements.

PART 3 PRODUCTS

3.1 COMPATIBILITY

3.1.1 All materials in a sealant system are to be compatible with each other and with the substrate.

3.1.2 Colour or colours of the sealants are to be selected are to match existing substrate and are to be approved by the Consultant.

3.2 SEALANT MATERIALS

3.2.1 Exterior Metal To Wood, Masonry, Stone Or Porous Surfaces:

.1 One-part elastomeric, non-sag urethane based sealant. Accepted products:

(a) “Dymonic” as manufactured by Tremco

(b) “Sikaflex 1-A” as manufactured by Sika Canada

(c) “Vulkem 931” by Mameco as manufactured by Tremco

(d) “SK-1 Structural Sealant” as supplied by Chemlink.

3.2.2 Exterior And Interior Metal To Metal And Metal To Glass Joints:

.1 One-part Silicone based sealant. Accepted Products:

(a) “Spectrum 2” as manufactured by Tremco

(b) "Contractors SCS 1000 Sealant" as manufactured by GE Silicones Canada

(c) "DC 999-A Silicone Building & Glazing Sealant" as manufactured by DowCorning Canada.

3.3 JOINT BACKING

3.3.1 Extruded polyethylene, urethane, neoprene or vinyl foam recommended by sealant Manufacturer. Extruded closed-cell foam, Shore "A" Hardness 20, Tensile Strength of 140-200 Kpa.

3.3.2 Circular shape with a diameter 25% greater than the joint width before installation.

3.4 VOID FILLER

3.4.1 Glass fibre or Rockwool insulation with a nominal density of 14 kg/m^3 (2.86 lbs. / cu. ft.) Sized for 25% compression.

3.5 BOND BREAKER TAPE

3.5.1 Pressure sensitive plastic tape which will not bond to sealants. Supplied or recommended by the sealant Manufacturer.

3.6 PRIMER

3.6.1 As recommended by the sealant Manufacturer to assure adhesion of the compound and to prevent staining of the substrate.

3.7 CLEANING AGENTS

3.7.1 Joint cleaning compounds as recommended by the sealant Manufacturer. Xylol (Xylene), Methyl Ethyl Ketone (MEK) or non-corrosive type compatible with joint forming materials.

PART 4 EXECUTION

4.1 EXAMINATION

4.1.1 Inspect existing conditions, and substrates upon which Work of this Section is dependent. Report to the *Consultant* in writing any defects or discrepancies. Commencement of Work implies acceptance of existing conditions and assuming full responsibility for the finished condition of the Work.

4.1.2 Verify, before commencing Work, that the joint size, depth and substrate will not adversely affect execution, performance or quality of completed Work; and that the joints can be sealed in an acceptable condition by means of preparation specified in this Section. Verify site conditions together with sealant Manufacturer's representative.

4.1.3 Defective Work resulting from application to unsatisfactory joint conditions will be considered the responsibility of those performing the Work of this Section.

4.2 GENERAL

4.2.1 Apply in accordance with the Drawings, Specifications and requirements of the jurisdictional authorities and the Canadian Roofing Contractors Association's Roofing Manual.

4.2.2 Regard the Manufacturer's printed recommendations and Specifications as a minimum requirement for materials, methods and quality of Work not otherwise specified herein.

4.2.3 Make adjustments to the specified procedures caused by weather and site conditions only with the Consultants approval.

4.2.4 Conform to the Details.

4.2.5 Examine joints before caulking to ensure that the configuration, surface and widths are suitable for the sealant and service, and that the execution of caulking and performance of sealants will not be adversely affected.

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4.2.6 Verify, before commencing the Work, that the joint size, depth and substrate will not adversely affect the execution, performance or quality of the completed Work; and that joints can be sealed in an acceptable condition by means of the preparation specified in this Section. Verify the site conditions together with the sealant Manufacturer's representative.

4.2.7 Defective Work resulting from the application to unsatisfactory joint conditions will be rejected.

4.3 REMOVAL & PREPARATION

4.3.1 Remove the existing sealant and backing material and all deleterious material from the joint. Use the method of surface preparation suitable for substrate that does not damage adjacent surfaces, as recommended by the sealant Manufacturer.

4.3.2 Rake out joints, cracks and crevices to receive sealant to a depth measuring half (1/2) the joint width.

4.3.3 Brush, scrub, scrape or grind the inner face surfaces to remove loose mortar, dust, oil, grease, oxidation, mill scale, and other materials which will affect the adhesion and integrity of the sealant.

4.3.4 Wipe down metal surfaces with clean cellulose sponges or rags soaked in solvent compatible with the sealant, and dry with clean cloths. Ensure solvents do not damage painted surfaces.

4.3.5 Ensure that surfaces have not been coated with release agents, coating or other treatments, or that, if present, they are entirely removed.

4.3.6 Examine joint sizes and correct to achieve width to depth ratio of 1:2 with joint size no less than 12.7mm (1/2") width and 25.4mm (1") depth.

4.3.7 Install joint filler to achieve correct depth, if required.

4.3.8 Where necessary to prevent staining, mask adjacent surfaces prior to priming and sealant application.

4.3.9 Apply bond breaker tape where required to sealant Manufacturer's printed instructions.

4.4 JOINT DEPTH

4.4.1 Provide the following Depth To Width Ratios:

.1 Masonry:

(a) 6.35mm (1/4") deep, up to 12.7mm (1/2") wide

(b) 9.53.16mm (3/8") deep, up to 19.05mm (3/4") wide

(c) 12.7mm (1/2") deep, up to 25.4mm (1") wide

(d) 19.05mm (3/4") deep, up to 50.8mm (2") wide.

.2 Non Porous Materials:

(a) Joint depth and width to be not be less than 6.35mm (1/4").

(b) Maintain a minimum of a 2:1 width to depth ratio or what is listed above in 3.3.1.1 and 3.3.1.2, whichever is more stringent.

4.5 PRIMING

4.5.1 Prime the inner face surfaces of joints as necessary for the substrate, in accordance with the sealant Manufacturer's Specification, to provide full adhesion and to prevent staining of the face surface at the joint.

4.5.2 Prime surfaces prior to installing the joint backing rod.

4.6 JOINT FILLING AND BACKING

4.6.1 Install joint backing where required to maintain the joint depth.

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4.6.2 Pack joints tightly with sealant in accordance with the Manufacturer's Specifications using pressure guns. Fill joints completely to the required depths with sealant compound. Use sufficient pressure to fill all voids and joints. Sealant is to bond to both sides of the joint.

4.6.3 Apply bond breaker tape, prior to applying sealant, where joints are of insufficient size to install backer rod or at 90° junctions or where recommended by the sealant Manufacturer or *Consultant.* Ensure bond surface area meets the minimum required size recommended by the sealant Manufacturer.

4.6.4 Mask, with masking tape, all surfaces adjacent to joints which are likely to become coated with sealant during sealant application.

4.6.5 Apply sealant using gun dispenser with proper size nozzle for joint to be sealed to leave a weather tight, airtight installation.

4.6.6 Fill joints completely to required depths with sealant compound. Use sufficient pressure to fill all voids and joints solid. Sealant shall bond to both sides of the joints but not to backing material. ***Superficial pointing with skin bead is not acceptable***.

4.6.7 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets or embedded impurities. Neatly tool surface to create a slightly concave joint.

4.6.8 Slope sealant surface at top of surface reglet flashings to create positive water shed.

4.6.9 Finish joints smooth, free of wrinkles, ridges, air pockets and imbedded foreign materials. Tool joints to a slight concave surface using a soap/water mixture.

4.6.10 Cure sealants in accordance with the sealant Manufacturer's instructions.

4.6.11 Do not cover up sealants until proper curing has taken place.

4.6.12 Do not allow sealants to cover or spot surfaces outside of joints. Use masking tape on all surfaces adjacent to joints which may become coated with sealant during the caulking process.

4.7 CLEAN UP

4.7.1 Remove from surfaces of other work sealant smears, droppings and masking tape immediately after caulking. Use recommended cleaners as required.

4.7.2 Clean surfaces soiled by Work of this Section. Do not use chemicals, scrapers, or other tools in cleaning which will damage surfaces. Make good other Work.

4.7.3 Clean up and remove from the job site on a daily basis, all rubbish and surplus materials resulting from this Work.

4.7.4 Joint sealants shall be protected from physical damage and the elements until such time as the sealant will not be affected by same.

END OF SECTION 07 92 00

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Part 1 General

1.1 SECTION INCLUDES

.1 Materials, preparation and application for caulking and sealants.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 07 62 00 – Sheet Metal Flashing and Trim.

.3 Section 08 11 14 – Steel Doors and Frames.

.4 Section 04 21 13 - Masonry.

.5 Section 07 46 13 – Preformed Metal Siding.

1.3 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)

.1 ASTM C919-[02], Standard Practice for Use of Sealants in Acoustical Applications.

.2 Canadian General Standards Board (CGSB)

.1 CGSB 19-GP-5M-[1984], Sealing Compound, One Component, Acrylic Base, Solvent Curing (Issue of 1976 reaffirmed, incorporating Amendment No. 1).

.2 CAN/CGSB-19.13-[M87], Sealing Compound, One-component, Elastomeric, Chemical Curing.

.3 CGSB 19-GP-14M-[1984], Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing (Reaffirmation of April 1976).

.4 CAN/CGSB-19.17-[M90], One-Component Acrylic Emulsion Base Sealing Compound.

.5 CAN/CGSB-19.24-[M90], Multi-component, Chemical Curing Sealing Compound.

.3 Department of Justice Canada (Jus)

.1 Canadian Environmental Protection Act, 1999 (CEPA).

.4 General Services Administration (GSA) - Federal Specifications (FS)

.1 FS-SS-S-200-[E(2)1993], Sealants, Joint, Two-Component, Jet-Blast-Resistant, Cold Applied, for Portland Cement Concrete Pavement.

.5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

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.6 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act, 1992 (TDGA).

1.4 SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Manufacturer's product to describe.

.1 Caulking compound.

.2 Primers.

.3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.

.3 Submit manufacturer's instructions in accordance with Section 01 33 00 - Submittal Procedures.

.1 Instructions to include installation instructions for each product used.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, handle, store and protect materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver and store materials in original wrappings and containers with manufacturer's seals and labels, intact. Protect from freezing, moisture, water and contact with ground or floor.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal of paper, plastic, polystyrene, corrugated cardboard, or packaging material [in appropriate on-site bins] for recycling.

.3 Place materials defined as hazardous or toxic in designated containers.

.4 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.

.5 Unused [sealant] material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

.6 Divert unused joint sealing material from landfill to official hazardous material collections site approved by Consultant.

.7 Empty plastic joint sealer containers are not recyclable. Do not dispose of empty containers with plastic materials destined for recycling.

.8 Fold up metal banding, flatten, and place in designated area for recycling.

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1.7 PROJECT CONDITIONS

.1 Environmental Limitations:

.1 Do not proceed with installation of joint sealants under following conditions:

.1 When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 degrees C.

.2 When joint substrates are wet.

.2 Joint-Width Conditions:

.1 Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

.3 Joint-Substrate Conditions:

.1 Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.8 ENVIRONMENTAL REQUIREMENTS

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to Labour Canada.

.2 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

1.9 WARRANTY

.1 Submit a warranty that caulking work will not leak, crack, crumble, melt, shrink, run, lose adhesion or stain adjacent surfaces, in accordance the General Conditions of the Contract, but for two (2) years total. Contractor shall supply all labour, materials, tools and equipment to repair and/or replace any work judged to be defective by the Consultant and sealant manufacturer at no additional cost to the owner for a period of 2 years from the date of Substantial Completion.

.2 Submit a manufacturer’s warranty against defects in materials and workmanship covering the components of the sealant for a period of ten (10) years. The manufacturer shall supply a non-pro-rated warranty covering labour, materials, tools and equipment to repair and/or replace any materials defects at no additional cost, for a period of 10 years

Part 2 Products

2.1 SEALANT MATERIALS

.1 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.

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.2 When low toxicity caulks are not possible, confine usage to areas which off gas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize off gas time.

.3 Where sealants are qualified with primers use only these primers.

2.2 SEALANT MATERIAL DESIGNATIONS

.1 Primers: type recommended by sealant manufacturer.

.2 Joint Fillers:

.1 General: compatible with primers and sealants, outsized 30 to 50%.

.2 Polyethylene, urethane, neoprene or vinyl: extruded closed cell foam, Shore A hardness 20, tensile strength 140 to 200 kPa.

.3 Neoprene or butyl rubber: round solid rod, Shore A hardness 70.

.4 Polyvinyl chloride or neoprene: extruded tubing with 6 mm minimum thick walls.

.5 Bond breaker: pressure sensitive plastic tape which will not bond to sealants.

.6 Sealant Type A: One component, chemical curing, conforming to CAN2-19.13-M82, Class C-2-25-B-N; multi-component, chemical curing, conforming to CAN2-19.24-M80, Type 2, Class B.

.7 Sealant Type B: Multi-component, chemical curing mildew resistant conforming to CGSB 19-GP-22M.

.8 Sealant type C: Multi-component, acrylic emulsion base, conforming to CGSB 19-GP-17M.

.9 Sealant type D: One component, polyurethane base, chemical curing, conforming to CAN2-19.13-M82, Class C-1-25-B-N; or multi-component, chemical curing, conforming to CAN2-19.24-M80, type 1.

.10 For exterior aluminum to masonry, aluminum to wood and aluminum to metal joints: high performance, single component modified elastomeric joint sealant conforming to CAN2-19.24-M80. Acceptable Materials: Sonolastic Ultr***a*** by Degussa.

.11 For interior aluminum to masonry, aluminum to wood and aluminum to metal joints: high performance, single component low odour sealant conforming to CAN/CGSB-19.13-M87. Acceptable materials: Spectrem 2 by Tremco.

.3 Color of Sealants: to be selected by Consultant. Allow for a total of two (2) colours for Type A, two colours for Type B, two colours for Type C and one colour for Type D. Locations as directed on site by Consultant.

.4 Joint cleaner: xylol, methylethyl-ketone or non-corrosive type recommended by sealant manufacturer and compatible with joint forming materials.

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

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2.3 JOINT CLEANER

.1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant recommended by sealant manufacturer.

.2 Primer: as recommended by manufacturer.

Part 3 Execution

3.1 PROTECTION

.1 Protect installed Work of other trades from staining or contamination.

3.2 SURFACE PREPARATION

.1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.

.2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair Work.

.3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.

.4 Ensure joint surfaces are dry and frost free.

.5 Prepare surfaces in accordance with manufacturer's directions.

3.3 PRIMING

.1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.

.2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

3.4 BACKUP MATERIAL

.1 Apply bond breaker tape where required to manufacturer's instructions.

.2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

3.5 MIXING

.1 Mix materials in strict accordance with sealant manufacturer's instructions.

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3.6 APPLICATION

.1 New Work:

.1 Remove dust, paint, loose mortar and other foreign matter. Dry joint surfaces.

.2 Remove rust, mill scale and coatings from ferrous metals by wire brush, grinding or sandblasting.

.3 Remove oil, grease and other coatings from non-ferrous metals with joint cleaner.

.4 Prepare concrete, masonry, glazed and vitreous surfaces to sealant manufacturer's instructions.

.5 Examine joint sizes and correct to achieve depth ratio 1/2 of joint width with minimum width and depth of 6 mm, maximum width 25 mm.

.6 Install joint filler to achieve correct joint depth.

.7 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.

.8 Apply bond breaker tape where required to manufacturer's instructions.

.9 Prime sides of joints to sealant manufacturer's instructions immediately prior to caulking.

.2 Sealant.

.1 Apply sealant in accordance with manufacturer's written instructions.

.2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.

.3 Apply sealant in continuous beads.

.4 Apply sealant using gun with proper size nozzle.

.5 Use sufficient pressure to fill voids and joints solid.

.6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.

.7 Tool exposed surfaces before skinning begins to give slightly concave shape.

.8 Remove excess compound promptly as work progresses and upon completion.

.9 Apply sealant to joints between window or door frames to adjacent building components around perimeter of every external window or door opening, to control joints in masonry walls and where indicated. In masonry cavity construction, vent caulked joints from cavity to 3 mm beyond external face of wall by inserting vent tubing at bottom of each joint and maximum to 1500 mm o.c. vertically. Position tube to drain to exterior.

.10 Apply sealant to close gaps at all junctures of all interior walls meeting exposed ceilings. Provide required foam backer rods to ensure integrity of sealant bead when applied to juncture. Tool finish smooth to receive paint finish.

.11 Use sealants specified in the following locations:

.1 Type A: Joints between windows or door frames and adjacent building components; control and expansion joints and all other locations where sealing is required, except in locations designated for Type B, C and D. Ensure that sealant chosen (from the several specified under

"MATERIALS") for each location is recommended by manufacturer for use on surfaces encountered.

.2 Type B: Joints between splash backs and walls.

.3 Type C: Joints between interior metal door frames and partitions.

.4 Type D: Joints in horizontal surfaces between concrete slabs.

.3 Curing.

.1 Cure sealants in accordance with sealant manufacturer's instructions.

.2 Do not cover up sealants until proper curing has taken place.

.4 Cleanup.

.1 Clean adjacent surfaces immediately and leave Work neat and clean.

.2 Remove excess and droppings, using recommended cleaners as work progresses.

.3 Remove masking tape after initial set of sealant.

3.7 WORK INCLUDED

.1 Work shall include but not limited to the following areas:

.1 exterior and interior hollow metal frames and screens; both sides;

.2 exposed control and expansion joints in masonry walls, masonry corners, joints in front of steel lintels bearing on exterior brick jambs;

.3 joints at all washroom vanities, hair dryers, hand dryers, electrical panels, access doors and adjacent surfaces. (Use sanitary caulking.)

.4 joints between masonry and concrete surfaces.

.5 joints between gypsum board and masonry, or other materials.

.6 joints between louvres and other surfaces.

.7 exterior siding, prefinished metal fascia, flashing and trim.

.8 penetrations through roofs, floors and walls other than firestopping

.9 at all other locations on drawings, except as noted below.

.2 Sealing of joints to the underside of exposed precast slab to be by precast installer.

.3 Sealing of all joints at top of walls meeting exposed flat or sloped precast ceilings to be included in this section.

3.8 REQUIRED INSPECTION

.1 Contractor to engage exterior sealant manufacturer’s representative to review in order to provide manufacturer’s warranty. Manufacturer’s representative shall review substrate conditions as prepared on site and prior to the application of the sealant. If requested, manufacturer to supply a written copy of this warranty.

END OF SECTION

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Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 07 92 10 - Joint Sealing: Caulking of joints between frames and other building components.

.3 Section 08 71 10 - Door Hardware - General: Supply of finish hardware, including weatherstripping and mounting heights.

.4 Section 09 91 23 - Interior Painting.

.5 Section 09 91 13 - Exterior Painting.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM International)

.1 ASTM A653/A653M-[01a], Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM B29-[92(1997)], Specification for Refined Lead.

.3 ASTM B749-[97], Specification for Lead and Lead Alloy Strip, Sheet and Plate Products.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.181-[99], Ready-Mixed Organic Zinc-Rich Coating.

.2 CGSB 41-GP-19Ma-[84], Rigid Vinyl Extrusions for Windows and Doors.

.3 Canadian Standards Association (CSA International)

.1 G40.20/G40.21-[98], General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CSA W59-[M1989(R2001)], Welded Steel Construction (Metal Arc Welding) (Metric Version).

.4 Canadian Steel Door Manufacturers' Association, (CSDMA).

.1 CSDMA, Specifications for Commercial Steel Doors and Frames, [1990].

.2 CSDMA, Recommended Selection and Usage Guide for Commercial Steel Doors, [1990].

.5 National Fire Protection Association (NFPA)

.1 NFPA 80-[99], Standard for Fire Doors and Fire Windows.

.2 NFPA 252-[99], Standard Methods of Fire Tests of Door Assemblies.

.6 Underwriters' Laboratories of Canada (ULC)

.1 CAN4-S104-[80(R1985)], Fire Tests of Door Assemblies.

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.2 CAN4-S105-[85(R1992)], Fire Door Frames Meeting the Performance Required by CAN4-S104.

.7 CAN/ULC-S701-[01], Thermal Insulation, Polystyrene, Boards and Pipe Covering.

.8 CAN/ULC-S702-[97], Thermal Insulation, Mineral Fibre, for Buildings.

.9 CAN/ULC-S704-[01], Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

1.3 DESIGN REQUIREMENTS

.1 Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -35°C to 35°C.

.2 Maximum deflection for exterior steel entrance screens under wind load of 1.2 kPa not to exceed 1/175th of span.

1.4 WORK INCLUDED

.1 A single manufacturer shall fabricate products included within the scope of this Section.

.2 Manufacturer shall be a member in good standing of the Canadian Steel Door Manufacturers Association (CSDMA).

.3 Supply only of steel frame products including frames, transom frames, sidelight and window assemblies with provision for glazed, paneled or louvered openings, fire labeled and non-labeled, as scheduled or detailed by the Consultant.

.4 Supply only of flush steel doors with provision for glazed, paneled or louvered openings, insulated and un-insulated, fire labeled, with or without temperature rise ratings and non-labeled, as scheduled or detailed by the Consultant.

.5 Supply only of steel panels, similar in construction to steel doors, with flush or abetted bottoms for steel frames, transom frames, sidelight and window assemblies, fire labeled and non-labeled, as scheduled or detailed by the Consultant.

1.5 RELATED WORK

.1 Building-in of frame product into unit masonry, previously placed concrete, structural or steel or wood stud walls.

.2 Supply and installation of wood, plastic or composite core doors.

.3 Supply and installation of builders' hardware except as specified for acoustic assemblies.

.4 Drilling and tapping for surface mounted or non-templated builders' hardware.

.5 Caulking of joints between frame product and other building components.

.6 Supply and installation of gaskets or weather-strip.

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.7 Supply and installation of louvers or vents.

.8 Supply and installation of glazing materials.

.9 Site touch-up and painting.

.10 Wiring for electronic or electric hardware.

.11 Field measurements.

.12 Fasteners for frame product in previously placed concrete, masonry or structural steel.

.13 Steel lintels, posts, columns or other load-bearing elements.

.14 Field welding.

1.6 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazed, or louvred, arrangement of hardware and fire rating and finishes.

.3 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings and reinforcing and fire rating finishes.

.4 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

.5 Submit test and engineering data, and installation instructions.

1.7 REQUIREMENTS

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

1.8 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling.

.3 Divert unused paint and sealant materials from landfill to official hazardous material collections site approved by Consultant.

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.4 Do not dispose of unused paint and sealant materials into sewer systems, into lakes, streams, onto ground or in other locations where it will pose health or environmental hazard.

.5 Divert unused metal materials from landfill to metal recycling facility approved by Consultant.

.6 Divert unused wood materials from landfill to recycling, reuse or composting facility wherever possible.

.7 Damaged or broken glazing materials are not recyclable. These materials must not de disposed of with materials destined for recycling.

1.9 TESTING AND PERFORMANCE

.1 Door constructions covered by this specification shall be certified as meeting Level "A" (1,000,000 cycles) and Twist Test Acceptance Criteria (deflection not to exceed 6.4 mm /13.6kg force, total deflection at 136.1kg force not to exceed 63.5 mm and permanent deflection not to exceed 3.2 mm) when tested in strict conformance with ANSI-A250.4-1994. Test shall be conducted by an independent nationally recognized accredited laboratory.

.2 Fire labeled product shall be provided for those openings requiring fire protection and temperature rise ratings, as determined and scheduled by the Architect. Doors, frames, transom frames and sidelight assemblies shall be tested in strict accordance with CAN4-S106. Product shall be listed by Underwriters Laboratories of Canada under an active Factory Inspection Program and shall be constructed as detailed in Follow-Up Service procedures issued to the manufacturer.

.3 Should any door or frame specified by the Architect to be fire rated, not qualify for labeling due to design, hardware, glazing or any other reason, the Consultant shall be so advised before manufacturing commences.

.4 Core materials for exterior doors shall attain a thermal resistance rating of RSI 1.06 (R6.0) when tested in accordance with ASTM C177 or ASTM C518.

.5 Product shall be manufactured by a firm experienced in the design and production of standard and custom commercial steel door and frame assemblies, the integration of builders' or electronic hardware and glazing materials and their impact on the scope of work.

.6 Manufacturer shall be assessed and registered as meeting the requirements of Quality Systems under ISO 9001.

.7 Product quality shall meet standards set by the Canadian Steel Door Manufacturers Association.

1.10 TEST REPORTS

.1 All alternates to this specification shall be submitted to the Architect for acceptance ten (10) days prior to bid date, complete with test reports from independent, nationally recognized testing authorities, certifying that:

.1 Steel door and frame assemblies furnished under this section meet the acceptance criteria of ANSI-A250.4-1994, Level "A".

.2 Insulated door cores furnished in exterior doors under this Section meet the specified thermal resistance rating.

.2 All reports shall include name of testing authority, date of test, location of test facility, descriptions of test specimens, procedures used in testing and indicate compliance with acceptance criteria of the test.

1.11 WARRANTY

.1 All steel door and frame product shall be warranted from defects in workmanship for a period of one (1) year from date of shipment.

.2 All steel door and frame product shall be warranted against rust perforation for a period of ten (10) years when the installed and finish painted with a commercial quality paint to the manufacturers recommendations.

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

Part 2 Products

2.1 MATERIALS

.1 Doors shall be fabricated from tension leveled steel to ASTM A924-M97, galvanized to ASTM A653-M97, Commercial Steel (CS), Type B, coating designation ZF75, known commercially as paintable Galvanneal.

.1 Acceptable Manufacturer: Flemming

.2 Acceptable Alternate Manufacturer: Trillium Steel Doors Limited, or others meeting these exact specifications outlined in this section.

.2 Door Cores:

.3 Honeycomb:

.1 Structural small cell (25.4 mm maximum) kraft paper "honeycomb". Weight: 36.3 kg per ream (minimum), density: 16.5 kg/m^3 (minimum), sanded to the required thickness.

.4 Polystyrene:

.1 Rigid extruded, fire retardant, closed cell board, density 16kg/m^2, thermal values: RSI 1.06 minimum, conforming to ASTM C578.

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.5 Temperature Rise Rated (TRR):

.1 Solid slab core of non-combustible, inorganic composite to limit temperature rise on the "unexposed" side of door to 250°C at 30 or 60 minutes, as required by governing building code requirements and determined and scheduled by the Architect.

.6 Adhesives:

.1 Honeycomb Cores and Steel Components: Heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement or ULC approved equivalent.

.7 Interlocking Edge Seams:

.1 Resin reinforced polychloroprene (RRPC), fire resistant, high viscosity, sealant/adhesive or UL approved equivalent.

.8 Polystyrene Cores:

.1 Heat resistant, epoxy based, low viscosity, contact cement.

.9 Primer:

.1 Rust inhibitive touch-up only.

.10 Exterior Top Caps:

.1 Rigid polyvinylchloride (PVC) extrusion.

2.2 DOOR FABRICATION

.1 This section is based on doors and frames as manufactured by Fleming. Doors and frames by other manufacturers are acceptable subject to be similar to the one specified and meeting the terms of this section.

.2 Doors shall be swinging, 44.4 mm thick of the types and sizes indicated on the Architect's schedules or drawings.

.3 Exterior doors shall be lock seam, flush.

.4 Face sheets for exterior doors shall be fabricated from (16) gauge steel.

.5 Longitudinal edges of exterior doors shall be fully welded, ground smooth with no visible seams.

.6 Face sheets of interior doors shall be fabricated from 18 gauge steel, except for heavy traffic doors (noted **HT** in Door Schedule) face sheet to be 16 gauge.

.7 Longitudinal edge of heavy traffic doors (noted **HT** in Door Schedule) shall be mechanically interlocked, fully welded, ground smooth with no visible seams. Do not fill seams.

.8 Interior doors shall be stiffened, insulated and sound deadened with honeycomb core laminated under pressure to each face sheet.

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.9 Stiffened, insulated and sound deadened with Fleming's propriety core where Temperature Rise Rated (TRR) fire labeled doors are specified on the Architect's schedules.

.10 Longitudinal edges of interior doors shall be mechanically interlocked, adhesive assisted with edge seams and tack-welded every 150 mm and filled flush.

.11 Door faces of all steel doors shall be fabricated without visible seams, free of scale, pitting, coil brakes, buckles and waves.

.12 Formed edges shall be true and straight with a minimum radius for the thickness of steel used.

.13 Lock and hinge edges shall be beveled 3 mm in 50 mm unless builders' hardware or door swing dictates otherwise.

.14 Top and bottom of doors shall be provided with inverted, recessed, 16 gauge steel end channels, welded to each face sheet at 150 mm on center maximum.

.15 Exterior doors shall be provided with factory installed flush PVC top caps. Fire labeled exterior doors shall be provided with factory installed flush steel top caps.

.16 Unless ineligible due to design, size, hardware or glazing specified on the Architects' or hardware Suppliers' schedules or details, fire labeled doors shall be provided for those openings requiring fire protection ratings and temperature rise ratings, as determined and scheduled by the Architect.

.17 Exterior doors and high traffic doors shall be internally reinforced with 20 gauge continuous; interlocking steel stiffeners at 150mm O.C. max, with voids between stiffeners filled and insulated with 24kg/m3 density loose batt type fiberglass material to suit fully welded design.

.18 Doors shall be factory blanked, reinforced, drilled and tapped for fully templated mortised hardware only, in accordance with the final approved schedule and templates provided by the hardware supplier.

.19 Doors shall be factory blanked and reinforced only for mortised hardware that is not fully templated.

.20 Doors shall be factory reinforced only for surface mounted hardware.

.21 Templated holes 12.7mm diameter and larger shall be factory prepared, except mounting and through bolt holes, which shall be by the contractor responsible for installation on site, at the time of application. Templated holes less than 12.7mm diameter shall be factory prepared only when required for the function of the device (for knobs, levers, cylinders, thumb or turn pieces) or when these holes over-lap function holes.

.22 Drilling and tapping for surface mounted hardware or mortised hardware that is not fully templated shall be by the contractor responsible for installation on site, at the time of application.

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.23 Hinge and pivot reinforcements shall be 10 gauge steel minimum high frequency type reinforcing.

.24 Hinge reinforcements for acoustic doors and doors in excess of 2450mm rabbet height shall be 10 gauge minimum with each cutout provided with 114.3mm heavy weight (4.6mm) high frequency type.

.25 Lock, strike and flush bolt reinforcements shall be 12 gauge steel minimum.

.26 Reinforcements for concealed closers and holders shall be 12 gauge steel minimum.

.27 For surface mounted hardware, reinforcements shall be 16 gauge steel minimum.

.28 All pairs of fire labeled doors shall be provided with 12 gauge steel surface mounted flat bar astragal, shipped loose for application on site, by the contractor responsible for installation.

.29 Pairs of doors up to 2450mm x 2450mm, to 1½ hour fire rating maximum shall be provided without astragals. Lock edge seam of such doors shall be tacked-welded and ground smooth. All other fire labeled pairs shall be provided with 12 gauge steel surface mounted flat bar astragal, shipped loose for application on site, by the contractor responsible for installation.

.30 Where electrically or electronically operated hardware is specified on the Architects' schedules or details of the final approved schedule and templates provided by the hardware supplier, hardware enclosures and/or junction boxes, where indicated on the templates, shall be provided and interconnected with CSA Approved 12.7mm diameter conduit and connectors.

.31 Prepare doors to receive security door contacts – refer to electrical drawings for locations. Door contacts to be installed at 100 mm from the latch side door edge.

2.3 GLAZING

.1 Where 6mm thick glazing materials are specified on the Architects schedules or details, doors shall be provided with 20 gauge steel glazing trim and snap-in glazing stops.

.2 Where other that 6mm glazing is specified on the Architect's schedules or details, doors shall receive 20 gauge steel trim and screw fixed glazing stops. Screws shall be #6 x 32mm oval head scrulox (self-drilling) type at 300mm on center maximum.

.3 Glazing trim and stops shall be accurately fitted, butted at corners, with removable glazing stops located on the 'push' side of the door.

2.4 LOUVER

.1 Where specified on the Architect's schedules or details, non-labeled doors shall be prepared on accordance with the louver manufacturer's details.

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.2 Where specified on the Architect's schedules or details, fire labeled doors shall be prepared for UL listed sight-proof fusible link louvers in accordance with the louver manufacturer's details.

.3 Louvers shall be supplied and installed by others.

2.5 FINISHING

.1 Remove weld slag and splatter from exposed surfaces.

.2 All tool marks, abrasions and surface blemishes shall be filled and sanded to present smooth uniform surfaces.

.3 On exposed surfaces where zinc coating has been removed during fabrication, doors shall receive a factory applied touch-up primer.

.4 Primer shall be fully cured prior to shipment.

2.6 PANELS

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

2.7 PRIMER

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

2.8 PAINT

.1 Field paint steel doors and frames in accordance with Section[s] [09 91 23 - Interior Painting], [09 91 13 - Exterior Painting]. Protect weatherstrips from paint. Provide final finish shall be free of scratches or other blemishes.

2.9 FRAMES FABRICATION GENERAL

.1 Steel:

.1 Frame product shall be fabricated from tension leveled steel to ASTM A924-M97, galvanized to ASTM A653-M97, Commercial Steel (CS), Type B, coating designated ZF75, known commercially as paintable Galvanneal.

.2 Primer:

.1 Rust inhibitive touch up only.

.3 Miscellaneous:

.1 Door Silencers: GJ-64, Single Stud rubber/neoprene type

.2 Thermal Breaks: Rigid polyvinylchloride (PVC) extrusion

.3 Fiberglass: Loose batt type, density: 24kg/m^3 (minimum), conforming to ASTM C665.

.4 General:

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.1 All steel frame product shall be as manufactured by Fleming of the types, sizes and profiles indicated on the Architects' schedules or details.

.2 Exterior frames shall be thermally broken, Fleming *Therma-Frame* Series, fabricated from 16 gauge steel.

.3 Exterior frame product shall be supplied profile welded (PW)

.4 Interior and exterior sections of thermally broken frames shall be separated by a continuous PVC thermal break.

.1 Thermally broken sections shall not be assembled by means of screws, grommets or other fasteners and welds shall not cause thermal transfers between interior and exterior surfaces of the frame sections.

.2 Closed sections (mullions and center rails) of thermally broken frames shall be factory insulated with 24kg/m^3 loose batt type fiberglass material.

.5 Insulation of open sections (jambs, heads and sills) on exterior frame product shall be provided and installed by the contractor responsible for installation.

.6 Interior frames shall be Fleming F-Series, fabricated from 16 gauge steel.

.7 Interior frame product shall be supplied profile welded (PW)

.8 Knocked-down and knocked-down drywall frames shall not be acceptable.

.9 Jambs, heads, mullions, sills and center rails shall be straight and uniform throughout their lengths.

.10 Frame product shall be square, free of defects, wraps or buckles.

.11 Corner joints shall be profile welded (PW) (continuously welded on the inside of the profiles' faces, rabbets, returns and soffit intersections with exposed faces filled and ground to a smooth, uniform, seamless surface)"

.12 Joints at mullions, transom bars, sills or center rails shall be coped accurately, butted and tightly fitted, with faces securely welded, matching corner joint faces.

.13 All steel mullions will be fabricated from the same materials as specified for the steel frames. Steel mullions will be fabricated as a fully assembled three piece unit consisting of a front, back and full height one piece attachment clip as per Fleming F Series. The attachment clip will completely fill the stop area of the mullion on both sides and span the void between each side forming a grid channel like structure. Mullions used as hinge mullions or strike mullions between doors will be filled with grout by the general contractor either prior to or following installation of the frame. The head of the frame shall have an opening sufficient for the grout to be poured in to the mullion.

.14 Mullions shall be fabricated with continuous 20 gauge galvanneal steel internal reinforcing clips.

.15 Frame product shall be fabricated with integral door stops having a minimum height of 16mm.

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.16 Glazing stops shall be formed 20 gauge steel, 16mm height channel, accurately fitted, butted at corners and fastened to frame sections with #6 x 32mm oval head scrulox (self-drilling) type screws at 300mm on center maximum.

.17 Where required due to site access, as indicated on the Architects' schedules or details, when advised by the contractor responsible for co-ordination or installation, or when shipping limitations so dictate, frame product shall be fabricated in sections for splicing in the field.

.1 Field spliced jambs, heads and sills shall be provided with 16 gauge steel splice plates securely welded into one section, extending 100mm minimum each side of splice joint.

.2 Field splices at closed sections (mullions or center rails) shall be 16 gauge steel splice angles securely welded to the abutting member. Face of splice angle shall extend 100mm minimum into closed sections when assembled.

.3 Field splice joints shall be welded, filled and ground to present a smooth uniform surface by the contractor responsible for installation after assembly.

.18 Each door opening shall be provided with two (2) temporary steel jamb spreaders welded to the base of the jambs or mullions to maintain proper alignment during shipping and handling. Spreaders shall be removed by the contractor responsible for installation prior to anchoring of frame to floor.

.19 Each door opening shall be prepared for GJ-64 or equivalent, single stud door silencers, three (3) for single door openings, two (2) for double door openings. Silencers shall be shipped loose for installation by the contractor after finish painting.

.20 Unless ineligible due to design, size, hardware or glazing specified on the Architects' or Hardware Suppliers' schedules or details, fire labeled frame product shall be provided for those openings required fire protection ratings as determined and scheduled by the Architect.

.21 Hardware Preparations:

.1 Frame product shall be blanked, reinforced, drilled and tapped for fully template mortised hardware only, in accordance with the final approved schedule and template provided by the hardware supplier.

.2 Frame product shall be factory blanked and reinforced only for mortised hardware that is not fully template.

.3 Frame product shall be reinforced only for surface mounted hardware.

.4 Drilling and tapping for surface mounted hardware or mortised hardware that is not fully template shall be by the contractor responsible for installation on site, at the time of application.

.5 Frames shall be prepared for 114.3mm standard weight hinges (minimum).

.6 Hinge and pivot reinforcements shall be 10 gauge steel minimum reinforcing, high frequency type shall be provided.

.7 Hinge reinforcements for acoustic frames and frames in excess of 2450mm rabbet height shall be 10 gauge minimum with each cutout provided with 114.3mm heavy weight (4.6mm) high frequency type.

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.8 Strike reinforcements shall be 16 gauge steel minimum.

.9 Reinforcements for surface mounted hardware, concealed closers and holders and flush bolts shall be 12 gauge steel minimum.

.10 Mortised cutouts shall be protected with 22 gauge steel minimum guard boxes.

.11 Where electrically or electronically operated hardware is specified on the Architects schedules or details or the final approved schedule and templates provided by the hardware supplier, hardware enclosures and/or junction boxes, where indicated on templates, shall be provided and inter-connected with CSA Approved 12.7mm diameter conduit and connectors.

.12 Prepare frames to receive security door contacts – refer to electrical drawings for locations. Door contacts to be installed at 100 mm from the latch side door edge.

.22 Anchorage:

.1 Frame product shall be provided with anchorage appropriate to floor, wall and frame construction.

.2 Each wall anchor shall be located immediately above or below each hinge reinforcement on the hinge jamb and directly opposite on the strike jamb, except as indicated below.

.3 Frame product installed in unit masonry partitions shall be provided with 4.0mm diameter steel wire anchors, 18 gauge steel adjustable stirrup and strap or “T” type anchors as conditions dictate.

.4 Where frame product is installed prior to construction of the adjacent wall, each jamb shall be provided with 16 gauge steel floor anchors. Each anchor shall be provided with two (2) holes for mounting to the floor and shall be securely welded to the inside of the jamb.

.5 Floor anchors for thermally broken exterior frames shall be designed so as not to permit thermal transfers from exterior to interior surfaces of the frame sections.

.6 Frame product installed in drywall partitions shall be provided with 20 gauge steel snap-in or “Z” type stud type anchor.

.7 Jambs of frames in previously placed concrete, masonry or structural steel shall be punched and dimpled to accept machine bolt anchors, 6.4mm diameter, located not more than 150mm from the top and bottom of each jamb. Anchor preparations and guides shall also be located immediately above or below the intermediate hinge reinforcing and directly opposite on the strike jamb. Each preparation shall be provided with 16 gauge anchor bolt guides.

.8 Anchor bolts and expansion shell anchors for the above preparations shall be provided by the contractor responsible for installation.

.9 After sufficient tightening of the anchor bolts, the heads shall be welded do as to provide a non-removable application. Welded bolt head and dimple shall be filled and ground to present a smooth uniform surface by the contractor responsible for installation, prior to finish painting.

.10 Where indicated on the Architects’ schedules or details, channel extensions shall be provided from the top of the frame assembly to the underside of the structure above. Extensions shall be fabricated from 12 gauge steel formed channel, mounting angles welded to inside of frame head and adjusting brackets. Formed channels, adjusting brackets and fasteners shall be shipped loose. Channels shall

be mechanically connected to mounting angles and adjusting brackets with supplied fasteners, on site, by contractor responsible for installation.

.23 Finishing:

.1 Remove weld slag and spatter from exposed surfaces.

.2 All tool marks, abrasions and surface blemishes shall be filled and sanded to present smooth and uniform surfaces.

.3 On exposed surfaces where zinc has been removed during fabrication, frame product shall receive a factory applied touch-up primer.

.4 Primer shall be fully cured prior to shipment.

2.10 SIZES AND TOLERANCES

.1 All sizes and tolerances shall be in accordance with the Canadian Steel Door Manufacturers Association "Recommended Dimensional Standards for Commercial Steel Doors and Frames" as follows:

.1 Widths of door openings shall be measured from inside of frame jamb rabbet with a tolerance of +1.6mm, -0.8mm.

.2 Heights of door openings shall be measured from the finished floor (exclusive of floor coverings) to the head rabbet of the frame with a tolerance of $\pm$ 1.2mm.

.3 Unless builders' hardware dictates otherwise, doors shall be sized so as to fit the above openings and allow a 3mm clearance at jambs and head. A clearance of 19mm between the bottom of the door and the finished floor (exclusive of floor coverings) shall be provided. Tolerances on door sizes shall be $\pm$ 1.2mm.

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

2.11 HARDWARE LOCATIONS

.1 Hardware preparations in frame product shall be as noted below and locations on doors shall be adjusted for clearances specified in 2.4.

.2 Top of upper hinge preparation for 114.3mm hinges shall be located 180mm down from head, transom mullion or panel as appropriate. The top of the bottom hinge preparation for 114.3mm hinges shall be located 310mm from finished floor as defined in 2.4.3. Intermediate hinge preparations shall be spaced equally between top and bottom cutouts. For dutch door frames, top and bottom hinge locations shall be as above, with the tops of intermediate hinges located at 930mm and 1403mm from finished floor.

.3 Strike preparations for unit, integral, cylindrical and mortise locks and roller latches shall be centered 1033mm from finished floor. Strikes for deadlocks shall be centered at 1200mm from finished floor. Strikes for panic or fire exit hardware shall be located as per device manufacturer's templates.

.4 Push and/or pulls on doors shall be centered 10701mm from finished floor.

.5 Preparations not noted above shall be as per hardware manufacturer's templates.

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.6 Hardware preparation tolerances shall comply with the ANSI A115 series standards.

Part 3 Execution

3.1 SITE AND PROTECTION OF MATERIALS

.1 The contractor responsible for installation shall remove wraps or covers from door and frame product upon delivery at building site.

.2 All materials shall be thoroughly inspected upon receipt and all discrepancies, deficiencies and/or damages shall be immediately reported in writing to the supplier, All damage shall be noted on the carriers' Bill of Landing.

.3 Contractor responsible for installation shall ensure all materials are properly stored on planks or dunnage in a dry location. Product shall be stored in a vertical position, spaced with blocking to permit air circulation between them. Materials shall be covered to protect them from damage from any cause.

.4 Contractor shall notify the supplier in writing of any errors or deficiencies in the product itself before initiating any corrective work.

3.2 INSTALLATION GENERAL

.1 Install labelled steel fire rated doors and frames to NFPA 80 except where specified otherwise.

.2 Install doors and frames to CSDMA Installation Guide.

.3 Install doors and frames in accordance with the Door and Hardware Institute "Installation guide for doors and hardware".

.4 Set frame product plumb, square, aligned, without twist at correct elevation.

.5 Frame Product Installation Tolerances:

.1 Plumbness tolerance, measured through a line from the intersecting corner of vertical members and the head to the floor, shall be $\pm$ 1.6mm.

.2 Squareness tolerance, measured through a line 90^0 from one jamb at the upper corner of the product, to the opposite jamb, shall be $\pm$ 1.6mm.

.3 Alignment tolerance, measured on jambs, through a horizontal line parallel to the plane of the wall, shall be $\pm$ 1.6mm.

.4 Twist tolerance, measured at face corners of jambs, on parallel lines perpendicular to the plane of the wall, shall be $\pm$ 1.6mm.

.6 Fire labeled product shall be installed in accordance with NFPA-80.

.7 Secure anchorages and connections to adjacent construction.

.8 Brace frame product rigidly in position while building-in. Remove temporary steel shipping jamb spreaders. Install wood spreaders at mid points of frame rabbet height and at floor level to maintain frame widths. Provide vertical support at center of head for

openings exceeding 1250mm in width. Remove wood spreaders after product has been built-in.

.9 Frame product in unit masonry shall be fully grouted in place.

.10 Install doors maintaining clearances outlined in Section 2.4.

.11 Install louvers and vents.

.12 Adjust operable parts for correct clearances and function.

.13 Steel surfaces shall be kept free of grout, tar or other bonding materials or sealers.

.14 Any grout or other bonding material shall be cleaned from products immediately following installation.

.15 Exposed field welds shall be finished to present a smooth uniform surface and shall be touched-up with a rust inhibitive primer.

.16 Exposed surfaces that have been scratched or otherwise marred during shipment, installation or handling shall be touched-up with a rust inhibitive primer.

.17 Finish paint in accordance with Section 099116 and 099123.

.18 Install glazing materials and door silencers.

3.3 INSPECTION

.1 In accordance with Section 01 11 00, upon assignment of an inspection agency the following inspections shall be performed:

.1 review of shop drawings for compliance with specification

.2 shop inspection during production. Should inspection notification not be given suitable to review fabrication, destructive testing of one or more doors will be undertaken either in the shop or on site at no additional cost to the owner. Doors destroyed for invasive inspection shall be replaced as part of the contract price.

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

3.4 FINISH REPAIRS

.1 Touch up with primer finishes damaged during installation.

.2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

3.5 GLAZING

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

END OF SECTION

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Part 1 General

1.1 GENERAL NOTES

.1 Find the Door Schedule on the following pages.

.2 This schedule MUST be read in conjunction with a complete set of drawings and a complete Hardware Schedule.

.3 Refer to AD Drawings for door and frame types and details.

1.2 ABBREVIATIONS CODE

.1 The following abbreviations are used in the Door Schedule.

Code		Reference
.1	DC	Door Contact (security)
.2	FR, FRG	Fire rated glazing
.3	P	Paint
.4	HM	Hollow Metal
.5	TP	Tempered Glass
.6	45 MIN	45 minute fire rating
.7	20 MIN	20 minute fire rating
.8	HT	Heavy Traffic – see spec for welded seams, special reinforcing.
.9	B/F	Barrier-Free
.10	WD	Laminate Faced Wood Door
.11	PLAM	Plastic Laminate Finish on Wood Door
.12	ALUM.	Aluminum
.13	ANNO.	Anodized Finish
.14	CW	Curtain Wall Designation

1.3 DOOR SCHEDULE

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

END OF SECTION

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Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 Submittal Procedures.

.2 Section 08 44 13 Glazed Aluminum Curtain Wall.

.3 Section 08 80 50 Glazing.

1.2 REFERENCES

.1 American Architectural Manufacturers Association (AAMA):
- .1 AAMA 2605-05, Voluntary Specification for High Performance Coatings on Architectural Extrusions and Panels.
- .2 AAMA CW-10-04, Care and Handling of Architectural Aluminum from Shop to Site.

.2 American National Standards Institute (ANSI):
- .1 ANSI, H35.1M-2009, Alloy and Temper Designation Systems for Aluminum (Metric).

.3 American Society for Testing and Materials (ASTM):
- .1 ASTM A167-99(2009), Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
- .2 ASTM B221M-08, Specification for Aluminum-Alloy Extruded Bars, Rods, Wires, Shapes and Tubes.
- .3 ASTM F738M-02(2008), Specification for Stainless Steel Metric Bolts, Screws, and Studs.

.4 Canadian General Standards Board (CGSB):
- .1 CAN/CGSB-1.108-M89, Bituminous Solvent Type Paint.

.5 Canadian Standards Association (CSA):
- .1 CSA W59-M-03(R2008), Welded Steel Construction (Metal Arc Welding).

1.3 DESIGN REQUIREMENTS

.1 Design aluminum doors in accordance with following Climatic Design Data for the project location contained in the Ontario Building Code:
- .1 Design temperature: January 1%, July 2 1/2% .
- .2 Hourly wind pressures: 1 in 50 year occurrence.

.2 Design aluminum doors to accommodate following without producing detrimental effect:
- .1 Cyclic 40 degrees C daily thermal swing of components.
- .2 Cyclic, dynamic loading and release of loads such as wind loads.
- .3 13 mm vertical deflection in supporting structure and movement of supporting structure due to live, dead load, and creep or deflections, seismic load, sway displacement and

similar items.

.3 Prevent deflection and permanent or progressive glazing displacement. Restrict horizontal and vertical deflection to less than L/175 (under uniformly distributed positive design wind load), and 10 mm maximum regardless of span.

1.4 SUBMITTALS

.1 Shop drawings:
- .1 Submit shop drawings in accordance with the Section 01 33 00 indicating:
  - .1 Plans, sections, details, type of extrusions, profiles, anchorage, glazing details, and finishes.
  - .2 Section and hardware reinforcement.

.2 Samples:
- .1 Submit sampled in accordance with the Section 01 33 00 of the following:
  - .1 One complete corner detail of door frame, glazing, and finish for each door type.
  - .2 Each door hardware item for the Consultant's approval.

.3 Reports:
- .1 Submit substantiating engineering data, and independent test results of pre-tested, existing doors to substantiate compliance with the design criteria.
- .2 Submit documentation to substantiate ten years of experience in aluminum door manufacture and installation.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Handle aluminum work in accordance with AAMA CW-10.

.2 Protect aluminum surfaces with strippable coating. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather. Do not remove before final cleaning of building.

Part 2 Products

2.1 ACCEPTABLE MANUFACTURER(S) AND SYSTEM(S)

.1 Aluminum doors:
- .1 Interior:
  - .1 '400A Series' by Alumicor Limited.
  - .2 '350 Swing Doors' by Kawneer Company Canada Limited.
  - .3 Or approved alternative.
- .2 Exterior:
  - .1 '400A Insuldoor' by Alumicor Limited.
  - .2 '360 Insulclad Doors' by Kawneer Company Canada Limited.

.3 Or approved alternative.

2.2 MATERIALS

.1 General:
- .1 All materials under Work of this Section, including but not limited to, sealants and coatings are to have low VOC content limits.
- .2 Wherever possible, metals used in work of this Section are to contain recycled content.

.2 Aluminum extrusions and channels: ASTM B211 and ANSI H35.1 AA6063 alloy, T6 temper.

.3 Reinforcements and anchors: ASTM A167, Type 304 to AISI No. 2B finish. Size as shown.

.4 Glass and glazing materials: As specified in Section 08 80 50.

.5 Frame sealant: Type as recommended by the aluminum work manufacturer.

.6 Screws, bolts and other fasteners: ASTM F738M; Stainless Steel Type 304.

.7 Isolation coating: CAN/CGSB-1.108-M; Bitumastic coating, acid and alkali resistant material.

.8 Foam insulation: One component polyurethane foam for installation within closures and fillers; Enerfoam by Dow Chemical Canada Inc.

.9 Weatherstripping: Durable, non-absorbing material resistant to deterioration by aging and weathering.

.10 Door hardware: Supplied by Section 08 71 00, preparation and installation by this Section.

2.3 FABRICATION

.1 Fabricate sections true to detail, free from defects impairing appearance, strength and durability. Fabricate extrusions with sharp, well defined corners.

.2 Fabricate, fit, and secure framing joints and corners accurately, with flush surfaces, and hairline joints. Apply frame sealant at joints for weatherproof seams.

.3 Conceal anchors, reinforcement and attachments from view. Fabricate reinforcement in accordance with design requirements.

.4 Do not expose manufacturer's identification labels on aluminum assemblies.

.5 Fabricate doors and frames complete with internal reinforcements, cut-outs, and recesses to accommodate finish hardware. Reinforce cut-outs to assure adequate strength.

.6 Double weatherstrip doors. Install weatherstripping in specially extruded ports and secure to

prevent shrinkage or movement.

.7 Fabricate doors of welded construction.

.8 Glazing stop: Square, snap-on type, designed for neoprene glazing system.

2.4 FINISH

.1 Extrusion finish: Clear anodized to AAMA 611 per Aluminum Association Designation System for Aluminum Finishes AA-M12C22A41.

Part 3 Execution

3.1 INSTALLATION

.1 Install aluminum doors in accordance with reviewed shop drawings, and manufacturer's written instructions.

.2 Install Work of this Section securely, in correct location, level, square, plumb, at proper elevations, free of warp or twist.

.3 Apply isolation coating at 0.8 mm dry film thickness to prevent corrosive or electrolytic action between dissimilar materials such as aluminum to concrete, masonry, galvanized steel and similar conditions.

.4 Fill voids between aluminum framing and adjacent construction with foam insulation.

.5 Install aluminum door manufacturer's standard weatherstripping at door frame perimeter. Install weatherstripping throughout entire length and width of doors at jambs and heads.

.6 Install doors and hardware to manufacturers' written instructions. Clean and adjust hardware for correct performance.

.7 Adjust operable parts for correct function.

.8 Remove damaged or unacceptable Products and assemblies from Site and replace to Consultant's acceptance.

.9 Install glass presence markers, in two cross stripes extending from diagonal corners. Maintain markers until final clean-up.

3.2 CLEANING

.1 Maintain aluminum doors, inside and outside, in clean condition throughout construction period.

.2 Remove labels, protective material, and glass presence markers from prefinished surfaces.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

1. Section 08 71 10 – Door Hardware
2. Section 10 11 25 – Manufactured Specialties Item 2.1.14

1.2 REQUIRMENTS OF REGULATORY AGENCIES

1. Fabricate and install all doors to the following standards. AWMAC Quality Standards for Architectural Woodwork, latest edition
2. CAN/CSA-0132.2 Series-90, Wood Flush Doors
3. CAN4-S104-M80, fire tests of door assemblies
4. CAN4-S105-M85, Fire Door Frames
5. NFPA-80, Fire doors and Windows, latest edition.

1.3 SAMPLES

1. Submit samples in accordance with Section 01 33 00
2. Submit one 12” x 12” corner sample of each type of door
3. Show door construction, core, glazing details and faces.

1.4 SHOP DRAWINGS

1. Submit shop drawings in accordance with Section 01300 Submittals.

1.5 GUARANTEE

1. All doors shall be fully guaranteed for a period of three (3) years against manufacturing defects, core ghosting and warping, delamination of veneer, after Substantial Completion.

Part 2 General

2.1 MATERIALS

1. Acceptable door manufacturers:
   - .1 Algoma
   - .2 Cambridge
   - .3 Dormond
   - .4 Lambton
   - .5 Marshfield

2. Doors shall be of the sizes, thickness and type as shown on the drawings.

3. Solid core doors shall be constructed with urea-formaldehyde free particle board to ANSI A208.1, lD2. For Fire rated doors provide core in accordance with fire test requirements..

4. Doors shall be provided with vision panels as called for on the Door Schedules and supplied complete with wood glazing stops for 20 minute rated doors and ULC approved metal glazing stops for 45 minute or 60 minute rated doors.

5. Doors shall be complete with labels indicating approved fire resistance rated as required.

6. Undercut or rebate bottom rails as required.

7. Crossband – 3 ply hardwood plywood not less than 1/8" thick before sanding

8. Vertical and horizontal edges, stops and beads for glass and grilles to match face veneer. Edges shall be minimum 1 ½" wide by thickness of door.

9. Stiles and rails to be low density softwood staved type minimum 1 ½" wide with ¾" thick hardwood edge banding. Moisture content shall not exceed 8%.

10. Glazing beads to be flush type front edge recessed 1/8" at bottom. Mitre cut and fil all corners to form tight flush joints.

11. Face veneer shall be plastic laminate from Nevamar Plastic Laminate ARP surface distributed by McFaddens. Approved alternates by Wisonart, Formica or Arborite. Allow for maximum of 2 colours from full range, including solids and wood grains as chosen by Consultant.

12. Colours to later selection by Consultant as specified in Plastic Laminates.

2.2 FABRICATION

1. Door cores unframed, solid laminated wood stave core construction, comprising narrow pieces of kiln dried wood, grain running vertically and end joints well staggered, solid, (no voids) and electronically glue bonded. Floating core construction will not be accepted. Sand door cores boths sides prior to application of faces.

2. If particle board core or fire rated cores used, frame with 1 1/8" minimum wood stiles and 2 ¾" minimum wood rails; edge stiles with birch ¾" wide minimum, full length piece. Glue tiles and rails to core and apply face veneer and machine flush with door edges.

3. Seal tope and bottom edges with two coats urethane finish or lacquer applied to door manufacturer's plant.

4. Attach ULC labels to fire doors and frames as required

5. Preparation of doors shall include provision for extra hinges, heavy weight butts and mortised or cylinder locksets as required of hardware tender documents.

6. Preparation of doors and frames shall make appropriate provision for sound seals as indicated on Door Schedule.

7. Prepare glazing stops to receive insulated, sealed glazing as required on Door Schedule.

Part 3 Execution

3.1 FITTING AND HANGING DOORS

1. Doors shall be delivered to site, protected in transit from any damage from weather or handlying and similarly stored in a protected area until hung in place.

2. Doors shall be hung by skilled carpenters.

3. Any planning of edges required for proper installation shall be sanded smooth prior to final installation.

4. Neatly and accurately fit required finishing hardware. Refer to section 08 71 10 - Finishing Hardware.

5. The completed installation required all doors to fit accurately in their frames, swing easily without binding and close slugly without movement when latch is engaged.

3.2 HARDWARE INSTALLATION

.1 Receive hardware from Section 08 71 10.

.2 Installation of the hardware is the responsibility of the General Contactor.

.3 Adjust for correct function.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 00 Closeout Submittals.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM International)

.1 ASTM A653/A653M-09a, Standard Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot Dip Process.

.2 Canadian Standards Association (CSA)

.1 CSA C22.1-09, Canadian Electrical Code, Part 1, Safety Standards for Electrical Installations.

.2 CAN/CSA-G40.20/G40.21-M-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels.

.3 CAN/CSA G164-M92 (R2003), Hot Dip Galvanized of Irregulary Shaped Articles.

.4 CSA S136-M-07, North American Specification for the Design of Cold Formed Steel Structural Members.

1.3 DESIGN REQUIREMENTS

.1 Provide insulated manually and electrically operated overhead coiling doors where indicated.

.2 Calculate properties of steel sections and allowable stresses used in determination of structural performance in accordance CSA S136-M.

.3 Design for means of fully reversing downward descent of door, if door comes down on an obstruction. Door to cycle closed until obstruction is removed.

.4 Design electrical components for doors in accordance with CSA C22.1 and the Ontario Hydro Electric Safety Code.

1.4 SUBMITTALS

.1 Product data:

.1 Submit duplicate copies of manufacturer's Product data in accordance with Section 01 22 00 indicating:

.1 Performance criteria, compliance with appropriate reference standard(s), characteristics, limitations, and trouble-shooting protocol.

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.2 Product transportation, storage, handling and installation requirements.

.2 Shop Drawings:

.1 Submit shop drawings in accordance with Section 01 33 00 indicating:

.1 Elevations, sections, details, materials, operating components, dimensions, gauges, finishes, arrangement of hardware, require clearances, and relationship to adjacent construction.

.2 Complete electrical wiring diagrams including electrical schematics and sequence of operation.

.3 Complete engineering design data confirming that Products meet design criteria specified.

1.5 QUALITY ASSURANCE

.1 Perform Work of this Section by a company that has a minimum of five years proven experience in the installation of overhead coiling doors of a similar size and nature and that is approved by manufacturer. Submit to Consultant, applicator's current certificate of approval by the material manufacturer as proof of compliance.

1.6 EXTENDED WARRANTY

.1 Submit a warranty for Work of this Section in accordance with General Conditions, except that warranty period is extended to 3 years.

.1 Warranty against failure to meet design criteria and specified requirements

.2 Coverage: Complete replacement including affected adjacent Work.

Part 2 Products

2.1 ACCEPTABLE PRODUCTS AND MANUFACTURERS

.1 Door (Type 1 – manually operated):

.1 'Atlas Doors Model T33PS' by Clopay Building Products Company Inc. or approved alternative.

.2 For use at Receiving. Door to be sized at approximately 1800 mm wide x 2134 mm high.

2.2 MATERIALS

.1 Steel angles, shapes, plates, and similar items: CAN/GSA-G40.20/G40.21-M, Grade 350W.

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.2 Galvanized steel sheet: commercial quality to ASTEM A653/A653M with Z275 zinc coating. Minimum sheet thickness to be as recommended by door manufacturer to suit intended application.

.3 Insulation: Polyurethane foam-injected insulation as required to meet desired thermal value.

.4 Weather stripping:

.1 Sills: bulb type full width extruded neoprene weatherstrip.

.2 Jambs and head: extruded aluminum and arctic grade vinyl weatherstrip to manufacturer's standard.

2.3 HARDWARE

.1 Brackets: Fabricated from 6.35 mm steel plate, with sealed ball bearings on the operating side.

.2 Guides: Fabricated from structural steel, complete with integral windlock bar, of sufficient depth to retain curtain to meet design criteria. Provide vinyl guide weather strip on operating side.

.3 Spring counter balance: heavy duty oil tempered torsion spring with manufacturers standard brackets:

.3 Drum: Die cast aluminum; size as recommended by door manufacturer to suit intended application.

.4 Shaft: Solid steel; size as recommended by door manufacturer to suit intended application.

.4 Crank hoist operator: Provide waist high crank hoist operator using gears and removable hand crank.

.5 Hood: Minimum 24 ga. Galvanized steel sheet. Provide neoprene hood baffle in hood to prevent air infiltration.

.6 Endlocks: Each end of alternate slats to be fitted with endlocks to act as a wearing surface in the guides and maintain slat alignment. Provide roller endlocks and windlocks for Door Type 2 as required.

.7 Reinforcing: Provide reinforcing as required for complete installation and to prevent sag.

.8 Chain Operator unit (emergency): Hand-chain actuated unit of type appropriate for the track type used. Furnish endless chain of sufficient length to come within 600mm of floor and furnish a wall mounted keeper. Design gear reduction unit to reduce pull required on the hand chain to 35 pounds maximum.

.9 Locking:

.1 Door (Type 1): Locking disc on crank box of crank hoist suitable for padlocking. Padlock by Owner.

□

2.5 FABRICATION

.1 Fabricate overhead coiling doors in accordance with reviewed shop drawings and manufacturer's written instructions.

.2 Coiling door curtain interlocking slat sections:

.1 Roll formed steel: no less than 66.68 mm high.

.2 Profile: 'Type T3' slat profile.

.3 Rivet continuous end locks to slat ends.

.4 Provide bottom bar of double equal weight steel angles.

.5 Form guides of metal angles of sections of 6 mm minimum thickness for between jambs installation.

.6 Construct counterbalance assembly of heat treated torsion spring with 25% overload factor. Enclose spring in steel pipe to support door curtain and counterbalance mechanism. Provide ball bearings and rotating points. Provide spring tension adjusting wheel, accessible for setting.

.7 Support counterbalance assembly on 6.35 mm minimum thickness steel plate bracket, forming end enclosures.

.8 Enclose counterbalance assembly with galvanized steel sheet formed hood.

2.6 FINISHES

.1 Prefinish sheet steel: Galvanized finish with baked on epoxy modified polyester finish in colour as selected by the Consultant.

.2 Steel: Hot dip galvanized in accordance with CAN/CSA G164-M.

Part 3 Execution

3.1 EXAMINATION

.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of Work means acceptance of existing conditions.

3.2 INSTALLATION

.1 Install doors as shown and in accordance with reviewed shop drawings and manufacturer's printed instructions.

.2 Fasten door guides and associated components securely to walls using anchors where required.

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.3 Supply and install all necessary steel, brackets, clips, angles, supports, anchors, etc., which may be required to support the door and mechanisms.

.4 Install operator including electrical motors, controller units, pushbutton stations, relays and other electrical equipment required for door operation in accordance with CSA C22.1 and Ontario Hydro Electrical Safety Code.

.5 Erect door true to line with all hardware carefully and neatly applied. Make all necessary adjustments and leave door in proper working order.

.6 Install crank hoist in location indicated.

.7 Adjust door operating components to ensure smooth opening and closing of doors.

3.3 ERECTION TOLERANCES

.1 Maintain dimensional tolerances and alignment with adjacent work and as follows:

.1 Maximum variation and alignment from plum: 1.5 mm.
.2 Maximum variation from level: 1.5 mm.
.3 Longitudinal or diagonal warp: Plus or minus 3 mm per 3 m straight edge.

3.4 FIELD QUALITY CONTROL

.1 Testing: Test operate door and demonstrate the operation of same to the satisfaction of the Consultant.

.2 Adjust door operating components to ensure smooth opening and closing of doors.

END OF SECTION

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Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 61 00 - Common Product Requirements.

.3 Section 01 78 00 - Closeout Submittals.

.4 Section 05 50 00 - Metal Fabrications: Metal fabricated framed openings, structural support framing for sloped glazing.

.5 Section 07 27 10 - Air Barriers - Descriptive or Proprietary.

.6 Section 07 84 00 - Firestopping: Fire safing between floor edge and curtain wall system.

.7 Section 07 92 10 - Joint Sealing: System perimeter sealant and back-up materials.

.8 Section 08 80 50 - Glazing.

.9 Section 09 91 23 - Interior Painting: Field painting of interior surface of infill.

1.2 REFERENCES

.1 Aluminum Association Designation System For Aluminum Finishes (AA)-[1997].

.1 DAF 45 [2003], Designation System For Aluminum Finishes.

.2 American Architectural Manufacturers Association (AAMA).

.1 AAMA CW-DG-1-[96], Aluminum Curtain Wall Design Guide Manual.

.2 AAMA CW-10-[97], Care and Handling of Architectural Aluminum From Shop to Site.

.3 AAMA CW-11-[85], Design Wind Loads for Buildings and Boundary Layer Wind Tunnel Testing.

.4 AAMA T1R-A1-[02], Sound Control for Fenestration Products.

.5 AAMA 501-[94], Methods of Test for Exterior Walls.

.6 AAMA 503-[92], Voluntary Specification for Field Testing of Metal Storefronts, Curtain Wall and Sloped Glazing Systems.

.7 AAMA 611-[98], Voluntary Specifications for Anodized Finishes Architectural Aluminum.

.8 AAMA 612-[02], Voluntary Specifications, Performance Requirements, and Test Procedures for Combined Coatings of Anode Oxide and Transparent Organic Coatings on Architectural Aluminum.

.9 AAMA 2603-[02], Voluntary Specification Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.

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.10 AAMA 2604-[02], Voluntary Specification Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.

.3 American Society for Testing and Materials International, (ASTM).

.1 ASTM A36/A36M-[103a], Specification for Carbon Structural Steel.

.2 ASTM A123/A123M-[02], Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.3 ASTM A167-[99], Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

.4 ASTM A653/A653M-[03], Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.5 ASTM B209-[02a], Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

.6 ASTM B221-[02], Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

.7 ASTM E283-[91(1999)], Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

.8 ASTM E330-[02], Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls, by Uniform Static Air Pressure Difference.

.9 ASTM E331-[00], Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform Static Air Pressure Difference.

.10 ASTM E413-[87(1999)], Classification for Rating Sound Insulation.

.11 ASTM E1105-[00], Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference.

.4 Canadian General Standards Board (CGSB).

.1 CAN/CGSB 1.108-[M89], Bituminous Solvent Type Paint.

.2 CAN/CGSB-12.20-[M89], Structural Design of Glass for Buildings.

.5 Canadian Standards Association (CSA International).

.1 CSA-G40.20/G40.21-[98(R2003)], General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels.

.2 CAN/CSA-G164-[M92(R2003)], Hot Dip Galvanizing of Irregularly Shaped Articles.

.3 CSA-S136-[01], North American Specification for the Design of Cold-Formed Steel Structural Members.

.4 CAN3-S157-[M83(R2002)], Strength Design in Aluminum.

.5 CSA W59.2-[M1991(R2003)], Welded Aluminum Construction.

.6 Environmental Choice Program (ECP).

.1 CCD-45-[95], Sealants and Caulking Compounds.

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.2 CCD-47-[1998], Surface Coatings.

.3 CCD-48-[95], Recycled Water-Borne Surface Coatings.

.7 Society for Protective Coatings (SSPC).

.1 SSPC - Paint 20 Zinc Rich Coating.

.2 SSPC - Paint 25 Alkyd, Zinc Oxide Linseed Oil and Primer for Use Over Hand Cleaned Steel Type 1 and Type 2.

1.3 SYSTEM DESCRIPTION

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

1.4 QUALITY ASSURANCE

.1 Installation crews engaged or provided by the approved supplier shall have proven experience specifically trained and qualified in this work (written proof of minimum of five (5) years employment or service with the window manufacturer or similar manufacturer). Individuals are to be either employees of the manufacturer and/or workers approved by the manufacturer.

.2 Provide one (1) thoroughly experienced. reliable, qualified and competent foreman in charge of the work to be on site at all times when work is taking place. Individual to be designated in charge from start of activities on site until final deficiencies are complete. Foreman may only be changed by written approval *or request* of the Consultant or owner.

.3 Window supplier is to have adequate plant and skilled tradesmen and is known to have manufactured and installed similar windows for a minimum of five (5) years in the Province of Ontario.

1.5 PERFORMANCE REQUIREMENTS

.1 Structural performance shall be based on CSA standard CAN3-S157 "Strength Design in Aluminum" and a maximum deflection of 1/175 of the span.

.2 Air infiltration shall not exceed 0.06 cfm/ft2 (0.0003 m3/s-m2) when tested in accordance with ASTM E283 at a pressure differential of6.24p.s.f. (300 Pa.)

.3 There shall be no water infiltration when tested in accordance with ASTM E331 with a pressure differential of 15.0 p.s.f. (720 Pa.) Thermally, the grid members shall have a condensation resistance equal to or better than the area along the bottom of a 1" sealed glass unit with standard metal spacer edge construction.

.4 Size glass units and glass dimensions to limits established in CAN/CGSB-12.20.

.5 Provide system to accommodate, without damage to components or deterioration of seals:

.1 Movement within system.

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.2 Movement between system and perimeter framing components.

.3 Dynamic loading and release of loads.

.4 Deflection of structural support framing.

.5 Shortening of building concrete structural columns.

.6 Creep of concrete structural members.

.6 Vapour seal with interior atmospheric pressure of 25 mm sp, 22 degrees C, 40% RH: No failure.

.7 Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to the exterior by a weep drainage network.

.8 Ensure no vibration harmonics, wind whistles, noises caused by thermal movement, thermal movement transmitted to other building elements, loosening, weakening, or fracturing of attachments or components of system occur.

1.6 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Provide component dimensions; describe components within assembly, anchorage and fasteners, glass and infill, internal drainage details and water flow diagrams.

1.7 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate system dimensions, framed opening requirements and tolerances, internal million reinforcement, adjacent construction, anchor details anticipated deflection under load, affected related Work, weep drainage network, expansion and contraction joint location and details, and field welding required.

.3 Curtain wall shop drawings are to be approved for structural integrity by a Professional Engineer licensed to design structures in the Province of Ontario. Shop drawings are to bear Engineer's seal of approval.

1.8 SAMPLES

.1 Drawings and specifications for work of this section are based upon Thermawall 2600 series Curtain Wall system by Alumicor. For all approved products and acceptable alternatives, submit supporting technical literature, samples, drawings and performance data to meet or exceed these specifications.

.2 Submit two samples 800 x 800 mm in size illustrating prefinished aluminum surface, finish, colour, texture, specified glass units, insulated infill panels, glazing materials illustrating edge and corner.

1.9 DESIGN DATA

.1 Submit design data in accordance with Section 01 33 00 - Submittal Procedures.

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.2 Provide framing member structural and physical characteristics, calculations, dimensional limitations, special installation requirements.

1.10 TEST REPORTS

.1 Submit test reports in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit substantiating engineering data, test results of previous tests by independent laboratory which purport to meet performance criteria, and supportive data.

1.11 REGULATORY REQUIREMENTS

.1 Conform to applicable code for acoustic attenuation, and sound transmission.

.2 Use the following paragraph for assessing full sized erected assemblies for review of construction, coordination of work of several sections, testing, or observation of operation. A mock-up may also be used for assessing field applied finishes.

1.12 MOCK-UP

.1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control.

.2 Locate where directed.

.3 Allow 24 hours for inspection of mock-up Consultant before proceeding with work.

.4 When accepted, mock-up will demonstrate minimum standard for this work. Mock-up may not remain as part of finished work.

1.13 PRE-INSTALLATION MEETING

.1 Convene one week before starting work of this section.

1.14 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, handle and protect materials in accordance with Division 1 requirements.

.2 Handle work of this section in accordance with AAMA CW-10.

.3 Protect prefinished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.

1.15 ENVIRONMENTAL REQUIREMENTS

.1 Do not install sealants when ambient and surface temperature is less than 5 degrees C.

.2 Maintain this minimum temperature during and after installation of sealants.

1.16 SEQUENCING

.1 Coordinate work of this section with installation of fire stopping, air barrier placement, vapour retarder placement, flashing placement, installing ductwork to rear of louvers.

1.17 WARRANTY

.1 Submit a manufacturer's warranty against defects in materials and workmanship covering the components of the window system for a period of ten (10) years. The manufacturer shall supply a non-pro-rated warranty covering labour, materials, tools and equipment to repair and/or replace any materials defects at no additional cost, for a period of ten (10) years including defects or failures due to poor workmanship and installation.

.2 The supplier shall also submit a warrantee, in accordance with Section 088050-Glazing, for 10 years warranting the sealed units against defects.

1.18 MAINTENANCE DOCUMENTS AND MATERIALS

.1 Provide 2 copies of data for maintenance and routine cleaning.

.2 Provide 2 copies of final record reviewed shop drawings for owner's records.

.3 Contractor shall supply all accessories as may be required for the operation and performance of the windows system.

1.19 EXTRA MATERIALS

.1 Provide extra materials of glass units in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide protected and packaged in wood crates suitable for storage. Clearly identify each crate.

.3 Deliver Consultant, upon completion of the work of this section.

.4 Store where directed by Consultant.

1.20 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

Part 2 Products

2.1 MATERIALS

.1 **Exterior Curtain Walls** – Alumicor Thermawall 2600 or Kawneer 1600UT, Ultra Thermal Performance curtain wall, (63.5 mm x 190.5mm – incl. glazing & cap).

.1 Must be designed to withstand a wind load of min. 30 psf.

.2 Provide high thermal performance gaskets.

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.3 Fixed (non opening) thermally broken anodized aluminum curtain wall system, glazed with tempered, insulating vision glass and tempered spandrel glass.

.4 Standard pressure cap for most locations.

.5 Deep Pressure Cap: Provide 150mm extended pressure cap where noted on drawings.

.6 Provide double width mullion where required (near main entrance).

.7 Provide Structural Silicone Mullion (SSG) where noted on drawings. Back section depth to match capped assembly where noted in drawings.

.8 Provide operable 'phantom vent 5000' where indicated on drawings.

.9 Provide insect screens to operable vents at Learning Commons and Art Classrooms.

.2 **Interior Curtain Walls** - Drawings and Details are based on Alumicor Versawall 2500 (non-thermal) curtain wall, (63.5 mm x 153mm – incl. glazing & cap).

.1 Fixed (non opening) anodized aluminum curtain wall system, glazed with tempered, vision glass and tempered spandrel glass.

.3 Acceptable Materials : Curtain wall systems meeting or exceeding these specifications manufactured by:

.1 Alumicor
.2 Aerloc Industries
.3 Alwind Industries
.4 Kawneer Company of Canada
.5 Windspec Inc.

.4 Extrusions shall be 6063 T54 alloy and temper.

.5 Formed aluminum components shall be sheet of alloy and temper suitable for their purpose and finish.

.6 Fasteners shall be 300 series stainless steel or 400 series stainless steel cadmium plated and of sufficient size and quantity to perform their intended function.

.7 Weathering and glazing gaskets shall be extruded, black, closed cell or dense elastomer of durometer appropriate to the function.

.8 Provide glazed and aluminum spandrel sections where indicated on drawings.

.9 Provide structural silicone mullions where described on drawings.

.10 Refer to Section 08 80 50 – Glazing for information on tinted glazing sections and glazed spandrel panels. Refer to drawings for locations.

.11 Manufacturer / Installer to determine if mullions require internal reinforcement to achieve specified load resistance.

□

.12 At all curtain wall spandrel panels exposed on interior of building, curtain wall spandrel panels shall be laminated with aluminum panel of same pre-finish as mullions with bent edges.

.13 Allow for two (2) additional colours of exterior infill panels other than anodized. Enamel finish shall be PPG Duranar finish (Kynar 500), 10,000 series or approved alternate.

2.2 FINISHES

.1 CLEAR ANODIZED.

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

.2 Custom Duranar finish on accent extended depth mullions where noted on drawings. Colour to be selected by consultant.

2.3 ALUMINUM SPANDRAL PANEL

.1 Composition: Two sheets of aluminum sandwiching a core of extruded thermoplastic formed in a continuous process without the use of glues or adhesives between dissimilar materials. Bond integrity testing to adhere to ASTM D1781-76

.2 Aluminum face sheets: Aluminum alloy 3003, thickness: 0.51 mm

.3 Panel thickness: 4 mm

.4 Panel weight: 5.28 kg/sq.m.

.5 Tolerances:

.1 Panel bow: Maximum 0.8% of panel dimension (width or length).

.2 Panel Dimensions: Take site measurements before proceeding with production unless dimensions can be guaranteed by General Contractor.

.3 Panel lines, breaks and angles to be sharp and true; panel surfaces to be free from warp or buckle.

.6 Panel System: Dry joint SL-2000 with 12.5 mm wide panel joints using proprietary aluminum extrusions.

.7 Acceptable material and manufacturer:

.1 Alucobond Plus supplied by Sobotec Ltd., 67 Burford Road, Hamilton Ontario, L8E 3C6 Tel: 905-578-1278.

.2 Similar systems meeting the exact fire rated and compositional requirements of this specification section by "Alpolic" by Mitsubishi Chemical; Vicwest (905 825-2252), Kanalco Ltd (tel: 905-623-2303) or Flynn Canada, or Alcotex as supplied by Ontario Panelization (tel. 519 659-8900) or others approved by Consultant.

.8 Aluminum Composite to have a fire resistant core, meeting OBC requirements for non-combustible materials.

.9 Refer to 'Glazing' specification for glazed spandrel panels.

.2 Panel finishes: Duranar, three coat, coil-coated baked enamel finish containing Kynar 500 polyvinylidene fluoride resin, metallic finish as specified below.

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.3 Panel Colours: Allow for 1 colour as follows:

.1 **Colour A**: to match quality level, finish and colour series as Alpolic Metallic Series, colour to be confirmed.

.2 Locations: spandrel wall panels noted on drawings.

.3 Contractor to submit triplicate samples of colours for review by Consultant prior to order and fabrication.

2.4 FABRICATION

.1 Fabricate aluminum work in accordance with reviewed shop drawings and manufacturer's written instructions.

.2 Fabricate framing from extrusions of size and shape shown on shop drawings.

.3 Vertical and horizontal members shall be tubular extrusions designed for shear block comer construction.

.4 All joints shall be accurately machined, assembled and sealed to provide neat weather tight joints. Shielded drainage and pressure equalization vents shall be provided where required. AH horizontal members shall be sealed to vertical members to provide individual compartments within the system in accordance with the rain screen principle.

.5 Fabricate system components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

.6 Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.

.7 Prepare components to receive anchor devices. Install anchors.

.8 Arrange fasteners and attachments to ensure concealment from view.

.9 Reinforce framing members for external imposed loads.

.10 Visible manufacturer's identification labels not permitted.

.11 Break shapes must be approved by the Consultant prior to use.

.12 At all curtain wall spandrel panels exposed on interior of building, curtain wall spandral panels shall be laminated w/ aluminum panel of same pre-finish as mullions with bent edges.

.13 Provide spandrel panels at locations of exterior light fixtures as shown on elevations. Coordinate with Div. 16 for lighting location and size of openings.

.14 All perimeter sections to be tubular/closed back sections for continuous adhesion and continuity of building envelope membrane.

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.15 Spandrel panels:

.1 Fabricate insulated spandrel panel inner facing of 20 gauge aluminum sheet. Wrap edges with aluminum sheet, enabling installation and minor movement of perimeter seal.

.2 Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.

.3 Place insulation within panel, adhered to exterior face of interior panel sheet over entire area of sheet with impale fasteners.

.4 Provide integral reinforcing and stiffeners as required to reinforce panel against deflection caused by wind and suction loads.

.5 Provide non-metallic spacers as necessary to separate dissimilar metals.

.6 Ventilate and pressure equalize the air space outside the exterior surface of the insulation, to the exterior.

.7 Arrange fasteners and attachments to ensure concealment from view.

.8 Glass panels: Consists of spandrel glass in accordance with Section 08 80 00 to the exterior with insulated backpan to the inside. Interior face of panel to be finished with a pre-finished aluminum sheet of the same grade as the exterior, colour matching the exterior. Insulation thickness shall be as indicated, retained with stick clips. Seal all joints in shop with high grade butyl sealant, including perimeter seal at backpan. Colour to later selection by Consultant.

.9 Metal panels: Consists of an exterior prefinished flush aluminum panel with panel stiffeners as required, to match colour of window framing, with insulation core thickness as indicated and galvanized sheet back-pan. Interior face of panel to be finished with a pre-finished aluminum sheet of the same grade as the exterior, colour matching the exterior.

Part 3 Execution

3.1 EXAMINATION

.1 Verify dimensions, tolerances, and method of attachment with other work.

.2 Verify wall openings and adjoining air barrier and vapour retarder materials are ready to receive work of this section.

3.2 INSTALLATION

.1 Framing shall be installed, glazed and adjusted by experienced personnel in accordance with the manufacturer's instructions and approved shop drawings. All items in this section shall be set in their correct location and shall be set level, square, plumb and at proper elevations and in alignment with other work.

.2 Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

.3 Provide alignment attachments and shims to permanently fasten system to building structure. Clean weld surfaces; apply protective primer to field welds and adjacent surfaces.

□

.4 Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances and align with adjacent work.

.5 Provide thermal isolation where components penetrate or disrupt building insulation.

.6 Co-ordinate attachment and seal of perimeter air barrier and vapour retarder materials.

.7 Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

.8 Install fire-safing in areas as indicated.

3.3 FIELD QUALITY CONTROL

.1 Inspection will monitor quality of installation and glazing.

.2 Test to ASTM E1105, and AAMA 501.

.3 Evaluate installed system by thermo-photographic scan.

3.4 ADJUSTING

.1 Adjust operating sash for smooth operation.

3.5 CLEANING

.1 Remove protective material from prefinished aluminum surfaces.

.2 Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

.3 Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

3.6 PROTECTION

.1 Protect finished Work from damage.

.2 Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint."

END OF SECTION

□

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 11 – Final Cleaning.

.3 Section 08 80 50 – Glazing.

.4 Section 07 92 10 - Joint Sealing: caulking of joints between frames and other building components.

1.2 REFERENCES

.1 Aluminum Association (AA), Designation System for Aluminum Finishes (2000)

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.40-[97], Anticorrosive Structural Steel Alkyd Primer.

.2 CAN/CGSB-79.1-[M91], Insect Screens.

.3 Canadian Standards Association (CSA) International

.1 CSA-A440-[00]/A440.1-[00], A440-[00], Windows / Special Publication A440.1-[00], User Selection Guide to CSA Standard A440-[00], Windows.

.2 CAN/CSA-G164-[M92(R1998)], Hot Dip Galvanizing of Irregularly Shaped Articles.

.3 CAN/CSA-Z91-[M90(R2000)], Safety Code for Window Cleaning Operations.

1.3 SYSTEMS AND MANUFACTURERS

.1 Drawings and details are based on 1970 Series RainBlade with 1350 Series Vents as manufactured by Alumicor Ltd.

.2 Approved exterior window systems meeting or exceeding these specifications by the following manufacturers are to be supplied:

.1 Alumicor
.2 Aerloc Industries
.3 Alwind Industries
.4 Kawneer Company of Canada
.5 Windspec Inc.”

.3 Work of this Section must be designed by a Professional Engineer licensed to design structures in the Province of Ontario.

.4 By submitting a price for supply and install; the Contractor for work to this section shall guarantee that he has carried products and pricing from one of the above approved manufacturers.

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.5 All curtain wall framing has been drawn using a nominal 5-1/4" framing and set back 30mm from brick veneer face.

.6 All punch window framing has been drawn using a nominal 6" framing and set back 60mm from brick veneer face.

1.4 QUALITY ASSURANCE

.1 Installation crews engaged or provided by the approved supplier shall have proven experience specifically trained and qualified in this work (written proof of minimum of five (5) years employment or service with the window manufacturer or similar manufacturer). Individuals are to be either employees of the manufacturer and/or workers approved by the manufacturer.

.2 Provide one (1) thoroughly experienced. reliable, qualified and competent foreman in charge of the work to be on site at all times when work is taking place. Individual to be designated in charge from start of activities on site until final deficiencies are complete. Foreman may only be changed by written approval *or request* of the Consultant or owner.

.3 Window supplier is to have adequate plant and skilled tradesmen and is known to have manufactured and installed similar windows for a minimum of five (5) years in the Province of Ontario.

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Clearly indicate on shop drawings all materials and large scale details for head, jamb and sill as they will be installed in contact with building components for this project, profiles of components, elevations of unit, anchorage details, location of isolation coating, location of insulation to jambs head and sill, drainage locations, description of related components and exposed finishes and fasteners.

.3 Show paths of interior drainage and venting.

1.6 CERTIFICATES

.1 Submit manufacturer's certificate, and test performance data certifying compliance with specification requirements from an Independent Testing Laboratory, for:

.1 windows
.2 finishes.
.3 removable self framed insect screens.
.4 infiltration/exfiltration rates.
.5 thermal transfer resistance of frames.
.6 locking hardware
.7 vandal resistance

1.7 PERFORMANCE

.1 The overall thermal transmittance of fenestration assemblies shall be less than 0.81 Btu. Thermal transmittance for the fenestration shall be determined using ASHRAE 90.1 calculation procedures and shall include the effect of sash, frame, edge effect and spacer for multiple-glazed units.

.2 Fenestration shall meet CAN/CSA – A440 windows:

.1 Air Leakage: A3

.2 Water Leakage: B7

.3 Wind Load Resistance: C5

.4 Condensation Resistance Factor: fixed frame: 60 minimum

.5 Glass: 59 minimum

.3 Window shall also meet the requirements for blocked operation, ease of operation, sash strength, stiffness and resistance to forced entry.

.4 Submit test reports from a recognized Canadian Independent Testing Laboratory as well as manufacturer's certificate, certifying compliance with the above-noted requirements.

1.8 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal recyclable packaging materials in appropriate on-site for recycling.

.3 Unused or damaged glazing materials are not recyclable and must not be diverted to municipal recycling programs.

.4 Divert unused or damaged wood materials from landfill to recycling facility approved by Consultant.

.5 Divert unused metal materials from landfill to metal recycling facility approved by Consultant.

.6 Divert unused caulking material from landfill to official hazardous material collections site approved by Consultant.

.7 Plastic caulking tubes are not recyclable and must not be diverted for recycling with other plastic materials.

1.9 WARRANTY

.1 Submit a manufacturer’s written warranty against defects in materials and workmanship covering the components of the window system for a period of five (5) years. The manufacturer shall supply a non-pro-rated warranty covering labour, materials, tools and equipment to repair and/or replace any materials defects at no additional cost, for a period of five (5) years including defects or failures due to poor workmanship and installation.

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.2 The supplier shall also submit a written warrantee, in accordance with Section 088050-Glazing, for ten (10) years warranting the sealed units against defects.

1.10 MAINTENANCE DOCUMENTS AND MATERIALS

.1 Provide 2 copies of data for maintenance and routine cleaning.

.2 Provide 2 copies of final record reviewed shop drawings for owner's records.

.3 Contractor shall supply all accessories as may be required for the operation and performance of the windows system.

1.11 MOCK UP

.1 Construct a window mock up in accordance with Section 01 45 00 – Quality Control. Allow 24 hours for inspection of mock-up by Consultant before proceeding with work. When accepted, mock-up will demonstrate minimum standard for this work. Mock-up may not remain as part of finished work."

Part 2 Products

2.1 MATERIALS

.1 Extrusions shall be AA6063 T54 alloy and temper for framing.

.2 Formed aluminum sheet and plate components shall be AA1100-H14 alloy and temper suitable for their purpose and finish.

.3 Exposed anodized sheet and plate to AA5005-H14 alloy and temper or AA1100-H14 alloy and temper (anodizing quality, 1.6 mm thickness).

.4 Non-exposed sheet and plate to AA3003-H14 alloy and temper, mill finish.

.5 Fasteners shall be 300 series stainless steel or 400 series stainless steel cadmium plated and of sufficient size and quantity to perform their intended function.

.6 Weathering and glazing gaskets shall be extruded, black, closed cell or dense elastomer of durometer appropriate to the function.

.7 Glazing tapes shall be preformed polyisobutylene-butyl glazing tape with integral shim strip, 10-15 durometer, hardness, paper release, black color. Acceptable materials: Tremco Polyshim II by Tremco Ltd.

.8 Exterior Sills: extruded aluminum, minimum 3 mm thick, complete with joint covers, complete with jamb drip deflectors on both sides of each sill (refer also to drawings for type), chairs, anchors, anchoring devices. All corners shall be ground or rounded to eliminate burrs and sharp edges. Sills to be one continuous piece along sill of window. Review installation with the consultant prior to caulking.

.9 Sealants: shall be in accordance with Section 07900. Colours to Consultant's selection to either match building materials or window frame.

.10 Foam Backer Rod: to be extruded, closed cell foam, round polyethylene rope, minimum 25% wider than width of joint cavity to be caulked. To be compatible with primers and sealants.

.11 Void filler foam: one part expanding polyurethane closed cell foam by BASF, Hilti or approved alternate specifically designed for window applications. To be compatible with primers and sealers

.12 Bedding Compound: to CGSB 19-GP-14M.

.13 Isolation Coating: alkali resistant bituminous paint.

.14 Vandal Screens: if called for on drawings, prefinished metal vandal screens shall be by Armoured Guard Security Screens Inc. Tel. 1 877-372-7336. Colour as selected by Architect.

2.2 FABRICATION

.1 Fabricate in accordance with CSA-A440/A440.1 supplemented as follows:

.2 Fabricate framing from extrusions of size and shape shown on shop drawings. Interior and exterior extruded aluminum framing sections shall be integrated with a glass reinforced nylon thermal break to form a rigid composite assembly without the use of fasteners or other thermal bridging elements.

.3 Composite frame assembly shall have a minimum of 1100 lbf/4 in. (4815N/ 100 mm) resistance to shear between the aluminum and the thermal break materials.

.4 Dry shrinkage of the thermal break shall not exceed 0.1% of the framing member length.

.5 Fixed framing shall be designed for screw spline corner construction. 518 ISOPORT frameless vent operating sash extrusions shall be tubular with mitred, clip, adhesive , stake joint construction.

.6 All framing joints shall be accurately machined, assembled, and sealed to provide neat weather tight connections. Coupling mullions shall be designed to provide a functional split to permit modular construction and allow for thermal expansion. Glass stops shall be aluminum and lock-in screwless type.

.7 All glazing pockets shall be vented, pressure equalized and drained to the exterior.

.8 Elastomeric air seal gasket shall be installed around the full perimeter of glass and sealed at corners wit silicone sealant. Air seal gasket must provide adhesion with silicone sealant.

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2.3 ALUMINUM FINISHES

.1 Exposed aluminum sections and infill panels or interior column covers, if any, shown on drawings be given an anodic oxide treatment in accordance with Aluminum Association specification AA-M12C22A31. and clear anodized Class II, 10μm (.0004 inch.) in accordance with AAMA 611.

.2 For exterior spandrel panels –if required on the project, to be a clear anodized infill panel to match windows finish complete with solid support substrate and insulation layer, anodized aluminum smooth or textured finish to Consultant selection.

.3 Allow for two (2) additional colours of infill panels other than anodized. Enamel finish shall be PPG Duranar finish (Kynar 500), 10,000 series or approved alternate.

.4 Final approval of finish and colour to be made by Consultant.

2.4 HARDWARE

.1 Hinging hardware shall be 4 bar concealed hinge 301 Series Heavy Duty Steel 4 bar hinges by Anderberg with positive stop and adjustable friction shoe. Following review window operator location conditions on site, install metal bar restrictors to each hinge at jamb to allow maximum 225 mm opening. only following Consultant direction. Sash projection shall not extend past exterior plane of building wall

.2 For bottom hinged open-in vents, where shown, provide solid cast cam handles and keepers in white satin bronze. Do not cut cam handles to fit sash profiles. Where possible secure cam handles with fastenings concealed from view at underside of frame for top hinged units. Provide a minimum of two (2) solid bronze or stainless steel cam handles per awning unit.

.3 For top hinged/side hinged open out sashes provide roto-operators.

.4 If shown on drawings, provide Teleflex mechanical operators and manual crank operating system for all windows where cams are required to be higher than 1800 above finished floor. Refer to drawings for locations.

2.5 INSECT SCREENS

.1 Fly screens: Provide to all operable units meeting CGSB 79-GP-1M and CSA/CAN-A440 rating heavy duty shall consist of extruded aluminum frame having a wall thickness of 1.9 mm, finish to match windows. Screen cloth shall be 18 x 14 aluminum mesh.

2.6 ISOLATION COATING

.1 Isolate aluminum from following components, by means of isolation coating:

.1 Dissimilar metals except stainless steel, zinc, or white bronze or small area.

.2 Concrete, mortar and masonry.

.3 Wood.

□

2.7 GLAZING

.1 Prepare windows to receive 25 mm thick double glazed insulating glass specified under Section 088050 – Glazing. Glaze windows in accordance with CSA-A440/A440.1.

2.8 THRU-WALL FLASHING

.1 Sub-sill flashings to be Blueskin SA by Bakor in locations shown on drawings. Adhere to substrate using primer approved by manufacturer. Ensure clean-up of excess primer and no visible edges of flashing upon completion of the work.

2.9 EXTRUDED SILLS

.1 Sills are to be a minimum of 7 degree (7°) downward slope and integral drip which extends a minimum of 25 mm from the face of the wall cladding.

.2 Install metal sills with uniform wash to exterior, level in length, straight in alignment with plumb upstands and faces. Break form shapes are not permitted.

2.10 ALUMINUM PANNING

.1 Panning to be extruded aluminum minimum 1.6 mm thick with pre-coated finish to be identical process and match to aluminum frames and sills. Break form shapes are not permitted.

.2 Submit samples of panning along with samples of other extrusions and materials.

.3 Metal panning to be designed to lock into new window frames and have true flat planes with no twists, buckles dents, “oil canning” or other similar visual defects caused by manufacturing or handling.

Part 3 Execution

3.1 PREPARATION

.1 Protect adjacent surfaces from damage resulting from work under this specification.

3.2 WINDOW INSTALLATION

.1 Install in accordance with CSA-A440/A440.1.

.2 Arrange components to prevent abrupt variation in colour.

.3 Install the windows in accordance with the manufacturer’s instructions. Install the windows plumb, level and true relative to building structure. Do not exceed 3mm in 3050 mm (1/8” in 10’0”) variation from plumb and level. Foam insulate between the frame members and the window opening using a single component polyurethane foam, insulating sealant.

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Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 11 – Final Cleaning.

.3 Section 01 78 00 - Closeout Submittals

.4 Section 08 11 14 – Metal Doors and Frames.

.5 Section 08 50 50 – Aluminum Windows.

.6 Section 07 92 10 - Joint Sealing: caulking of joints between frames and other building components.

.7 Section 10 28 10 – Toilet, Bath and Laundry Accessories.

1.2 REFERENCES

.1 American National Standards Institute (ANSI).

.1 ANSI/ASTM E330-[02], Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

.2 American Society for Testing and Materials International, (ASTM).

.1 ASTM C542-[94(1999)], Specification for Lock-Strip Gaskets.

.2 ASTM D790-[02], Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

.3 ASTM D1003-[00], Test Method for Haze and Luminous Transmittance of Plastics.

.4 ASTM D1929-[96(R2001)e1], Test Method for Determining Ignition Temperature of Plastics.

.5 ASTM D2240-[02b], Test Method for Rubber Property - Durometer Hardness.

.6 ASTM E84-[01], Test Method for Surface Burning Characteristics of Building Materials.

.7 ASTM F1233-[98], Test Method for Security Glazing Materials and Systems.

.3 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-12.1-[M90], Tempered or Laminated Safety Glass.

.2 CAN/CGSB-12.2-[M91], Flat, Clear Sheet Glass.

.3 CAN/CGSB-12.3-[M91], Flat, Clear Float Glass.

.4 CAN/CGSB-12.4-[M91], Heat Absorbing Glass.

.5 CAN/CGSB-12.5-[M86], Mirrors, Silvered.

.6 CAN/CGSB-12.6-[M91], Transparent (One-Way) Mirrors.

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.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-12.1-M90 Tempered or Laminated Safety Glass

.14 CAN/CGSB-12.3-M76 Glass, Polished Plate or Float, Flat, Clear

.4 Canadian Standards Association (CSA International).

.1 CSA A440.2-[98], Energy Performance Evaluation of Windows and Sliding Glass Doors.

.2 CSA Certification Program for Windows and Doors [2000].

.5 Environmental Choice Program (ECP).

.1 CCD-045-[95], Sealants and Caulking.

.6 Flat Glass Manufacturers Association (FGMA).

.1 FGMA Glazing Manual - [1997].

.7 Laminators Safety Glass Association (LSGA).

.1 LSGA Laminated Glass Design Guide [2000].

1.3 SAMPLES

.1 Submit a 300 x 300 sample of all glass products in accordance with Section 01 33 00 - Submittal Procedures.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 013300 – Submittal Procedures. Co-ordinate location with Consultant.

1.5 WARRANTY

.1 Contractor hereby warrants glass against defects and failure, including leakage, under normal conditions of use, in accordance with the Contract, but for ten (10) years total, as follows:

.2 Supplier shall submit a written warranty from the insulated glass manufacturer to replace or repair any defects in materials or sealed units for a period of ten (10) years from the date of Substantial Completion.

.3 Mirrors:

.1 Submit a warranty for mirrors, covering the repair or replacement of defective work in accordance with the Contract, but for five (5) years total.

.2 Warranty shall apply against defects in workmanship and materials and, against silver deterioration and loosening of fastenings.

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1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal [paper] [plastic] [polystyrene] [corrugated cardboard] packaging material [in appropriate on-site] for recycling.

.3 Unused or damaged glazing materials are not recyclable and must not be diverted to municipal recycling programs.

.4 Divert unused or damaged wood materials from landfill to [recycling] [reuse] [composting] facility approved by Consultant.

.5 Divert unused metal materials from landfill to metal recycling facility approved by Consultant.

.6 Divert unused caulking material from landfill to official hazardous material collections site approved by Consultant.

.7 Plastic caulking tubes are not recyclable and must not be diverted for recycling with other plastic materials.

Part 2 Products

2.1 MATERIALS

.1 Acceptable Manufacturers:

.1 AFG Glass Inc
.2 Libby-Owens Ford
.3 PPG Industries

.2 Exterior Tempered Safety Glass: All exterior Vision Glass to exterior windows, curtain wall and non-fire-rated screens to be sealed insulated units conforming to CAN/CGSB-12.8. Exterior lite 6mm tempered clear glass, Solarban 70 Low Emissivity Coating on inner pane (2nd surface), 13mm Argon filled air space, inner lite 6 mm clear tempered glass.

.1 All tempered glass to conform to CAN2-12.1 M-90 Type 2 tempered glass, Class B Double glazed units to have an integral non-metallic space creating a 13 mm hermetically sealed Argon filled air space. Spacers shall be continuous with butt joints (if any) at corners only. Pieces are not permitted. Butyl based spacers are not permitted.

.3 Polished Plate or Float Glass: To CAN/CGSB-12.3 clear.

.4 Spandrel Glass (SP): CAN/CGSB-12.9-M, 6 mm thick unless otherwise indicated, with water-based silicone emulsion coating applied to backside, ‘Opaci-Coat 300' by ICD High Performance Coatings or approved alternative. Colour: To be selected by the Consultant.

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.5 Fire Rated Glazing ('FR' 'FRG' or 'GW'): Fire rated glazing to be impact safety rated, intumescent laminated glazing to meet required fire resistance rating. Coordinate glazing thickness with screen frame manufacturer. Refer to drawing A01 "Fire Separations Plans & OBC Data Matrix" for fire separation ratings. Intumescent laminated glazing to be supplied by:

.1 Fireswiss "Fireswiss Foam C44++" (for 3/4 hour rating) by GLASSOPOLIS
.2 Pyrostop "Pyrostop 45" (for 3/4 hour rating) by TECHNICAL GLASS PRODUCTS
.3 Firelite Plus (for 3/4 hour rating)
.4 Pyran Platinum L (for 3/4 hour rating)

.6 Georgian Wired rated glazing: not to be used on this project.

.7 Spandrel glass (SP): CAN/CGSB-12.9-M, 6 mm thick unless otherwise indicated, with water-based silicone emulsion coating applied to backside, 'Opaci-Coat 300' by ICD High Performance Coatings or approved alternative. Colour: To be selected by the Consultant.

.8 Mirrors: Refer to Section 10 28 10 Washroom Accessories.

.9 Setting blocks: neoprene, 80 durometer hardness, 102 mm x 6 mm width to suit glass to extend from the fixed stop to the opposite face of the glazing unit.

.10 Spacer Blocks: neoprene, thickness to provide a minimum glass to face clearance of 3mm.

.11 Glazing tape**:** preformed polyisobutylene-butyl glazing tape with integral shim strip, 10-15 durometer, hardness, paper release, black color. Acceptable materials**:** Tremco Polyshim II by Tremco Ltd. or approved alternate.

.12 Gasket: black neoprene "U" cavity type with lock strip.

.13 Sealant: one component silicone, Spectrem 2 by Tremco Ltd. Refer to Section 07900.

.14 Display cases: shelves to be 13mm tempered glass with polished rounded edges. Doors to be tempered 8mm tempered glass. Coordinate sizes and provide to Section 06 40 00 for installation.

.15 Frosted Glazing Film:
.1 3M™ Crystal Glass Film
.2 To be applied on glazing at Quiet Rooms, as directed by Consultant.

2.2 FABRICATION

.1 Fabricate in accordance with CSA-A440/A440.1 supplemented as follows:

.2 Make field measurements before cutting and assembling materials.

.3 Maintain minimum bite or lap of glass as recommended by the glazing unit manufacturer.

.4 Each glass lite shall be labeled with the name of the product, weight and quality and year manufactured.

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.5 If requested, provide owner or consultant access to the plant or shop to review fabrication. Consultant or owner to provide 24 hour advance notice of visit.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 EXAMINATION

.1 Verify that openings for glazing are correctly sized and within tolerance.

.2 Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.

3.3 PREPARATION

.1 Clean contact surfaces with solvent and wipe dry.

.2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.

.3 Prime surfaces scheduled to receive sealant.

3.4 INSTALLATION:

.1 Inspect all glazing channels prior to application. All openings in joints and channels to be sealed shall be clean, dry and free of dust, oil, grease, loose mortar or any foreign material.

.2 All surfaces to receive glazing tape shall be wiped dry with a clean rag dampened in Xylol, followed by a dry wipe.

.3 Examine all sashes prior to glazing to determine if the openings are square and plumb. Any butt and miter joints which are open shall be sealed prior to glazing. Adjust all operating sashes and glaze in the closed position.

.4 Compression Glazing:

.1 When butt joint is in a vertical direction, the glazier shall first run the tape on the head and sill members while going over the joint. If joints at the sash run horizontally, the tape must be applied first to the jambs so that it crosses over the joint.

.2 When an offset condition exists at each corner where a horizontal member passes behind vertical mullions, two different sized tapes shall be used to equalize the pressure seal. The thinner tape is to applied first on the glazing leg closest to the interior. The thicker tape shall be cut to the length between the two tapes and applied.

□

.3 Each section of tape shall butt the adjoining tape and be united with a tool to eliminate any openings. Lapping of the adjoining tapes at the corners is not permitted.

.4 Remove paper backing just prior to setting glass and apply a toe bead of sealant 150 mm long in each of the corners.

.5 Position one setting block at the quarter point of each corner on the sill members or as recommended by IGMA guidelines.

.6 Set the glass on the setting blocks and press firmly in place. Snap in the interior glazing stops.

.7 Set the spacer blocks to prevent any “walking” of the lite.

.5 Mirrors:

.1 Install mirrors by means of concealed vandalproof clips If clips are used, install cushioning tape completing around perimeter of mirror back, set in concealed location within 25 mm of edge. Install fixed mirrors in washrooms at two different heights as indicated on drawings.

.2 Follow manufacturer’s installation recommendations.

.6 Install any wired glass with the wire parallel to the opening.

.7 Replace any loose glazing stops and tighten all screws.

.8 Contractor shall include for needle point (cap beads) at all lower horizontal rail joints of all sash/glazing units at the discretion of and as may be requested by the Consultant or owner.

3.5 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Remove traces of primer, caulking.

.3 Remove glazing materials from finish surfaces.

.4 Remove labels after work is complete.

.5 Immediately upon job completion and when sealants have cured, remove any temporary protection and clean all exposed interior and exterior surfaces. Use proper cleaning materials only which will not harm the window components or any adjacent surfaces.

.6 Ensure all temporary labels have been removed and fully cleaned.

.7 Mirrors:

.1 Clean mirrors using non-abrasive soap or detergent and rinse with clean water. Leave in clean, polished condition for Owner occupancy.

3.6 INSPECTION

.1 Where inspection is called for elsewhere in the specification, perform Window air and water leakage test to ensure installation meets performance requirements stated herein. Should test fail, take remedial measures and re-test a different location at not additional cost to the owner until the test passes.

END OF SECTION

□

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 Submittal Procedures.

.2 Section 01 78 00 Closeout Submittals.

.3 Section 05 50 00 Metal Fabrications.

.4 Section 08 80 50 Glazing.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM International)
- .1 ASTM A167-99 (2009), Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
- .2 ASTM A276-10, Specification for Stainless and Heat-Resisting Steel Bars and Shapes.
- .3 ASTM F738M-02 (2008), Specification for Stainless Steel Metric Bolts, Screws, and Studs.

.2 Canadian General Standards Board (CGSB):
- .1 CAN/CGSB-19.13-M87, Sealing Compound, One-Component, Elastomeric, Chemical Curing.

1.3 DESIGN REQUIREMENTS

.1 Design the entire glass balustrade system, including all glazing supports as required for complete and secure installation.

.2 Design members to withstand dead load and live loads calculated in accordance with OBC and applicable local regulations.

1.4 SUBMITTALS

.1 Shop drawings: Submit shop drawings in accordance with Section 01 33 00 indicating:
- .1 Plans, sections, details, type of extrusions, profiles, thicknesses, seals, finishes, panels, operating components, related flashings, closures, fillers, and end caps, and sealants.
- .2 Products and glazing types.
- .3 Anchorage inserts, system installation tolerances.
- .4 Section and hardware reinforcement, anchorage, assembly fixings.
- .5 Detailing, locations, and allowances for movement, expansion, contraction.

.2 Samples: Submit two samples of the following in accordance with Section 01 33 00:
- .1 250 mm long samples of each type of extrusion and finish.
- .2 250 x 200 mm samples of glass.

.3 Reports/Certificates:
- .1 Submit documentation to substantiate ten years of experience in glazed system manufacture and installation.
- .2 Submit written manufacturer's certificate certifying compliance with the specifications.

.4 Close-out submittals: Submit data for incorporated into the Operations and Maintenance Manual as part of Section 01 78 00.

1.5 QUALITY ASSURANCE

.1 Retain a licensed Professional Engineer, registered in Province of Ontario, to perform following services for interior glazed system Work:
- .1 Design of interior glazed system work.
- .2 Review, stamp, and sign shop drawings.
- .3 Conduct on-site inspections and prepare and submit inspection reports.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Protect surfaces with strippable coating. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather. Do not remove before final cleaning of building.

1.7 EXTENDED WARRANTY

.1 Submit a warranty for glazed system work in accordance with General Conditions, except that warranty period is extended to 5 years.
- .1 Warrant against failure to meet the design criteria and requirements.
- .2 Coverage: Complete replacement including affected adjacent Work.

Part 2 Products

2.1 ACCEPTABLE MANUFACTURERS

.1 Glass balustrade manufacturers:
- .1 C. R. Laurence of Canada
- .2 Mogg, Mississauga 905 696-9828
- .3 Inkan Limited.
- .4 Or approved alternative.

.2 Glazed balustrade system – Learning Commons Mezzanine:
- .1 19 mm tempered glass railing set in stainless steel shoe moulding, minimum 100 mm high with dry mount system.
- .2 Stainless steel roll formed cap rail with mitred elbow corners; anchored to concrete slab.
- .3 Material: Type 316 stainless steel with polished finish.
- .4 Glazed balustrade system is to comply with OBC SB13 requirements.

2.2 MATERIALS

.1 General: All materials under Work of this Section, including but not limited to, sealants and coatings are to have low VOC content limits.

.2 Stainless steel sheet and channels: ASTM A167, Type 316. Size as shown.

.3 Stainless steel shapes: ASTM A276, Type 316. Sizes and shapes as shown.

.4 Reinforcements and anchors: ASTM A167, Type 316. Size as shown.

.5 Glass and glazing materials: In accordance with Section 08 80 50.

.6 Glazing gasket: EPDM roll-in glazing gasket.

.7 Sealant: CAN/CGSB-19.13-M; Single-Component, silicone sealant; ‘Spectrem 1' by Tremco or ‘790 Silicone Building Sealant' by Dow Corning Corporation. Colour as selected by Engineer.

.8 Joint backing: Closed cell foam polyethylene rod, outsized minimum 30-50% larger than joint width and compatible with joint sealant. Product as recommended by sealant manufacturer.

.9 Anchors, clips, and angles: Stainless steel.

.10 Flashings, closures and trim: 1 mm minimum stainless sheet, finish to glazed system.

.11 Screws, bolts and other fasteners: ASTM F738M; Stainless Steel Type 316.

.12 Glass mounted handrail: Stainless steel glass mounted handrail with bracket, fabricated from 38 mm diameter tubing; ‘HRS Handrails Adjustable Glass Mounted Hand Railing Bracket' by C.R. Laurence or approved alternative.

.13 Stainless steel handrail: In accordance with Section 05 50 00 – Metal Fabrications.

2.3 FABRICATION

.1 Fabricate glass railing system in accordance with reviewed shop drawings, Contract Drawings and manufacturer’s written instructions.

.2 Fabricate sections true to detail, free from defects impairing appearance, strength and durability. Fabricate extrusions with sharp, well defined corners.

.3 Fabricate, fit, and secure framing joints and corners accurately, with flush surfaces, and hairline joints.

.4 Conceal anchors, reinforcement and attachments from view. Fabricate reinforcement in accordance with design requirements.

.5 Do not expose manufacturer's identification labels on glazed assemblies.
.6 Fabricate filler and closure pieces as necessary for a complete installation.

.7 Fabricate glazed balustrade work closures and trim from stainless steel sheet.

Part 3 Execution

3.1 INSTALLATION

.1 Install interior glazed system work in accordance with reviewed shop drawings, manufacturer's written instructions.

.2 Install Work of this Section securely, in correct location, level, square, plumb, at proper elevations, free of warp or twist.

.3 Install closures and trim pieces.

.4 Location: Around ramp in Learning Commons ‘B’ 1079. Install glazing in accordance with Section 08 80 50.

.5 Install glass in balustrades properly centred with uniform bite and face and edge clearance, free from twist, warp or other distortion likely to develop stress.

.6 Remove damaged or unacceptable Products and assemblies from Site and replace to Engineer's acceptance.

.7 Install glass presence markers, in two cross stripes extending from diagonal corners. Maintain markers until final clean-up.

3.2 ERECTION TOLERANCES

.1 Tolerances: Non-cumulative.
- .1 Maximum variation from plumb: 1.5 mm/3 m non-cumulative or 12 mm/30 m, whichever is less.
- .2 Maximum misalignment of two adjoining members abutting in plane: 0.8 mm.
- .3 Vertical and horizontal positions: +/- 3 mm.
- .4 Racking of face: 6 mm, nil in elevation.
- .5 Maximum perimeter sealant joint between glazed system and adjacent construction: 12 mm.

3.3 JOINT BACKING AND SEALANT

.1 Prepare substrate surface and mask as recommended by sealant manufacturer.

.2 Install joint backing and sealant at glazed system work and perimeter joints for sound tight installation in accordance with sealant manufacturer's instructions. Tool sealant. Remove excess sealant.

3.4 CLEANING

.1 Maintain glazed system work, inside and outside, in clean condition throughout construction period.

.2 Remove labels, protective material, and glass presence markers from prefinished surfaces.

.3 Wash glazed system work with solution of mild detergent in warm water, with particular attention to recesses and corners. Wipe surfaces clean and dry.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 Submittal Procedures.

.2 Section 01 78 00 Closeout Submittals.

.3 Section 07 92 10 Joint Sealants.

1.2 REFERENCES

.1 American Architectural Manufacturers Association (AAMA) Aluminum Association Designation System for Aluminum Finishes.

.2 American Society for Testing and Materials (ASTM International)
- .1 ASTM B209M-07, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- .2 ASTM B211M-03, Specification for Aluminum and Aluminum-Alloy Bar, Rod and Wire.
- .3 ASTM C920-10, Specification for Elastomeric Joint Sealants.

.3 Canadian General Standards Board (CGSB):
- .1 CAN/CGSB-1.108-M89, Bituminous Solvent Type Paint.

1.3 DESIGN REQUIREMENTS

.1 Design louvre Work in accordance with OBC and to withstand live, dead, lateral. wind, seismic, handling, transportation and erection loads.

.2 Design louvers to accommodate expansion and contraction of components due to temperature changes.

1.4 SUBMITTALS

.1 Shop drawings: Submit shop drawings in accordance with Section 01 33 00 indicating fabrication and erection details, including anchorage, accessories, thicknesses, profiles, finishes, pressure drop, face area, and free area.

.2 Samples: Submit duplicate 600 x 600 mm samples of louvres in accordance with Section 01 33 00 indicating frame and reinforcing, finished in selected colours.

.3 Certification: Submit certified data from independent laboratory substantiating aerodynamic performance.

.4 Close-out submittals: Submit operation and maintenance data for incorporation into Operations and Maintenance Manual in accordance with Section 01 78 00.

Part 2 Products

2.1 MANUFACTURED UNITS

.1 Mechanical Penthouse Louvre:
- .1 Conforming to ASTM B209M and ASTM B211M;
- .2 100 mm (4") weather resistant louvre, 'Model SP-645' as manufactured by McGill Louvers, (Pickering ON 905-420-0485).
- .3 Acceptable Alternate: Product meeting the same profile and specifications as above by Cometal Inc. (Quebec, Ph: 418-839-8831), TenPlus Architectural and Ventex.
- .4 Colour: Custom colour to be later selected by the Consultant.
- .5 Provide concealed mullions. Refer to Exterior Elevations & sections.
- .6 Locations:
  - .1 Second floor Mechanical Room.

.2 Isolation coating: CAN/CGSB-1.108-M; Bituminous solvent type paint.

.3 Anchors and fasteners: AISI Type 304 stainless steel.

.4 Sealant: ASTM C920, Type M, Grade NS, Class 25; Two-part, Polyurethane non-sag type. Dymeric by Tremco Ltd., Sikaflex 2C-NS by Sika Inc., colour as selected by Consultant. Primer and joint backing as recommended by sealant manufacturer.

.5 Sunshades:
- .1 Outrigger sunshade by CRL, comprised of:
  - .1 Square profile outrigger
  - .2 Flat bar or rectangular tube blades
  - .3 Wall mount bracket
  - .4 C Channel Fascia
  - .5 Finish: anodized aluminium
  - .6 102mm (4") high x 900mm (36") outrigger x length noted on drawings
- .2 Locations: Refer to exterior elevation drawings.

Part 3 Execution

3.1 INSTALLATION

.1 Coordinate framing and anchorage for louvres with other parts of the Work.

.2 Install louvres in accordance with manufacturer's instructions and accepted shop drawings. Securely anchor into opening.

.3 Apply isolation coating to separate dissimilar metals, and metals and masonry or concrete unless neoprene washers are shown.

.4 Seal louvre perimeter perimeter with sealant and joint backing for weather tight seal in accordance with requirements of Section 07 92 10.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 04 21 13 – Masonry

.3 Section 09 22 16 – Non-structural Metal Framing.

.4 Supply of access doors for mechanical and electrical devices in mechanical and electrical sections.

1.2 REFERENCES

.1 Aluminum Association

.1 Designation for Aluminum Finishes-[1997].

.2 American Society for Testing and Materials International, (ASTM)

.1 ASTM C36/C36M-[01], Specification for Gypsum Wallboard.

.2 ASTM C79/C79M-[01], Standard Specification for Treated Core and Non-treated Core Gypsum Sheathing Board.

.3 ASTM C442/C442M-[01], Specification for Gypsum Backing Board, Gypsum Coreboard, and Gypsum Shaftliner Board.

.4 ASTM C475-[01], Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

.5 ASTM C514-[01], Specification for Nails for the Application of Gypsum Board.

.6 ASTM C557-[99], Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.

.7 ASTM C630/C630M-[01], Specification for Water-Resistant Gypsum Backing Board.

.8 ASTM C840-[01], Specification for Application and Finishing of Gypsum Board.

.9 ASTM C931/C931M-[01], Specification for Exterior Gypsum Soffit Board.

.10 ASTM C954-[00], Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.

.11 ASTM C960/C960M-[01], Specification for Pre-decorated Gypsum Board.

.12 ASTM C1002-[01], Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

.13 ASTM C1047-[99], Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.

.14 ASTM C1280-[99], Specification for Application of Gypsum Sheathing Board.

.15 ASTM C1177-[01], Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

□

.16 ASTM C1178/C1178M-[01], Specification for Glass Mat Water-Resistant Gypsum Backing Board.

.3 Association of the Wall and Ceilings Industries International (AWEI)

.4 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.34-[M86(R1988)], Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

.2 CAN/CGSB-71.25-[M88], Adhesive, for Bonding Drywall to Wood Framing and Metal Studs.

.5 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S102-[1988(R2000)], Surface Burning Characteristics of Building Materials and Assemblies.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials in original packages, containers or bundles bearing manufacturers brand name and identification.

.2 Store materials inside, level, under cover. Keep dry. Protect from weather, other elements and damage from construction operations and other causes.

.3 Handle gypsum boards to prevent damage to edges, ends or surfaces. Protect metal accessories and trim from being bent or damaged.

1.4 SITE ENVIRONMENTAL REQUIREMENTS

.1 Maintain temperature minimum 10 degrees C, maximum 21 degrees C for 48 hours prior to and during application of gypsum boards and joint treatment, and for at least 48 hours after completion of joint treatment.

.2 Apply board and joint treatment to dry, frost free surfaces.

.3 Ventilation: Ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment material immediately after its application.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal [paper] [plastic] [polystyrene] [corrugated cardboard] packaging material [in appropriate on-site] for recycling.

.3 Divert unused gypsum from landfill to gypsum recycling facility for disposal approved by Consultant.

.4 Divert unused metal materials from landfill to metal recycling facility approved by Consultant.

.5 Divert unused wood materials from landfill to [recycling] [composting] facility approved by Consultant.

□

.6 Divert unused paint and caulking material from landfill to official hazardous material collections site approved by Consultant.

.7 Do not dispose of unused paint and caulking materials into sewer systems, into lakes, streams, onto ground or in other locations where it will pose health or environmental hazard.

Part 2 Products

2.1 MATERIALS

.1 Standard board: to ASTM C36/C36M, 13mm, 16 mm or 19 mm thick or as indicated, tapered edges.

.2 Standard board: to ASTM C36/C36M, X Rated, 16 mm or 19 mm thick or as indicated, tapered edges.

.3 Water-resistant board: to ASTM C630/C630M, 13 mm water resistant, tapered edges (WRGB in Finish Schedule).

.4 Abuse resistant/Fire rated: to CSA A82.27-M1977 Fire-Rated Type X, 5/8" thick, "Abuse Resistant Fire Code" gypsum board panels, tapered edges, by CGC, Fibrerock interior AquaTuff panel. All gypsum board to have anti-microbial and anti-mould properties.

.5 All gypsum board to have Anti-Microbial and Anti Mold properties. Acceptable Manufacturers; CGC inc., Certain Teed, or others meeting these specifications at time of tender.

.6 Nails: to ASTM C514.

.7 Steel drill screws: to ASTM C1002.

.8 Stud adhesive: to CAN/CGSB-71.25.

.9 Laminating compound: as recommended by manufacturer, asbestos-free.

.10 Concrete Anchors: Phillips Red Head TW-614 or equivalent. Do not use powder activated fasteners for ceiling support.

.11 Tie Wire: #16 ga. galvanized soft annealed steel wire.

.12 Caulking: Acoustical sealant.

.13 38 mm thick mineral wool batts ULC labeled, if indicated on drawings.

.14 Casing beads, corner beads, control joints and edge trim: to ASTM C1047, 0.5 mm base thickness commercial sheet steel with G90 zinc finish, perforated flanges, and one piece length per location.

.15 Sealants: in accordance with Section 07 92 10 - Joint Sealing.

□

.16 Insulating strip: rubberized, moisture resistant, [3] mm thick [cork] [closed cell neoprene] strip, [12] mm wide, with self sticking permanent adhesive on one face, lengths as required.

.17 Joint compound: to ASTM C475, asbestos-free.

2.2 ACOUSTIC WALL ASSEMBLY

.1 Acoustic insulation inside partitions: AFB Acoustic Fire Bat by Roxul or equivalent product by Fibrex, or Quietzone by Owens Corning.

.2 Steel deck closures: Emseal 25V Expanding Foam Sealant sized and shaped to fit flutes.

.3 Acoustic Insulation: mineral fibre acoustical batt insulation, as specified under Section 07210. Thickness of 90% of wall assembly cavity depth; Acceptable products:

.1 Fibrex ‘Sound Attenuation Fire Batt (SAFB)’
.2 Johns Manville ‘Sound-SHIELD’.
.3 Roxul ‘AFB’.
.4 Owens-Corning ‘QuietZone’.
.5 Certain Teed ‘Noise Reducer’.

.4 Acoustical sealant: CAN/CGSB-19.21-M87; non-skinning acoustic sealant, non-hardening type.

.5 Acoustical compound: pre-mixed perlite plaster.

.6 Fasteners: use mechanical fasteners to secure batts into position as recommended by manufacturer.

Part 3 Execution

3.1 ERECTION

.1 Do application and finishing of gypsum board in accordance with ASTM C840 except where specified otherwise.

.2 Erect hangers and runner channels for suspended gypsum board ceilings in accordance with ASTM C840 except where specified otherwise.

.3 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.

.4 Install work level to tolerance of [1:1200].

□

3.2 APPLICATION

.1 Do not apply gypsum board until bucks, anchors, blocking, sound attenuation, electrical and mechanical works are approved.

.2 Apply single layer gypsum board to metal furring or framing using screw fasteners and laminating adhesive. Maximum spacing of screws 300 mm on centre.

- .1 Single-Layer Application:
  - .1 Apply gypsum board on ceilings prior to application of walls in accordance with ASTM C840.
  - .2 Apply gypsum board vertically or horizontally, providing sheet lengths that will minimize end joints.
- .2 Double-Layer Application:
  - .1 Install gypsum board for base layer and exposed gypsum board for face layer.
  - .2 Apply base layer to ceilings prior to base layer application on walls; apply face layers in same sequence. Offset joints between layers at least 250 mm.
  - .3 Apply base layers at right angles to supports unless otherwise indicated.
  - .4 Apply base layer on walls and face layers vertically with joints of base layer over supports and face layer joints offset at least 250 mm with base layer joints.

.3 Apply water-resistant gypsum board [where [wall tiles] [coating] to be applied] [and] [adjacent to [slop sinks] [janitors closets] [___]]. Apply water-resistant sealant to edges, ends, cut-outs which expose gypsum core and to fastener heads. [Do not apply joint treatment on areas to receive tile finish.]

.4 Apply gypsum board to concrete block surfaces, where indicated, using laminating adhesive.

.5 Apply type X gypsum board where indicated, in accordance with U.L.C. requirements and with supplement to the National Building Code of Canada to obtain the required fire protection, fire rating and fire separation.

.6 Install ceiling boards in direction that will minimize number of end-butt joints. Stagger end joints at least 250 mm.

.7 Where indicated on drawings, staple blanket to wallboard in accordance with ULC design requirements. Blanket shall be continuous and tightly fitted between studs and at perimeter.

.8 Install gypsum board on walls vertically to avoid end-butt joints. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs, except where local codes or fire-rated assemblies require vertical application.

.9 Install gypsum board with face side out.

.10 Do not install damaged or damp boards.

□

.11 Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite sides of wall.

.12 Where a floor or roof structural member interferes with an interior partition wall at which a smoke or fire separation is required, a gypsum board enclosure with a fire rating not less than required for the wall must be provided to continue the required, a gypsum board enclosure with a fire rating not less than required for the wall must be provided to continue the required separation to the floor or roof above (typical)

3.3 INSTALLATION

.1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure [at [150] mm on centre] [using contact adhesive for full length].

.2 Install casing beads around perimeter of suspended ceilings.

.3 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. [Seal joints with sealant.]

.4 Construct control joints of [preformed units] [two back-to-back casing beads] set in gypsum board facing and supported independently on both sides of joint.

.5 Provide continuous polyethylene dust barrier behind and across control joints.

.6 Locate control joints [where indicated] [at changes in substrate construction] [at approximate [10] m spacing on long corridor runs] [at approximate [15] m spacing on ceilings].

.7 Install control joints straight and true.

.8 Construct expansion joints [as detailed], at building expansion and construction joints. Provide continuous dust barrier.

.9 Install expansion joint straight and true.

.10 Install cornice cap where gypsum board partitions do not extend to ceiling.

.11 Fit cornice cap over partition, secure to partition track with two rows of sheet metal screws staggered at [300] mm on centre.

.12 Splice corners and intersections together and secure to each member with 3 screws.

.13 Seal with acoustical sealant at ceilings, floors, wall intersections and all penetrations such as electrical outlets.

.14 Install access doors to electrical and mechanical fixtures specified in respective sections.

.1 Rigidly secure frames to furring or framing systems.

□

.15 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces.

.16 Gypsum Board Finish: finish gypsum board walls and ceilings to following levels in accordance with Association of the Wall and Ceiling Industries (AWCI) International Recommended Specification on Levels of Gypsum Board Finish:

.1 Levels of finish:

.1 Level 0: No tapping, finishing or accessories required.

.2 Level 1: Embed tape for joints and interior angles in joint compound. Surfaces to be free of excess joint compound; tool marks and ridges are acceptable.

.3 Level 2: Embed tape for joints and interior angles in joint compound and apply one separate coat of joint compound over joints, angles, fastener heads and accessories; surfaces free of excess joint compound; tool marks and ridges are acceptable.

.4 Level 3: Embed tape for joints and interior angles in joint compound and apply two separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.

.5 Level 4: Embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.

.6 Level 5: Embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; apply a thin skim coat of joint compound to entire surface; surfaces smooth and free of tool marks and ridges.

.17 Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.

.18 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.

.19 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.

.20 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.

.21 Apply one coat of white primer sealer over surface to be textured. When dry apply textured finish in accordance with manufacturer's instructions.

.22 Mix joint compound slightly thinner than for joint taping.

.23 Apply thin coat to entire surface using trowel or drywall broadknife to fill surface texture differences, variations or tool marks.

.24 Allow skim coat to dry completely.

□

.25 Remove ridges by light sanding or wiping with damp cloth.

.26 Provide protection that ensures gypsum drywall work will remain without damage or deterioration at time of substantial completion.

END OF SECTION

□

Part 1 General

1.1 RELATED SECTIONS

.1 Section 09 21 16 - Gypsum Board Assemblies.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).

.1 ASTM C645-[00], Specification for Nonstructural Steel Framing Members.

.2 ASTM C754-[00], Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

.2 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-1.40-[97], Primer, Structural Steel, Oil Alkyd Type.

.3 Environmental Choice Program (ECP).

.1 CCD-047a -[98], Paints - Surface Coatings.

.2 CCD-048-[98], Surface Coatings - Recycled Water-borne.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal [paper] [plastic] [polystyrene] [corrugated cardboard] packaging material in appropriate on-site bins for recycling.

.3 Divert unused metal materials from landfill to metal recycling facility approved by Consultant.

.4 Divert unused gypsum materials from landfill to recycling facility approved by Consultant.

Part 2 Products

2.1 MATERIALS

.1 Non-load bearing channel stud framing: to ASTM C645, roll formed from 0.59mm thickness hot dipped galvanized steel sheet, for screw attachment of gypsum lath and metal lath. Knock-out service holes at 150 mm centres.

.2 Floor and ceiling tracks: to ASTM C645, in widths to suit stud sizes, 30 mm legs for floor track, 50 mm for ceiling track.

.3 Metal channel stiffener: 38 mm size, 2 mm thick cold rolled galvanized steel.

.4 Metal Accessories: CSA A82.30-1965 (R-1971).

□

.5 "Unistrut" support channel framing, by Tyco Electrical and Metal Products.

Part 3 Execution

3.1 ERECTION

.1 Align partition tracks at floor and ceiling and secure at 600 mm on centre maximum.

.2 Place studs vertically at 400 mm on centre and not more than 50 mm from abutting walls, and at each side of openings and corners. Position studs in tracks at floor and ceiling. Cross brace steel studs as required to provide rigid installation to manufacturer's instructions.

.3 Erect metal studding to tolerance of 1:1000.

.4 Attach studs to bottom track using screws.

.5 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.

.6 Install steel frames and anchor frames securely to studs using minimum of three (3) anchors per jamb for jambs up to 2100 mm high and a minimum of four (4) anchors per jambs for jambs over 2100 mm high.

.7 Provide two (2) studs at each side of openings wider than stud centre specified.

.8 Install, cut to length, piece of runner horizontally over door frames and at top and bottom of rough opening in glazed partitions.

.9 Provide 38 mm x 89 mm vertical and horizontal wood studs secured between metal studs for attachments of bathroom fixtures, accessories, cabinet work, and other fixtures, including grab bars, towel rails, attached to steel stud partitions.

.10 Install steel stud or furring channel between studs for attaching electrical and other boxes.

.11 Extend all partitions to underside of deck above for sound and fire separation.

.12 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs.

3.2 CEILING FURRING TO CANOPIES & CEILING PANELS

.1 Provide to all interior and exterior canopies where shown to receive wood slat or plywood finishes.

.2 Framing channel to be model P1000 (1-5/8") ; 12 ga.

.3 For exterior locations provide with 4 m dia. Holes at 500 o.c. for drainage and hot dip galvanize.

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.4 Provide shop drawings for layouts.

.5 Refer to drawings for locations.

3.3 CEILING FURRING

.1 Install runners level to tolerance of 3 mm over 3.5 m. Provide runners at interruptions of continuity and change in direction.

.2 Frame with furring channels, perimeter of openings to accommodate access panels, light fixtures, diffusers, grilles, etc.

.3 Furr for bulkheads within or at termination or ceilings.

.4 Install furring channels at 400 mm o.c. maximum.

3.4 WALL FURRING

.1 Install steel furring, as indicated.

.2 Frame opening and around built-in equipment on four (4) sides with channels.

.3 Box-in beads, columns, pipes, and around exposed services.

3.5 FIRE RATED ASSEMBLIES

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

3.6 CLEANING

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

END OF SECTION

□

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 07 92 10 - Joint Sealing.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/Ceramic Tile Institute (CTI)

.1 ANSI A108.1-[99], Specification for the Installation of Ceramic Tile (Includes ANSI A108.1A-C, 108.4-.13, A118.1-.10, ANSI A136.1).

.2 CTI A118.3-[92], Specification for Chemical Resistant, Water Cleanable Tile Setting and Grouting Epoxy and Water Cleanable Tile Setting Epoxy Adhesive (included in ANSI A108.1).

.3 CTI A118.4-[92], Specification for Latex Portland Cement Mortar (included in ANSI A108.1).

.4 CTI A118.5-[92], Specification for Chemical Resistant Furan Resin Mortars and Grounts for Tile Installation (included in ANSI A108.1).

.5 CTI A118.6-[92], Specification for Ceramic Tile Grounts (included in ANSI A108.1).

.2 American Society for Testing and Materials (ASTM International) International

.1 ASTM C144-[99], Specification for Aggregate for Masonry Mortar.

.2 ASTM C 207-[91(1997)], Specification for Hydrated Lime for Masonry Purposes.

.3 ASTM C847-[95(2000)], Specification for Metal Lath.

.4 ASTM C979-[99], Specification for Pigments for Integrally Coloured Concrete.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.34-[M86(R1988)], Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

.2 CGSB 71-GP-22M-[78], Adhesive, Organic, for Installation of Ceramic Wall Tile.

.3 CAN/CGSB-75.1-[M88], Tile, Ceramic.

.4 CAN/CGSB-25.20-[95], Surface Sealer for Floors.

.4 Canadian Standards Association (CSA International)

.1 CAN/CSA-A3000-[98], Cementitious Materials Compendium (Consists of A5-98, A8-98, A23.5-98, A362-98, A363-98, A456.1-98, A456.2-98, A456.3-98).

.2 CSA A123.3-[98], Asphalt Saturated Organic Roofing Felt.

.5 Terrazzo Tile and Marble Association of Canada (TTMAC)

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.1 Tile Specification Guide 09300 [2000], Tile Installation Manual.

.2 Tile Maintenance Guide [2000].

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Include manufacturer's information on:

.1 Ceramic tile, marked to show each type, size, and shape required.

.2 Chemical resistant mortar and grout (Epoxy and Furan).

.3 Cementitious backer unit.

.4 Dry-set Portland cement mortar and grout.

.5 Divider strip.

.6 Elastomeric membrane and bond coat.

.7 Reinforcing tape.

.8 Levelling compound.

.9 Latex-Portland cement mortar and grout.

.10 Commercial Portland cement grout.

.11 Organic adhesive.

.12 Slip resistant tile.

.13 Waterproofing isolation membrane.

.14 Fasteners.

1.4 SAMPLES

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

.2 Base tile: submit 300 x 300 mm sample panels of each colour, texture, size, and pattern of tile.

.3 Floor tile: submit 300 x 300 mm sample panels of each colour, texture, size, and pattern of tile.

.4 Trim shapes, bullnose cap and cove including bullnose cap and base pieces at internal and external corners of vertical surfaces, each type, colour, and size.

.5 Stair Accessories: submit duplicate samples of each trim.

.6 Adhere tile samples to [11] mm thick plywood and grout joints to represent project installation.

.7 Prepare a 2 m x 3m mock-up sample on site to ensure demonstration of installation details and quality control. Include stair accessories in mock-up.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials in containers with labels legible and intact and grade-seals unbroken.

.2 Store material so as to prevent damage or contamination.

.3 Store materials in a dry area, protected from freezing, staining and damage.

.4 Store cementitious materials on a dry surface.

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1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal packaging material in appropriate on-site bins for recycling.

.3 Unused adhesive, sealant and coating materials must be disposed of at an official hazardous material collections site as approved by the Consultant.

.4 Unused adhesive, sealant and coating materials must not be disposed of into the sewer system, into streams, lakes, onto the ground or in other location where it will pose a health or environmental hazard.

.5 Broken ceramic materials must be diverted from landfill to a local facility as approved by Consultant.

1.7 ENVIRONMENTAL CONDITIONS

.1 Maintain air temperature and structural base temperature at ceramic tile installation area above 12 ^{o}C for 48 h before, during, and 48 h after, installation.

.2 Do not install tiles at temperatures less than 12 ^{o}C or above 38 ^{o}C.

.3 Do not apply epoxy mortar and grouts at temperatures below 15 ^{o}C or above 25 ^{o}C.

1.8 EXTRA MATERIAL

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide minimum 5% of each type and colour of tile required for project for maintenance use. Store where directed.

.3 Maintenance material to be of same production run as installed material.

1.9 EXTENDED WARRANTY

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

Part 2 Products

2.1 FLOOR TILE

.1 Porcelain floor tile (Designation: POR): to CAN/CGSB-75.1.

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.1 Acceptable Materials: Size 300 mm x 600 mm; "Urbancrete" or "Adrock" by Centura or "Regal" by Olympia Tile, in matte finish. Allow for one (1) field colour from manufacturer's full line and two (2) accent floor tiles.

.2 Locations: First Floor corridors, vestibules, washrooms and stairs where indicated – refer to drawings. Refer to Room Finish Schedule for locations.

.3 Install in a one-third staggered pattern.

.4 Provide prefabricated movement joints in conjunction with slab saw cuts approx. 3500-6000mm distance (refer to floor pattern drawing).

.2 Porcelain tile (Designation: POR-WD): to CAN/CGSB-75.1, Type 5, Class MR 4, 100mm wide x 700mm size, 'wood look' and slip resistant Porcelain Tile. Colour to be selected from full line. Thin-set application.

.1 Acceptable Material: "Treverkfusion Series", by Olympia.

.2 Alternative: similar 100mm wide product by Centura as approved by architect.

.3 Grout joints for POR3 to be 1.5mm-2.0mm (1/16").

.2 Porcelain floor tile bull-nose base (Designation: POR): to CAN/CGSB-75.1.

.1 Acceptable Materials: Size 76mm or 100 mm x 300 mm 'sit-on' **bull-nose top** base; "Vitra", by Centura or "Omnia", by Olympia Tile, "Ultra Modern" by Daltile, or "Anchorage" by Daltile, all in matte finish. Allow for two (2) colours from manufacturer's Category/Group 2 colours. Cut tile is not acceptable.

.3 Porcelain Tactile Attention Indicator Tiles: to CAN/CGSB-75.1.

.1 Acceptable Materials: Size 300 mm x 300 mm GT Black STOP Matt, 11 ¾" x 11 ¾", as manufactured by Atlas Concorde and distributed by Centura Tile. Colour: contrasting to field tile.

.2 Conforming to OBC Article 3.8.3.18., required to be installed at the top of all stairs, starting one tread depth back from the edge of the top stair. The depth of the tactile attention indicator shall be not less than 300mm and not more than 610mm. Tactile attention indicator to be porcelain tile of contrasting colour from landing and stair treads with differing textured finish.

.4 Designation CMT (floor): 50 x 50 porcelain mosaic floor tile to CAN/CGSB-75.1.

.1 Acceptable materials: Dotti by Vitra as distributed by Centura Tile. 2 colours from full range in matte non-slip finish.

.2 Acceptable Alternates: Quebec distributed by Olympia; Dal 'Keystone' by Dal-tile and American Olean full mosaic collection, including 'Egyptstone' Series. Allow 2 colours from manufacturer's full range.

.3 Include cove base, top slope edges, fitted corners; include all pieces and trims. Contractors to fit around bullnose block walls.

.4 Locations: shower within UTR. Refer to Room Finish Schedule and drawings.

2.2 WALL TILE

.1 Ceramic tile (Designation: CWT): to CAN/CGSB-75.1, Type 5, Class MR 4

.1 Size: 4" x 16", matte surface.

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.2 Four colours to be selected from full colour line. Thin-set application.
.3 Acceptable Materials: Urban Max, by Centura or similar by Olympia.

.2 Locations: Washrooms, Drinking Fountain Niches, Corridor locations, other locations noted on Interior Elevations

.3 Tile Edging - wall: Purpose-made, anodized aluminum, polished chrome finish, metal edge strips as manufactured Schluter Systems at all exposed tile edging: Profile – JOLLY; thickness as required for wall tile and tile set.

2.3 TRIM SHAPES

.1 Conform to applicable requirements of adjoining floor and wall tile.

.2 Use slip resistant trim shapes for horizontal surfaces of showers, overflow ledges, recessed steps, shower curbs, drying area curbs, and stools.

.3 Use trim shapes sizes conforming to size of adjoining field wall tile, including existing spaces, unless specified otherwise.

.4 Internal and External Corners: Provide trim shapes as follows where indicated.

.1 Bullnose shapes for external corners including edges.
.2 Coved shapes for internal corners.
.3 Special shapes for:
.1 Base to floor internal corners to provide integral coved vertical and horizontal joint.
.2 Base to floor external corners to provide bullnose vertical edge with integral coved horizontal joint. Use as stop at bottom of openings having bullnose return to wall.
.3 Wall top edge internal corners to provide integral coved vertical joint with bullnose top edge.
.4 Wall top edge external corners to provide bullnose vertical and horizontal joint edge.

.5 Provide cove and bullnose shapes for where indicated and required to complete tile work.

2.4 MORTAR AND ADHESIVE MATERIALS

.1 Manufacturer’s of commercial mortar, grout and adhesive having Product considered acceptable for use:

.1 Mapei
.2 Laticrete
.3 Flextile

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

.3 Floors:

.1 Cement Mortar: Mixture of 1 part Portland cement, 4 parts dry sand and 1/10 hydraulic lime. Materials shall conform to the following:

.2 Portland Cement: To CAN3-A, Type 10.

.3 Hydrated Lime: To ASTM C-206 or 207, Type 5.

.4 Sand: To CSA A82.56, passing 1.6 mm sieve.

.5 Water: Potable, containing no contaminants which cause efflorescence.

.6 Thin Set Mortar: field mixed, blended sand-Portland cement-latex mortar, "Kerabond/Keralastic by Mapei.

.1 Acceptable Alternates: "Laticrete 4237 distributed by Ceratec Inc., or Flextile 52 thin set.

.2 Latex Additive: "Cemtex" by Master Builders, Laticrete 2022" distributed by Ceratec Inc.,

2.5 GROUT

.1 Colouring Pigments:

.1 Pure mineral pigments, limeproof and nonfading, complying with ASTM C979.

.2 Colouring pigments to be added to grout by manufacturer.

.3 Job coloured grout are not acceptable.

.4 Use in Commercial Portland Cement Grout, Dry-Set Grout, and Latex-Portland Cement Grout.

.2 Chemical-Resistant Grout for Walls:

.1 Epoxy grout: to ANSI A108.1, having quality, colour and characteristics to match epoxy bond coat. Adhesive and grout by same manufacturer.

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

.3 Floors:

.1 Polymer modified grout as manufactured by MAPEI.

2.6 ACCESSORIES

.1 Stairs Nosings and Edge Trims:

.1 Stair nosing to be Kinesik, M series tile nosing with yellow non-slip glow in the dark contracting strip, model M4150.10 (as appropriate for the thickness of porcelain file flooring). Install in conjunction with porcelain tile as per manufacturer's recommendations.

.2 SCHIENE edge protection by Schluter, anodized aluminum to be installed at all exposed stair tile edges (except nosing). Mitre joints to suit stair angle. Size as required for tile and mortar bed.

.2 Prefabricated Movement Joints: purpose made Schluter, Dilex-KSN aluminum, sized as required for tile and mortar bed. Colour to be selected by consultant. To be installed directly above slab saw-cuts. Refer to floor pattern drawing for locations.

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.3 Tile Edging – floor & bench applications: Purpose-made metal edge and transition strips as manufactured Schluter Systems at all exposed tile edging or transitions between materials: Profile – to be selected by architect from full line, as required for specific application.

.4 Reinforcing mesh: 50 x 50 x 1.6 x 1.6 mm galvanized steel wire mesh, welded fabric design, in flat sheets.

.5 Divider strips:

.1 Laminated strips, core 32 x 3 mm black neoprene, outsides (both sides) brass 32 x 1.29 mm complete with anchors, both sides spaced at 150 mm on centre.

.2 Brass complete with anchors, both sides spaced at 150 mm on centre.

.6 Cleavage plane: [polyethylene film to CGSB 51-34] [No. 15 asphalt saturated felt to CSA A123.3] .

.7 Metal lath: to ASTM C847 finish, 10 mm rib at 2.17 kg/m^2.

.8 Transition Strips: purpose made metal extrusion; stainless steel type.

.9 Reducer Strips: purpose made metal extrusion; stainless steel type; maximum slope of 1:2.

.10 Prefabricated Movement Joints: purpose made, having a Shore A Hardness not less than 60 and elasticity of plus or minus 40 percent when used in accordance to TTMAC Detail 301EJ.

.11 Sealant: in accordance with Section 07 92 10 - Joint Sealing.

.12 Floor sealer and protective coating: [to CAN/CGSB-25.20, Type [1] [2]] [to tile and grout manufacturers recommendations].

2.7 MIXES

.1 Portland Cement:

.1 Scratch coat: 1 part portland cement, 1/5 to 1/2 parts hydrated lime to suit job conditions, 4 parts sand, 1 part water, [and latex additive where required]. Adjust water volume depending on water content of sand.

.2 Slurry bond coat: portland cement and water mixed to creamy paste. Latex additive may be included.

.3 Mortar bed for floors: 1 part portland cement, 4 parts sand, 1 part water. Adjust water volume depending on water content of sand. [Latex additive may be included].

.4 Mortar bed for walls and ceilings: 1 part portland cement, 1/5 to 1/2 parts hydrated lime to suit job conditions, 4 parts sand and 1 part water. Adjust water volume depending on water content of sand. [Latex additive may be included].

.5 Levelling coat: 1 part portland cement, 4 parts sand, minimum 1/10 part latex additive, 1 part water including latex additive.

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.6 Bond or setting coat: 1 part portland cement, 1/3 part hydrated lime, 1 part water.

.7 Measure mortar ingredients by volume.

.2 Dry set mortar: mix to manufacturer's instructions.

.3 Organic adhesive: pre-mixed.

.4 Mix bond and levelling coats, and grout to manufacturer's instructions.

.5 Adjust water volumes to suit water content of sand.

2.8 PATCHING AND LEVELING COMPOUND

.1 Portland cement base, acrylic polymer compound, manufactured specifically for resurfacing and levelling concrete floors. Products containing gypsum are not acceptable.

.2 Have not less than the following physical properties:

.1 Compressive strength - 25 MPa.

.2 Tensile strength - 7 MPa.

.3 Flexural strength - 7 MPa.

.4 Density - 1.9.

.3 Capable of being applied in layers up to 50 mm thick, being brought to feather edge, and being trowelled to smooth finish.

.4 Ready for use in 48 hours after application.

2.9 CLEANING COMPOUNDS

.1 Specifically designed for cleaning masonry and concrete and which will not prevent bond of subsequent tile setting materials including patching and levelling compounds and elastomeric waterproofing membrane and coat.

.2 Materials containing acid or caustic material are not acceptable.

Part 3 Execution

3.1 WORKMANSHIP

.1 Do tile work in accordance with TTMAC Tile Installation Manual 2000, "Ceramic Tile", except where specified otherwise.

.2 Apply tile [or backing coats] to clean and sound surfaces.

.3 Fit tile around corners, fitments, fixtures, drains and other built-in objects. Maintain uniform joint appearance. Cut edges smooth and even. Do not split tiles.

.4 Maximum surface tolerance 1:800.

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.5 Make joints between tile uniform and approximately [1.5 mm] wide, plumb, straight, true, even and flush with adjacent tile. Ensure sheet layout not visible after installation. Align patterns.

.6 Lay out tiles so perimeter tiles are minimum 1/2 size.

.7 Install floor tiles as per pattern. Layout and install flash cove tile first, before floor tile, ensuring a flush edge on the horizontal surface by feathering to masonry walls as required to produce a straight line on the floor. Install floor tiles to pattern supplied by Architect at a later date. Contact consultant to review when approximately no more than 10 sq. m has been installed.

.8 Sound tiles after setting and replace hollow-sounding units to obtain full bond.

.9 Make internal angles square, external angles rounded.

.10 Make internal angles square, external angles chamfered at 45° with narrow tile strip.

.11 Construct cove base, as described using all special pieces available for inside and outside corners.

.12 For Floors: Use bull nose edged tiles at termination of wall tiles, except where tiles abut projecting surface or differing plane.

.13 Seal grouted joints with sealer.

.14 Keep building expansion joints free of mortar or grout.

.15 For Walls: Use round edged tiles at termination of wall tile panels, except where panel abuts projecting surface or differing plane.

.16 Install divider strips at junction of tile flooring and dissimilar materials.

.17 Allow minimum 24 h after installation of tiles, before grouting.

.18 Clean installed tile surfaces after installation and grouting cured.

3.2 FLOOR TILE

.1 Install in accordance with TTMAC to applicable thinset detail.

3.3 STAIR TILE ACCESSORIES

.1 Install all accessories specified per manufacturer’s instructions using whole lengths.

.2 Provide sample installation for architect for review.

3.4 FLOOR SEALER AND PROTECTIVE COATING

.1 Apply in accordance with manufacturer's instructions.

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END OF SECTION

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Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 00 - Closeout Submittals.

.3 Section 06 10 10/06101 - Rough Carpentry: Wood strapping.

.4 Fabrication: to ASTM 365-78 and CAN/GSB-92.1-M77.

.5 Installation: to ASTM C636-76, except where specified otherwise.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM E1264-[98], Classification for Acoustical Ceiling Products.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.34-[M86], Vapour Barrier, Polyethylene Sheet, for Use in Building Construction.

.2 CAN/CGSB-92.1-[M89], Sound Absorptive Prefabricated Acoustical Units.

.3 Canadian Standards Association (CSA)

.1 CSA B111-[74(R1998)], Wire Nails, Spikes and Staples.

.4 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102-[88(R2000)], Surface Burning Characteristics of Building Materials.

1.3 SAMPLES

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

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

1.4 REGULATORY REQUIREMENTS

.1 Fire-resistance rated floor/ceiling and roof/ceiling assembly: certified by a Canadian Certification Organization accredited by Standards Council of Canada.

1.5 DESIGN CRITERIA

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

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1.6 WASTE MANAGEMENT AND DISPOSAL

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

1.7 ENVIRONMENTAL REQUIREMENTS

.1 Permit wet work to dry before commencement of installation.

.2 Maintain uniform minimum temperature of 15^0C and humidity of 20 - 40% before and during installation.

.3 Store materials in work area 48 hours prior to installation.

1.8 EXTRA MATERIALS

.1 Provide extra materials of acoustic units in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide acoustical units amounting to 2 % of gross ceiling area for each pattern and type required for project.

.3 Extra materials to be from same production run as installed materials.

.4 Clearly identify each type of acoustic unit, including colour and texture.

.5 Store where directed by Consultant.

Part 2 Products

2.1 MATERIALS

.1 Acoustic units for suspended ceiling system: to CAN/CGSB-92.1.

.2 Acoustic Ceiling Panels, Designation LAP: Acoustic Ceiling Panels, wet formed mineral fibre panels, by Armstrong World Industries Canada Inc. or Rockfon by Roxul. Colour: White; Types as noted below:

.3 **Panel Types**:

.1 Type 1: LAP: 600 x 1200 mm x 15.9 mm thick; 'Fine Fissured 1729 by Armstrong' or 'Pacific by Rockfon' with medium texture, Square Lay-In; Location: For use at classroom areas, corridors and all other areas as indicated.

.2 Type 2: ACP: 1200 x 2400 x 22 mm thick, 'Optima White' Square Edge with acoustically transparent membrane #3934. Refer to Reflected Ceiling Plan for locations. Use with CAPZ accent hardware.

.3 Type 3: AB: Acoustic Linear Panels: Microperforated Metalworks Linear 4" x 96" '5492 Effects Oak FXOK' ceiling panels by Armstrong Ceilings, installed in locations and patterns noted on Reflected Ceiling Plans. Location: Entrance Lobby 102, CO-Lab 210, 304

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& 307. Colour: Effects Oak. Provide matching colour 150mm deep axiom trim (Armstrong) and groupings of hanging panels.

.4 Type 4: CLD: Acoustical Clouds: 1" thick, Soundscapes Acoustical Clouds, circular shape, by Armstrong. Location: Corridor 127. Colour: Allow for three colours to be selected by Consultant from manufacturer's full range. Sizes: dia. 2440mm.

Acceptable alternates for CLD 'Acoustical Clouds': similar purpose-designed acoustical panels such as 'Avanti' acoustical ceiling clouds by Sound Solutions and 'Nuvola' Acoustical Clouds by Decoustics or Sound Seal (dist. By Wallworks Acoustic Arch. Products 647 808-5450), Shapes by Sound Concepts or Conwed Skyway Cloud by Owens Corning.

.4 Acceptable alternates for LAP: similar purpose-designed high humidity ceiling panels by Rockfon – Roxul, Armstrong, CGC Interiors, BPB Canada Inc. and Certainteed.

.5 **Suspension System Type 1**: 23.8 mm (15/16") "Prelude XL" exposed tee bar grid, including wall moulding, by Armstrong. Colour: white. Acceptable alternate: similar suspension system by CGC Interiors, Oakville and Chicago Metallic Corp. Grid sizes to suit ceiling panel types as shown on drawings.

.6 **Hanging Panel Trim:** 50mm, 100mm & 150mm Axiom Classic Trim by Armstrong World Industries Canada Inc., or acceptable alternate. Location: various locations with floating LAP and acoustic ceilings including in corridor outside Kindergarten Classroom doors. Refer to Drawings.

.7 **Accent Hardware:** 'Capz (ARCAPSL)' by Armstrong World Industries Canada Inc., or acceptable alternate in silver colour with smooth finish. For use with Type 4 acoustic tile type at Art Classroom 243.

.8 Suspension System for Radiant Panel Heaters: not applicable to this project.

.9 Hangers: 2.6 mm galvanized soft annealed steel wire.

.10 Accessories: splices, clips, retainers, etc., to complement suspension system components.

.11 Adhesive: low VOC type recommended by acoustic unit manufacturer.

.12 Staples, nails and screws: to CSA B111 non-corrosive finish as recommended by acoustic unit manufacturer.

.13 Hold down clips: purpose made clips to secure tile to suspension system, approved for use in fire-rated systems.

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Part 3 Execution

3.1 EXAMINATION

.1 Do not install acoustical panels and tiles until work above ceiling has been inspected by Consultant.

3.2 INSTALLATION

.1 Install acoustical panels and tiles in ceiling suspension system.

.2 Install acoustic units parallel to building lines with edge unit not less than 50% of unit width.

.3 Scribe acoustic units to fit adjacent work. Butt joints tight, terminate edges with moulding.

.4 Support suspension system main runners at 1200 oc maximum with hangers from structure. Assembly shall support super-imposed loads. Maximum permissible deflection, 1/360 of span.

.5 Attach cross member to main runner to provide rigid assembly.

.6 Install suspension assembly to manufacturer's written instructions.

.7 Install flush edge moulding at junction of acoustic unit ceiling and other materials around entire length of joint. Secure to construction. Butt joints neatly, square and true in alignment.

.8 Set acoustic units in place.

.9 Set all ceiling levels by the use of transit or laser level.

.10 Ensure all installations are clean upon owner acceptance. Be responsible for monitoring damage and soiling after installation and before owner occupancy. Prior to owner takeover, replace all tiles with damage, blemishes or soiling whether caused by subcontractor handling or post installation above-ceiling adjustments, balancing, cabling, etc.

.11 Provide for Owner twelve (12) complete, undamaged ceiling tiles of each type, sealed and boxed. Leave in location as directed by Architect.

3.3 INTERFACE WITH OTHER WORK

.1 Co-ordinate ceiling work to accommodate components of other sections, such as light fixtures, diffusers, speakers, sprinkler heads, to be built into acoustical ceiling components.

END OF SECTION

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Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM International)

.1 ASTM F1303-[99], Specification for Sheet Vinyl Floor Covering with Backing.

.2 Canadian Standards Association (CSA International)

.1 CAN/CSA-ISO 14040-[97], Environmental Management - Life Cycle Assessment - Principles and Framework (Adopted ISO 14040:1997, first edition).

1.3 SAMPLES

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit duplicate 300 x 300 mm sample pieces of sheet material, 300 mm long base, nosing, feature strips, treads, edge strips.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for resilient flooring for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 ENVIRONMENTAL REQUIREMENTS

.1 Maintain air temperature and structural base temperature at flooring installation area above 20^{o} for 48 hours before, during and 48 hours after installation.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Do not dispose of unused sealant and adhesive materials into landfill. Divert materials to municipal hazardous materials depot approved by Consultant.

.2 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Consultant.

.3 Remove from site and dispose of packaging materials at appropriate recycling facilities.

1.7 QUALITY ASSURANCE

.1 Supplier shall be an established firm experienced in the field.

.2 Installer:

.1 Flooring contractor experienced in the field and approved by the manufacturer.

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.2 Flooring contractor shall have manual instructions and be trained by the manufacturer and distributor.

.3 Manufacturer's recommendations for the correct preparation, finishing and testing sub floor surface.

1.8 EXTENDED WARRANTY

.1 Submit a warranty for all the installation of all resilient sheet flooring, covering materials and labour and the repair or replacement of defective work in accordance with the General Conditions of the Contract, but for seven (7) years total.

Part 2 Products

2.1 MATERIALS

.1 Resilient Sheet Flooring **Type 1** (SF-Sp): Acceptable materials:

.1 Acceptable Materials:
- .1 Gerflor, Taraflex Sport 'M Plus'
- .2 Tarkett OmniSports Active+

.2 Locations: Gymnasium. Refer to Room Finish Schedule and Drawings

.2 Resilient Sheet Flooring **Type 2** (SF): Acceptable materials:

.1 Acceptable Materials:
- .1 Gerflor, Recreation 45
- .2 Tarkett OmniSports Speed

.2 Locations: Kindergarten and Childcare classrooms and associated cubbie areas; Music and Music Practice Rooms. Refer to Room Finish Schedule and Floor Pattern Drawing.

.3 Allow for four (4) colours from manufacturer's full range for Kindergarten Classrooms. Refer to Floor Pattern Drawing.

.1 Surface resistance: Unaffected by surface water and chemicals.

.2 Slip resistance tested in accordance with ASTM D2047 Static coefficient of friction: Dry 0.95, Wet 0.93.

.3 Meets ULC 102.2 Flame spread 5, Smoke developed 295.

.4 Wear Resistance: ASTM C501 Wear index 436.

.5 Static Load Limit: 500 PSI.

.6 Hygiene: Bacteriostat retards the growth of bacteria.

.4 Self Levelling Underlayment: **"**Ultraplan 1**"** by Mapei fast setting, polymer-modified; for over cured concrete, plywood, ceramic tile, old cutback adhesive, and old vinyl and vinyl composition flooring, feather edge to 1 1/2" (38 mm).for use to prepare floor at locations where existing flooring has been removed and subfloor is not level..

.5 Filler and Cover Former:

.1 As recommended by manufacturer to suit subfloor on which its material is installed and to suit vertical wall/floor junctions.

.6 Primers and Adhesives: As recommended by manufacturer of material to suit subfloor condition.

.7 Cleaner: Neutral chemical compound that will not damage sheet or affect its colour.

.8 Welding Rod: PVC welding rod, colour to match resilient sheet flooring.

.9 Cap strip: sized to suit application, type recommended by flooring manufacturer, Altro Stainless Steel Cap, mechanically fastened to wall

Part 3 Execution

3.1 SITE VERIFICATION OF CONDITIONS

.1 Ensure concrete floors are clean and dry by using test methods recommended by flooring manufacturer.

3.2 PREPARATION

.1 Scope includes preparation of floor using self levelling coating and patching compound as required.

.2 Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler.

.3 Clean floor and apply filler; trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler cured and dry.

.4 Remove or treat old adhesives to prevent residual, old flooring adhesives from bleeding through to new flooring and/or interfering with the bonding of new adhesives.

.5 As required, seal concrete slab to resilient flooring manufacturer's printed instructions.

3.3 INSTALLATION

.1 Install on a smooth, flat concrete finish, which will be achieved manually or mechanically.

.2 Ensure concrete sub floor temperature to be maintained at a minimum of 70°F during installation and ensure the moisture content does not exceed 3 Lbs per 1000 Sq Ft per 24 hours or lower.

.3 Paint game lines using approved game line paint primer and game line paint in strict accordance with the game line paint manufacturer’s instructions.

.4 Before proceeding with any work, inspect the sub floor surface and report, in writing, to the project manager and the General Contractor any visible defect on the surface, such as cracks, bumps, rough areas or variations in planarity.

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.5 This installation is to proceed on an existing concrete slab in addition to new concrete work as required for mechanical services. Ensure slab is adequately cured and free of moisture or contaminants. If necessary, as part of the work of this section, scarify existing surfaces to prepare surface for adhesive, or to meet manufacturer's installation requirements. Fill joints, cracks, and holes in these surfaces and level surface irregularities with filler. Remove prime paint and wire brush steel base surfaces.

.6 Check for any grease, oil, paint, duct or any combination remaining on the concrete sub floor.

.7 Before proceeding with installation, clean concrete surface to remove any dirt or foreign materials, rinse thoroughly and allow eight (8) hours minimum to dry, if required, sanding is necessary in all installations.

.8 Fill any areas not meeting ±1/8" in 10' for level before installation. This will insure levelness and proper adhesion of material.

.9 Lay each material in accordance with manufacturer's specifications.

.10 Weld joints on flooring and internal and external angles of coves using welding rod in matching plain colours, and the standard hot-air-welding technique.

.11 Install standard rubber base at resilient sheet flooring locations.

.12 Flash into drain openings; do not cut on surface at edge of drain cover. Coordinate with Division 15 for installation with suitable drain type and cover. Bond flooring to drain flange under clamping ring using epoxy adhesive.

.13 Extend resilient sheet under all cabinet work and casework to the wall line.

3.4 CLEANING

.1 Remove excess adhesive from floor, base and wall surfaces without damage.

.2 Clean, seal and wax floor and base surface to flooring manufacturer's printed instructions.

3.5 PROTECTION

.1 Protect new floors from time of final set of adhesive, with polyethelene or Kraft paper until final inspection.

.2 Prohibit traffic on floor for 48 hours after installation.

.3 Do not wax.

END OF SECTION

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Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 03 30 00 – Cast-in-Place Concrete.

.3 Section 03 35 05 – Concrete Floor Hardeners.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM International)

.1 ASTM F1066-[99], Specification for Vinyl Composition Floor Tile.

.2 ASTM F1344-[00], Specification for Rubber Tile.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-25.20-[95], Surface Sealer for Floors.

.2 CAN/CGSB-25.21-[95], Detergent-Resistant Floor Polish.

1.3 SAMPLES

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit duplicate tile in size specified, 300 mm long.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal [paper] [plastic] [polystyrene] [corrugated cardboard] packaging material in appropriate on-site bins for recycling.

.3 Dispose of unused finish and adhesive materials at official hazardous material collections site approved by Consultant.

.4 Do not dispose of unused finish and adhesive materials into sewer system, into streams, lakes, onto ground or in other locations where it will pose health or environmental hazard.

1.5 ENVIRONMENTAL REQUIREMENTS

.1 Maintain air temperature and structural base temperature at flooring installation area above 20^{o}C for 48 hours before, during and for 7 days after installation.

1.6 EXTRA MATERIALS

.1 Provide 6 m^2 or 3% of each colour, pattern and type flooring material required for this project for maintenance use.

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.2 Extra materials to be from same production run as installed materials.

.3 Clearly identify each container of floor tile and each container of adhesive.

.4 Store where directed by Consultant.

Part 2 Products

2.1 MATERIALS

.1 Luxury Vinyl Tile (LVT): 30 MIL (0.70mm) wear layer thickness, 3mm tile thickness, square or plank sizing, with 20 year commercial warranty. Allow for total of three (3) colours from full line.

.1 Mirra, by Centura

.2 Event, by Tarkett

.3 Creation 70, by Gerflor

.2 Resilient base (RR): rubber, top set coved, 3 mm thick, rubber, 100 mm high minimum 1200 mm long, including premoulded end stops and external corners. Acceptable materials: non-shrink Rubber Wall Base with toe as manufactured by Johnsonite. Colours: Six (6) from full Johnsonite "Coloright" colour line.

.3 Rubber Stair Tread/ Riser combination (RSTR): Minimum of 5 mm thick, visually impaired Round Raised Disk pattern, rubber one-piece tread/ riser combination with speckled pattern. Stair tread to be one piece, for full width of stair. Include contrast strip on stair nosing for visual impaired, including mid and upper landings. Acceptable materials: VIRTR-Rd, as manufactured by Johnsonite, ROPPE, Activa Rubber Flooring, Flexco or Nora Rubber Flooring. Stair tread with contrast edge strip and no upstand is to be inserted into floor tile at top stair at mid and top landings. Stair treads to be speckled using minimum three colours.

.4 Rubber Tile at Stair Mid and Upper Landings (RT): Minimum of 5 mm thick, hammered finish rubber tile, 600mm x 600mm square. Stair tread with contrast edge strip and no upstand is to be inserted into floor tile at top stair at mid and top landings. Acceptable materials: Johnsonite, ROPPE, Activa Rubber Flooring, Flexco, or Nora Rubber Flooring. Tile to be marbleized or speckled using three colours.

.5 Tactile attention indicator: conforming to OBC Article 3.8.3.18. required to be installed at the top of all stairs, starting one tread depth back from the edge of the top stair. The depth of the tactile attention indicator shall be not less than 300mm and not more than 610mm. Tactile attention indicator to be rubber tile of contrasting colour from landing and stair treads with differing textured finish. Acceptable Products: 300mm x 600mm ‘Safe Sense Warning Indicator’ rubber tiles by Johnsonite, or approved alternates.

.6 Vinyl Cove Base adhesives: ‘Johnsonite 990 Solvent Free Environmentally Safe White Acrylic Cove Base Adhesive’. Submit product data sheets.

.7 Primer: ‘Flextile 43 Latex Additive’ by Flextile. Submit product data sheets

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.8 Sub-floor filler and leveller: 'Flextile Patch' by Flextile, or alternate as recommended by flooring manufacturer for use with their product.

.9 VCT Adhesive: Acceptable Materials: Armstrong S-515 Moisture Resistant, clear, waterproof adhesive. Submit product data sheets

.10 Metal edge strips: aluminum extruded, smooth, with lip to extend under floor finish, shoulder flush with top of adjacent floor finish.

.11 Polyethylene sheet: to CAN2 51.33-M77, Type 2, for protection.

.12 Nose filler: Epoxy caulking compound Johnsonite 930.

.13 Nose filler: Epoxy caulking compound Johnsonite 930.

.14 Transition strips; as required between adjacent flooring finishes: manufactured by Johnsonite or Mercer or Finercraft to suit conditions at the place of the work for smooth transition. Colour to later selection by Consultant from manufacturer's full range. Adhesive to be as recommended by manufacturer.

.15 Vinyl Reducing Strip: Johnsonite RRS-XX-C; to suit thickness of flooring; colours selected by Consultant.

.16 Vinyl Adaptor: Johnsonite CTA-XX-K; colours selected by Consultant.

Part 3 Execution

3.1 INSPECTION

.1 Ensure concrete floors are dry, by using test methods recommended by tile manufacturer. Inspect for negative alkalinity, carbonization or dusting.

.2 Commencement of work indicates acceptance of conditions by flooring installer.

3.2 SUB-FLOOR TREATMENT

.1 Confirm concrete floors where porcelain tile meets resilient has been depressed to allow for flush condition. Do NOT feather edges of resilient tile floors flush without prior review and approval of the Architect.

.2 Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler.

.3 Clean floor and apply filler; trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler cured and dry.

3.3 TILE APPLICATION

.1 Apply adhesive uniformly using recommended trowel in accordance with flooring manufacturer's instructions. Do not spread more adhesive than can be covered by flooring before initial set takes place.

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.2 Lay flooring with joints parallel to building lines to produce symmetrical tile pattern. Border tiles minimum half tile width.

.3 Install tiles in corridor as per pattern provided by Consultant. Pattern will be provided at a later date.

.4 Cut tile and fit neatly around fixed objects.

.5 Install flooring in pan type floor access covers. Maintain floor pattern.

.6 Terminate flooring at centerline of door in openings where adjacent floor finish or colour is dissimilar.

.7 Install metal edge strips at unprotected or exposed edges where flooring terminates.

.8 At doorways to incrapack units, extend tile and base fully into door opening to incrapak classroom.

.9 Install solid colour vinyl strip to form gymnasium game lines, as indicated on drawings. Cut field tiles tight and smooth contour against game lines. Strips to be minimum of 300 mm long on curves and of indicated width and colour.

3.4 BASE APPLICATION

.1 Lay out base to keep number of joints at minimum. Use lengths as long as practicable and not less than minimum 500 mm long.

.2 Clean substrate and prime with one coat of adhesive.

.3 Apply adhesive to back of base.

.4 Set base against wall and floor surfaces tightly by using 3 kg hand roller.

.5 Install straight and level to variation of 1:1000.

.6 Scribe and fit to door frames and other obstructions. Use premoulded end pieces at flush door frames.

.7 Miter internal corners. Use premoulded corner pieces at all external corners and ensure full adhesion through to ends of corner pieces. See detail for termination at door frames.

.8 Install toeless type base before installation of carpet on floors.

.9 Leave in the building one (1) complete carton of each of two (2) colours of floor tile and twelve (12) tiles of each of the remaining colours. Colours of extra tile to be specified by Consultant.

3.5 INITIAL MAINTANANCE AFTER INSTALLATION

.1 Broom sweep or vacuum thoroughly.

.2 Do not wet mop, wash, scrub, or strip the floor. These procedures will be done by the Owner.

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3.6 PROTECTION OF FINISHED WORK

.1 Following broom sweeping, protect new floors with 0.15 mm thick Polyethylene cover and lay planking in all necessary traffic areas to minimize damage by other trades. Maintain until just before final inspection.

.2 Prohibit traffic on floor for 48 hours after installation.

3.7 PREPARATION FOR INSPECTION

.1 Only if so notified by Architect, and in the presence of the Owner, scrub the floor using a neutral detergent and a floor machine of 170-250 rpm capability equipped with a scrub brush or a scrubbing pad (3M blue or equal).

.2 Lightly rinse and allow to dry. Note: Do not flood the floor with rinse water, scrubbing, or stripping solutions. Final re-washing, if required, and waxing will be done by owner.

END OF SECTION

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Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures

.2 Section 01 51 00 - Temporary Utilities.

.3 Section 01 78 00 - Closeout Submittals.

1.2 REFERENCES

.1 American Association of Textile Chemists and Colorists (AATCC)

- .1 AATCC 16-[1998], Color Fastness to Light.
- .2 AATCC 23-[1999], Color Fastness to Burn Gas Fumes.
- .3 AATCC 118-[1997], Oil Repellency: Hydrocarbon Resistance Test.
- .4 AATCC 129-[2001], Colour Fastness to Ozone in the Atmosphere Under High Humidities.
- .5 AATCC 134-[2001], Electrostatic Propensity of Carpet.
- .6 AATCC 171-[2000], Carpets: Cleaning of; Hot Water Extraction Method.
- .7 AATCC 174-[1998], Antimicrobial Activity Assessment of Carpets.
- .8 AATCC 175-[1998], Stain Resistance: Pile Floor Coverings.
- .9 AATCC 189-[2001], Fluorine Content of Carpet Fibers.

.2 American Society for Testing and Materials (ASTM International)

- .1 ASTM D1055-[97], Specification for Flexible Cellular Materials - Latex Foam.
- .2 ASTM D1335-[98], Tuft Bind of Pile Floor Coverings.
- .3 ASTM D1667-[97], Standard Specification for Flexible Cellular Materials-Vinyl Chloride Polymers and Copolymers (Closed-Cell Foam).
- .4 ASTM D3936-[00] Standard Test Method for Resistance to Delamination of the Secondary Backing of Pile Yarn Floor Covering.
- .5 ASTM D5252-[98a], Standard Practice for the Operation of the Hexapod Drum Tester.
- .6 ASTM D5417-[99], Standard Practice for Operation of the Vettermann Drum Tester.
- .7 ASTM E84-[01], Test Method for Surface Burning Characteristics of Bulding Materials.
- .8 ASTM E648-[00], Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.
- .9 ASTM E662-[01], Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.

.3 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-4.2 No.27.6-[M91], Textile Test Methods - Flame Resistance - Methemine Tablet Test for Textile Floor Coverings.

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.2 CAN/CGSB-4.2 No.77.1-[94]/ISO 4919:1978, Textile Test Methods - Carpets - Determination of Tuft Withdrawal Force.

.3 CGSB 4-GP-36M-[78], Carpet Underlay, Fiber Type.

.4 CAN/CGSB-4.129-[93(R1997)], Carpets for Commercial Use.

.5 CGSB 20-GP-23M-[78], Cushion, Carpet, Flexible Polymeric Material.

.6 CAN/CGSB-25.20-[95], Surface Sealer Floors.

.4 Carpet and Rug Institute (CRI)

.1 CRI-104-[96], Standard Installation of Commercial Carpet.

.2 IAQ Carpet Testing Program.

.5 National Floor Covering Association (NFCA)

.1 Floor Covering Specification Manual [1998].

.6 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S102-[88(R2000)], Surface Burning Characteristics of Building Materials and Assemblies.

.2 CAN/ULC-S102.2-[88(R2000)], Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials and Assemblies.

1.3 SUBMITTALS

.1 Submit control submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit verification to demonstrate compliance with CAN/ULCS102 and CAN/ULCS102.2.

.3 Submit proof that carpet has been tested and passed the Indoor Air Quality (IAQ) Carpet Testing Program requirements of the Carpet and Rug Institute (CRI) and the Canadian Carpet Institute (CCI).

.4 Submit report verifying that tuft bind meets requirements of CAN/CGSB-4.129 when tested to CAN/CGSB-4.2 No.77.1.

.5 Submit report outlining proposed dust control measures.

.6 Submit carpet schedule using same room designations indicated on drawings.

.7 Submit carpet manufacturer's installation instructions: Indicate special procedures and perimeter conditions requiring special attention.

.8 Submit certification and description of carpet recycling process

1.4 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit product data sheet for each carpet, undercushion, adhesive, carpet protection and subfloor patching compound.

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.3 Submit WHMIS MSDS - Material Safety Data Sheets acceptable to Labour Canada and Health Canada for carpet adhesive and seam adhesive. Indicate VOC content.

.4 Submit data on specified products, describing physical and performance characteristics, sizes, patterns, colours, and methods of installation.

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate locations and lengths of seams for carpeted areas.

.3 Indicate nap direction, open edges, special patterns, and other details required by Consultant to clarify work.

.4 Submit drawings showing columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cut-outs are required as well as direction of carpet pile and pattern, location of edge mouldings and edge bindings to Consultant for review prior to installation of carpet.

1.6 SAMPLES

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit duplicate 225 x 225 mm pieces for each colour selected, 300 mm square pieces of under-cushion, 150 mm lengths of carpet gripper and binder bars, base, divider strips.

1.7 CLOSEOUT SUBMITTALS

.1 Submit operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

.2 Submit maintenance data: Include maintenance procedures, recommendations for maintenance materials and equipment, and suggested schedule for cleaning.

.3 Schedule of carpet reclamation activities indicating following:

.1 Detailed sequence of removal work.
.2 Inventory of items to be removed and reclaimed.
.3 Proposed packing and transportation measures.

.4 Certification: Reclamation Agency to verify in writing that used carpet was removed and recycled in accordance with carpet manufacturers' reclamation program.

.1 Record off-site removal of debris and materials and provide following information regarding removed materials.

.1 Time and date of removal.
.2 Type of material.
.3 Weight and quantity of materials.
.4 Final destination of materials.

□

1.8 QUALIFICATIONS

.1 Installer Qualifications:

.1 Flooring contractor requirements.

.1 Specialty contractor normally engaged in this type of work, with prior experience in installation of these types of materials.

.2 Certified by carpet manufacturer prior to [tender] [bid] submission.

.3 Must not sub-contract labour without written approval of Consultant.

.2 Be responsible for proper product installation, including floor testing and preparation as specified and in accordance with carpet manufacturers written instructions.

1.9 REGULATORY REQUIREMENTS

.1 Prequalification: tested to CAN/CGSB-4.2-No.27.6.

.2 Indoor Air Quality: compliance with CRI/CCI Green Label Indoor Air Quality Program, CRI/CCI-IAQ requirements for maximum total volatile chemicals released into air. Label each carpet product with CRI/CCI-IAQ label.

1.10 DELIVERY, STORAGE AND HANDLING

.1 Label packaged materials. For carpet tile products indicate nominal dimensions of tile and indicate installation direction.

.2 Packaging, labelling, packing and marking details.

.3 Store packaged materials in original containers or wrapping with manufacturer's seals and labels intact.

.4 Store carpeting and accessories in location as directed by Consultant. Store carpet and adhesive at minimum temperature of 18ºC and relative humidity of maximum 65% for minimum of 48 hours before installation.

.5 Prevent damage to materials during handling and storage. Keep materials under cover and free from dampness.

.6 Store materials in area of installation for minimum period of 48 hours prior to installation.

.7 Modular carpet: store on pallet form as supplied by Manufacturer. Do not stack pallets.

1.11 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.2 Vacuum used carpet before removal.

.3 Maintain possession of removed used carpet.

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.4 Carpet undercushion: provide recycling of carpet padding where locally available or as designated by carpet reclamation program.

1.12 ENVIRONMENTAL REQUIREMENTS

.1 Moisture: Ensure substrate is within moisture limits and alkalinity limits prescribed by manufacturer. Prepare moisture testing and provide report to Consultant

.2 Temperature: Maintain ambient temperature of not less than 18 ºC from 48 hours before installation to at least 48 hours after completion of work.

.3 Relative humidity: Maintain relative humidity between 10 and 65% RH for 48 hours before, during and 48 hours after installation.

.4 Safety: Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.

.5 Ventilation:

.1 Ventilate area of work as directed by Consultant by use of approved portable supply and exhaust fans.

.2 Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities. Provide fans with HEPA filters.

.3 Provide continuous ventilation during and after carpet application. Run ventilation system 24 hours per day during installation; provide continuous ventilation for 7 days after completion of carpet installation.

.6 Test existing floor levelling compound for presence of asbestos contamination. Notify Consultant for additional instructions where asbestos is discovered.

.7 Do not install carpet until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete.

1.13 EXTRA MATERIALS

.1 Provide extra materials of carpet, carpet base, and adhesives in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide 20 m^2 of each colour, pattern and type of carpeting.

.3 Extra materials to be from same production run as installed materials.

.4 Identify each package of carpet and each container of adhesive.

.5 Deliver to Consultant and store where directed by Consultant.

Part 2 Products

2.1 MANUFACTURERS

.1 Certified to Carpet and Rug Institute's and the Canadian Carpet Institute IAQ requirements.

2.2 CARPET TILE (CPT) – Carpet Tiles

Product shall be suitable for direct glue-down installation as per CGSB-4-SP-156. Pre-glued products are NOT acceptable

1.1.1 Manufacturer: Interface

1.1.2 Style: Open Air 404

1.1.3 All carpet supplied for each installation shall be manufactured from yarn of the same dye lot. Carpet will be selected by the Project Manager or Board Designee from Manufacturer's stock colour and pattern range.

1.1.2 'NEW' CARPET PRODUCTS

When requested, and if time allows, new carpet products other than those indicated above, to be considered, must be submitted to the School Board along with specification sheets and samples. If samples are deemed appropriate for further testing and approval, the Board will require an installation at a School Board site for sampling. The site sample installation to be provided and installed free of charge and to be left on site for a set period of time to be arranged and agreed to at the time of installation. The decision to accept any samples provided for future use within the Board is at the sole and unfettered discretion of the Board.

The Board may award the supply and installation of specialty products other than those noted within the specifications at its sole and unfettered discretion.

1.1.3 WARRANTY

Carpet and installation shall carry a minimum Manufacturer’s ten (10) year warranty.

1.1.4 ADHESIVES

Use Manufacturers recommended adhesive. Provide with bid submission all adhesive products MSDS.

IMPORTANT: Spraying of adhesive will not be accepted.

1.1.5 INSTALLATION

All carpet to be installed as per Manufactures instructions (latest editions/amendments) and in accordance with good installation practices.

IMPORTANT: Spraying of adhesive will not be accepted.

Carpet shall be of maximum widths and lengths, with all pile running the same direction, free from end joints in a run and with a minimum of side seams. Side seams shall be parallel to each other.

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Where variations of colour within normal textile tolerance occur (i.e. more than two (2) variations of colours within a given room), the change in colour shall be restricted to between individual classrooms and/or designated rooms, with such changes occurring at the door line unless authorized in writing to do otherwise by the School Board. No rooms shall have two (2) variations of the same colour and pattern within its boundaries, unless written authority from the School Board.

Carpeting shall be wall to wall, where carpet meets vinyl tile or other surfaces of less thickness, a carpet to resilient adapter as manufactured by Johnsonite or Schluter, compatible with the decor, shall be installed, using mechanical fasteners, plastic plugs and screws or concrete nails. Do not use powder actuated devices. Carpet shall neatly follow line of walls, bulkheads, columns and door framing.

At openings, seams to occur under door edges.

1.1.6 SEAMS

End seams arzfe generally not acceptable. However where such seams can be so located that they are hidden from view or are otherwise inconspicuous, Project Manager or Board Designee may permit an exception.

.1

.2 Carpet: to CAN/CGSB-4.129 and as follows.

.1 Certified for flammability to Health Canada regulations under "Hazardous Products (Carpet) Regulations", Part II of the Schedule.

.2 Maximum flame spread rating 300, maximum smoke developed classification 500, when tested to CAN/ULC-S102.2 .

.3 Certified to Carpet and Rug Institute's and the Canadian Carpet Institute's IAQ requirements.

.4 Performance rating: to ASTM D5252 or ASTM D5417.

.3 Construction: woven.

.4 Pile fibre: to CAN/CGSB-4.129.

.1 Nylon: BCF.

.1 Type: Nylon 6.6.

.5 Colourfastness to light: to CAN/CGSB-4.2No.18.3.

.6 Colour Fastness to Atmospheric Fading: to AATCC 129 and AATCC 23.

.7 Tufted Carpet backing: to CAN/CGSB-4.129.

.8 Colour Fastness to Atmospheric Fading: to AATCC 129 and AATCC 23.

.9 Lamination Strength of Secondary Backing: to ASTM D3936, minimum acceptable peel strength of [7.4] kg/25 mm.

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.10 Tear Strength: to ASTM D2661, minimum acceptable tear strength in both length and width to be:

.1 11.3 kg for carpets to be installed by glue down installation.

.2 15.9 kg for carpet to be installed by power stretch.

.11 Permanent static control: to AATCC 134, 3000V maximum at 20%RH and 22°C.

.12 Anti-microbial: to AATCC 174, 99% reduction, 0% growth.

.13 Stain resistance: to AATCC 175, [8].

2.3 ACCESSORIES

.1 Base:

.1 Carpet base: 100 mm high, same material, colour, pattern and texture as adjoining carpet. Bound edge. Vinyl cap strip to accommodate carpet base thickness, colour to match carpet.

.2 Carpet tackstrips: types recommended by carpet manufacturer.

.3 Seaming tape: types recommended by carpet manufacturer for purpose intended.

.4 Seaming sealer adhesive: type recommended by carpet manufacturer for purpose intended.

.5 Binder bars: aluminum

.6 Adhesive:

.1 Multi-purpose adhesive type: recommended by carpet manufacturer for direct glue down installation.

.2 Pressure sensitive type: recommended by carpet manufacturer for direct glue down installation of modular carpet or speciality backed carpets.

.7 Carpet protection: non-staining heavy duty kraft paper.

.8 Concrete floor sealer: to CAN/CGSB-25.20, Type 1.

.9 Subfloor patching compound: Portland cement base filler, mix with latex and water to form a cementitious paste.

Part 3 Execution

3.1 SUB-FLOOR TREATMENT

.1 Concrete shall be inspected to determine special care required to make it a suitable foundation for carpet. Cracks [3] mm wide or protrusions over [0.8] mm will be filled and levelled with appropriate and compatible [latex] [polymer fortified] patching compound.

.2 Do not exceed manufacturer's recommendations for patch thickness.

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.3 Large patch areas are to primed with a compatible primer.

.4 Concrete substrates shall be cured, clean and dry.

.5 Concrete substrates shall be free of paint, dirt, grease, oil, curing or parting agents, and other contaminates, including sealers, that may interfere with the bonding of the adhesive.

.6 Wherever a powdery or porous concrete surface is encountered, a primer compatible with the adhesive shall be used to provide a suitable surface for glue-down installation.

3.2 PREPARATION

.1 Prepare floor surfaces in accordance with CRI 104 Standard for Installation of Commercial Carpet.

.2 Pre-condition carpeting following manufacturer's printed instructions.

3.3 INSTALLATION

.1 Install carpeting and undercushion using minimum of pieces.

.2 Install in accordance with manufacturer's printed instructions and in accordance with Carpet and Rug Institute Standard for Installation of Commercial Carpet, CRI 104.

.3 Install carpet and undercushion after finishing work is completed but before demountable office partitions and telephone and electrical pedestal outlets are installed.

.4 Finish installation to present smooth wearing surface free from conspicuous seams, burring and other faults.

.5 Use material from same dye lot. Ensure colour, pattern and texture match within any one visual area. Maintain constant pile direction.

.6 [Hot melt] [Adhesive] seams and cross-joints. Seam edges must be sealed.

.7 Fit neatly around architectural, mechanical, electrical and telephone outlets, and furniture fitments, around perimeter of rooms into recesses, and around projections.

.8 Install carpeting to underfloor duct system and to access covers.

.9 Install carpeting in pan type floor access covers.

.10 Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

.11 Install carpet smooth and free of bubbles, puckers, and other defects.

3.4 CARPET TACKSTRIPS AND BINDER BARS

.1 Install carpet grippers at junctions of walls and vertical surfaces. Secure gripper to prevent movement.

.2 Install binder bars at exposed carpet edges and centre under doors in door openings.

3.5 UNDERCUSHION INSTALLATION

.1 Install undercushion fully adhered using minimum number of pieces. Secure undercushion to prevent shifting.

.2 Butt edges firmly together. Install to edge of gripper and tape top of joints. Remove bubbles and slightly stretch.

.3 Secure undercushion at projections and penetrations, and where cut to contours and ramps.

.4 Offset undercushion seams at least 300 mm from carpet seams.

3.6 DIRECT GLUE DOWN CARPET

.1 Apply adhesive and install carpeting over undercushion in accordance with manufacturer's written instructions, by direct glue-down method.

3.7 STRETCH-IN CARPET

.1 Install carpeting over undercushion and secure at carpet grippers in accordance with manufacturer's written instructions.

3.8 SEAMS

.1 Seal edges of cut-outs with binding method.

.2 Carpet visibility of seams and joints to acceptable industry standards.

3.9 BASE INSTALLATION

.1 Install bound edge carpet base to match adjacent carpeting.

.2 Attach carpet to wall with adhesive. Neatly fit against floor carpet and into cap strip.

.3 Extend floor carpeting over cove, up wall and into capstrip to form cove carpet base.

.4 Install resilient base in accordance with Section 09 65 19.

3.10 PROTECTION OF FINISHED WORK

.1 Vacuum carpets clean immediately after completion of installation. Protect traffic areas.

.2 Prohibit traffic on carpet for a period of 24 hours until adhesive is cured.

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.3 Install carpet protection to satisfaction of Consultant.

END OF SECTION

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Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 00 - Closeout Submittals.

.3 Section 09 22 16 - Non-structural Metal Framing.

.4 Section 06 10 10 - Rough Carpentry: Wood strapping.

.5 Section 09 51 13 – Acoustic panel Ceiling.

.6 Section 04 21 13 – Masonry.

.7 Section 06 40 00 – Architectural Woodwork.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM International)

.1 ASTM C423-[01], Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.34-[M86], Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

.2 CAN/CGSB-92.1-[M89], Sound Absorptive Prefabricated Acoustical Units.

.3 Canadian Standards Association (CSA International)

.1 CSA B111-[1974(R1998)], Wire Nails, Spikes and Staples.

.4 Underwriter Laboratories of Canada (ULC)

.1 CAN/ULC-S702-[97], Thermal Insulation, Mineral Fibre, for Buildings.

1.3 SAMPLES

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit one 300 x 300 sample of acoustic panel.

1.4 ENVIRONMENTAL REQUIREMENTS

.1 Commence installation after building enclosed and dust generating activities are completed.

.2 Permit wet work to dry prior to commencement of installation.

.3 Maintain uniform minimum temperature of 15°C and relative humidity of 20- 40% prior to, during and after installation.

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1.5 WASTE MANAGEMENT

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal paper, plastic, polystyrene, and corrugated cardboard, packaging material in appropriate on-site bins for recycling.

1.6 EXTRA MATERIALS

.1 Provide acoustical units for maintenance use amounting to 2% of gross wall area for each pattern and type required for project.

.2 Provide sufficient adhesive to install extra material provided.

.3 Extra materials to be from same production run as installed materials.

.4 Clearly identify each package of acoustical units including colour and type, and each container of adhesive.

.5 Store where directed by Consultant.

Part 2 Products

2.1 MATERIALS

.1 <u>Type 1: Fabric Acoustic Panels (FAB):</u>

.1 Supply and install surface mounted panels for use in Library.
.2 Acoustical construction products must:
  .1 Not require being labelled as poisonous, corrosive, flammable or explosive under the Consumer Chemical and Container Regulations of the Hazardous Products Act.
  .2 Be accompanied by detailed instructions for proper handling and installation so as to minimize health concerns.
.3 Composition: Fiberglass with resin-hardened edges with 25% recycled content.
.4 Panels shall be square edged with mechanical butt joints. A Flame Spread rating shall not exceed 25 and NRC-0.80 in accordance with ASTM C423.
.5 Finish: Fabric finish in three colours to be selected by Consultant from Manufacturer's standard colour range.
.6 Panel size: As indicated on drawings.
.7 Mounting method: Z-clips.
.8 Acoustic Insulation: CAN/ULC S702; 63 mm thick acoustic insulation "Fiberglass Noise Stop Blanket".
.9 Screws: Non corrosive finish, type recommended by acoustic unit manufacturer.
.10 'Soundsoak' by Armstrong (Contact: Ruth Shannon) or 'Acoustical Panel' by Decoustics, Wallworks 'Fabri-Lok' Tensioned Fabric System (Contact Darcey Jerrom 877 829-2550 Ext. 35), Conwed by Owens Corning, AP Impact Acoustical Panels by Sound Concepts or approved alternative manufacturer.

.2 Type 2: Perforated Wood Acoustic Panels (PWP)

.1 Core: FSC-certified fire retardant particle board with face-cut veneer.
.2 Finish: Face-cut veneer finish to be selected by Consultants in manufacturer full colour range with perforated option.
.3 Panel size: as indicated on drawings.
.4 Attachment method: Wall splines or z-clips.
.5 Acceptable Product: 'Woodworks' W2 with round perforations in straight pattern in maple or light cherry finish complete with solid wood peak corner (square) edge banding as manufactured by by Armstong, Atkar (905 648-7580), WoodTrends (dist. by Wallworks Acoustic Arch. Products 647 808-5450) or Decoustics (dist. by Kinetics Noise Control 905 670-4922), or by Norton Industries as distributed by Acoustex Group (604 720-0024) or by ACGI Wood as distributed by Rieger Architectural Products..
.6 Location: Refer to drawings and Room Finish Schedule.

.3 Type 3: Tectum Acoustic Panels (TEC)

.1 Use only undamaged, single pieces of 600 mm x 2400 mm nom. x 25 mm thick Tectum board. Material shall be ULC rated for fuel contributed, flame spread and smoke development in compliance with Ontario Building Code.
.2 Locations: refer to drawings and Room Finish Schedule
.3 Colour: pre-painted a custom colour to Architect's selection; installed with wood trim by Section 06 40 00.
.4 Acceptable alternate: Acoustiplank manufactured by Acoustex (tel: 905-692-0916)
.5 Provide solid maple or birch wood trim with clear satin finish, around perimeter of groupings.

.2 Metal Framing: 64 mm deep metal furring channels

.3 Acoustic Insulation: 63 mm thick acoustic insulation "Fiberglass Noise Stop Blanket".

Part 3 Execution

3.1 EXAMINATION

.1 Examine carefully surfaces to which panels will be attached and report defects to the Architect. Commencement of installation will signify complete acceptance of substrate.

3.2 INSTALLATION OF TECTUM PANELS

1. Fasten metal furring channels to wall at 600 mm O.C. and at perimeter to receive panels, insulation and wood trim. Refer to detail drawings.

2. Install acoustic insulation to suitable friction fit between channels.

3. Fasten Tectum panels, long dimension to the vertical, to furring using suitable self tapping screws at maximum 300 mm O.C.

4. Install wood surround trim. Refer to Section 06 40 00.

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3.3 INSTALLATION OF PANELS

1. Fasten zee clips to wall-shim, as required, for level and even appearance.

2. Install insulated panels on clips. Provide vandal resistant fastening and metal trim.

3.4 CLEANING

.1 Keep acoustic installation and all components clean. Remove blemishes immediately.

3.5 PROTECTION

.1 Use cardboard to protect finished acoustical wall treatment from damage.

.2 Remove prior to substantial completion.

END OF SECTION

□

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 06 40 00 - Architectural Woodwork.

.3 Section 05 12 23 – Structural Steel for Buildings.

.4 Section 05 50 00 – Metal Fabrications.

.5 Section 08 11 14 – Metal Doors and Frames.

.6 Section 09 91 27 – Finish and Colour Notes.

.7 Section 09 91 30 – Door and Room Finish Schedule.

1.2 REFERENCES

.1 Architectural Painting Specifications Manual, Master Painters Institute (MPI).

.2 Ontario Painting Contractors Association (OPCA) Architectural Specification Manual - referenced as OPCA Manual, latest Edition. Paint formulations and methods referred to herein refer to this Manual. If contractor is unfamiliar with this reference standard, contact the OPCA at (416) 498-1897.

1.3 WARRANTY

.1 At outset of the contract, contractor to register with the OPCA for the inspection service paid for from Cash Allowances.

.2 Upon completion of the inspection program, contractor to furnish an OPCA 2 Year Guarantee. The Guarantee shall warrant that the work has been performed with respect to the standards and requirements incorporated in the OPCA specification manual-latest edition.

1.4 ENVIRONMENTAL PERFORMANCE REQUIREMENTS

.1 Do not apply paint finish in areas where dust is being generated.

.2 Conform to requirements of OPCA Manual.

.3 Comply with the requirements of Section 01 35 30- Health and Safety.

1.5 JOB MOCK-UP

.1 Complete a mock-up room to be reviewed and approved by Owner, Consultant, and OPCA Inspector for approval on application of block filler and finish paint coats.

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1.6 SCHEDULING OF WORK

.1 Submit work schedule for various stages of painting to Consultant for approval. Submit schedule minimum of 72 hours in advance of proposed operations.

.2 Obtain written authorization from Consultant for any changes in work schedule.

.3 Schedule painting operations to prevent disruption of occupants in and about the building.

1.7 EXTRA MATERIALS

.1 Submit one - four litre can of each type and colour of primer and finish coating. Identify colour and paint type in relation to established colour schedule and finish system.

.2 Deliver to Contractor and store where directed.

1.8 DELIVERY, HANDLING AND STORAGE

.1 Labels shall clearly indicate:

.1 Manufacturer's name and address.
.2 Type of paint or coating.
.3 Compliance with applicable standard.
.4 Colour number in accordance with established colour schedule.

.2 Remove damaged, opened and rejected materials from site.

.3 Provide and maintain dry, temperature controlled, secure storage.

.4 Observe manufacturer's recommendations for storage and handling.

.5 Store materials and supplies away from heat generating devices.

.6 Store materials and equipment in a well ventilated area with temperature range 7^0C to 30^0C.

.7 Store temperature sensitive products above minimum temperature as recommended by manufacturer.

.8 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Consultant. After completion of operations, return areas to clean condition to approval of Consultant.

.9 Remove paint materials from storage only in quantities required for same day use.

.10 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.

.11 Fire Safety Requirements:

.1 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

.2 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

1.9 FINISHES AND COLOURS

.1 Review the requirements outlined in Section 099127, Finish Schedule and Colour Notes. A separate colour schedule will be issued after contract award.

.2 Allow for 10 colours total from all formulations for this project including room wall accent colours.

1.10 WASTE MANAGEMENT AND DISPOSAL

.1 Paint, stain and wood preservative finishes and related materials (thinners, solvents, etc.,) are regarded as hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from Provincial Ministries of Environment and Regional levels of Government.

.2 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.

.3 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.

.4 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into ground the following procedures shall be strictly adhered to:

.1 Retain cleaning water for water-based materials to allow sediments to be filtered out.

.2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.

.3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.

.4 Dispose of contaminants in an approved legal manner in accordance with hazardous waste regulations.

.5 Empty paint cans are to be dry prior to disposal or recycling (where available).

.5 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.

.6 Set aside and protect surplus and uncontaminated finish materials: galvanized touch up; wood stain, prefinished metal touch up paint. Deliver to or arrange collection by recycling organization for verifiable re-use or re-manufacturing.

.7 Close and seal tightly partly used sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.

Part 2 Products

2.1 MATERIALS

.1 Acceptable Manufacturer's: Where OPCA code numbers are not referenced, use Products from one of the following manufacturers:

.1 Benjamin Moore & Co. Ltd.
.2 ICI (Glidden) Paints.
.3 Para Paints.
.4 Pratt & Lambert Inc.
.5 The Sherwin-Williams Company.

.2 Manufacturers of intumescent coatings having Product considered acceptable for use:

.1 A/D Fire Protection Systems Inc.
.2 Carboline.

.3 Paint materials for paint systems shall be products of a single manufacturer.

.4 Acceptable products: Per Chapter 5 OPCA Manual and as listed.

.5 Paint materials for each paint system to be products of a single manufacturer.

.6 Use low-VOC and low-odour paints only.

Part 3 Execution

3.1 GENERAL

.1 Prepare surfaces to receive paint per Chapter 3 OPCA Manual.

.2 For doors supplied by Relocatable Contractor as indicated in the Door Finish schedule, clean and re-prime all surfaces prior to painting. Refer to AD drawings for Door Finish Schedule.

3.2 APPLICATION

.1 Sand and dust between each coat to remove defects visible from distance up to 1.5 m.

.2 Finish closets and alcoves as specified for adjoining rooms.

.3 Apply each coat at the proper consistency. Each coat of finish should be fully dry and hard before applying the next coat, unless the manufacturer's instructions state otherwise.

.4 Method of application to be as approved by Consultant. Conform to manufacturer's application instructions unless specified otherwise.

.5 Brush and Roller Application:

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.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.

.6 Spray application:

.1 Provide and maintain equipment that is suitable for intended purpose, capable of properly atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.

.2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.

.3 Apply paint in a uniform layer, with overlapping at edges of spray pattern.

.4 Brush out immediately all runs and sags.

.5 Use brushes to work paint into cracks, crevices and places which are not adequately painted by spray.

.7 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access and only when specifically authorized by Consultant.

.8 Apply coats of paint as a continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.9 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.10 Sand and dust between coats to remove visible defects.

.11 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.

.12 Finish inside of cupboards and cabinets as specified for outside surfaces.

.13 Finish closets and alcoves as specified for adjoining rooms.

.14 Finish top, bottom, edges and cut-outs of doors after fitting as specified for door surfaces.

3.3 MECHANICAL/ELECTRICAL EQUIPMENT

.1 Refer also to Finish Notes in Section 099127- Finish and Colour Notes.

.2 Paint exposed conduits, pipes, hangers and other mechanical and electrical equipment occurring in finished areas as well as inside cupboards and cabinet work. Colour and texture to match adjacent surfaces, except as noted otherwise. Coordinate with

mechanical trades applying banding and labeling after pipes have been painted. Do not paint white PVC covers on exposed mechanical water, drain and other lines

.3 Paint gas piping standard yellow where visible on roof or in service spaces. Do not paint gas meter or gas equipment in wall niche yellow—colour to later selection by Architect.

.4 Paint surfaces inside of ductwork and elsewhere behind grilles where visible using primer and one coat of matte black paint.

.5 Paint both sides and edges of plywood backboards for equipment before installation.

.6 Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

3.4 PAINT SYSTEMS

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

3.5 INTERIOR FINISHES

.1 Wood, where applicable:

.1 Doors, miscellaneous trim: INT. 1-A, Alkyd Semi-Gloss Finish, Premium Grade

.2 Casework and miscellaneous wood items:

.1 Exterior surfaces: INT. 1-A, Alkyd Semi-Gloss Finish, Premium Grade

.2 Interior surfaces: INT. 1-A, Alkyd Semi-Gloss Finish, Premium Grade

.3 Wood Benches and Upper Shelves: INT. 2-F, Stained Alkyd Satin Finish, Premium Grade.

.4 Gym Storage Shelves: INT. 3-A, Stain Finish, Custom Grade

.2 Gypsum board: INT.4-B, Latex Eggshell Finish, Premium Grade.

.3 Acoustical wall panels: INT. 6-A, Latex Flat Finish, Custom Grade.

.4 Concrete Block: INT.8-C -modified; Latex Semi-Gloss Finish, Premium Grade. Modified system refers to all work where 2 full coats of block filler shall be applied.

.5 Concrete Block: Alkyd Gloss Finish, Premium Grade - shown on Room Finish Schedule as P-GF (Paint - Gloss) finish.

.6 Concrete Floors; refer to Section 03 35 05- Concrete Floor Hardeners and Sealers for liquid sealer.

.7 Exposed Cast in Place Concrete ceilings: INT. 8-A, Latex Flat Finish, Premium Grade

.8 Exposed Precast Concrete ceilings: INT. 8-A, Latex Flat Finish, Custom Grade

.9 Miscellaneous metal:

.1 Primed: INT. 12-A, Alkyd Semi-Gloss Finish, Premium Grade

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.2 Galvanized: INT. 13-A, Alkyd Semi-Gloss Finish, Premium Grade

.3 INT. 12-G, Water based Epoxy finish, two coats on a rust inhibitive primer for all exposed steel on stairs including exposed steel nosing at porcelain tile stair landing, stair stringer, pickets and railings.

.4 Provide a water-based latex/acrylic primer to steel decks in exposed areas prior to finish painting.

.10 Galvanized metal: INT. 13-A, Alkyd Semi-Gloss Finish, Premium Grade

.11 Hollow Metal Doors and Frames: Without exception, all wipecoated Galvanized Hollow Metal Doors, Frames and Screens, interior and exterior shall be field cleaned with solvent, galvanized prime paint coated and then finished with INT. 13-A Premium Grade, Gloss Finish. Base coat primer shall be submitted for review in advance or door/frame painting shall be rejected by Consultant. For exterior hollow metal frames, if any, adjacent to aluminum windows, provide finish coat as an exterior premium grade metallic gloss finish to match anodized windows or Aluminum Composite panels. Colour to be confirmed by Architect during construction.

.12 Gymnasium Painting:

.1 Painting of gymnasium acoustic deck and structural steel is part of painting contract.

.2 Allow for single colour for deck and joists.

.3 Allow for complete painting of all hangers and equipment brackets including but not limited to basket ball baskstops, electrical pipe rails, mechanical equipment fan cages, etc.

.4 Allow for accent painting to walls and over proscenium.

.13 Other Painting:

.1 Painting of Elevator/Lift doors and frame is part of this contract.

.2 In the following rooms with exposed metal deck including mechanical rooms and storage rooms:

.1 Allow for single colour for deck and joists.

.2 Allow for complete painting of all hangers and equipment brackets including but not limited to, electrical and mechanical equipment, etc.

.3 Painting deck/floor slab and structural steel is part of painting contract.

3.6 EXTERIOR PAINTING

.1 Pavement markings: EXT. 7-A, Zone Marking Alkyd Finish, Premium Grade.

.2 Steel columns at exterior (other than those to receive intumescent paint finish): EXT. 6F, Two component epoxy finish, Premium Grade. Custom colour.

.3 Miscellaneous metal:

.1 Primed: EXT. 11-A-Gloss, Premium Grade

.2 Galvanized: Touch up any welds, cuts or damage with ‘Galvafroid’ Paint by W.R. Meadows prior to prime and finish coats.; Finish System EXT. 12-A-Gloss, Premium Grade

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.4 Galvanized Structural Steel: Touch up any welds, cuts or damage with 'Galvafroid' Paint by W.R. Meadows prior to prime and finish coats.; Finish System: EXT. 12-A-Gloss, Premium Grade.

.5 Steel - high heat: EXT. 15-A

3.7 INSPECTIONS

.1 Register with OPCA at the outset of the project.

.2 Provide Architect with all formulations at outset of project.

.3 Provide inspections by representative of the Ontario Painting Contractors Association (OPCA) in compliance with the terms of the Canadian Painting Contractors Association Inspection and Guarantee Program.

.4 Cooperate at all times with the paint inspection agency in the performance of their duties as required as part of the work of this Section.

.5 OPCA inspection costs to be paid from Cash Allowance.

END OF SECTION

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Part 1 General

1.1 GENERAL FINISH NOTES

.1 The Material and Colour Schedule will be issued by the Consultant after tender. It shall be read in conjunction with the Drawings, Specifications, Room Schedule and Door Schedule. Colour and material references named will be based on one manufacturer, as carried by the Contractor or, in the case that no specific manufacturer is carried, based on the Consultant's choice.

.2 Approved alternative manufacturers will be acceptable only as indicated in the specifications. However, approved alternate products submitted must match the products named in the Specification to the Consultant's selection. Alternate products other than those named in the specifications will not be allowed unless previously approved by the Consultant.

.3 Consult Consultant prior to painting any surface not included in the formulae as listed.

.4 Final colour for exterior painted surfaces and prominent interior areas shall be approved on the job site by the Consultant.

.5 Paint samples: Contractor to submit paint samples for all areas required to "Match Adjacent Finish".

.6 All similar paint formulations are to be identical when dry. Variations in tone, texture or sheen shall not be accepted.

.7 Submit two 300 mm x 300 mm paint samples of each colour required for approval by the Architect.

.8 Exact locations of accent paint called for in the Material and Colour Schedule, to be issued after Contract award, not specifically identified on the drawings are to be verified on site with the Consultant.

1.2 EXTERIOR FINISH NOTES

.1 All exposed metal (doors, frames, lintels, stairs, handrails, mechanical equipment, etc.) to be painted except for prefinished metal louvres, stainless steel, and aluminum. Mechanical equipment is to be painted whether delivered to the site prepainted or not (exhaust fans, goosenecks, exhaust stacks, supports, HVAC units, HRU units, etc.). Colours to match adjacent material-generally either to match brick or tan to match flashing or siding material. Do not paint exposed white PVC pipe covers on interior. Architect will advise on jobsite which other items mentioned above, if any, do not require painting.

.2 All unfinished metal work provided by landscaping is to be painted by Section 099122-Painting.

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1.3 INTERIOR FINISH NOTES

.1 All heating units, recessed convectors, grilles, pipes, access panels, hangers and miscellaneous exposed metal work (except stainless steel or anodized aluminum) to be painted to match the surfaces on which they occur unless noted otherwise on the colour schedule, prefinished in suitable colour or directed by the Consultant. If prefinished equipment is damaged, it shall be re-painted. Painting to be by formulations specified in Section 09 91 12- Painting.

.2 All interior fitments, casework, millwork, etc. to be melamine unless otherwise noted. Refer to Sections for specific requirements regarding materials, construction, finishes and hardware. Note that drawer and cupboard interiors are to be considered as exposed surfaces and will therefore be finished.

.3 Do not paint over nameplates, identification tags, etc.

.4 Make good all existing surfaces and finishes that are damaged during construction.

END OF SECTION

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1 General

1. SUMMARY

.1 Section Includes:
- .1 Compliance with requirements of the sections of Division 1 of the specifications.
- .2 Requirements for providing the concrete floor sealer parts of the Work.

2. SUBMITTALS

.1 Product Data:
- .1 Submit manufacturer's technical data, installation instructions, maintenance instructions and general recommendations for concrete floor sealer.

.2 Samples:
- .1 Provide samples as specified in section 01 33 00 Samples, supplemented as follows:
  - .1 Submit 300 mm x 300 mm square sample of concrete floor sealer applied to a smooth trowel finish concrete paver.
  - .2 Submit each type of sample in triplicate.
  - .3 Modify and resubmit samples as many times as may be necessary to obtain Consultant’s approval.

.3 Closeout Documents:
- .1 Provide manuals that contain the floor sealer manufacturer's maintenance and repair manual. The maintenance and repair manuals shall give specific warning of maintenance practices, Products and materials which may cause damage and disfigurement.

3. QUALITY ASSURANCE

.1 Single Source Responsibility:
- .1 Obtain concrete floor sealer Products from the same manufacturer with not less than ten (10) years of successful experience in manufacturing and installing principal materials described in this section. Contractor must have completed at least five projects of similar size and complexity. Provide secondary materials only of type and from source recommended by manufacturer of primary materials.

.2 Pre-installation Meeting:
- .1 Hold a pre-installation meeting at the Place of the Work.

.3 Mock-up:
- .1 At site, under manufacturer's supervision, apply for approval 9 m2 of each type of complete floor finish in area designated, to match submitted samples. When approved, site applied sample to be standard for appearance, texture, workmanship, etc. All Work to conform to this sample.

4. DELIVERY, STORAGE AND HANDLING

.1 Deliver Products to the Place of the Work. Check material for completeness and shipping damage prior to job start.

.2 All materials must be factory pre-weighed and pre-packaged in single, easy to manage batches to eliminate on site mixing errors. No on site weighing or volumetric measurements allowed.

.3 Store Products in a dry, enclosed area protected from exposure to moisture. Temperature of storage area shall be maintained between 16° and 32°C.

5. PROJECT CONDITIONS

.1 Environmental Requirements:
- .1 Concrete substrate must be properly cured for a minimum of 30 days.

.2 Temperature:
- .1 Maintain ambient temperature of not less than 18 deg.C/65 deg.F and a floor temperature of not less than 16 deg.C/60 deg.F from 7 days before installation to at least 48 hours after completion of work and maintain relative humidity not higher than 40% during same period.

.3 Moisture:
- .1 Ensure substrate is within moisture limits prescribed by concrete floor sealer manufacturer.

.4 Protection:
- .1 Areas to accept concrete floor sealer shall be free of other trades during, and for a period of 24 hours, after floor installation.

.5 Manufacturer’s Representative:
- .1 Manufacturer's representative must be on job site at start of installation.

6. WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate packaging material for recycling in accordance with the Waste Management Plan.

.2 Remove from the Place of the Work and dispose of packaging materials at appropriate recycling facilities.

.3 Dispose of unused finish and adhesive materials at official hazardous material collections site.

7. WARRANTY

.1 Furnish a single, written warranty covering both material and workmanship for a period of three (3) full years from date of Substantial Performance of the Work. The Warranty shall cover defects such as cracking, delamination under impact and under heavy loaded carts and under thermal shock, and excessive wear.

2 Products

1. MATERIALS

.1 Manufacturers:
  .1 The specifications are based on Products manufactured by Sika Canada Inc. Products by Duochem Inc, division of Corrosion Services, CPD Construction Products, Niagara Protective Coatings, Selby/Ucrete,. Stonhard Ltd. Euclid, Mapei or other approved manufacture may be approved on condition of being able to furnish evidence of equivalency or better to the specified Products.

.2 Concrete Floor Sealer System (EWPM)
  .1 General:
    .1 Two-component, clear, water based mat epoxy coating, Sika MRW roller applied two coat system on a sealed/primed substrate.
  .2 Characteristics
    .1 Seamless and very easy to clean.
    .2 Abrasion and chemical resistant.
    .3 No odour typical of solvent based coatings
  .3 Minimum Technical requirements
    .1 Solids content: 100% by weight, 100% by volume.
    .2 Pot life90 mins.
    .3 Application method: Brush, or roller.
    .4 Number of coats: Two.
    .5 Dry film thickness per coat: as per manufacturer's instructions
    .6 Cleaning solvent: Warm water.
    .7 Cure time: Touch dry: 4-5 hours.
      .1 Hard dry: 16-18 hours.
      .2 Complete cure: 7 days.
    .8 Recoat time: 16 hours.
  .4 Minimum Physical properties
    .1 Abrasion resistance: 175 mg loss per ASTM D 4060 CS-17 wheels 1000 revolutions 1000 gr/wheel.
    .2 Tensile strength 2.1 MPa per ASTM D 2370 (2.8 mils D.F.T.)
  .5 Primer: as recommended by manufacturer.

3 Execution

1. WORKMANSHIP

.1 General
  .1 Handle, mix and apply Products as per the Product manufacturer's printed surface preparation and application specifications, and as specified in this specification section 09 97 24.
  .2 Application tools and equipment shall be as per the Product manufacturer's printed requirements.

2. PREPARATION

.1 Prepare concrete by sanding smooth and for removal of bond inhibiting substances.
.2 Apply as per manufacturer's instructions.

3. APPLICATION

.1 Apply concrete sealer as indicated.
.2 Rolling direction of each coat shall be the same.

4. FIELD QUALITY CONTROL

.1 The Owner reserves the right to invoke the following material testing procedure at any time, and any number of times during period of flooring application.

.2 The Owner may engage service of an independent testing laboratory to sample materials being used on the jobsite. Samples of material will be taken, identified and sealed, and certified in presence of Contractor.

.3 Testing laboratory will perform tests for any of characteristics specified, using applicable testing procedures referenced herein, or if none referenced, in manufacturer's product data.

.4 If test results show materials being used do not comply with specified requirements, the Contractor may be directed by Owner to stop work; remove non-complying materials; pay for testing; reapply flooring materials to properly prepared surfaces which had previously been coated with unacceptable materials.

5. CURING, PROTECTION AND CLEANING

.1 Cure concrete floor sealing materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process. Close area of application for a minimum of 24 hours.

.2 Protect concrete floor sealing from damage and wear during construction operation. Where temporary covering is required for this purpose, comply with manufacturer's recommendations for protective materials and method of application. Contractor is responsible for protection and cleaning of surfaces after final coats.

.3 Cleaning: Remove temporary covering and clean flooring just prior to final inspection. Use cleaning materials and procedures recommended by the concrete floor sealer manufacturer.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

1.2 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop Drawings:

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.3 Samples:

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

.4 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site packaging materials at appropriate recycling facilities.

.2 Dispose of recyclable packaging material in appropriate on-site bin for recycling.

Part 2 Products

2.1 MATERIALS

.1 Tack Boards (TB) - As supplied by CPE Design Solutions Inc, ASI or Global School Products Inc.:

.1 **NATURAL CORK TACKBOARDS** 12.7mm (1/2”) factory prelaminated consisting of 6mm (1/4”) thick a.s.p. natural cork laminated to 6mm (1/4”) particle board or masonite substrate under mechanical pressure in maximum panel sizes of 1219mm x 2438mm (4’0” x 8’0”). Bonding of materials by a waterproof adhesive that will not delaminate or rupture at the contact surfaces.

.2 All tackboards shall meet the minimum requirements of the applicable building code and/or Ontario Fire Marshall’s office.

.4 Shop finish rear faces of tackboard units being installed in horizontal sliding trim to a matte black finish.

.5 Refer to Construction Drawings for locations & sizes required.

.6 Tackboard Mounting Heights: Coordinate with interior elevations.

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- Typical (Staff Areas / Rooms / Corridors): 1000mm AFF
- Childcare Classrooms: 1000mm AFF
- Kindergarten Classrooms: Installed vertical. Refer to Interior Elevations.
- Typical Ground Floor Classrooms (Primary Literacy Room and Life Skills Classroom): 800mm AFF
- Second Floor Classrooms: 800mm AFF
- Third Floor Classrooms: 1000mm AFF

.2 Linoleum Bulletin Boards (BB) - As manufactured by FORBO.

.1 FORBO BULLETIN BOARDS (BB) 12.7mm (1/2") thick panels cut to sizes as indicated on drawings.

.2 All bulletin boards shall meet the minimum requirements of the applicable building code and/or Ontario Fire Marshall's office.

.3 Perimeter Trim: extruded aluminum trim for all tackboards and also vertical jambs of chalkboards.

.4 Refer to Drawings for locations & sizes required.

.5 Linseed oil, Forbo Tackboard, surfacing to also be applied to include on inside of all display cases by Section 06 40 00.

.3 White Boards (WB**)** - "Vit-Rite: Rite on, Wipe off" model as supplied by CPE Design Solutions Inc, ASI or Global School Products Inc.:

.1 WHITEBOARD – VITRITE

by architectural school products Ltd., Mississauga, Ontario, consisting of a sandwich type construction composed of face panel, core and balancing rear sheet, in maximum panel sizes of 1524mm (5'0") x 4877mm (16'0") with no joints.

.2 Face Panel – 22 gauge high quality enameling steel base with a porcelain enamel writing surface used to a ground coat of not less than 0.076mm (.003") nor more than 0.127mm (.005") after firing at temperatures between 700°C (1300°F) and 800°C (1500°F) in accordance with the Porcelain Enamel Institute Standards PEI S104 as regards to durability, smoothness of texture, colour continuity and a gloss factor of 6 – 8 as measured by 45° glossometer.

.3 Core – 11.1mm (7/16") impregnated sound absorbing fibreboard laminated under heat and pressure to face panel and back sheet utilizing adhesives that ensure rupturing of the component materials before failure of joint contact surfaces.

.4 Back up balancing sheet – 28 gauge zinc coated stretcher leveled steel in one unjointed section. Overall thickness of Whiteboard lamination shall be 12.7mm (1/2").

.5 Colour: White

.6 Refer to Construction Drawings for locations & sizes required.

.7 Manufacturer's Warranty: warrant White Boards for a period of 10 years against defects due to normal usage and wear.

.8 All whiteboards to have a magnetic surface.

.9 Kindergarten classrooms to not have marker trays.

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.10 All connecting whiteboards to have splice joints. Refer to interior elevations.

.11 White Board Mounting Heights: Coordinate with interior elevations.

- Typical (Staff Areas / Rooms / Corridors): 1000mm AFF
- Childcare Classrooms: 1000mm AFF
- Kindergarten Classrooms: Installed vertical. Refer to Interior Elevations.
- Typical Ground Floor Classrooms (Primary Literacy Room and Life Skills Classroom): 800mm AFF
- Second Floor Classrooms: 800mm AFF
- Third Floor Classrooms: 1000mm AFF

.4 White Board Music Lines: Provide black epoxy painted music lines on whiteboard in Music Room. Quantity and Length shown on Interior Elevations.

.5 White Board, Tack Board and Bulletin Board Fixed Trim: Series 200 to match details and profiles shown on architectural drawings. Aluminum to be 6063-T5 alloy with 0.051 mm thick clear anodized satin finish, free from extruding draw marks and surface scratches; components as follows:

.1 Perimeter Trim: extruded aluminum trim for all tackboards and also vertical jambs of chalkboards; e.g. No. 205.

.2 Divider Bar: extruded aluminum trim to adjacent chalkboard/tackboard panels and adjacent tackboard panels of elevations greater then 2,440 mm; e.g. No. 207.

.3 Marker Tray: extruded aluminum triangular box section for chalkboard elevation only complete with contour fitting end castings; 102 mm projection from finished wall; e.g. No. 212.

.4 Marker Tray Over Millwork: extruded aluminum trims section for elevations mounted directly on or above millwork; 70 mm projection from finished wall; e.g. No. 264.

.5 Refer to Construction Drawings for locations & sizes required.

.6 Back Painted Glass Writing Surface (GWS)

.1 Frameless, seamless, sized to fit entire area noted on drawings within the Co-Lab spaces. Concealed mounting.

.2 Tempered glass at ¼" low iron UltraClearTM

.3 Provide magnetic backing (to receive magnetics)

.4 Backpainted colour to be selected by architect from full range of colours. Allow for four (4) colours.

.5 Acceptable manufacturers: ASI

.7 Lockers, Single Tier: 305 wide x 380 deep x 1828 high Fabricate from cold rolled steel, with plastic bottom shelf (floor), min. Unless noted; lockers will mount on 100 mm concrete base.

.1 Lockers must be fabricated with the following attributes:

1. 14 Gauge Doors
2. 16 Gauge Interior Shelves

□

3. 16 Gauge Slope/Fillers/End Panels
4. 20 Gauge Sides/Backs
5. Solid Plastic Bottom Shelves
6. ASTM D3363 - Ultra Anti-Graffiti Coating Paint with 4H Rating

.2 Locker Count: refer to drawings for quantity of lockers required for entire school

.3 Continuous piano hinge, recessed extruded aluminum lock pocket, metal hasp with no moving part for padlock, individual number plate,

.4 Inside Equipment: 2 metal shelves (one near top and one near mid height), 2 hooks (one on side wall near top and one on side wall at underside of mid height shelf.)

.5 Sloping Tops: pre-finished steel; c/w clips and other attachment devices.

.6 Shelves shall have rolled fronts and rear flanges. Provide 25 mm air space between shelf and back of locker for ventilation. Install shelves at height to be determined by Architect at shop drawing stage.

.7 Colours: Allow for 3 colours: single standard colour for the frame with contrasting doors in two custom colours to later selection by Architect.

.8 Lockers to be installed on a 100 mm concrete base.

.9 Acceptable products: providing they meet or exceed all details of this specification as manufactured by:

.1 Hadrian Manufacturing Inc

.2 Shanahan Manufacturing Ltd

.3 North American Steel Equipment Co. Ltd

.4 Buddsteel Architectural Products Ltd

.5 Decor Tri-Lo Titan II by General Storage Systems

.6 Emperor (modified) by Hadrian.

.7 SML Deluxe (modified) by Shanahan's

.8 'Nova' Lockers by Lincora Canada Inc., as distributed by SP Stalls & Storage, Mount Brydges, ON (519) 264-1494

.9 'Atlas' Lockers by Anthony Steel Manu. Ltd., Brampton, ON (905) 791-9616

.10 ASI Group

.11 Y&M Manufacturing / Mitchell Division 10

.8 Expansion Joint Sealer**:**

.1 Seismic Colorseal by Emseal to be installed where shown on Construction Drawings. Colour to be selected by Consultant.

.9 Safety Release Coat Hook (BH):

.1 Refer to Sections 06 40 00 where specified for Childcare and Kindergarten Cubbies.

.2 This section to supply safety hooks for all other locations, such as barrier free washroom locations.

.3 High strength polycarbonate coat hook with safety release weight under downward pressure to not exceed 12 kg (26 lbs.)

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.4 Supply all suitable mounting hardware for a vandal proof, secure installation using stainless steel sleeve bolts on partition doors or panels. Do not supply standard Robertson or Phillips head screws.

.5 Colours:

.1 Allow for two (3) colours from Manufacturers standard line

.6 Acceptable Materials: “HenkelHook” as manufactured/distributed by Henkel Diversified Inc, London ON, tel (519) 641-5872.

.7 Locations:

.1 Coat hooks to be mounted in ALL barrier free washrooms & Change Rooms and shall be safety release style and mounted on the side wall.

.2 Childcare and Kindergarten Cubbie Areas & Teachers Closets to be provided by Section 06 40 00.

.8 Samples: submit test data and samples for review as specified in Section 013330 – Submittal Procedures.

.10 Flagpole - Stepped aluminum flagpole: Model No. TS 30 as manufactured by Daf Indal Ltd.

.1 Cone tapered models meeting or exceeding these criteria will ne accepted as alternate products.

.2 minimum 9150 mm high (30'), complete with tilt anchor base, base cover, and concrete anchors.

.3 Shaft to be fitted with an internal #12 braided nylon halyard revolving truck system, stepped shaft aluminum alloy 6063-T6 (butt 127 o.d., butt wall 4.8 mm).

.4 Ball -152 mm in diameter, color ball: clear anodized.

.5 Finish of pole and accessories: Clear anodized.

.6 Base cover spun aluminum alloy 6061, 254 mm in diameter, wall thickness of 2.3 mm.

.7 Acceptable Alternates: John Ewing or All-Canadian Flagpole Co..

.8 Quantity: 1; Location: as shown on Drawing SP.1 and AD 212.

.11 Electric Projector Screen (Gym/Stage):

.1 Projection Screen: 110V power supply; dual motors, one motor operating the closure door and the second motor operating the projection screen; with remote control and switched operation; sizes and surfaces as indicated below; Cosmopolitan Electrol by Da-Lite Screens Inc.

.2 Projector Screen Components:

.1 Gym Screen: Wall Mounted; 2670mm x 3560mm size viewing surface, heavy duty matte white; 450mm block top skirt, black masking borders; 10mm OD tubular steel bottom slat, with baked enamel finish and plastic end caps.

.2 Enclosure: flat back design, rectangular steel case, baked enamel finish; for wall mount application; with fully automatic ceiling closure doors and in-the-roller motor mounting system; one required for each screen.

.3 Remote Control System: dual motor low voltage control system with three-button wireless radio frequency remote receiver and transmitter; separate UP, DOWN, and STOP commands, complete with control

module, three-button keyed wall switch, box, cover plate and three button control radio frequency transmitter with receiver; one required for each screen.

.3 Location: 1 required at Gym Stage.

.4 Shop Drawings: Submit shop drawings in accordance with Section 01300 Submittals.

.12 Wire Storage System:

.1 Welded wire mesh partition and swing doors as manufactured by Spinnaker.

.2 provide a complete assembly, complete with hinges and locking hasps; for application room wood storage compartment.

.3 Refer to Detail AD 510.

.13 Bicycle Racks: Model MBR400-7-S as manufactured by Maglin or approved alt. by Belson or Landscape Structures Inc.

.1 Prefinished powdercoat colour: Black.
.2 Each unit to be supplied with anchor assembly for individual anchoring to concrete footing.
.3 Refer to Site Plan for detail.
.4 Coordinate installation with asphalt paving installation.
.5 Quantity: Refer to Site Plan for location and quantity.

.14 Change Table with integrated sink:

.1 Change table with sink, manufactured by Totmate.
.2 Model 8543A, Maple finish, right handed.
.3 Include pull-out toddler walk-up.
.4 Location & Quantity: Refer to drawings (Childcare and Child & Family areas).

.15 Coat Rod and Hooks:

.1 Student line Model STL 75 as manufactured by Architectural School Products, Mississauga. Mounted to underside of cubbies. Refer to AD drawings for locations. Mount directly to underside of upper cubbies.

.16 Stainless Steel Worktables:

.1 Rear Upturn, Stainless Steel Tubular Base
Tabletop: 1 5/8" diameter 180 degrees rolled edge on front. Ends are turned down 90 degrees providing for flush installations when required. 16 gauge 300 series polished stainless steel. Crossbracing 1 1/4" diameter: Heavy gauge type 304 stainless steel. Aluminum castings join crossbraces, legs and rear brace. Legs 1 5/8" diameter: Units 96" to 120" long come with six legs; Units 132" and 144" come with eight legs. Patented uni-lok gusset system (patent # 5,165,349): gussets are recessed into hat channel, reducing lateral movement. Heavy gauge stainless steel. Galvanized gussets. 1" adjustable stainless steel feet
.2 By Eagle Group or alternate meeting or exceeding these specifications.
.3 Quantity 1
.4 Room Kitchen 419
.5 Dimensions: Refer to drawings
to suit W x H x D of adjacent millwork countertop
.6 Detailed shop drawings to be provided prior to fabrication



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.17 Science Room Moveable Tables (ST):

.1 Provide moveable science room tables with chemical resistant top.
.2 Diversified Maple Lab Table - Epoxy Resin Top
.3 Size to be 24” wide x 60” long by 36” high.
.4 Units may be fabricated by millwork contractor, or purchased.
.5 Model #DBT-2460EH https://www.hertzfurniture.com/Lab-Tables--Diversified-Maple-Lab-Table---Epoxy-Resin-Top--12849--mo.html
.6 Manufacturer: Diversified Woodcrafts
.7 Weight: 150 lbs.
.8 Adjustable Glides Leg
.9 Finish: Acrylic Finish
.10 Leg Specs: Solid Wood, 2.25"square
.11 Seating Capacity: 2
.12 Tabletop Core Material: Epoxy
.13 Tabletop Edge: Self Edge
.14 Tabletop Support: Solid-Wood Apron
.15 Tabletop Surface Material: Solid Epoxy
.16 Tabletop Thickness: 1"
.17 Tabletop Weight Capacity: 500 Lbs. Evenly Distributed
.18 Warranty: Limited Lifetime
.19 Location: Science Room. Designation ‘ST’.



.18 Exterior Semi-Recessed (Buried) Garbage Container

.1 EarthBin front loader truck collected, semi-recessed Garbage containers as manufactured by EarthBin,
.2 Capacity: 6.5 cubic yard (5m3) each.
.3 Lids:
.1 Standard Garbage, square opening lid for one unit. Black.
.2 Large Carboard Slot for second unit. Blue.
.4 Framing panel colour: cedar
.5 Include excavation, supply and install of units.
.6 Location: 2 units; refer to Site Drawing.
.7 Acceptable alternates meeting or exceeding the above specifications. Must be front loader truck collected units.
.8 Refer to drawing 3/SP2.

.19 Galvanized Steel Stock Tank

.1 Behlen 2’x2’x6’ Oval Stock Tank galvanized steel planter for garden bed.
.1 169 gallon, product #10038122
.2 Locations: Outdoor play areas (refer to drawing LP.2)

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

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3.2 INSTALLATION

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

3.3 DEMONSTRATION AND TRAINING

.1 Provide demonstration of operation to the Owner and his representatives.

.2 Provide training for operation, maintenance and repairs.

3.4 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Clean surfaces after installation using manufacturer's recommended cleaning procedures.

.3 Clean aluminum with damp rag and approved non-abrasive cleaner.

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

END OF SECTION

□

Part 1 General

1.1 RELATED WORK

.1 Section 01 33 00 - Submittal Procedures.

1.2 WORK INCLUDED

.1 Supply and install exterior signage as specified and listed. All signage may not be shown on the drawings.

.2 Supervision, inspection and checking of signage as installed on site.

1.3 REFERENCES

.1 All fire route signage to be fabricated in strict accordance with the signage standard of the Municipality where the site is located. All other exterior signage such as stop signs, one-way signs, do not enter signs, etc., shall be to M.O.T. standard.

.2 Aluminum Association, Inc. (AA)

.1 Designation System for Aluminum Finishes -[1997].

.3 American Society for Testing and Materials (ASTM)

.1 ASTM A653/A653M-[01a], Standard Specification for Steel Sheet, Zinc-Coated, (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM B32-[00], Standard Specification for Solder Metal.

.3 ASTM B456-[95], Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

.4 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.81-[M90], Air Drying and Baking Alkyd Primer for Vehicles and Equipment.

.2 CAN/CGSB-1.88-[92], Gloss Alkyd Enamel, Air Drying and Baking.

.3 CGSB 31-GP-107Ma-[90], Non-Inhibited Phosphoric Acid Base Metal Conditioner and Rust Remover.

.4 CGSB 41-GP-6M-[1983], Sheets, Thermosetting Polyester Plastics, Glass Fibre Reinforced. Reaffirmation of September 1976.

.5 Canadian Standards Association (CSA)

.1 CAN/CSA-G164-[M92(R1998)], Hot Dip Galvanizing of Irregularly Shaped Articles.

.2 CSAW47.2-[M1987(R1998)], Certification of Companies for Fusion Welding of Aluminum.

.3 CSA W59-[M1989(R2001)], Welded Steel Construction (Metal Arc Welding) (Imperial Version).

.4 CSA W59.2-[M1991(R1998)], Welded Aluminum Construction.

□

.6 Canadian Sheet Steel Building Institute (CSSBI)

.1 Sheet Steel Facts # 6, Metallic Coated Sheet Steel for Structural Building Products-[July 1995].

.7 The Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual - [March 1998].

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

1.5 SAMPLES

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

1.6 QUALITY ASSURANCE

.1 Welding Certification in accordance with CSA W47.2.

1.7 SIGNAGE LIST

.1 A full Signage list is listed below and shown on site plan drawing.

1.8 GUARANTEE

.1 Submit a written Guarantee to the Board, that all work of this Tender shall be free from defects in workmanship and materials for a minimum period of one (1) year from date of approved completion.

.2 All defects (excluding vandalism) in materials and workmanship that become apparent during the Guarantee period shall be made good or material replaced at no cost to the Board.

1.9 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal packaging material for recycling.

.3 Place materials defined as hazardous or toxic in designated containers.

.4 Divert unused materials from landfill to metal recycling facility as approved by Consultant.

.5 Unused paint or coating material must be disposed of at an official hazardous material collections site as approved by Consultant.

.6 Fold up metal banding, flatten and place in designated area for recycling.

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.7 Do not dispose of unused paint material into sewer system, into streams, lakes, onto ground or in any other location where it will pose health or environmental hazard.

Part 2 Products

2.1 MATERIALS

.1 Aluminum extrusions: to designation AA 6063-T5 and AA 6006-T5.

.2 Sheet aluminum: anodizing quality.

.3 Prefinished sheet steel: conforming to CSSBI - Sheet Steel Facts #6: for normal environment: in colours selected from manufacturer's standard range.

.4 Galvanized steel sheet to ASTM A653/A653M: Commercial Quality.

.5 Welding materials: to CSA W59.

.6 Solder: to ASTM B32, Type [Sn50].

.7 Self-stick foam tape: 2.4 mm thick, [352.4] Kg/m^3 density polyurethane open-cell foam tape for sign purposes, with synthetic self-stick adhesive on both sides. Width: to suit sign sizes.

.8 Acrylic top-coat: clear, non-yellowing, exterior grade, satin finish, acrylic polyester resin protective coating, compatible with metal surface of type recommended by sheet manufacturer.

.9 Bituminous paint: to MPI [EXT 5.4D].

.10 Mounting Hardware:

.1 Furnish all signage with the necessary screws, bolts, and other fasteners of suitable size and type, to anchor signage into position for long life under hard use.

.2 Exterior Fire route and School signs shall be permanently mounted on a strong flanged hot dipped rolled high tensile galvanized steel U-Channel posts. Theses posts are to have 10mm (3/8”) dia. Holes spaced 25mm (1”) on centre for easy sign mounting. Signs to be mounted to flanged side of post. All exterior signs are to come completed with galvanized steel mounting hardware, necessary to properly mount sign for exterior use. Fire route sign FR-6 when required is to be installed at a 45 degree angle in relation to the edge of the traveled portion of the designated fire route facing approaching traffic. Fire route signs FR-7 and FR-8 when required are to be installed at a 90 degree angle in relation to the edge of the traveled portion of the designated fire route, in such manner as to allow both sign faces to be visible to traffic, or as listed otherwise. Fire route sign FR-9 when required is to be installed at a 90-degree angle to the edge of the traveled portion of the designated fire route. Not withstanding what is stated here in 2.1.2, all signage must comply with the latest by-laws in the Municipalities applicable to the work.

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.11 School Name, Address & School Board Logo (**this item only by Cash Allowance**):

.1 This item only by Cash Allowances. Refer to Section 01 11 00.

.12 U-Posts:

.1 Hot dipped rolled light temple galvanized steel
.2 Type: Flanged, 10 mm 0 holes @ 25 mm.o.c.
.3 Height: 3658 mm overall

.13 Free Standing Posts:

.1 Material: 25 mm x 25 mm galvanized steel hollow sections, primed + 2 coats exterior grade enamel
.2 Base: 100lb weight concrete base.
.3 Modified height: bottom of base to top of port: 15 25 mm

.14 Exterior Traffic Signs:

.1 Material: Aluminum
.2 Letters: Refer to style detail
.3 Mounting height: 2.0 to bottom of sign

2.2 SIGNAGE LIST

.1 All styles, quantities and location to be confirmed prior to ordering.

.2 "Stop" Signs:

.1 600 m x 600 m, red background, white lettering, white border.
.2 Quantity: refer to drawing SP-1.

.3 "Do Not Enter" Signs:

.1 600mm x 750mm, background, red circle, white bar, black border and lettering
.2 Quantity: refer to drawing SP-1.

.4 "One Way" Signs (arrow left):

.1 300 mm x 900 mm, black background, white arrow and border, black listing
.2 Quantity: refer to drawing SP-1.

.5 "Fire Department Connection" Signs:

.1 300mm x 450 mm, red background, white letters and borders
.2 1 required
.3 Mount on building at Fire Department Connection

.6 "Fire Route" Signs:

.1 As per Municipal standards
.2 Allow for supply and installation of 10 signs

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.3 6 signs mounted on U-posts driven through sod and 4 mounted to building.

.7 "Handicapped" Signs:

.1 300 mm x 600mm white background, black border and letters, blue handicapped symbols and border, red circle and diagonal bar

.2 Quantity: refer to drawing SP-1.

.8 "No Left Turn" Signs:

.1 600mm x 600mm, white background red circle with slash, black arrow.

.2 Quantity: refer to drawing SP-1.

.9 "Keep Right" Signs:

.1 450mm x 300mm, white background, black arrow & lettering.

.2 Quantity: refer to drawing SP-1.

.10 "School Bus Loading Zone" Signs:

.1 450mm x 300mm, white background black arrow & lettering.

.2 Quantity: refer to drawing SP-1.

Part 3 Execution

3.1 INSTALLATION

.1 Erect and secure signs plumb and level at elevations as indicated.

.2 Comply with sign manufacturer's installation instructions and approved shop drawings.

.3 Mechanical attachment:

.1 To concrete or solid masonry use lag screws and expansion bolts or screws and fibre plugs, as appropriate for stresses involved.

.2 To hollow masonry use toggle bolts or equivalent.

.3 To steel use bolts with nut and lock washers, self-tapping screws.

.1 Do [steel welding to CSA W59] [and] [aluminum welding to CSA W59.2]. Finish exposed welds flush and smooth.

.4 To wood use screws.

.5 Secure into framing members behind stud walls or above ceilings.

.6 Mechanical fasteners on exterior to be non-staining, non-ferrous type.

.7 Fabricate special fasteners as required for installation conditions.

.8 Mechanical fasteners and methods of attachment subject to Engineer's approval. Obtain Engineer's approval before fixing to structural steel.

.4 Adhesive attachment:

.1 Use self-stick adhesive foam tape to manufacturer's instructions to adequately fix sign and prevent "rocking". Keep tape maximum 1.6mm from edges.

3.2 CLEANING

.1 Leave signs clean. Remove debris from interior of sign boxes.

.2 Touch up any damaged finishes.

END OF SECTION

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Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 05 50 00 - Metal Fabrications: Suspended channel support for ceiling hung partitions.

.3 Section 10 28 10 - Toilet And Bath Accessories.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM A167-[99], Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-71.20-[M88], Adhesive, Contact, Brushable.

.3 Canadian Standards Association (CSA)

.1 CAN/CSA-B651-[95(R2001)], Barrier-Free Design.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate fabrication details, plans, elevations, hardware, and installation details.

1.4 SAMPLES

.1 Submit samples of finish hardware and phenolic plastic in selected colour and finish in accordance with Section 01 33 00 - Submittal Procedures, for approval of Consultant.

1.5 STORAGE AND PROTECTION

.1 Protect finished laminated plastic surfaces during shipment and installation. Do not remove until immediately prior to final inspection.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal [paper] [plastic] [polystyrene] [corrugated cardboard] packaging material [in appropriate on-site bins] for recycling.

.3 Place materials defined as hazardous or toxic in designated containers.

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.4 Divert unused metal materials from landfill to metal recycling facility as approved by Consultant.

.5 Unused sealant and adhesive material must be disposed of at an official hazardous material collections site as approved by Consultant.

.6 Fold up metal banding, flatten and place in designated area for recycling.

.7 Do not dispose of unused sealant and adhesive material into sewer system, into streams, lakes, onto ground or in any other location where it will pose health or environmental hazard.

Part 2 Products

2.1 MATERIALS

.1 Doors, Panels and Pilasters:

- .1 Phenolic or high density polyethylene (HDPE) fabricated from polymer resins compounded under high pressure, forming single thickness panel.
- .2 Waterproof and non-absorbent, with anti-graffiti, self-lubricating surface, resistant to marks by pens, pencils, markers, and other writing instruments.
- .3 Thickness: 1 inch (25 mm) with 1/4 inch (6 mm) radiused edges. One edge of pilaster and transom panels to be ship lapped.
- .4 Panel above door must be translucent (frosted) resin or acrylic type material, to allow emergency strobe light transmission through into washroom stall. Manufacturer must be able to provide this translucent panel.
- .5 Fire Rating: Tested in accordance too NFPA 286: Pass.
- .6 Fire Rating: Tested to meet ASTM E 84: Class B flame spread/smoke developed rating.
- .7 Standard Collection, Does not meet NFPA 286 or ASTM E84.
- .8 Aluminum and Aluminum Extrusions: ASTM B221, 6463-T5 alloy and temper.
- .9 Stainless Steel: ASTM A167, Type 304.

2.2 TOILET COMPARTMENT SYSTEM

.1 Basis of Design: ARIA Toilet Partitions as manufactured by and supplied by Scranton Products.

- .1 Style: **Full height** floor mounted overhead braced toilet compartments.
- .2 Sightline-free, gap-free interlocking doors and stiles design.
- .3 Acceptable products: ARIA by Scranton Products, BRIO Series by EAD Design and EURO - Highrise by Bradley. Must provide translucent panel above door for emergency strobe light transmission into stall.

.2 System Construction:

- .1 System Specified Height: Full height floor to ceiling (no gaps) as confirmed on site.

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.2 Doors: **Full height floor to ceiling, mounted 1/2 inch (13 mm) maximum** above finished floor (to accommodate slopes in floor only) at doors only. All other panels to be floor to ceiling with no gaps.

.3 Dividing Panels: **Full height floor to ceiling, mounted 1/2 inch (13 mm) maximum** above finished floor (to accommodate slopes in floor only) at doors only. All other panels to be floor to ceiling with no gaps.

.4 Two panels stacked and secured with 3 dowels ensuring proper alignment totaling the system specified height.

.1 Trim: Application to hide seam gap between dividing panels.

.5 Pilasters: System specified height, shoeless system secured with 3/4 inch (19 mm) long stainless steel tamper resistant Torx head screws and angled wall brackets.

.6 Transom Panel: Height required to accommodate specified system height with ship lap on one edge. Mounted with four mending plates using 3/4 inch (19 mm) long stainless steel tamper resistant Torx head screws.

.7 Wall Brackets: 54 inches (1372 mm) long, heavy-duty aluminum with bright dip anodized finish. Mounts to pilasters, panels and walls with 3/4 inch (19 mm) long stainless steel tamper resistant Torx head screws.

.8 Quantity & Location: In washrooms and change rooms where indicated on drawings

.3 System Design:

.1 Door Design: Traditional Series; Model 1000 standard flat panel door, side panels and pilasters.

.2 Door Design: As determined by the Architect from Manufacturer's selection.

.3 Side Panel Design: Plain (standard).

.4 Color: As determined by the Architect from Manufacturer's selection.

.5 Trim: As determined by the Architect from Manufacturer's selection.

.6 Trim Color: As determined by the Architect from Manufacturer's selection.

2.3 HARDWARE:

.1 Hinges: Helix style 78 inches (1981 mm) edge mounted continuous hinge.

.1 Stainless steel: 0.074 inch (1.88 mm) thick 304-2B stainless steel using a stainless-steel pin in 0.234 inch (5.94 mm) diameter.

.2 Closing degree: Set hinges so that doors stay open min. 15 degrees and max. 30 degrees when compartment is not in use.

.2 Occupancy Indicator Latch and Housing: Satin stainless-steel showing green and red occupancy indicators.

.1 Latch housing: Satin stainless steel.

.2 Slide bolt and button: Satin stainless steel.

.3 Door Pulls: Satin stainless steel.

.3 Coat Hook and Bumper:

□

.1 Combination type, chrome plated Zamak.

.2 Equip outswing handicapped doors with second door pull and door stop.

.4 Hardware:

.1 Stainless steel surface-mounted slide latch and keeper.
.2 Continuous stainless steel spring-loaded hinge.
.3 Continuous stainless steel brackets.
.4 Door pull: Barrier-free type suited for out-swinging doors stainless steel.

2.4 MATERIAL DESCRIPTION

.1 1.6 mm high pressure laminate facings and edging on phenolic core, and complete with stainless steel hardware and fittings.

.2 Doors, pilasters and partitions to be min, 25 mm thick.

.3 headrails to be 24 x 41 anodized aluminum anti-grip type with sloped top configured and installed to prevent swinging or concealment of small items.

.4 pilasters to have 3.2 mm core and integral leveling device concealed by 100 mm high stainless steel shoe.

.5 all doors to have rubber tipped bumper and slide bar latch, combination door stop and keeper, all attached with stainless steel sleeve bolts with theft proof heads.

.6 coat hooks to be provided as noted above.

.7 provide stops on top and bottom of all doors

.8 All partitions to be anchored to wall by means of stainless steel channel bracket for full height of partition.

Acceptable Materials: as manufactured by Scranton Products and other companies providing full height partitions meeting or exceeding these exact specifications if reviewed and approved by the Consultant during the tender period.

2.5 COMPONENTS

.1 Safety Release Coat Hook (SCH):

2 High strength polycarbonate coat hook with safety release weight under downward pressure to not exceed 12 kg (26 lbs.)

.3 Supply all suitable mounting hardware for a vandal proof, secure installation using stainless steel sleeve bolts on partition doors or panels. Do not supply standard Robertson or Phillips head screws.

.4 Colours: white

.5 Acceptable Materials: “Model 1150 – Safety Coat Hook” with stainless steel base as manufactured/distributed by Frost.

.6 Locations: Refer to drawings for locations.

.1 Samples: submit test data and samples for review as specified in Section 013330 – Submittal Procedures.

□

2.6 FABRICATION

.1 Fabricate pilasters and stiles minimum 25 mm thick, and panels and doors minimum 25 mm thick, of materials as specified.

.2 Supply steel floor inserts and locations to Contractor for placing prior pouring of floor slab.

.3 Provide pilasters with 2.9 mm, stainless steel leveling bar, rod and anchor concealed by one-piece 102 mm high stainless steel.

.4 Include panel brackets, hinges, door stops, latches, safety release coat hooks for metal partitions, fastening devices, bumpers, and pull on the outside of doors to handicapped accessible compartments.

.5 Coat hooks to be mounted in ALL washroom toilet stalls and shall be safety release style and mounted on the side wall or to consultant direction.

Part 3 Execution

3.1 INSTALLATION

.1 Install compartments in accordance with reviewed shop drawings and in a neat, rigid manner free of defects.

.2 Provide anchors, inserts and fixings necessary for attachment of supports. Supply steel floor inserts and locations to Contractor for placing prior pouring of floor slab. Elsewhere, drill supports as required to receive attachment of compartments.

.3 Install units secure, accurately positioned, plumb, level, square and free from sag and distortion. Provide 3 brackets per partition.

.4 Perform drilling of steel, masonry and concrete necessary to install this work.

.5 Ensure spaces between panels and pilasters, between panels and walls and between pilasters and walls are of uniform consistent width and sized to ensure it is not possible to see persons using the compartments.

.6 Coordinate installation with the work of trades providing ceilings, wall and floor finishes, shower accessories and other adjacent components and construction.

.7 Use stainless steel anchors and fasteners; ferrous metals are not acceptable.

.8 Provide for adjustment of ceiling variations with screw jack through steel saddles made integral with pilaster. Conceal fixings with stainless steel shoes.

.9 Do work in accordance with CAN/CSA-B651.

□

3.2 ADJUSTMENT

.1 Upon completion of the work or when directed, remove all traces of protective coating or paper.

.2 Clean exposed surfaces and fittings.

.3 Test safety release Coat Hooks, hinges, locks and hatches and where necessary, adjust and lubricate.

.4 Set hinges so that doors stay open min. 15 degrees and max. 30 degrees when compartment is not in use. Ensure that partitions are in working order.

END OF SECTION

□

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 05 50 00 – Metal Fabrications.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM E90-[99], Standard Test Method for Laboratory Measurement of Airborne-Sound Transmission Loss of Building Partitions and Elements.

.2 ASTM E336-[97], Standard Test Method for Measurement of Airborne Sound Insulation in Buildings.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-11.3-[M87], Hardboard.

.3 Canadian Standards Association (CSA)

.1 CSA O115-[M1982(R2001)], Hardwood and Decorative Plywood.

.2 CSA O151-[M1978(R1998)], Canadian Softwood Plywood.

.4 Underwriters Laboratories' of Canada (ULC)

.1 CAN/ULC-S102-[1998R2000], Surface Burning Characteristics of Building Materials and Assemblies.

1.3 DESIGN REQUIREMENTS

.1 Use carpet finish for covering with maximum

.1 flame spread -[25];

.2 fuel contributed -[35];

.3 smoke developed -[50]; when tested to CAN/ULC-S102.

1.4 WELDING

.1 Welding of structural components shall be done only by fabricators certified by CSA Welding Qualification Codes, CSA W47 or W55.3 as applicable, for welding of steel, and who shall perform welding to meet specified requirements of CSA W55.2 or W59.1, as may apply.

.2 Weld all connections where possible, and bolt where not possible. Provide method to prevent loosening of nuts. Ream holes drilled for fastenings. Make welded joints tight, flush, and in true planes with base metals. Make welds continuous at joints. Grind welds in exposed locations smooth in a manner that will not leave blemishes on exposed surfaces. Join members generally by inert metal arc welding where practicable, using

materials recommended by manufacturers of metals being welded. Remove flux completely following welding, and grind and polish joints smooth and clean.

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

1.6 SAMPLES

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

1.7 MAINTENANCE DATA AND OPERATING INSTRUCTIONS

.1 Provide maintenance and operating instructions for incorporation into maintenance manual in accordance with Section 01 33 30- Submittal Procedures.

1.8 TEST DATA

.1 Submit test reports to the Consultant from ULC confirming that carpet and vinyl fabric conforms to these Specifications.

.2 Submit tests to confirm STC ratings based on ASTM E90-04.

.3 Submit test reports from an independent laboratory confirming that the partition meets the flame spread and STC ratings specified.

.4 Submit test data indicating compliance with design criteria regarding sound transmission and fire hazard classification.

1.9 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal [paper] [plastic] [polystyrene] [corrugated cardboard] packaging material [in appropriate on-site bins] for recycling.

.3 Divert unused [wood] [and] materials from landfill to recycling facility as approved by Consultant.

.4 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 DESIGN CRITERIA

.1 Use finish for partition covering with maximum flame spread 25; fuel contributed 35; smoke developed 50; when tested to ASTM E84-81a.

□

.2 Specifications in this Section are based upon products and systems as manufactured by Modernfold. It is understood that certain aspects of partition systems by other manufacturers are slightly different than those specified. The Consultant will make some allowances for differing designs when reviewing shop drawings but will insist that the overall system present features and performance which are at least equal to those specified.

2.2 DESCRIPTION OF PARTITIONS

.1 Stage/Gymnasium Partition:

.1 Location: Gymnasium / Stage - One required.

.2 Type: Modernfold 931 - STC 50 or approved equivalent by Moderco, Hufcor or C.S.I. Sales and Manufacturing, Aluflex and Moduflex by Panelfold.

.3 Features: Manually operated, single panels, acoustically rated system. Panel facing shall be roll formed steel welded to panel frame. Integral whiteboards and recessed marker tray on stage side of partition on all panels, head and floor retractable seals; end panel modified; end panel modified to suit end wall condition. Carpet finish both sides, colour selection by Consultant from full range.

.4 Opening Size: Refer to floor plan and confirm on site.

2.3 MATERIALS

.1 General: Metals shall be free from defects which impair strength or durability, or which are visible. Metals shall be new, of best quality, and free from rust, or waves, or buckles, clean, straight, and with sharply defined profiles.

.2 Metals:

.1 Steel: Structural: hot rolled to meet requirements of CAN3-G40.21, Grade 50W for tubes and Grade 44W for flat shapes. Sheet: cold-rolled furniture steel, double annealed, mill stretched and levelled, and fully pickled. Otherwise, steel shall be hot-rolled or cold-rolled of alloy to suit needs of fabrication, use, and appearance.

.3 Carpet: Acoustical, non-woven needle punch carpet, with fused fibers to prevent unravelling or fray of material.

.4 Provide min. 100mm high stainless steel kickplates on stage side of all panels.

2.4 COMPONENTS

.1 Overhead suspension system.

.1 Track: manufacturer's standard cold rolled steel channel housing designed to support partitions.

.1 Equip track with brackets for hanger attachment.

.2 Provide threaded steel rods and nuts type hangers and stabilizers.

.2 Trolley: nylon wheels with ball bearings, equipped with thrust bearing and steel pendant bolt at each wheel assembly for height adjustment.

□

.2 Hardware.

.1 Equip partition with manufacturer's standard hardware. Hardware finish selected from manufacturer's [standard] [special] finishes.

.3 Sound seals.

.1 Provide sound seals to manufacturer's standard.

.2 Use head and floor retractable compression type floor and head seals.

.3 Design retractable seals to secure panel in position.

.4 Use manufacturer's standard astragal inserts for jamb and panel joint seal. Finish in Satin Black.

2.5 ACCESSORIES

.1 Provide manufacturer's standard closure panel, with lever operator.

Part 3 Execution

3.1 INSTALLATION

.1 Secure and level track.

.2 Install folding partitions in accordance with manufacturer's printed instructions.

.3 Touch up damaged finishes, repair damage to partitions to match original finish.

.4 Clean folding partition system and protect from damage.

.5 Adjust and leave partitions in smooth operating condition.

3.2 SITE TESTS

.1 Provide demonstration of operation to the Owner and his representatives.

.2 Provide training for operation, maintenance and repairs.

END OF SECTION

□

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 10 21 14 – Metal Toilet Compartments.

.3 Section 10 28 10 – Plastic Toilet Compartments.

.4 Section 08 80 50 – Glazing: Mirrors.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM A167-[99], Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

.2 ASTM B456-[95], Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

.3 ASTM A653/A653M-[99], Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.4 ASTM A924/A924M-[99], Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.81-[M90], Air Drying and Baking Alkyd Primer for Vehicles and Equipment.

.2 CAN/CGSB-1.88-[92], Gloss Alkyd Enamel, Air Drying and Baking.

.3 CAN/CGSB-12.5-[M86], Mirrors, Silvered.

.4 CGSB 31-GP-107Ma-[90], Non-inhibited Phosphoric Acid Base Metal Conditioner and Rust Remover.

.3 Canadian Standards Association (CSA)

.1 CAN/CSA-B651-[95], Barrier-Free Design.

.2 CAN/CSA-G164-[M92], Hot Dip Galvanizing of Irregularly Shaped Articles.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures

.2 Shop drawings of units for use by the handicapped shall be distinctly marked and cross-referenced to the corresponding article in the specifications.

1.4 WASTE MANAGEMENT AND DISPOSAL

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

□

Part 2 Products

2.1 MATERIALS

.1 Ferrous Steel: Sheet, cold-rolled furniture steel, double annealed, mill stretched and leveled, and fully pickled. Otherwise, steel shall be hot-rolled or cold-rolled of alloy to suit needs of fabrication, use, and appearance.

.2 Galvanized Steel: For sheet, Z275 zinc coating designation in accordance with ASTM Specification A525. For irregular sections, hot dip galvanized to comply with CSA G164.

.3 Stainless steel sheet metal: to ASTM A167, Type 304, with No. 4 finish.

.4 Anchors and Fastenings: Where exposed, use stainless steel and otherwise to match metal anchored. Where non-exposed, use the same as that specified for exposed, or use galvanized steel. Anchors and fastenings shall be of the type appropriate for the substrate to which accessory unit is secured.

2.2 COMPONENTS

.1 Hand Dryers – Semi-recessed (HD): refer to Electrical specifications.

.2 Fixed Grab Bars (GB): 32 mm outside diameter; 1.2 mm thick stainless steel; pended non-slip finish; round or oval concealed flange attachments, as described below:

.1 Straight Profile - horizontal: e.g. Frost Model 1001-NP-24.
.2 Straight Profile – vertical at shower: e.g. Frost Model 1001-NP-48.
.3 L-Shaped Profile at water closet: e.g. Frost Model 1003-NP-30x30.
.4 L-Shaped Profile at shower: e.g. Frost Model 1003-SP-40x30.
.5 All bars to have concealed mounting hardware
.6 Quantity: refer to drawings
.7 All bars to withstand horizontal and vertical pull of 2.2 Kn
.8 Location: Washrooms, refer to contract drawings.

.3 Handicapped Grab Bars - Flip-Up (GBF)
.1 18 gauge stainless steel, 32 mm diameter, 800 mm long flip-up grab bar with white wall mounting bracket, automatic locking system.
Model: Flip-up by Dunleavy Cordun Associates (Tel: 905-470-6685)
.2 If locking grab bar not required, provide Bobrick B4998.99 and/or 812825 (with toilet paper holder)
.4 Location: Orthopedic Washrooms, refer to drawings for locations and quantities.

.4 Toilet Backrest (BR)
.1 Model: Shallow Depth Toilet Backrest, Model # 1028-5 1/12 by Frost.
.2 Quantity and locations: washrooms. Refer to drawings

.5 Convenience Shelves (CS): Model B295x16 by Bobrick
.1 Quantity: refer to drawings
.2 Location: washrooms, refer to drawings where noted.

□

.6 Toilet Paper Dispenser (TD): Model 150 by Frost
- .1 Quantity: refer to drawings
- .2 Location: Washrooms , refer to drawings.

.7 Paper Towel Dispenser (PTD): Model F101-1 by Frost
- .1 Quantity: refer to drawings
- .2 Location: refer to drawings.

.8 Soap Dispenser (SD): Model 710A, by Frost
- .1 Quantity: refer to drawings
- .2 Location: refer to drawings.

.9 Sanitary Napkin Disposal (SN): Model 620, by Frost
- .1 Quantity: refer to drawings
- .2 Location: Washrooms, refer to drawings

.10 Sanitary Napkin Dispenser (recessed) : Model 615-5, by Frost
- .1 Quantity: refer to drawings
- .2 Location: Washrooms, refer to drawings

.11 Janitorial Shelf (JS):
- .1 0.9 mm thick stainless steel, 914 x 203 mm size, surface mounted; complete with 3 mop/broom holders, 2 pail hooks and an 8 mm OD chrome plated drying rod
- .2 Model 1115, by Frost
- .3 Quantity: refer to drawings
- .4 Location: Custodian Rooms, Storage Rooms & Receiving Room, where noted.

.12 Safety Release Coat Hook (SCH):
- .1 Refer to drawings for locations.
- .2 High strength polycarbonate coat hook with safety release weight under downward pressure to not exceed 12 kg (26 lbs.)
- .3 Supply all suitable mounting hardware for a vandal proof, secure installation using stainless steel sleeve bolts on partition doors or panels. Do not supply standard Robertson or Phillips head screws.
- .4 Colours:
  - .1 Allow for two (3) colours from Manufacturers standard line
- .5 Acceptable Materials: “Henkel Hook” as manufactured/distributed by Henkel Diversified Inc, London ON, tel (519) 641-5872.
- .6 Locations:
  - .1 Washrooms
  - .2 Change Room benches and shower rooms
  - .3 Refer to drawings for locations
- .7 Samples: submit test data and samples for review as specified in Section 013330 – Submittal Procedures”

.13 Shower Curtain & Rod (SC+R):

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.1 Refer to drawings for locations.

.2 Rod: No. B6047 extra heavy duty, by Bobrick or Frost F-1145-S, 18 gauge stainless steel

.3 TA-15 204-1 Shower Curtain Rod Hooks /type-304 Stainless Steel

.4 Curtain: 8 gauge vinyl fabric No. B204-3 (1780mm width) B204-1 shower curtain hook by Bobrick; 1830 mm high, 300 mm wider than opening.

.14 Mirrors

.1 Fixed Mirrors (designation Type M):

.1 Best quality, 6 mm thick float glass, with concealed tamperproof clip fasteners.

.2 24 ga., Type 302 or 304 No 4 finish stainless steel frames on all edges and galvanized iron backing with concealed mounts.

.3 Sizes: each unit 457 mm x 610 mm.

.4 Locations: as shown on Drawings.

.5 Acceptable Materials: Frost ‘Stock series’ model 941TG Tempered Glass; 18” x 24” each.

.6 Acceptable alternate: Model 5440 by Twin Cee; or "Tamperproof" model by Pilkington Ford

.2 Fixed Mirrors (designation Type ML):

.1 Best quality, 6 mm thick float glass complete with concealed, tamperproof clip fasteners

.2 24 ga., Type 302 or 304 No 4 finish stainless steel frames on all edges and galvanized iron backing with concealed mounts.

.3 Sizes: each unit 610 mm x 1520 mm.

.4 Locations: as shown on Drawings.

.5 Acceptable Materials: Bobrick Model B-290 2460; 24” x 60” each.

.6 Acceptable alternate: equivalent size and details by Bobrick or Twin Cee

.3 Barrier-Free/Tilt Mirrors (designation Type TM):

.1 Acceptable Materials: Frost ‘Stock series’ model 941FG Tempered Glass; Bobrick 290 series or Frost F974FT series

.2 18” x 24” each..

.3 Locations: as shown on drawings.

.4 Frames: Type 302 or 304 No. 4 finish stainless steel.

.5 Mirror Cushioning: PVC pressure-sensitive foamed tape, 6 mm thick with adhesive on one side.

.15 Folding Shower Seat (FSS):

.1 Folding Shower Seats (FSS): Model B5181 by Bobrick or F974-P by Frost.

.2 Stainless Steel fasteners/retaining clips.

.3 Location: Universal Washroom 152.

.16 Recessed Soap Dish:

.1 Heavy duty stainless steel recessed soap holder and grip bar.

.2 Frost model ‘1133-HD’

.3 Location: Universal Washroom.

.17 Acceptable Alternates to those items listed above as manufactured by Bradley Corp. & Supplied by Wentworth Assoc. Ltd., Frost Products Ltd., Watrous (ASI) or Bobrick Washroom Equipment Co. and Saferail meeting or exceeding these specifications.

□

2.3 FABRICATION

.1 Construction**:** Fabricate with materials, component sizes, metal gauges, reinforcing, anchors and fasteners of adequate strength to withstand intended use.

.2 Where specified as frameless, provide stainless steel accessories with one-piece fronts having 90 degree formed returns at their edges and openings.

.3 Where accessory fronts are framed, frame edges, both inside and outside, with 90 degree formed returns continuously welded and ground smooth at the corners. Doors shall also have 90 degree formed returns as specified.

.4 Unless otherwise specified, hinges shall be semi-concealed stainless steel piano hinges extending full-length of hinged element. Provide hinged elements with concealed, mechanically-retained rubber bumpers for silent closing, and shall close flush with faces of fronts or frames.

.5 Ensure that work will remain free of warping, buckling, opening of joints and seams, distortion and permanent deformation.

.6 No exposed fixings permitted. Cut edges and openings square and smooth. Chamfer corners of edges and cut-outs 1.6 mm.

.7 Assembly: Accurately cut, machine and fit joints, corners, copes and mitres so that junctions between components fit together tightly and in true planes.

.8 Fasten work with concealed methods, unless otherwise indicated on Drawings.

.9 Weld all connections where possible, bolt where not possible and cut off bolts flush with nuts. Countersunk bolt heads, and provide method to prevent loosening of nuts. Ream holes drilled for fastening.

.10 Welded joints shall be tight, flush, and in true planes with base metals. Make welds continuous at joints where entry of water into voids of members or assemblies is possible.

.11 Provide for differential movements within assemblies and at junctions of assemblies with surrounding work.

.12 Welds in exposed locations shall be ground and polished smooth.

.13 Finish Work**:** Provide holes and connections for related work installed under other Sections of this specification, if applicable.

.14 Cleanly and smoothly finish exposed edges of materials, including holes.

Part 3 Execution

3.1 INSPECTION OF SECTION

.1 Take site measurements to ensure that work is fabricated to fit surrounding construction around obstructions and projects in place, or as shown on drawings, and to suit service locations.

3.2 INSTALLATION

.1 Install all accessories in accordance with manufacturers' instructions at their recommended mounting heights unless noted otherwise on drawings.

.2 Securely fasten accessories plumb, true, square, straight, level, and accurately and tightly fitted together and to surrounding work. Install in locations shown and specified herein. Mounting heights as shown or in accordance with the OBC in the case of barrier-free accessories.

.3 Work shall include anchor bolts, bolts, washers and nuts, lag screws, expansion shields, toggles, straps, sleeve brackets, clips, and other items necessary for secure installation, as required by loading and by Jurisdictional Authorities.

.4 Attach work at wood by screws through countersunk holes in metal.

.5 Attach work to masonry with lead plugs and non-corrosive fastenings, to support load with a safety factor of 3. Perform all drilling necessary to install the work.

.6 Insulate between dissimilar metals or between metals and masonry or concrete with bituminous paint, to prevent electrolysis.

.7 Coordinate installation with the work of other trades adjacent to accessories to achieve the reveals or other edge conditions shown, where their front faces are flush with the finished wall surfaces.

.8 Owner to supply and install remainder of washroom accessories not specified here (toilet paper dispensers, etc.). Cooperate with Owner as required.

3.3 CLEANING UP AND ADJUSTMENT

.1 Upon completion of the work, or when directed, remove all traces of protective coatings or paper.

.2 Test mechanisms, hinges, locks and latches, and where necessary, adjust and lubricate and ensure that accessories are in perfect working order.

END OF SECTION

□

Part 1 General

1.1 RELATED WORK

.1 Section 01 33 00 - Submittal Procedures.

1.2 WORK INCLUDED

.1 Supply and install prefabricated unit as specified in location shown on drawings.

.2 Supervision, inspection and checking of unit as installed on site.

1.3 REFERENCES

.1 Drawing designation: “Precast Concrete Storage Shed”. Refer to Site Plan drawing.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

1.5 SAMPLES

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

1.6 GUARANTEE

.1 Submit a written Guarantee to the Board, that all work of this Tender shall be free from defects in workmanship and materials for a minimum period of one (1) year from date of approved completion.

.2 All defects (excluding vandalism) in materials and workmanship that become apparent during the Guarantee period shall be made good or material replaced at no cost to the Board.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling.

.3 Place materials defined as hazardous or toxic in designated containers.

.4 Divert unused metal materials from landfill to metal recycling facility as approved by Consultant.

.5 Unused paint or coating material must be disposed of at an official hazardous material collections site as approved by Consultant.

□

.6 Fold up metal banding, flatten and place in designated area for recycling.

.7 Do not dispose of unused paint material into sewer system, into streams, lakes, onto ground or in any other location where it will pose health or environmental hazard.

1.8 LOCATION

.1 Provide two (2) units in outdoor Kindergarten Play Area. Refer to site drawing for location.

Part 2 Products

2.1 MATERIALS

.1 Outdoor Storage Unit as manufactured by RM Products/ Fiberglass Structures (Orillia), 1-800-363-0867 | 705-326-5580.
.2 Description: 3/12 pitch roof with lockable man door.
.3 Location: Kindergarten outdoor play area (not childcare).
.4 Size: 8’ x 8’

Part 3 Execution

3.1 INSTALLATION

.1 For concrete or asphalt surface: Bearing pads to be provided if levelling is required

.2 For grass site: 11'0" x 11'0" x 6" thick compacted stone chip base with 2" loose stone chips on top.

.3 Comply manufacturer's installation instructions and approved shop drawings.

END OF SECTION

□

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 03 30 00- Cast-in-Place Concrete.

.3 Section 04 21 13 – Masonry.

.4 Section 05 21 10 – Steel Joists Framing.

.5 Section 05 50 00 – Metal Fabrications.

.6 Electrical Connections : Division 26 (16)

1.2 REFERENCE STANDARDS

.1 All gymnasium equipment shall meet all regulatory requirements of the International Amateur Athletics Federation (I.A.A.F.) for official tournament play as well as all safety standards as set forth by CSA and/or CGSB for the applicable equipment item and/or category, as well as all local codes and regulations.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 As part of Shop Drawings, details of attachment to the building structure (walls and roof structure) must bear stamp of a professional engineer licensed to design structures in the Province of Ontario certifying their strength and safety.

.3 Clearly indicate fabrication details, plans, deviations, hardware and installation details.

.4 Take measurements on site of spaces and conditions to which work must conform.

.5 At completion of installation provide written certification from professional engineer that the installation is structurally safe and in accordance with approved shop drawings.

1.4 PROTECTION

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

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

□

.2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material [in appropriate on-site bins] for recycling Divert unused metal materials from landfill to metal recycling facility as approved by Consultant.

.3 Unused paint or coating material must be disposed of at an official hazardous material collections site as approved by Consultant.

.4 Fold up metal banding, flatten and place in designated area for recycling.

1.6 PROTECTION

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

Part 2 Products

2.1 MATERIALS

.1 Motorized Basketball Backstops to Main Court:

.1 Location: Ceiling mounted at Main Court. Total of two complete assemblies required.

.2 Steel frame: 3mm thick steel tubing, 50x50mm size, eg. BB-15RG by Gymnasium & Health Equipment Ltd.

.3 Safety Belt: BB-48 Auto-Loc by Gymnasium & Health Equipment Ltd. One required for each ceiling suspended backstop assembly.

.4 Backboard: 1067 x 1829mm size, 13mm thick tempered glass set in extruded aluminum frame, official border and target area fired into glass, BB-29-RGII by Gymnasium & Health Equipment Ltd.

.5 Cushion Edge Padding: pre-moulded urethane foam, purpose made to fit along lower edge of glass backboard, c/w fixing hardware, colour shall be selected by Consultant, BB-44 by Gymnasium & Health Equipment Ltd.

.6 Goal: 457mm OD, front mounted shock absorber goal, with completely enclosed positive locking mechanism, BB-33B by Gymnasium & Health Equipment Ltd.

.7 Net: 120 count nylon, hourglass design, official anti-whip net, BB-41 by Gymnasium & Health Equipment Ltd.

.8 Electric winch: model TW1000 for electrically-operated ceiling-suspended backstops, complete with flush wall-mounted key switch mounted 1350mm above finished floor.

.2 Basketball Backstops at Cross Courts:

.1 Location: At cross courts. A total of four (4) complete assemblies are required.

.2 Backstops: BB-12 with BB-3 height adjustor by Gymnasium and Health Equipment, Markham.

.3 Backboard, Goal and Nets: Model BB-22 backboard with target orange border area, Model BB-30 and net BB-40 and hardware all by Gymnasium and Health Equipment, Markham.

□

.4 Operator: Not required.

.5 Safety Straps: not required.

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

.3 Co-ordination for Items 2.1 and 2. 2:

.1 Provide Section 04 22 00- Masonry with all mounting locations, types and hardware for wall-mounted backstops.

.2 Co-ordinate design of swing up type to permit maximum clear height in up position.

.4 Floor Sockets:

.1 Supply and install Model MA Series, 47.6 mm (1-7/8") I.D. By Murray Anderson Ltd. complete with retainer ring, removable cap and threaded assembly. Refer to Drawings for detail.

.2 Locations: As located on Drawings (designation FS).

.3 Provide six (6) additional floor sockets in Gym Storage 154. Location to be confirmed by Owner prior to installation.

.5 Gymnasium Divider Curtain:

.1 Type: Electrically operated, vertically folding divider curtain. Curtain is to fold accordion style.

.2 Curtains: Abrasion resistant polyester reinforced vinyl for the lower 3m, the remaining upper section being 1¼" net.

.1 curtain weight 25 oz/sq yd minimum.

.2 Tensile strength: 300 lb minimum.

.3 Tear strength: 100 lb minimum

.4 Vinyl curtain and net to meet ULC S109, S102.2 and NFPA 701, flame spread not to exceed 75. Fire label to be fixed permanently to the curtain.

.5 Curtain to have vertical welded seams at 1.5 m interval and side shall be hemmed and quadruple sewn to provide clean and durable edge. Seam strength to equal fabric strength.

.6 Colour: To later selection by Consultant from manufacturer's full range.

.3 Valence: same material as curtain fabric on each side of retracted curtain and motor mechanism so as to fully conceal curtain and motor.

.4 Raising mechanism:

.1 motor drive unit, 3 phases, 208V, equipped with magnetic contractor to reverse movement of the curtain at any point, an emergency break and travel limit switches for up and down position.

.2 Lifting pullies at 3 m o.c. attached to the structure, lifting cables to be 5 mm aircraft type.

.3 All roller chains tension shall be monitored by safety switches.

.4 Hydraulic emergency stopping device shall be installed to prevent the free fall of the curtain or to limit the descending speed.

.5 The operating control shall be spring leader type key switch.

□

.5 Mounting Hardware:

.1 include all mounting hardware for a complete installation

.2 Refer to structural drawings and include all subframing required to fasten to structure. The curtain mount is to be designed to allow the curtain to be raised within the centre joist space.

.6 Warranty: Total warranty for a period of 5 years

.7 Acceptable products: noting or exceeding these specifications 1100 Series by Corflex Partitions Inc. or Moderco Inc., Arpro Folding partitions, Porter, Hufcor, or Quad.

.6 Acceptable Alternates to Specified Products:

.1 Products and complete systems meeting or exceeding the quality and features specified as manufactured by Porter and supplied by Hussey Seating Co.; or Laurentian Gymnastics Industries Ltd.; or Sheridan Gym Equipment or Centaur Products Inc; or Ash-Stevenson or Forum Athletic Products Inc.

Part 3 Execution

3.1 FABRICATION

.1 Fix and assemble work in shop where possible.

.2 File and grind exposed welds, smooth and flush. Make exposed welds continuous.

.3 Workmanship shall be best grade of modern shop and field practice known to recognized manufacturers specializing in this work. Accurately fit joints and intersecting members and made in true planes with adequate fastening.

3.2 INSTALLATION

.1 Install work square, plumb, straight, true and accurately fitted.

.2 Included anchors, dowels and fastenings necessary to anchor work together or to work of other trades.

.3 Where installing in masonry, centre equipment between masonry block joints unless indicated otherwise on details. Verify location mounting heights, and dimensions of all units before installation. Anchor in accordance with manufacturer’s printed instructions.

.4 Insulate where necessary to prevent electrolysis between dissimilar materials.

.5 Co-ordinate installation of floor sockets with Section 09 65 19.

.6 Install, connect, make operational and adjust all electrically operated components for proper function.

.7 Deliver to Owner all special tools, accessories, controls, spare parts, etc. which are related to the work of this Section.

3.3 DEMONSTRATION AND CLEANING

.1 Provide demonstration of operation to the Owner and his representatives.

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.2 Provide training or maintenance and repairs to the Stage Rigging and Drapery.

END OF SECTION

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Part 1 GENERAL

1.1 GENERAL REQUIREMENTS

.1 Comply with requirements of Division 1.

1.2 RELATED WORK

.1 Section 06 40 00 - Architectural Woodwork:

1.3 DESIGN

.1 Design and construct metal storage shelving for minimum rated shelf capacity of 180 kg.

.2 Design shelving to accommodate vertical adjustment of shelves in 25mm increments and to permit easy assembly, expansion, dismantling and re-use of shelving component parts.

1.4 SHOP DRAWINGS

.1 Submit detailed shop drawings.

.2 Indicate shelving layouts, number of bays, number of shelves, system of bracing and anchoring devices.

Part 2 Products

2.1 OPEN SHELVING

.1 Product: boltless, clipless system: Dexion' Shelving by Redirack, similar system by E-Z-Rect, North American Steel, Triple-A, or equivalent system by other manufacturer approved by Consultant.

.2 Sizes, unless otherwise shown:

.1 Height of bay: 2100 mm

.2 Length of bay: 915 mm

.3 Depth of bay: 460mm and 600 mm.

.3 Provide seven shelves, including top and bottom, at each by, unless otherwise indicated.

.4 Uprights: 2 mm thick square tubular posts with slots at 25 mm o.c.

.5 Shelves: full panel steel shelves with U-shaped front edge.

.6 Beams: 2 mm thick, with double locking, V-type clip, 25 mm high.

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.7 Base plate: 2 mm thick, similar to beam, 40 mm high.

.8 Foot plates: square steel, designed to clip onto posts.

.9 Beam safety clips: designed to lock beam to post, easily removable.

.10 Post caps: plastic.

.11 Provide a total of 17 units in rooms as follows:

- 4 qty. (Depth: 600) units in Recycling & Custodian Storage Areas 114
- 5 qty. (Depth: 460) units in Art Storage 313A.
- 4 qty. (Depth: 600) units in Applications 312
- 2 qty. additional 600 deep units and 2 qty. additional 460 deep units to be turned over to the Board for future installation by school.

2.2 FINISHES

.1 Finish all shelving components to manufacturer's standard.

.2 Suitably pretreat metal surfaces, apply primer and two coats of metal enamel and bake on.

.3 Where more than one colour is available from manufacturer, Consultant will make selection.

.4 Manufacturers or brand names acceptable if not prominently displayed.

Part 3 EXECUTION

3.1 INSTALLATION

.1 Assemble and install metal storage shelving in accordance with reviewed layout, and in accordance with manufacturer's direction.

.2 Provide beams at front and back of each shelf and lock shelf in place.

.3 Provide base plate at bottom of units.

.4 Provide foot plate and cap at each post.

.5 Make good baked enamel surfaces damaged during shipment or installation.

END OF SECTION

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Part 1 General

1.2 RELATED WORK

.1 Section 08 44 13 – Glazed Aluminum Curtain Walls
.2 Section 08 50 00 – Aluminum Windows

1.3 SUBMITTALS

.1 Product data:
  .1 Submit duplicate copies of manufacturer's Product data in accordance with Section 01 33 00 indicating:
    .1 Performance criteria, compliance with appropriate reference standard(s), characteristics, limitations, and finishes.
    .2 Product transportation, storage, handling and installation requirements.

.2 Shop drawings:
  .1 Submit shop drawings in accordance with Section 01 33 00.
  .2 Provide layout, details of track and operating hardware, installation details.

.3 Samples: Submit 600 mm x 600 mm duplicate samples of Dual Sun Shade material and colour.

.4 Closeout submittals:
  .1 Submit following for each Product for incorporation into Operations and Maintenance Manuals in accordance with Section 01 78 00:
    .1 Functional description detailing operation and control of components.
    .2 Performance criteria and maintenance data.
    .3 Operating instructions and precautions.
    .4 Safety precautions.
  .2 Submit maintenance data, wrenches or specialty tools, cleaning and maintenance instructions

1.5 QUALITY ASSURANCE

.1 Shades and track shall be installed by a qualified specialist with 5 years proven experience in this type of work.

Part 2 Products

2.1 MATERIALS

.1 **Motorized Shading System (MWC):**
  .1 Extruded aluminum hanger and closure using a linear motor, fabloc tube and necessary electrical accessories for a single switch or Motor group control operated as indicated on the Shading Schedule. Internal limit switches are adjusted by two hex keys to allow for exact stop positions. Solenoid activated disc brake stops and holds in any position. Asynchronous motor with built in reversible capacitor start

and run, 95-125V-AC at 60Hz CSA and UL approved.

.2 Specifications are based on 300 Series Solarblock 3%, colour to be selected later by Consultant.

.3 Locations: Gym and Library.

.4 'Motorized Shade with wall mount fascia' by Solarfective or approved alternative.

.5 Manufactured by Solarfective Products Ltd., Rep: Patri Products, Kevin Booth (416)421-3800 Fax: (416)421-8424, or Silent Gliss Model 4110 by Architectural Products, Rep. Tim MacCallum Tel: (905)507-1275 Fax: (905)507-1282 or Mecho/5 Model by CartsPlus Healthcare Products Ltd., Rep. Eva Speziale Tel: (905) 602-6794.

.6 All shades systems specified in this section shall be provided by one manufacturer who shall take full responsibility for the total individual school project.

.7 The above electric powered shades are to be included in base contract. Manual blinds to other windows are to be purchased through the project's Cash Allowance.

.2 **Manual Shading System (WC):**

.1 Manual operated window shades. Refer to Cash Allowance.

2.2 Solarfective Shading blackout fabric:

.1 Shade cloths shall be woven of .018 opaque, vinyl coated polyester yarn consisting of approx. 79% vinyl and 21% 500 dernier polyester core yarn. The fabric shall be tensioned in the finishing range prior to heat setting to keep the warp ends straight and minimize or eliminate weave distortion to keep the fabric flat. The fabric shall be dimensional stable. Colour will be selected from standard range. It shall be tear resistant meeting NFPA 701.

.2 Meet or exceed the following statistics:

Openness Factor			3%+0.0%-0.5%
Weight per sq.yd.			21 oz.
Warp ends per inch			42
Fill ends per inch			31
Stretch % (271lb.wt.):	warp		2%
	fill		3%
Set %	warp		1.5%
	fill		1.5%
Abrasion Resistance		YARN	none
(500 Tarber Cycles)		RAPTURE	none
		WEAR	TRACE
U.V. Deterioration		Fade	none
(200 Sun Fade Hours)			
Tensile Retention			96%

2.2 FABRICATION

.1 Fabricate shades in accordance with reviewed shop drawings and manufacturer's written instructions.

Part 3 Execution

3.1 INSTALLATION

.1 Securely install shades and track adding brackets as required but in no case less than four brackets.

.2 After installation fabric shall hang flat, without buckling or distortion. The edge when trimmed, shall hang straight without ravelling. An unguided roller shade cloth shall roll true and straight, without shifting sideways more than 3mm in either direction due to warp distortion, or weave design.

3.3 ASSEMBLY – MOTORIZED SHADE

.1 Extruded Aluminum Shade Tube: 1.52 mm thick, 75 mm diameter with three internal, continuous fins 4.82 mm high for strength and drive capabilities when attached to the nylon sprocket. The fins shall be spaced 120 degrees apart.

.2 Fascia: 1.7 mm thick, extruded aluminum cover, clear anodized finish. To cover front of shade and return at underside to conceal roller and hardware.

.3 Internal Limit switches: adjustable with two hex keys to allow exact setting of stop position. Micro switches to provide circuit breaking at end of run. Switch setting not to be disturbed by roller tube action.

.4 Brake: solenoid activated disc brake mechanism stops and holds any position, brake to disengage when motor is running.

.5 Motor: Built-in reversible capacitor start and run. Single phase 95-125V-AC, 60 Hz motor with thermally protected class A temperature rating.

.6 Gear box: Satellite gears with 3 levels for load distribution with planetary type gears machined to close tolerance of tempered steel.

.7 Controls: Motors will be operated by white three position rocker switch, located remotely.

.8 Exterior Hembar: Extruded aluminum in clear anodized finish with plastic end finials.

.9 Dynamic Hembar: At sill locations, in lieu of bottom channel, provide aluminum Dynamic Hembar with same finish as side channels. Upon contact with sill, it shall provide a light seal even if the sill is slightly out of level.

.10 Colour: Exposed surfaces (excluding fabric) shall be colour selected by Consultant, and not necessarily from manufacturer's full colour range. Metal components shall be pretreated and finished with an acceptable baked enamel finish.

.11 Fasteners: Non-corrosive metal screws for attachment to windows or curtain wall framing, concealed in completed installation.

.12 Shade and mounting system to be designed to allow air between shade and glass.

.13 Fabric shall hang flat, without buckling or distortion. Trimmed edges shall hang straight without curling or raveling.

.14 Unguided vertical shades shall not drift sideways more than 3 mm in total run.

.15 Provide stops at highest and lowest shade positions to prevent over winding and unrolling.

.26 Design and fabricate shades so that there is a maximum 12 mm gap both sides of fabric.

3.4 CLEAN UP

.1 At conclusion of work remove all debris, dirt; clean surfaces like glass, floor, stools, heating units if soiled. Test each re-installed drape, each sunshade numerous times and make adjustments to assure trouble-free installation and operation.

.2 Brief maintenance staff regarding proper care, cleaning, lubricating, adjusting, etc.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 11 00 – Summary of Work: Protection of openings; temporary power and lighting.

.2 Section 01 52 00 – Construction Facilities: Protection of openings; temporary power and lighting.

.3 Section 03 30 00 - Cast-in-Place Concrete: Elevator pit, elevator motor and pump foundation, and grouting thresholds

.4 Section 05 50 00 - Metal Fabrications: Divider beams, support for entrances and rails, hoisting beam at top of hoistway.

.5 Section 04 21 13 – Masonry: Masonry hoistway enclosure, building-in and grouting hoistway door frames, grouting thresholds.

.6 Section 05 50 00 – Metal Fabrications: Divider beams, support for entrances and rails, hoisting beam at top of hoistway.

.7 Division 26: Electrical service to elevator components.

1.2 SUMMARY

.1 This specification is based on a 2500lb capacity, hydraulic double-sided elevator for a three storey building (min. 12m travel distance) with additional stop (4 stops).

.2 Acceptable Alternates: Elevators meeting or exceeding these base specifications by Otis Elevator Company, TKE, Thyssen, Kone, Delta Elevator, Southwestern Elevator or others providing they meet this specification and complete data is submitted to the Architect's office not later than 10 business days prior to close of Tender and approved and formally accepted in writing by the Consultant during the tender period.

.3 Tender price shall include the complete price for supply and install and the **2 year** maintenance contract specified herein.

1.3 REFERENCES

.1 ADAAG, Americans with Disabilities Act Accessibility Guidelines.

.2 ANSI/NFPA 70, National Electrical Code.

.3 ANSI/NFPA 80, Fire Doors and Windows.

.4 ANSI/UL 10B, Fire Tests of Door Assemblies.

.5 CAN/CSA C22.1, Canadian Electrical Code.

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.6 CAN/CSA-B44, Safety Code for Elevators and Escalators.

.7 Model Building Codes.

.8 Ontario Building Code and all other local applicable codes.

.9 American National Standards Institute (ANSI)

.1 ANSI/NEMA MG1-[1993], Motors and Generators.

.10 Canadian Standards Association (CSA)

.1 CAN/CSA-B44-[M94], Safety Code for Elevators.

.2 CAN/CSA-B651-[95], Barrier-Free Design - Public Safety.

.11 National Building Code (NBC)

1.4 SYSTEM DESCRIPTION

.1 Performance Requirements for Elevators:

.1 Quantity & Elevator Numbers: 1 Elevator

.2 Type: Twin telescopic hydraulic cylinders without well holes

.3 Number of Stops: 4 stops (three stories + Stage)

.4 Number of Openings: 2 (front and back)

.5 Rise: As per drawings

.6 Rated Capacity/Speed: 2500 pounds, 100/ fpm (1361 kg, 0.50/ m/sec.)

.7 Minimum Car Inside: Front Opening: Model 2500: 6’ 8” wide x 4’ 3” deep (2032 mm x 1295 mm)

.8 Inside Cab Height: 8’0” (2438 mm); Height Under Ceiling: 7’ 4 1/2” (2223mm)

.9 Entrance Width & Type: Model 2500: Single-Slide Door 3’ 6” x 7’ 0” (1067 mm x 2134 mm)

.10 Main Power Supply: 208 Volts + or - 5% of normal, 3 Phase, with a separate equipment grounding conductor.

.11 Lighting Power Supply: 120 Volts, 1 Phase, 15 Amp, 60 Hz.

.12 Stopping Accuracy: ±1/4" (6.4 mm) under any loading condition or direction of travel.

.13 Door Opening Time for 7ft. painted hoist way and car doors: Model 2500: 4.0 seconds – Single Slide 42” door.

.2 Simplex Collective Operation: Using a microprocessor-based controller, operation shall be automatic by means of the car and hall buttons. If all calls in the system have been answered, the car shall park at the last landing served.

.3 Provide microprocessor-based control system, which utilizes on-board diagnostics for servicing, trouble-shooting, and adjusting without requiring the use of an outside service tool. If an on-board diagnostic system is not provided, a handheld service tool (or laptop), owner’s license, operation manual, and tool instructions must be provided in addition to the control system.

.4 Car Operating Features

.1 Full Collective Operation.
.2 Single Speed Fan.
.3 On/Off Light Switch.
.4 Solid State Starting
.5 Remote elevator monitoring REM® ready.
.6 Car-Stall Protection.
.7 Top of Car Inspection.

.5 Door Control Features:

.1 Closed Loop Door Operator is a closed loop, microprocessor based door operator system. The door operator will facilitate smooth operation under varying environmental influences such as, temperature, wind, friction, and component variation. The processor will monitor the door's actual position and velocity compared to its desired position and velocity. If variations are detected in the profile the command will be automatically corrected. The Closed Loop Door Operator control system shall not require machine room door control equipment.

.2 Door noise not to exceed 58dBA.

.3 Door control to open doors automatically when car arrives at a landing in response to a normal hall or car call.

.4 Door control to open doors automatically when car arrives at a landing in response to a normal hall or car call.

.5 Elevator doors shall be provided with a reopening device that will stop and reopen the car door(s) and hoistway door(s) automatically should the door(s) become obstructed by an object or person.

.6 Primary door protection shall consist of a two dimensional, multi-beam array projecting across the car door opening. Under normal operation and for any door position, the system shall detect as a blockage an opaque object that is equal to or greater than 1.3 inches (33 mm) in diameter when inserted between the car doors at vertical positions from within 1 inch (25 mm) above the sill to 71 inches (1800 mm) above the sill. Under degraded conditions (one or more blocked or failed beams), the primary protection shall detect opaque objects that are equal to or greater than 4" (100 mm) in diameter for the same vertical coverage. If the system performance is degraded to the point that the 4" object cannot be detected, the system shall maintain the doors open or permit closing only under nudging force conditions.

.7 The door reopening device shall also include a secondary, three dimensional, triangular infrared multi-beam array projecting across the door opening and extending into the hoistway door zone. The door opening device will cause the doors to reopen when it detects a person(s) or object(s) entering or exiting the car in the area between the hoistway doors or the entryway area adjacent to the hoistway doors.

.8 The size of the secondary protection zone shall vary as the door positions vary during opening and closing. The width of the zone shall be approximately one-third the size of the separation between the doors (or door and strike plate for single-slide doors) and shall be approximately centered in the door separation. In

order to minimize detection of hallway passers-by who are not entering the elevator, the maximum zone penetration into the entryway shall not exceed 20" for any door separation. Normal penetration depth into the entryway from the car doors shall be ~14" for a door separation of 42". The penetration shall reduce proportionally as the doors close. At door separations of 18" or less the secondary protection system may cease its normal operation since the depth of the zone recedes to where it is inside the hoistway doors. The vertical coverage of the secondary protection shall be ~19" (480 mm) above the sill to ~55" (1400 mm) above the sill (mid-thigh to shoulder of a typical adult).

.9 The secondary protection shall have an anti-nuisance feature which will ignore detection in the secondary zone after continual detection occurs for a significant time period in the secondary zone without corresponding detection in the primary protection zone; i.e. a person/object is in the entryway but does not enter. Normal secondary protection shall be re-enabled whenever detection occurs in the primary zone.

.10 The reaction time of the door detector sub-system shall not exceed 60 milliseconds when both primary and secondary protection capabilities are active; nor 40 milliseconds when the secondary protection is disabled.

.11 Door nudging operation to occur if doors are prevented from closing for an adjustable period of time.

.6 Provide equipment according to Seismic zone: zone 0

.7 Design and construct elevator in accordance with CAN/CSA-B44, local codes and regulations.

1.5 SUBMITTALS

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

.1 Signal and operating fixtures, operating panels and indicators.

.2 Cab design, dimensions and layout.

.3 Hoistway-door and frame details.

.4 Electrical characteristics and connection requirements.

.2 Shop Drawings: Submit in accordance with Section 01 33 00 - Submittal Procedures.

.1 Submit shop drawings to indicate project layout, including details and the following information:

.1 Car, guide rails, buffers and other components in hoistway.

.2 Maximum rail bracket spacing.

.3 Maximum loads imposed on guide rails requiring load transfer to building structure.

.4 Loads on hoisting beams.

.5 Clearances and travel of car.

.6 Clear inside hoistway and pit dimensions.

.7 Location and sizes of access doors, hoistway entrances and frames.

.2 Operation and Maintenance Data

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.1 Provide 4 copies manufacturer's standard operations and maintenance manual.

1.6 QUALITY ASSURANCE

.1 Manufacturer: Provide elevators manufactured by a firm with a minimum of 10 years experience in fabrication of elevators equivalent to those specified. Elevator manufacturer shall be ISO9002 certified.

.2 Installer: Elevators shall be installed by the manufacturer.

.3 Regulatory Requirements: Elevator system design and installation shall comply with the latest versions of CAN/CSA-B44 -00.

.1 Elevator shall be designed to meet to Americans with Disabilities Act Accessibility Guidelines (ADAAG)

.4 Permits and Inspections: Provide licenses and permits and perform required inspections and tests.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Manufacturer shall issue delivery schedule within 7 days of issuance of purchase order. Manufacturer shall maintain regular contact with the contractor and Consultant regarding expediting shop drawings and delivery.

.2 At least 3 weeks in advance of delivery, manufacturer’s representative shall visit the site to discuss site preparedness. Manufacturer’s rep. shall make a second visit one week in advance of the delivery and again liaise with General Contractor and Consultant to ensure site preparation.

1.8 WASTE MANAGEMENT AND DISPOSAL

.1 Deposit packaging materials in appropriate container on site for recycling or reuse.

.2 Avoid using landfill waste disposal procedures when recycling facilities are available.

.3 Collect and separate plastic, paper packaging and corrugated cardboard.

.4 Dispose of corrugated cardboard, polystyrene and plastic packaging material in appropriate on-site bin.

1.9 WARRANTY

.1 The elevator warranty shall cover defective functionality, programming, materials and workmanship for a period of One Year from the date of Substantial Completion of the contract. The guarantee includes ordinary wear but excludes improper use, vandalism, abuse, and misuse by the owner.

.2 Project Warranty: Refer to CCDC 2 for project warranty provisions.

1.10 MAINTENANCE SERVICE

.1 Included in the Tender price is the maintenance service consisting of regular examinations, adjustments and lubrication of the elevator equipment shall be provided by the elevator contractor for a period of three (3) years after the elevator has been turned over for the customer's use. This service shall not be subcontracted but shall be performed by the elevator contractor. All work shall be performed by competent employees during regular working hours of regular working days and shall include emergency 24-hour callback service. This service shall not cover adjustments, repairs or replacement of parts due to negligence, misuse, abuse or accidents caused by persons other than the elevator contractor. Only genuine parts and supplies as used in the manufacture and installation of the original equipment shall be provided.

Part 2 Products

2.1 MATERIALS

.1 Materials: As required to achieve specified performance criteria; functionally compatible with adjacent materials and components.

2.2 ACCEPTABLE MANUFACTURERS

.1 This specification is based on a **Model 2500** hydraulic elevator as manufactured by Otis Elevator Company.

.2 Acceptable Alternates: Elevators meeting or exceeding these base specifications by Thyssen, Kone, Delta Elevator or Southwestern Elevator, **or Vertechs.**

2.3 EQUIPMENT:

.1 The hydraulic system shall be of compact design suitable for operation under the required pressure. The power component shall be mounted in the hydraulic-fluid storage tank. The control valve shall control flow for up and down directions hydraulically and shall include an integral check valve. A control section including control solenoids shall direct the main valve and control: up and down starting, acceleration, transition from full speed to leveling speed, up and down stops, pressure relief and manual lowering. All of these functions shall be fully adjustable for maximum smoothness and to meet contract conditions. System to be provided with a muffler, low-pressure switch and a shut-off valve.

.2 A microprocessor-based controller shall be provided, including necessary starting switches together with all relays, switches, solid-state components and hardware required for operation, including door operation, as described herein. A three (3) phase overload device shall be provided to protect the motor against overloading.

.3 A manual lowering feature shall permit lowering the elevator at slow speed in the event of power failure or for adjusting purposes.

.4 Pressure Switch

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2.4 EQUIPMENT: HOISTWAY COMPONENTS

.1 Plunger(s) and Cylinder(s): Each cylinder shall be constructed of steel pipe of sufficient thickness and suitable for the operating pressure. The top of each cylinder shall be equipped with a cylinder head with a drip ring to collect any oil seepage as well as an internal guide ring and self-adjusting packing. Each plunger shall be constructed of selected steel tubing or pipe of proper diameter machined true and smooth with a fine polished finish. Each plunger shall be provided with a stop ring electrically welded to it to prevent the plunger from leaving the cylinder. Each plunger and cylinder shall be installed plumb and shall operate freely with minimum friction.

.2 Car Guide Rails: Tee-section steel rails with brackets and fasteners.

.3 Spring Buffer: Helical coil spring type.

.4 Wiring: Wiring for hoistway electrical devices included in scope of the elevator system, hall panels, pit emergency stop switch, and the traveling cable for the elevator car, operating telephone handset call system in Cab.

.5 Hoistway Entrances

.1 Frames: Entrance frames shall be of bolted construction for complete one-piece unit assembly. All frames shall be securely fastened to fixing angles mounted in the hoistway and shall be of 14-gauge (2 mm) sheet steel. Additional sill angle support will be provided with 4’0” and 4’6” two speed opening door arrangements (4500 & 5000 lb. cars). Sills shall be extruded aluminum.

.2 Doors: Entrance doors shall be of hollow metal construction with vertical internal channel reinforcements.

.3 Fire Rating: Entrance and doors shall be UL fire rated for 1-1/2 hour.

.4 Entrance Finish: stainless steel. All doors & frames, stainless steel.

.5 Entrance Markings: Entrance jambs shall be marked with 4” x 4” (102 mm x 102 mm) plates having raised floor markings with Braille adjacent. Markings shall be provided on both sides of the entrance.

.6 Sight Guards: Black sight guards will be furnished with any metal finish door. Powder paint matching sight guards will be furnished with powder paint doors.

2.5 EQUIPMENT: CAR COMPONENTS

.1 Car Frame: A suitable car frame shall be provided with adequate bracing to support the platform and car enclosure. The buffer striking plate on the underside of the car-frame platform assembly must fully compress the spring buffer mounted in the pit before the plunger reaches its lower limit of travel.

.2 Platform, Heavy Loading Type: The car platform shall be arranged to accommodate one-piece loads weighing up to 25% of the rated capacity, such as wheeled food carts, stretchers, x-ray equipment, etc. The platform shall be recessed 5/16” for flooring by others.

.3 Cab walls to have attached vertical non-removable panels, laminated front and back with plastic laminate.

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.4 Car Door Finish: Car front(s) and door finish can be independent elevators. Satin stainless steel

.5 Car top to be of wood material clad on both sides with a natural finish aluminum panel.

.6 Ceiling Type:

.1 Aluminum Eggcrate [DC22E Ceiling] suspended ceiling shall consist of aluminum eggcrate diffusers set in frame of extruded aluminum with fluorescent lighting fixtures.

.7 Emergency Car Lighting: An emergency power unit employing a 6 volt, sealed rechargeable battery and totally static circuits shall be provided to illuminate the elevator car and provide current to the emergency siren in the event of building power failure.

.8 Emergency Pulsating Siren: Siren mounted on top of the car that is activated when the Alarm button in the car operating panel is engaged. Siren shall have a rated sound pressure level of 80 dba at a distance of 3.0 m from the device. Siren shall respond with a delay of not more than 1 second after the switch or push button has been pressed

.9 Exhaust Fan: An exhaust fan shall be mounted on the car top.

.10 Utility Outlet: A 125V 15 amperes utility outlet with ground-fault circuit-interrupter protection shall be furnished on top of the cab.

.11 Handrail:

.1 Rectangular Tubular Metal Bar DH50 Handrails 1/2” (13 mm) x 1-1/2” (38 mm) in stainless steel.

.12 Threshold: aluminum.

2.6 EQUIPMENT: SIGNAL DEVICES AND FIXTURES

.1 Car-Operating Panel: A panel shall be provided which contains all push buttons, key switches, and message indicators for elevator operation. Raised markings Braille markings shall be provided for each push-button.

.2 Car Fixture Finish: satin stainless steel.

.1 [Series 2 Fixtures] Applied car operating panel shall be furnished. It shall contain a bank of round mechanical illuminated buttons marked to correspond to the landings served, an emergency call button, door open and door close buttons, and switches for lights, inspection and the exhaust fan. The emergency call button shall be connected to a bell that serves as an emergency signal. All buttons to have both raised and Braille markings. LED (red) button illumination with 1/8” projecting target. All buttons to be stain stainless steel.

.3 Car Position Indicator: A 16-segment, digital, vacuum fluorescent car position indicator shall be integral to the car operating panel.

.4 An ADA compliant communication device shall be provided which has been designed in response to ADAAG requirements integral with the car operating panel.

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.5 Car Lantern and Chime: A directional lantern visible from the corridor shall be provided in the car entrance. When the car stops and the doors are opening, the lantern shall indicate the direction in which the car is to travel and a chime will sound.

.6 Hall Fixtures: Hall fixtures shall be provided with necessary push buttons and key switches for elevator operation. Raised markings shall be provided for each push-button. Otis series 5.

.7 Fixture Finish**: satin stainless steel.**

.8 Landing Passing Signal: A chime bell shall sound in the car to tell a passenger that the car is either stopping at or passing a floor served by the elevator.

.9 Security Lockout Key switches to disable activation of hall buttons.

Part 3 Execution

3.1 MANUFACTURER=S INSTRUCTIONS

.1 Compliance: Comply with manufacturer=s written data, including product technical bulletins, product catalog installation instructions, product carton installation instructions, and data sheet.

3.2 PREPARARTION

.1 Take field dimensions and examine conditions of substrates, supports, and other conditions under which this work is to be performed. Do not proceed with work until unsatisfactory conditions are corrected.

3.3 INSTALLATION

.1 Installation of all elevator components except as specifically provided for elsewhere by others.

3.4 SITE TESTS

.1 Perform and meet tests required by CAN/CSA-B44.

.2 Supply instruments and execute specific tests.

.3 Furnish test and approval certificates issued by jurisdictional authorities.

3.5 CLEANING

.1 Remove protective coverings from finished surfaces and components.

.2 Clean surfaces and components ready for inspection.

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3.6 ADJUSTMENTS

.1 The elevator contractor shall make a final check of each elevator operation with the Owner or Owner's representative present prior to turning each elevator over for use. The elevator contractor shall determine that control systems and operating devices are functioning properly.

.2 Adjust door opening and closing times to suit handicapped users in accordance with Engineer's instructions.

.3 Adjust control system to cause elevators to answer hall calls during working day within performance criteria specified.

.4 Adjust for smooth acceleration and deceleration of car as so not to cause passenger discomfort.

.5 Adjust automatic floor levelling feature at each floor.

END OF SECTION

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1. GENERAL

1.1. General Requirements

1. Conform to the requirements stated in the General Conditions, Supplementary General Conditions of this Specification and all addenda for all work, including work outside the property line including work within Regional and Municipal right of way unless otherwise noted.

1.2. Related Work

1.	Site Grading	Section 31 23 13
2.	Excavation, Trenching and Backfilling	Section 31 23 10
3.	Granular Base	Section 32 11 23
4.	Granular Sub-Base	Section 32 11 19
5.	Asphalt Paving	Section 32 12 16

1.3. References

1. ASTM D4791-10, Test Method for Flat or Elongated Particles in Coarse Aggregate.
2. Ontario Provincial Standard Specification 1001.

1.4. Samples

1. Submit samples in accordance with Section 01 33 00.
2. Allow continual sampling by Consultant during production.
3. Provide Consultant with access to source and processed material for sampling.
4. Install sampling facilities at discharge end of production conveyor, to allow Consultant to obtain representative samples of items being produced. Stop conveyor belt when requested by Consultant to permit full cross section sampling.

2. PRODUCTS

2.1. Materials

1. Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, or other substances that would act in deleterious manner for use intended.
2. Flat and elongated particles of coarse aggregate: to ASTM D4791.
    1. Greatest dimension to exceed five times least dimension.
3. Fine aggregates satisfying requirements of applicable section to be one, or blend of following.
    1. Natural sand.
    2. Manufactured sand.
    3. Screenings produced in crushing of quarried rock, boulders or gravel.
4. Coarse aggregates satisfying requirements of applicable section to be one of or blend of the following:
    1. Crushed rock.

2. Gravel and crushed gravel composed of naturally formed particles of stone.

2.2. **Source Quality Control**

1. Inform Consultant of proposed source of aggregates and provide access for sampling at least four weeks prior to commencing production.
2. If, in opinion of Consultant, materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate an alternative source or demonstrate that material from source in question can be processed to meet specified requirements.
3. Advise Consultant four weeks in advance of proposed change of material source.
4. Acceptance of material at source does not preclude future rejection if it fails to conform to requirements specified, lacks uniformity, or if its field performance is found to be unsatisfactory.

3. **EXECUTION**

3.1. **Preparation**

1. Aggregate source preparation
    1. Prior to excavating materials for aggregate production, clear and grub area to be worked, and strip unsuitable surface materials. Dispose of cleared, grubbed and unsuitable materials as directed by Consultant.
    2. Where clearing is required, leave screen of trees between cleared area and roadways as directed.
    3. Clear, grub and strip area ahead of quarrying or excavating operation sufficient to prevent contamination of aggregate by deleterious materials.
    4. When excavation is completed, dress sides of excavation to nominal 1.5:1 slope, and provide drains or ditches as required to prevent surface standing water.
    5. Trim and dress slopes and leave site in neat condition.
2. Processing
    1. Process aggregate uniformly using methods that prevent contamination, segregation and degradation.
    2. Blend aggregates, if required, to obtain gradation requirements, percentage of crushed particles, or particle shapes, as specified. Use methods and equipment approved by Consultant.
    3. Wash aggregates to meet specifications. Use only approved equipment.
    4. When operating in stratified deposits use excavation equipment and methods that produce uniform, homogeneous aggregate.
3. Handling
    1. Handle aggregates to avoid segregation, contamination and degradation.
4. Stockpiling
    1. Stockpile aggregates on site in locations as indicated unless directed otherwise by Consultant. Do not stockpile on completed surfaces.
    2. Stockpile aggregates in sufficient quantities to meet project schedules.

3. Stockpiling sites to be level, well drained, and of adequate bearing capacity and stability to support materials and handling equipment.

4. Except where stockpiled on acceptably stabilized areas, provide compacted sand base not less than 300 mm in depth to prevent contamination of aggregate. Stockpile aggregates on ground but do not incorporate bottom 300 mm of pile into work.

5. Separate different aggregates by strong, full depth bulkheads, or stockpile far enough apart to prevent intermixing.

6. Do not use intermixed or contaminated materials. Remove and dispose of rejected materials as directed by Consultant within 48 h of rejection.

7. Stockpile materials in uniform layers of thickness as follows:

    1. Max. 1.5 m for coarse aggregate and base course materials.

    2. Max. 1.5 m for fine aggregate and sub-base materials.

    3. Max. 1.5 m for other materials.

8. Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.

9. Do not cone piles or spill material over edges of piles.

10. Do not use conveying stackers.

11. During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

3.2. **Cleaning**

1. Leave aggregate stockpile site in tidy, well drained conditions, free of standing surface water.

2. Leave any unused aggregates in neat stockpiles as directed by Consultant.

END OF SECTION

Part 1 General

1.1 A copy of the following investigations are enclosed in Binder C.

1.2 GEOTECHNICAL INVESTIGATIONS

.1 **Geotechnical Investigation**

Milton #13 Public School
Trudeau Drive and Street 1
Milton, Ontario
Prepared by: Soil Engineers Ltd.
Project No. : 2509-S167
Date: January 2026

1.3 DISCLAIMER

.1 The Geotechnical Report is not part of the Contract Documents prepared by the Architect or his sub consultants. It is bound into the Specifications set for convenient reference only. The Geotechnical report was not prepared by or under the supervision of the Architect. While every effort has been made to attempt to provide comprehensive geotechnical information for the purposes of design and tendering, the Architect claims no responsibility for the accuracy of the information contained in the report.

.2 Refer to Section 00 21 13 – 'Instruction to Bidders', article 1.24-Examination of the Site.

1.4 CAUTIONARY NOTE REGARDING SITE FILL

.1 The investigation referenced above took place after the site was filled by the subdivision developer.

.2 Report of the analysis for chemical testing of soil is included in Binder C.

Part 2 Products

2.1 NOT USED

.1 Not used.

.2

Part 3 Execution

3.1 NOT USED

.1 Not used.

.2

END OF SECTION

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Part 1 General

1.1 RELATED WORK

.1 Site Grading — Section 31 23 13

.2 Excavating, Trenching and Backfilling — Section 31 23 10

1.2 SCOPE and PREVIOUS FILL BY DEVELOPER

.1 Refer to drawings and other sections regarding extent of previous grading completed by the subdivision developer.

1.3 EXAMINATION

.1 Examine the Drawings, Specifications, and Geotechnical Report data which show soil conditions at boreholes, after the site was filled by the developer**,** in locations shown on Drawings. Visit the site and determine the work extent and nature of the existing conditions. In no circumstances will any claims against the Owner be allowed resulting from failure to ascertain the work herein described or implied.

.2 Report to the Consultant in writing any conditions which will prejudice the proper completion of the work of this Section. Commencement of work constitutes acceptance of existing conditions.

1.4 BURIED SERVICES

.1 Before commencing work confirm no buried services remain on the site and locate all services adjacent to the site. Engage private locate firm for underground scan for all areas of work outside the property lines.

.2 Other than items noted on drawings, buried services within the municipal right of way that require relocation is to be paid from the Cash Allowance.

1.5 PROTECTION

.1 Establish locations of all electrical, telephone, or other service installations existing in the areas of site preparation by contacting the service owners and obtaining their approval to work in such areas. Contact the Municipality, the Region of Halton and local utilities to review proposed scheduling, work activities and regulations pertaining to all work beyond the limits of the property including but not limited to parking areas, storm water outlet and headwall and asphalt driveway entrances. Provide adequate markers or take protective measures to ensure that no damage will be caused under this Section. Repair or replace damaged work as required without cost to the Owner.

.2 Electronically locate, map and record location of services prior to doing any excavation.

1.6 DUST CONTROL

.1 Provide and maintain to the Consultant's satisfaction, adequate system to avoid any nuisance caused by dust and dirt rising throughout the area of operations.

1.7 SILT CONTROL

.1 Provide and maintain to the Consultant's and to the Authorities' satisfaction, control systems to prevent silt from entering any storm drainage system.

Part 2 Products

2.1 NOT APPLICABLE

Part 3 Execution

3.1 DISPOSAL OF WASTE AND SURPLUS MATERIALS

.1 Except where specified or indicated on Drawings to be retained on site, or to be reused, remove from the site, all waste and surplus materials resulting from site preparation work on a daily basis. Dispose of as required in accordance with local or provincial regulations. Under no circumstances shall the burning of rubbish be permitted on the site. Where items are to be reused, store on site where designated and provide temporary protection to same to prevent damage by construction operations.

.2 It is the Contractor's responsibility to refer to the Soil Chemical Report provided by the Geotechnical Consultant, included for convenience in Binder C.

.3 All nine (9) soil samples met the MECP Table 1 RPIICC Standards for metals and ORPs analysis except 2 samples which exceeded the SCS for electrical conductivity (EC). Soil in the area of samples BH22-9 SS3 and BH22-13 SS3 that exceeded the Table 1 RPIICC SCS for EC is to remain on site under paved area planned in this location, or be disposed of at a receiving landfill site that accepts this type of material.

END OF SECTION

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Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 56 00 - Temporary Barriers and Enclosures.

.3 Section 01 35 43 - Environmental Procedures.

.4 Section 31 23 13 - Rough Grading.

.5 Section 32 91 21 – Top soil and Finish Grading.

.6 Section 31 05 17 - Aggregate Materials.

.7 Section 32 93 10 - Landscaping and Plant Maintenance.

.8 Section 33 46 20 – Foundation and Underslab Drainage.

.9 Section 32 12 17 – Asphalt Paving.

1.2 REQUIREMENTS OF REGULATORY AGENCIES

.1 Work of this Section shall include protection measures, consisting of materials, constructions, and methods required by the Occupational Health and Safety Act, 1987, of the Province of Ontario, and as otherwise imposed by Jurisdictional Authorities to save persons and property from harm.

.2 Submit shop drawings required by authorities.

1.3 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM C117-95, Standard Test Method for Material Finer Than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C136-96a, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D422-98, Standard Test Method for Particle-Size Analysis of Soils.

.4 ASTM D698-00a, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft ^{3}) (600 kN-m/m ^{3}).

.5 ASTM D1557-00, 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 D4318-00, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

.2 Canadian General Standards Board (CGSB)

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.1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.

.2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

.3 Canadian Standards Association (CSA)

.1 CAN/CSA-A3000-98-A5-98, Portland Cement.

.2 CAN/CSA-A23.1-00, Concrete Materials and Methods of Concrete Construction.

1.4 DEFINITIONS

.1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.

.1 Rock : any solid material in excess of 0.25 m^3 and which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95 to 1.15 m^3 bucket. Frozen material not classified as rock.

.2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.

.2 Unclassified excavation: excavation of deposits of whatever character encountered in Work.

.3 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.

.4 Waste material: excavated material unsuitable for use in Work or surplus to requirements.

.5 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.

.6 Unsuitable materials:

.1 Weak and compressible materials under excavated areas.

.2 Frost susceptible materials under excavated areas.

.3 Frost susceptible materials:

.1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM D422 and ASTM C136 : Sieve sizes to CAN/CGSB-8.1 CAN/CGSB-8.2.

.2 Coarse grained soils containing more than 20 % by mass passing 0.075 mm sieve.

.7 Unshrinkable fill: very weak mixture of Portland cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

1.5 SUBMITTALS

.1 Samples:

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

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.2 Inform Consultant at least 2 weeks prior to commencing Work, of proposed source of fill materials and provide access for sampling.

.3 Submit 25 kg samples of type of fill specified including representative samples of excavated material.

.4 Ship samples prepaid to Inspection firm, in tightly closed containers to prevent contamination.

1.6 QUALITY ASSURANCE

.1 Engage services of qualified professional Engineer who is registered or licensed in Province of Ontario, Canada in which Work is to be carried out to design and inspect cofferdams, shoring, bracing and underpinning required for Work, where required.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate plastic, paper packaging and corrugated cardboard and place in designated containers.

.2 Place materials defined as hazardous or toxic in designated containers.

.3 Ensure emptied containers are sealed and stored safely.

1.8 PROTECTION OF EXISTING FEATURES

.1 Refer to *Section 01 11 00 – 'Summary of Work – article 1.5 Existing Conditions'* and *Section 31 21 13 – 'Rough Grading'* for requirements to provide underground scan in addition to service locates for all areas of work beyond the property lines.

.2 Protect existing features in accordance with Section 01 56 00 - Temporary Barriers and Enclosures and applicable local regulations.

.3 Existing buried utilities and structures:

.1 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.

.2 Prior to commencing excavation Work, notify applicable Owner or authorities having jurisdiction, establish location and state of use of buried utilities and structures. Owners or authorities having jurisdiction to clearly mark such locations to prevent disturbance during Work.

.3 Confirm locations of buried utilities by careful test excavations.

.4 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered as indicated.

.5 Ensure that adjacent property is not damaged in any way by excavating and grading work; by the removing, stockpiling and transporting of materials; by blown sand and dust or by spillage during the removing, stockpiling and transporting of materials; by the collapse or movement of excavated banks and stockpiles; or by storm water from altered drainage course.

.6 Ensure that no damage is caused by earthwork to existing structures, trees, buried and above-ground services, bench marks, and survey monuments on the site, or

adjacent property. Arrange or ensure that all damage which occurs is repaired completely and immediately.

.7 Protect newly-graded areas from the action of the elements. Repair settlement and washouts that occurs before acceptance of the work, and re-establish grades to the required elevations and slopes. Fill to required subgrade levels any area where settlement occurs.

.8 Bail or pump all water out of excavation, from whatever cause, as it accumulates. Take all necessary measures to prevent flow of water and earth fines into the excavation.

.9 Support existing buildings, walks, roads, and services, and prevent cave-ins of excavated banks. A Professional Engineer specializing in this work shall design all protection. Provide shop drawings for authorities as required.

.10 Temporarily cover all existing catchbasins and manholes to prevent entry of earth or debris.

.11 Electronically locate underground services such as electrical and telephone lines, gas and water and sewer lines. Mark line of services with yellow ribbons or stakes with tip fluorescent painted, and indicating both plan location and depth.

.12 Protect the bottom and sides of the excavated pits and trenches from exposure to sun and rain to prevent cave-ins and softening of the bed upon which concrete and drains rest.

1.9 DUST CONTROL

.1 Provide and maintain adequate system to avoid any nuisance caused by dust and dirt rising throughout the area of operations. The use of calcium chloride is prohibited.

Part 2 Products

2.1 MATERIALS

.1 Fill "A": Granular material meeting OPSS Material Specification for Aggregates, Form 1010, Granular "A". Minimum compaction density 98% Standard Proctor. For use primarily as bedding material.

.2 Fill "B": Granular material meeting OPSS Material Specification for Aggregates, Form 1010, Granular "B"-Type 2 or imported 50mm crusher run limestone, type 2. Minimum compaction density 100% Standard Proctor. For use primarily as fill under building slab on grade areas and foundation backfill.

.3 Fill "C": Site (native) material, containing no organic or foreign matter, and which the Contractor can demonstrate is compactable to a density of 98% to 100% Standard Proctor. Minimum compaction density: 98% SPDD. For use primarily as fill under playfields areas and under paved areas up to underside of sub-base elevation.

.4 Fill “D”: Refer to Section 32 12 17 –‘Asphalt Paving’ for 50 mm Crushed limestone sub-base and 19 mm crushed limestone base course used under paved areas.

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.5 Crushed Stone Fill Under Slabs on Grade: Clean, Graded 20mm angular, natural clear crushed stone from approved source, free from shale, clay and friable materials and organic matter and containing no more than 10% passing the No.4 sieve.

.6 Impervious Fill: Fine grain material such as clay, which is relatively impervious to the flow of water.

.7 Granular Bedding: OPSS Granular "A", concrete sand (CAN/CSA A23.1-M90) or crusher-run limestone. Minimum compaction 100% Standard Proctor density.

Part 3 Execution

3.1 SITE PREPARATION

.1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.

.2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

3.2 EXAMINATION

.1 Ensure in examination of the site that all possible factors concerning earthwork are investigated, and that the following are known in particular:

.1 Methods and means available for material handling, disposal, storage, and transportation.

.2 Physical conditions of site, including ground water table and drainage courses.

.3 Conformation and condition of ground surfaces.

.4 Character, quality, and quantity of surface and subsurface materials.

3.3 SOIL INVESTIGATION

.1 Soil investigation of the site was carried out by other consultants engaged by the Owner for the purpose of guidance in design and construction. A report and bore hole log on this investigation were prepared and are provided for information purposes. No responsibility is assumed by the Owner or Architects for the scope, accuracy, or interpretation of the soil investigation report. Be responsible for adjusting estimates to incorporate conditions identified or reasonably inferred in the report, as documented in the Geotechnical Data.

3.4 STOCKPILING

.1 Stockpile fill materials in areas designated by Engineer Stockpile granular materials in manner to prevent segregation.

.2 Protect fill materials from contamination.

3.5 COFFERDAMS, SHORING, BRACING AND UNDERPINNING

.1 Obtain permit from authority having jurisdiction for temporary diversion of water course.

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.2 Construct temporary Works to depths, heights and locations as directed by Engineer.

.3 During backfill operation:

.1 Unless otherwise as indicated or as directed by Engineer, remove sheeting and shoring from excavations.

.2 Do not remove bracing until backfilling has reached respective levels of such bracing.

.3 Pull sheeting in increments that will ensure compacted backfill is maintained at an elevation at least 500 mm above toe of sheeting.

.4 When sheeting is required to remain in place, cut off tops at elevations as indicated.

.5 Upon completion of substructure construction:

.1 Remove cofferdams, shoring and bracing.

.2 Remove excess materials from site and restore water courses as indicated and as directed by Engineer.

3.6 DEWATERING AND HEAVE PREVENTION

.1 Keep excavations free of water while Work is in progress.

.2 Dewater the site as necessary for the installation of the work, by providing a series of temporary trenches/pits and pumping as necessary. Backfill temporary trenches/pits and restore area when dewatering is no longer required.

.3 At no additional cost to the Owner, dewater the site as necessary to maintain the schedule and protect the work. Ensure the water pumped from site does not contaminate sewers municipal or on site sewer system. If required, arrange and pay for the cost of flushing sewers used for dewatering drainage routes.

.4 Submit for Engineer's approval details of proposed dewatering or heave prevention methods, such as dikes, well points, and sheet pile cut-offs.

.5 Avoid excavation below groundwater table if quick condition or heave is likely to occur. Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.

.6 Protect open excavations against flooding and damage due to surface run-off.

.7 Dispose of water in accordance with Section 01 35 43 - Environmental Procedures and in manner not detrimental to public and private property, or any portion of Work completed or under construction.

.8 Provide flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers, water courses or drainage areas.

3.7 EXCAVATION

.1 Advise Engineer at least 7 days in advance of excavation operations for initial cross sections to be taken.

.2 Refer to Geotechnical Investigation Report included in Binder C for instructions on soil removal, reuse, imported material and compaction.

.3 Remove top layer of soil and fill containing organics.

.4 Excavated material will be very sensitive to moisture content and handling. Granular B to be used to backfill areas and raise grades as required.

.5 Perform bulk excavation and detailed excavation for construction of building (and for installation of mechanical and electrical services). Excavate beyond wall faces sufficiently to allow removal of forms, if applicable, but generally no more than 900 mm beyond centre of wall. Do not re-fill over excavated areas with materials removed, nor any other material without the approval of the Consultant. Excavation and disposal of boulders is part of this section.

.6 Remove disturbed earth displaced by adjacent construction.

.7 Notify the Consultant of completion of excavation work and before any concrete or fill is placed on the bearing strata, in order that he may inspect the exposed bearing surfaces.

.8 Remove excess and unsuitable excavated materials from the site. Comply with the MOE regulations and those of other regulating bodies, regarding disposal of contaminated soil.

.9 Blasting is prohibited, except upon written permission of Consultant. Rock removal, if required, shall be by means of Ram Splitting equipment only.

.10 Keep all surfaces against which concrete, unit masonry or fill is to be placed free from frost. Thaw out frozen surfaces against which concrete or fill is to be placed to unfrozen depth.

.11 Excavation must not interfere with bearing capacity of adjacent foundations.

.12 Do not disturb soil within branch spread of trees or shrubs that are to remain. If excavating through roots, excavate by hand and cut roots with sharp axe or saw.

.13 Keep excavated and stockpilled materials a safe distance away from edge of trench as directed by Engineer.

.14 Restrict vehicle operations directly adjacent to open trenches.

.15 Do not obstruct flow of surface drainage or natural watercourses.

.16 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.

.17 Notify Engineer when bottom of excavation is reached.

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.18 Obtain Engineer approval of completed excavation.

.19 Hand trim, make firm and remove loose material and debris from excavations. Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil. Clean out rock seams and fill with concrete mortar or grout to approval of Engineer.

3.8 COMPACTION

.1 Provide, operate and maintain compacting equipment necessary to achieve the compaction densities specified.

.2 Compact fill until the required density is achieved. Do not compact material containing frost.

.3 Fill hollows and depressions which develop under compaction with matching backfill material. If the base becomes rutted or displaced due to any cause, regrade the surface.

.4 Compact backfill by means of vibratory type equipment capable of achieving the desired degree of compaction. Use manually operated vibratory tampers in the proximity of foundations and in areas not readily accessible to roller equipment. Make good damage to the structure due to compaction and settlement of fill. Report damage to foundations promptly to the Consultant. Obtain approval of remedial procedures.

3.9 BACKFILLING

.1 Plug unused services such as drains, sewers, field tile, and service pipes uncovered by excavation.

.2 Backfill at foundation walls only after they have been approved by Consultant.

.3 Backfill with 200 mm deep layers of fill or as specified, each consolidated before the next is placed.

.4 Backfill to mechanical and electrical service trenches as specified in the electrical and mechanical specifications.

.5 When backfilling both sides of walls, place fill simultaneously on both inner and outer faces to balance pressure on wall.

.6 Where walls are to be backfilled on one side only, commence backfilling only when the ground floor structural members are in place, if applicable, or adequate bracing is provided for top and bottom of foundation walls.

.7 Compact fill to densities specified for material requirements.

.8 Do not proceed with backfilling operations until [Engineer] [Consultant] has inspected and approved installations.

.9 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.

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.10 Do not use backfill material which is frozen or contains ice, snow or debris.

.11 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.

.12 Backfilling around installations.

.1 Place bedding and surround material as specified elsewhere.

.2 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.

.3 Place layers simultaneously on both sides of installed Work to equalize loading.

.4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:

.1 Permit concrete to cure for minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure and approval obtained from Engineer.

.2 If approved by Engineer erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by Engineer.

.13 Install drainage system in backfill as directed by Consultant.

3.10 FILL UNDER FLOOR SLABS

.1 Prior to filling, proof-roll existing earth subgrade in order to identify inconsistencies or soft areas. Proceed with filling operations only after inconsistencies or soft areas have been reworked and compacted or excavated, backfilled and compacted as required to eliminate such conditions.

.2 Avoid proof-rolling close to caissons, columns, walls and other structures within the confines of the proof rolling operations.

.3 Prior to placing fill, ensure existing ground is compacted to 98% Standard Proctor density.

.4 Place approved fill under floor slabs as soon as foundation walls are completed to floor level and mechanical and electrical services are installed in trenches.

.5 Place fill in layers of 150mm maximum, and consolidate each before placing next layer.

.6 Compact fill to density specified for material requirements with a heavy vibrating roller. Compact fill adjacent to walls, piers, or wherever else heavy roller equipment cannot approach, with mechanical tampers to equivalent density. Dig out soft spots and re-fill and compact to specified density.

.7 Where undisturbed soil surface is low below areas of slab-on-grade, bring level up to within 200 mm of underside of slab fill with Fill "B". Do not use fill “C” within building area.

.8 Backfill trenches to within 200 mm of underside of slab fill with Fill "B".

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.9 The final 200 mm layer under slabs shall be clear crushed stone, as specified. Place crushed stone in maximum 100 mm layers and compact to 100% Standard Proctor Density.

3.11 FILL UNDER PAVED AREAS

.1 Prior to filling, proof-roll existing earth subgrade in order to identify inconsistencies or soft areas. Proceed with filling operations only after inconsistencies or soft areas have been reworked and compacted or excavated, backfilled and compacted as required to eliminate such conditions.

.2 Avoid proof-rolling close to caissons, columns, walls and other structures within the confines of the proof rolling operations.

.3 Prior to placing fill, ensure existing ground is compacted to 98% Standard Proctor density.

.4 Place specified granular fill in layers of 150mm maximum, and consolidate each before placing next layer, up to underside of pavement sub-base elevation.

.5 Compact fill to density specified for material requirements with a heavy vibrating roller. Compact fill adjacent to walls, piers, or wherever else heavy roller equipment cannot approach, with mechanical tampers to equivalent density. Dig out soft spots and re-fill and compact to specified density.

3.12 FILL UNDER PLAYFIELDS AND LANDSCAPED AREAS

.1 Construction access, contractor parking areas and Portables Area are intended to be reinstated in time for sod to have a minimum of 6 weeks to “take” prior to Fit for Occupancy. Identify this target date on the project schedule. Conduct site work and schedule accordingly to complete work related to sodding these areas as early as possible prior to contract completion.

.2 Use Fill “C” native site material for fill under the landscaped areas as indicated on drawings.

.3 Prior to placing fill, ensure existing ground is compacted to 95% Standard Proctor Density.

.4 Place fill in layers of 200 mm maximum and consolidate each before placing next layer.

.5 Compact Fill “C” to minimum 95% Standard Proctor Density under playfields.

3.13 RESTORATION

.1 Upon completion of Work, remove waste materials and, trim slopes, and correct defects as directed by Consultant.

.2 Place topsoil as directed by Consultant.

.3 Reinstate lawns to elevation which existed before excavation.

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.4 Reinstate pavements and sidewalks disturbed by excavation to thickness, structure and elevation which existed before excavation.

.5 Clean and reinstate areas affected by Work as directed by Consultant.

.6 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 hours.

.7 The Owner will engage the services of an Inspection and Testing Company to verify that work conforms to the requirements of the specifications.

.8 The Contractor shall cooperate fully with the testing and inspection company.

.9 The Contractor shall maintain its own quality control program to ensure that its work conforms to the drawings and specifications.

.10 Submit 4 kg. samples of the fill materials to the inspection and testing company at least 10 days prior to commencement of backfill operations. Materials tested and approved shall constitute a standard for the acceptance of material delivered to the site.

.11 The inspection and testing company shall be responsible for the following work:

.12 Determine the depth of unsatisfactory material, if any, to be removed.

.13 Inspect and approve the sub-grade prior to commencement of backfill operations.

.14 Test and approve the proposed backfill materials.

.15 Be present full time during operations in order to inspect and approve the methods of placing and compacting and to carry out the necessary tests to determine the Proctor Density of the backfill and the actual field densities being obtained. Take sufficient tests to ensure that adequate information is obtained to judge the uniformity of compaction. Inspect all piping and conduit in place in trenches prior to backfilling to ensure correct slope and placement as designed.

.16 Check the quality of backfill being delivered to the site.

.17 Check the depth of granular fill.

.18 Confirm bearing elevations. Confirm and record spot elevations of all piping at critical locations to confirm design depths and slopes.

.19 Check installation of weeping tile.

.20 Issue reports to the Consultant tabulating test results and giving final approval and suggestions as to the backfilling and compaction operation.

.21 The cost of such inspection and testing shall be paid for under the Fill and Compaction Testing Allowance specified in Section 01 11 00- Summary of Work. The cost of retesting unacceptable compaction shall be borne by this Section.

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3.14 INSPECTION AND TESTING

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

END OF SECTION

□

Part 1 General

1.1 RELATED SECTIONS

.1 Section 013543 – Environmental Protection.

.2 Section 329121 – Topsoil and Finish Grading.

.3 Section 329310 – Planting of Trees, Shrubs and Ground Covers.

.4 Section 31 23 10 - Excavation, Trenching and Backfilling.

.5 Section 33 46 20 – Foundation and Underslab Drainage .

.6 Section 033000 – Cast-in-Place Concrete.

.7 Section 32 12 17 – Asphalt Paving.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM D698-[91(1998)], Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m ^{3}).

1.3 EXISTING CONDITIONS

.1 Refer to Drawings and other sections regarding extent of fill and rough grading completed previously be the subdivision developer.

.2 Contractor shall coordinate and obtain required separate Permits for all work to public boulevard areas outside the property line. Refer to *Section 00 11 00 – 'Summary of Work, article 1.5 Existing Conditions*' and *Section 00 21 13 – 'Instructions to Bidders, article 1.26'* for additional permit requirements prior to construction.

.3 Refer to Geotechnical Report. Note that boreholes refer to data recorded prior to previous bulk rough grading contract being executed. Note that depth of previous excavation prior to backfill is provided for areas within the building envelope. Contractor is responsible to coordinate with Structural Drawings and Specifications to determine depths of foundations.

.4 Contractor is responsible to quantify all on-site material to achieve design grades and is responsible for the importation or exportation of material from the site as required.

.5 Known underground and surface utility lines and buried objects are indicated on site plan. Confirm exact locations of utility lines and buried objects prior to machine excavation or grading. In addition to all utility locates, contractor shall conduct engage a private locate company to conduct an underground scan for all areas of grading and excavation outside the property lines.

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1.4 PROTECTION

.1 Protect and/or transplant existing trees, landscaping, natural features, bench marks, pavement, surface or underground utility lines which are to remain as directed by Consultant. If damaged, restore to original or better condition unless directed otherwise.

.2 Maintain access roads to prevent accumulation of construction related debris on roads.

Part 2 Products

2.1 MATERIALS

.1 Fill material to all parking and driveway areas, asphalt and concrete paving areas and building pad: OPSS Granular B-Type 2 in accordance with of Section 31 23 10 - Excavating, Trenching and Backfilling.

.2 Excavated or graded material existing on site may be suitable to use as fill for grading work if approved by Consultant and uncontaminated type of existing materials meets the requirements herein for stated locations.

Part 3 Execution

3.1 STRIPPING OF TOPSOIL

.1 There is no reusable topsoil on this site. Topsoil has already been generally stripped and removed from the site as part of previous fill and rough grading operations.

.2 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected as determined by Consultant

.3 Examine the site and determine the extent of areas previously stripped and approximate depth of remaining topsoil, if any.

.4 Strip the remaining topsoil from the site as part of the work in this Section.

.5 Remove any remaining top soil that may exist from areas to be excavated, paved and regraded.

.6 Strip top soil when dry enough to prevent contamination of subgrade.

.7 Contractor is responsible to quantify all on-site material to achieve design grades and is responsible for the importation or exportation of material from the site as required. Existing excess topsoil, if any, must be quantified before tender and may be re-used for general sodded areas as described in Section 32 91 21 Topsoil Placement and Grading.

.8 Remove from site existing grass and vegetation and surplus top soil, if any.

3.2 GRADING

.1 Grading Plan includes the existing, as-built conditions of the site within the property limits.

.2 The Contractor shall use the information shown on the site plan, the grading plan, the Geotechnical Report, as well as the information observed during visits to the site during the Tender Period, as the. basis for the "Existing Conditions" of the site.

.3 Rough grade to levels, profiles, and contours allowing for surface treatment as indicated. Ensure that rough grading operations to not promote water ponding in construction areas.

.4 Perform construction grading to allow proper construction access to the work.

.5 Grade to prevent water ponding on site during construction period. Create additional ditches, swales, slopes, ponds, etc. as required by Contract Documents and Municipal Authorities for control of drainage, sedimentation and topsoil retention.

.6 Unless suitable uncontaminated fill or cut has been completed by previous contract, rough grade to following depths below finish grades:

- .1 150 mm for grassed areas.
- .2 400 mm for flowerbeds.
- .3 450 mm for shrub beds.
- .4 600 mm for heavy asphalt paving.
- .5 540 mm for medium duty asphalt paving.
- .6 275 mm for concrete walks.
- .7 Maximum tolerance for rough grade elevation : .+- 25 mm

.7 Slope rough grade away from building 1:50 2 % minimum.

.8 Grade swales and ditches to depths as indicated.

.9 Prior to placing fill over existing ground, scarify surface to depth of 150 mm. Maintain fill and existing surface at approximately same moisture content to facilitate bonding.

.10 Compact filled and disturbed areas to maximum dry density to ASTM D698, as follows:

- .1 95% under landscaped areas.
- .2 98 % under paved and walk areas.

.11 Do not disturb soil within branch spread of trees or shrubs to remain.

3.3 TESTING

.1 Inspection and testing of soil compaction will be carried out by testing agency hired by the owner.

.2 Tests to be conducted on imported soils and provided by a ULC designated laboratory prior to bringing to and placing on the site.

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.3 Costs of tests will be paid under a Cash Allowance. Refer to Section 01 11 00 – Summary of Work.

.4 Submit testing procedure, frequency of tests, [testing laboratory as designated by ULC or certified testing personnel to Consultant for approval and review.

3.4 SURPLUS MATERIAL

.1 Remove surplus material and material unsuitable for fill, grading or landscaping as directed by Consultant and Municipal Authorities.

.2 Include for removal and disposal of asphalt driveways, excess fill, rubble, etc. beyond property lines within work areas shown on SG.1 and SS.1

.3 Confirm locations on site prior to tender.

END OF SECTION

□

1. GENERAL

1.1. General Requirements

1. Conform to the requirements stated in the General Conditions, Supplementary General Conditions of this Specification and all addenda for all work.

1.2. Related Work

1. Aggregates — Section 31 05 17

1.3. References

1. ASTM D4791-10, Test Method for Flat or Elongated Particles in Coarse Aggregate.
2. Ontario Provincial Standard Specification 1001.

2. PRODUCTS

2.1. Materials

1. Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, or other substances that would act in deleterious manner for use intended.
2. Geotextile for siltation control fence shall be Class I non-woven geotextile fabric in accordance with OPSS 1860.

2.2. Source Quality Control

1. Inform Consultant of proposed source of aggregates and provide access for sampling at least four weeks prior to commencing production.
2. If, in opinion of Consultant, materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate an alternative source or demonstrate that material from source in question can be processed to meet specified requirements.
3. Advise Consultant four weeks in advance of proposed change of material source.
4. Acceptance of material at source does not preclude future rejection if it fails to conform to requirements specified, lacks uniformity, or if its field performance is found to be unsatisfactory.

3. EXECUTION

3.1. Installation

1. Silt Control Fence
    1. Install silt control fence along construction site perimeter including tee bars, geotextile filter fabric, clear stone along the upstream side of the fence in the instance the ground is frozen.

3.2. Maintenance

1. Maintain silt control fencing for the duration of the construction and replace as required until the site is stabilized.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 31 23 13 - Rough Grading.

.3 Section 31 23 10 – Excavation, Trenching and Backfilling.

.4 321613 Concrete Curbs and Gutters

.5 Section 32 17 23 – Pavement Markings

.6 Section 03 30 00 – Cast-in-Place Concrete.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)

.1 ASTM D698-[00a], Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.5- [M91 (March 1999)], Low Flash Petroleum Spirits Thinner (Reaffirmation of December 1991).

.2 CAN/CGSB-1.74- [2001], Alkyd Traffic Paint.

.3 Government of Québec, Minister of Transport

.1 Cahier des charges et devis généraux (CCDG)-[97].

.4 Ontario Provincial Standard Specifications (OPSS)

.1 OPSS 302-[April 1999], Construction Specification for Primary Granular Base.

.2 OPSS 310-[March 1993], Construction Specification for Hot Mixed, Hot Laid Asphaltic Concrete Paving and Hot Mix Patching.

.3 OPSS 314-[December 1993], Construction Specification for Untreated Granular, Subbase, Base, Surface Shoulder and Stockpiling.

.4 OPSS 1010-[March 1993], Material Specification for Aggregates, Granular A, B, M and Select Subgrade Material.

.5 OPSS 1103-[February 1996], Material Specification for Emulsified Asphalt.

.6 OPSS 1150-[May 1994], Material Specification for Hot Mixed, Hot Laid Asphalt Concrete.

1.3 SAMPLES

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit to Consultant, samples of material for sieve analysis at least 2 weeks before beginning Work.

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1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.2 Place materials defined as hazardous or toxic in designated containers.

.3 Divert unused aggregate materials from landfill to facility for reuse as approved by Consultant.

.4 Dispose of unused paint and paint thinner materials at official hazardous material collections site as approved by Consultant.

.5 Fold up metal banding, flatten and place in designated area for recycling.

.6 Do not dispose of unused paint and paint thinner material into sewer system, into streams, lakes, onto ground or in other location where it will pose health environmental hazard.

.7 Divert unused asphalt from landfill to facility capable of recycling materials.

1.5 EXTENDED WARRANTY

.1 Submit a warranty for asphalt paving installation, covering materials and labour and the repair or replacement of defective work in accordance with the Contract, but for two (2) years total.

Part 2 Products

2.1 MATERIALS

.1 Sub-Base**:** Suitably compacted native material only where approved density and drainage is achieved**.** Otherwise in upfill locations use Fill type"B" where required to reach design elevations.

.2 Base: Granular B or 50 mm and 19 mm graded, crusher run limestone to depths indicated in section 3.2 of this specification and the geotechnical report in Binder C.

.3 Heavy Duty Pavement for some Parking and Driveways noted on site drawings**:** Hot mix, hot laid asphaltic concrete HL8 and HL3, mixture conforming to O.P.S.S. #1150.05.

.4 Medium Duty Pavement for some Parking, Driveway, Play Areas and Walkways as noted on the site drawings**:** Hot mix, hot laid asphaltic concrete HL8 and HL3, mixtures conforming to O.P.S.S. #1150.05.

.5 Joint Painting Material**:** SS-1 emulsion in accordance with O.P.S.S. #1103.05.

Part 3 Execution

3.1 PREPARATION

.1 Regard locations and instructions on drawings. Report any discrepancies or questions to the Consultant prior to proceeding with the work. In particular pay attention to the exact delineation of all edges of pavement and types of pavement;

.2 Set out work in accordance with lines and levels shown on Drawings. Maintain such lines and levels through duration of work. Ensure positive drainage toward catch basins is maintained in all areas.

.3 Compact sub-grade to a minimum of 98% Standard Proctor density.

.4 Ensure the granular base extends beyond the proposed edge of asphalt where otherwise unsupported.

.5 Paint exposed edge of asphaltic joints, edge of manhole and catchbasin frames, curbs and similar items with SS-1 emulsion.

3.2 INSTALLATION

.1 Inspect site grades prior to installation. Review the precise grade requirements required on the grading plan. Review with the Consultant prior to installation if any conditions exist that may cause deviations from grades shown on Drawings. Coordinate catchbasin elevations with those shown on Mechanical site plan.

.2 Pavement Section:

.1 Heavy Duty: at all parking and driveway areas (refer also to AD drawings)

- .1 minimum 300 mm compacted thickness of Granular B or 50 mm crusher run limestone compacted to 100% Standard Proctor Maximum Dry Density (SPMDD), ASTM-D698 .
- .2 150 mm compacted thickness Base course of 19 mm crusher run limestone compacted to 100% SPMDD.
- .3 60 mm compacted thickness of granular asphalt HL8.
- .4 40 mm compacted thickness of granular asphalt HL3.

.2 Medium Duty: at parking areas & at rear and side yard play and walkway areas noted on Site Plans.(refer also to AD drawings)

- .1 200 mm compacted thickness of Granular B or 50 mm crusher run limestone Sub-Base compacted to 100% Standard Proctor Maximum Dry Density (SPMDD), ASTM-D698.
- .2 150 mm compacted thickness Base course of 19 mm crusher run limestone compacted to 100% SPMDD..
- .3 40 mm compacted thickness of granular asphalt HL8.
- .4 40 mm compacted thickness of granular asphalt HL3.

.3 Placing Granular Materials:

.1 Exercise due care at all times to prevent granular materials from being contaminated by clay or other types of deleterious materials.

.2 Place materials immediately after sub-grade is inspected by the Architect and as follows:

- .1 To required width and thickness indicated on Drawings in layers not exceeding 100 mm compacted thickness crusher run limestone.
- .2 Grade each layer and compact to a minimum 100% standard Proctor density to a smoother surface conforming to required cross-section.

.4 Finished surface of granular material must not deviate more than 10 mm from designed grade.

.5 Placing Asphaltic Pavement:

.1 Obtain Consultant's inspection of compacted granular base before commencing asphalt paving.

.2 Air temperature during placing of mixture must be minimum 7 deg. C and rising. Temperature of mixture when spread must be not less than 120 deg. C nor more than 150 deg. C. Do not increase temperature of mixture to offset long distance hauling.

.3 Compact asphaltic mixture as soon as it can bear roller without undue displacement and hairline cracking and continue until all roller marks are eliminated. Speed of roller must at all times be slow enough to avoid displacement of mixture. Keep roller wheels slightly moistened by water to prevent adhesion of mixture. Excess water will not be permitted. Compact mixture with hot tampers in locations that are not easily accessible to machine roller.

.4 Rolling Procedure:

.1 Initial and final rolling must be accomplished using self-propelled Class "B" roller.

.2 Intermediate rolling must be carried out using self-propelled Class "C" roller or "D" roller. Intermediate roller must follow breakdown roller as closely as possible.

.5 Upon completion of compaction each pavement course must be:

.1 Smooth and true to crown and grade with variation not more than 6 mm from thickness shown on Drawing. Do not place any asphaltic course less than 25 mm thick nor more than 75 mm thick.

.2 Free from depressions exceeding 3 mm as measured with 3 m straight edge paralleling centre line of driveways/aisles.

.3 Compacted to a density not less than 97% Marshall.

.6 Finishing:

.1 Backfill all curbs.

.7 Joints:

.1 Cut back bituminous course to its full depth in straight or curved lines as required to expose fresh, straight, vertical surface. Remove broken and loose material.

.2 Asphalt must be placed in such a manner that joint must not be allowed to cool before adjacent asphalt course is applied.

.3 Where paving is comprised of two or more courses, joints must overlap by not less than 600 mm.

.4 Carefully place and compact hot asphaltic material against joints. Correct any unsatisfactory joint before proceeding with work.

.5 Feathering of joints will not be permitted.

.8 Inspection and Testing:

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

.2 Field inspections during installation and core samples of all asphalt areas will be taken as part of Inspection and Testing. **If tests show asphalt to be substandard to that specified, all asphalt shall be removed and replaced at the Contractor's expense. Cash credits will not be accepted for work which does not fully comply with drawings and specifications.**

3.3 CERTIFICATION OF GRADES

.1 The Contractor is required to provide as-constructed elevations of the parking area by an O.L.S. surveyor to verify that the parking lot has been constructed in accordance with the contract drawings.

END OF SECTION

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1 General

1.1 RELATED SECTIONS

.1 Section 32 12 16 – Asphalt Paving

1.2 QUALITY ASSURANCE

.1 All materials must conform to CSA CAN A.23.1-M90, latest edition (metric).

.2 Furnish the owner with a certificate prepared by the Ready-Mix concrete suppliers stating that all requirements regarding strength, slump, air entrainment, mix, materials and ration have been maintained.

.3 When required by the owner, have core tests taken at not less than 30 metre intervals, to determine the actual thickness of the paving. Pay all costs incurred. Patch pave to satisfaction of the owner at no extra cost.

.4 When required by the owner, have all concrete tested for compressive strength, slump and air content, in accordance with CSA CAN A.23.2-M90. Submit test reports in duplicate and pay all costs incurred.

1.3 PRODUCT DELIVERY, STORAGE & HANDLING

.1 Store all materials in accordance with CSA CAN A.23.1-M90 latest edition.

.2 Store reinforcing steel on racks or skids. Protect from contamination by dirt or other materials. Maintain steel in its fabricated form.

.3 Store forms off the ground and sufficiently supported to prevent warping or distortion. Protect from contamination by oil, grease, water, earth, etc.

.4 All concrete is to be ready-mixed at plant and transported to the site by truck in accordance with CSA CAN A.23.1-M90. Hand mixed concrete is not allowed unless approved in writing by the owner prior to starting any work.

.5 Place concrete in final position at such a rate that it remains plastic at all times and flows readily between reinforcement, into all corners and crevices and around all embedded fixtures. Pour in a continuous operation between expansion joints.

.6 Do not allow concrete to be contaminated by foreign materials or hardened concrete. Do not use retempered concrete unless approved in writing by the owner.

1.4 JOB CONDITIONS

.1 Protect all concrete surfaces from damage or harmful effects of weather, water, mechanical shock or trespassers until concrete is properly cured.

.2 If temperature is expected to drop below 5° below, place and protect concrete in accordance with ACI.605.

1.5 INSPECTION

.1 Obtain the approval of the owner of the layout, compacted sub-grade, compacted granular base, formwork and reinforcing before proceeding with subsequent work.

2 Products

2.1 MATERIALS

.1 Fill, if required: earth fill imported to the site, free from organic and foreign matter, capable of being compacted to 98% SPD.

.2 Granular base: 19mm diameter crusher run limestone.

.3 Portland Cement: Standard grey Portland cement, conforming to CSA CAN-A5-M88, latest edition.

.4 Aggregates: Nominal size as specified and conforming to CSA CAN-A23.1-M90 latest edition.

.5 Water: Clean and free from oil, acid, alkali, organic matter and other deleterious substances.

.6 Air entraining admixtures: Conforming to CSA CAN-A266.1-M78 and of approved manufacturer.

.7 Reinforcing steel: Conforming to CSA G30.12-M1977 for bars and CSA G.30.5-M1983 for welded steel wire mesh.

.8 Synthetic reinforcing: Maximum 25mm long synthetic fibres such as “Fibrin 23”, “Fibremesh” or approved equal.

.9 Expansion joint filler: As specified, either moulded composition joint filler conforming to A.S.T.M. D-1752-60T (Type II) or self expanding cork (Code 4324) conforming to A.S.T.M. D-1752-60T (Type III).

.10 Curbing Compounds: Conforming to C.G.S.B. 90-GP-1.

.11 Formwork: Conforming to CSA CAN-A23.1-M90 and ACI-347 and of sound wood, in good condition and equal or better than No. 1 grade construction spruce or 19mm Douglas Fir plywood, with a smooth surface treatment.

2.2 MIXES

.1 Mix concrete materials in accordance with CSA CAN-A23.1 M90, in the proper proportions and ratios to provide a finished product as specified.

.2 Concrete mix shall meet the following requirements: Compressive strength – minimum 25Mpa at 28 days, exposure A, unless otherwise noted on drawings and details; slump – 75mm maximum at point of deposit; air entrainment – 6% (±1%).

.3 With the exception of air entraining agents, other admixtures may only be used with the written approval of the Owner. The use of agents to lower the freezing point of the mix will not be permitted.

.4 The contractor is responsible for ensuring concrete mixes shall conform to the above noted specifications. No concrete mix approvals will be issued by the consultant.

3 Execution

3.1 PREPARATION

.1 Fine grade bulk rough graded surface eliminating uneven areas and filling low spots to achieve the sub-base for the specific paving profile. Remove all debris.

.2 Compact finished sub-grade to 98% Standard Proctor Dry Density

3.2 GRANULAR BASE

.1 Spread the specified granular materials in horizontal layers not exceeding 100mm loose depth and compact to 98% Standard Proctor Dry Density.

.2 In areas where compaction by roller is not possible, compact with approved mechanical or hand tamping devices to the specified density.

.3 Correct all irregularities or depressions resulting from rolling and compact until the granular surface is smooth, uniform and true to line and grade.

3.3 FORM WORK

.1 Erect forms true to line and level in accordance with the drawings, and sufficiently braced to maintain their shape and alignment when pouring concrete.

.2 Prior to each pouring operation, coat affected form surfaces with an approved form separating material.

.3 Provide for all openings, sleeves, hangers, anchors and ties to be case into the concrete.

3.4 REINFORCEMENTS

.1 Before placing reinforcement, clean all loose scale, dirt and any other coating that would reduce bonding to concrete.

.2 Place all reinforcement accurately in accordance with the drawings and/or approved shop drawings. Use approved spacers, hangers or ties to secure the reinforcing in position.

.3 Unless directed otherwise, provide the following minimum concrete cover over reinforcing:

.1 75mm cover where concrete is deposited against soil.
.2 50mm for bars 10m and larger and 40mm for bars smaller than 10m where concrete surface is exposed.

3.5 JOINTS

.1 Locate expansion joints as shown on the drawings and between new concrete and all new or existing structures. Joints must be case in place. Sawcut joints will not be allowed.

.2 Execute construction joints in accordance with ACI-301 and as detailed on the drawings. Thoroughly clean the joint surface, wet thoroughly and slush with a coat of cement grout

immediately before placing new concrete.

.3 Except for expansion joints, continue reinforcing uninterrupted through joints, unless shown otherwise on the drawings or directed by the owner.

.4 Stop reinforcing on each side of expansion joints. Where dowels are indicated, cast one half into one side of the joints. The exposed half shall be machined smooth and heavily greased before placing adjoining sections.

.5 Locate control joints as shown on the drawings. Ensure joints are to a minimum depth of ¼ the thickness of the concrete. Make joints by one of the following methods:

.1 Sawed joints.
.2 Hand formed and hand tooled.
.3 Inset joints paced in plastic concrete.

.6 No offsets will be allowed between adjacent sections of joint fillers and no plugs of concrete will be permitted anywhere within an expansion joint.

.7 Apply joint sealant in accordance with the manufacturer's directions. Ensure joints are clean and free of any foreign substances before sealing. Clean any sealant spilled on concrete surface immediately.

3.6 PLACING OF CONCRETE

.1 Do not place concrete until formwork and grades have been inspected and approved by the owner.

.2 Convey concrete from the mixer to the place of final deposit as rapidly as possible, with as little re-handling as is practical. Avoid separation and/or loss of material.

.3 While placing concrete, compact thoroughly and uniformly by approved means to ensure a dense homogeneous structure free of air pockets or honeycombs and closely bonded with reinforcement.

.4 Do not over vibrate to a point where segregation of the mix occurs.

3.7 FINISHING

.1 Finish all surfaces in accordance with CSA CAN-A23.1-M90.

.2 Strike off and float all exposed paving surfaces as soon as possible after consolidation and in accordance with recommendations of the Portland Cement Association.

.3 Walkways shall have a broom finish, evenly swept perpendicular to length of walkway. Other concrete shall be finished as shown on drawings and details.

.4 Ensure finished surface is true to line and level as shown on the drawings. Walks adjacent to curbs will have a pitch of 20mm per meter towards the curb. Other walks will be pitched as shown on the drawings.

.5 All irregularities greater than 3mm under a 3m straight edge, operated parallel to the centre line must be repaired.

.6 Immediately after stripping form work, obtain the approval of the owner before commencing patching, finishing or curing operations.

.7 The intent, method and type of mix for patching shall have the approval of the owner before commencing work. Ensure patching mix contains an approved bonding and waterproofing agent and that it is installed in accordance with the manufacturer's specifications.

.8 Backfill all curbs and pathways in accordance with section 31 23 33

3.8 CURING

.1 Keep concrete moist for at least three days after placement, in accordance with CSA CAN-A23.1-M90.

.2 Moist curing: Use burlap or approved equal. Ensure it is thoroughly wet when applied and kept continuously wet and in full contact with the surface during the curing period.

.3 Waterproof paper or white polyethylene sheeting: Ensure sheet is large enough to cover entire concrete surface. Secure to prevent displacement during curing period. Immediately repair any tears or holes.

.4 White liquid membrane compound: Apply at the rate of 1 litre per five square metres after final finishing and all free water has disappeared. Keep membrane compound agitated to prevent settling of compound. Apply membrane compound to edges immediately after form work is removed. Ensure a continuous and unbroken membrane cover is applied.

3.9 CLEAN-UP

.1 Clean and remove all concrete spills from the site.

END OF SECTION

1. **GENERAL**

1.1 **Related Sections**

1.1.1 Site Plan drawings and Binder C detail drawings.

1.2 **Samples**

1.2.1 Submit a sample panel in accordance with Section 01 33 00 - Submittal Procedures.

1.3 **Warranty**

1.3.1 5 years after the date of installation that the panels purchased shall be free from defects in material and workmanship and shall not split or crack under normal use and conditions.

2. **PRODUCTS**

2.1 **Materials**

2.1.1 Detectable Warning Panels

.1 600mm x 600mm Detectable Warning Tactile Panels made with reinforced high strength concrete, polymer composite or ceramic.

.2 CASTinTACT® as manufactured by Masons Supply Company 2637 SE 12th Ave., Portland, Oregon 97202. Telephone (503) 234-4321.

.3 Approved Alternates: Armor-Tile dist. by Engineered Plastics Inc. or approved alternates.

.4 Install to be approx. 24" x 60" – 72" wide.

3. **EXECUTION**

3.1 **Installation**

3.1.1 Panels are to be cast in concrete at top of all pedestrian depressed curbs (whether shown on drawings or not) and additional locations where shown on drawings and where required by municipal by-law.

3.1.2 The work shall consist of all labor, material, tools, equipment and services necessary to satisfactorily complete the installation of detectable/tactile warning surfaces in non-vehicular areas, at curb ramps and other locations such as depressed corners, raised crosswalks, raised intersections, borders of medians and islands, the edge of transit platforms, and sidewalks where railroad tracks cross to warn pedestrians of an upcoming change from pedestrian to vehicular way.

3.1.3 Install per manufacturers recommendations.

3.1.4 Expansion joints and control joints shall be located in compliance with manufacturer's recommendations. Joint materials shall follow manufacturer's directions and instructions.

3.1.5 Protect installed products until completion of project. If necessary, protect panels with plywood and an underlayment layer of non-staining, non-woven curing blanket until acceptance of work. Secure plywood if needed.

END OF SECTION

□

1. GENERAL

1.1. General Requirements

1. Conform to the requirements stated in the General Conditions, Supplementary General Conditions of this Specification and all addenda for all work, including work outside the property line including work within Regional and Municipal right of way unless otherwise noted.

1.2. Related Work

1.	Excavating, Trenching and Backfilling	Section 31 23 10
2.	Granular Base	Section 32 11 23
3.	Granular Sub-Base	Section 32 11 19
4.	Asphalt Paving	Section 32 12 16

1.3. References

1. Canadian Standards Association (CSA)
    1. CAN/CSA-A23.1-94, Concrete Materials and Methods of Concrete Construction.
2. Canadian General Standards Board (CGSB)
    1. CAN/CGSB-1.2-M89, Boiled Linseed Oil
    2. CAN/CGSB-3.3-M89, Kerosene
3. American Society for Testing and Materials (ASTM).
    1. ASTM D698-12e2, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-1lf/ft^3) (600 kN-m/m^3)
4. Ontario Provincial Standard Specification 353.

2. PRODUCTS

2.1. Materials

1. Concrete mixes and material shall conform to Ontario Provincial Standard Specifications 1301, 1302, 1303, 1305, 1306, 1308, 1315, and 1350. Concrete for curb and toe wall construction shall have a minimum compressive strength of 30 MPa after 28 days.
2. Granular Base and Sub-Base: to Section 32 11 23and 32 11 19 respectively.
3. Non-staining mineral type form release agent: chemically active release agents containing compounds that react with free lime to provide water soluble soap.
4. Fill material: to Section 31 23 10.
5. Boiled linseed oil: to CAN/CGSB-1.2.
6. Kerosene: to CAN/CGSB-3.3.

3. EXECUTION

3.1. Grade Preparation & Sub-Base Course

1. Grading: to Section 32 23 13.
2. Place sub-base course of OPSS Granular 'B', Type I in maximum 150 mm loose lifts and compact to a minimum of 100% of SPMDD.

3.2. **Granular Base**

1. Obtain Consultant's approval of subbase before placing granular base.
2. Place compacted OPSS Granular 'A' to depth, lines and widths as indicated.
3. Compact granular base to a minimum of 100% of SPMDD.

3.3. **Concrete**

1. Obtain Consultant's approval of granular base.
2. Do concrete curb construction in accordance with OPSS 353.
3. Provide 1.0m. wide depressions in curb where specified on the drawings as required to allow surface drainage to be conveyed to adjacent bio-swale areas.

3.4. **Tolerances**

1. Finish surfaces to within 3 mm in 3 m as measured with 3 m straightedge placed on surface.

3.5. **Expansion and Contraction Joints**

1. Joints are to be constructed in accordance with OPSS 353.07.06

3.6. **Curing**

1. Cure concrete by adding moisture continuously in accordance with CAN/CSA-A23.1 to exposed finished surfaces for at least 1 day after placing, or sealing moisture in by curing compound approved by Consultant.
2. Where burlap is used for moist curing, place two prewetted layers on concrete surface and keep continuously wet during curing period.
3. Apply curing compound evenly to form continuous film. In accordance with manufacturer's requirements.
4. Concrete curing is to be in accordance with OPSS 904.

3.7. **Linseed Oil Treatment**

1. After concrete has cured for specified curing time and when surface of concrete is dry, apply two coats of linseed oil mixture uniformly to surfaces of curbs, walks and gutters.

3.8. **Backfill**

1. Allow concrete to cure for 7 days prior to backfilling.
2. Backfill to designated elevations with material approved by Consultant. Compact and shape to required contours as indicated or as directed by Consultant.

3.9. **Defective Concrete**

1. Concrete is defective when:
    1. Containing excessive honeycombing or embedded debris.
    2. Concrete damaged by freezing or which is unsatisfactory due to placement at too high a temperature.
    3. Average 28-day strength of any three consecutive strength tests is less than

specified minimum 28-day strength.

4. Any 28-day strength test result is more than 3.5 MPa below the specified minimum 28-day strength.

2. Repair of defective concrete work:

1. Repair defective areas while concrete is still plastic, otherwise wait until curing is completed. Use repair methods approved by Consultant.

2. Grind off high surface variations where directed by Consultant.

3. Remove and replace defective concrete where directed by Consultant:

1. Remove between joints by sawing through concrete across full width.

2. Replace with new concrete to this Section as directed by Consultant.

3. Construct contraction joint between sawn face of existing concrete and face of new concrete.

4. Install tie bars between old and new concrete as directed by Consultant.

3.10. **Field Quality Control**

1. Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by Consultant in accordance with CAN/CSA-A23.1.

2. Consultant may take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.

END OF SECTION

1. GENERAL

1.1. General Requirements

1. Conform to the requirements stated in the General Conditions, Supplementary General Conditions of this Specification and all addenda for all work, including work outside the property line including work within Regional and Municipal right of way unless otherwise noted.

1.2. Related Work

1.	Excavating, Trenching and Backfilling	Section 31 23 10
2.	Granular Base	Section 32 11 23
3.	Granular Sub-Base	Section 32 11 19
4.	Asphalt Paving	Section 32 12 16

1.3. References

1. Canadian Standards Association (CSA)
    1. CAN/CSA-A23.1-94, Concrete Materials and Methods of Concrete Construction.
2. Canadian General Standards Board (CGSB)
    1. CAN/CGSB-1.2-M89, Boiled Linseed Oil
    2. CAN/CGSB-3.3-M89, Kerosene
3. American Society for Testing and Materials (ASTM).
    1. ASTM D698-12e2, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-1lf/ft^3) (600 kN-m/m^3)
    2. Ontario Provincial Standard Specifications 1301, 1302, 1303, 1306, 1308, 1315, and 1350.
    3. Ontario Provincial Standards Drawing No. 310.010

2. PRODUCTS

2.1. Materials

1. Concrete mixes and material: to Section 03 30 00.
2. Joint filler and Curing Compound: to Section 03 30 00.
3. Granular Base and Sub-Base: to Section 32 11 23 and 32 11 19 respectively.
4. Non-staining mineral type form release agent: chemically active release agents containing compounds that react with free lime to provide water soluble soap.
5. Fill material: to Section 31 23 10.
6. Boiled linseed oil: to CAN/CGSB-1.2.
7. Kerosene: to CAN/CGSB-3.3.

3. EXECUTION

3.1. Grade Preparation & Sub-Base Course

1. Grading: to Section 31 23 13.
2. Compact subgrade to 95% of Standard Proctor Maximum Dry Density (SPMDD). Excavate and fill all weak and soft spots as required and backfill with compacted granular 'B', Type I to 100% SPMDD.

3.2. **Concrete**

1. Obtain Consultant's approval of granular base and reinforcing steel prior to placing concrete.
2. Do concrete work in accordance with Section 03 30 00.
3. Immediately after floating, give concrete walkway surface uniform broom finish to produce regular corrugations not exceeding 2 mm deep, by drawing broom in direction normal to centre line.
4. Provide edging as indicated with 10 mm radius edging tool.
5. Slip-form pavers equipped with string line system for line and grade control may be used if quality of work acceptable to Consultant can be demonstrated. Hand finish surfaces when directed by Consultant.

3.3. **Tolerances**

1. Finish surfaces to within 3 mm in 3 m as measured with 3 m straightedge placed on surface.

3.4. **Expansion and Contraction Joints - Concrete Walkways**

1. Install tooled transverse contraction joints after floating, when concrete is stiff, but still plastic, at intervals of 1.5 m.
2. Install expansion joints at intervals of 6 m.
3. Install expansion joints around manholes and catch basins and along length adjacent to concrete curbs, catch basins, buildings, or permanent structure.
4. Seal expansion joints with sealant approved by Consultant.

3.5. **Curing**

1. Cure concrete by adding moisture continuously in accordance with CAN/CSA-A23.1 to exposed finished surfaces for at least 1 day after placing, or sealing moisture in by curing compound approved by Consultant.
2. Where burlap is used for moist curing, place two prewetted layers on concrete surface and keep continuously wet during curing period.
3. Apply curing compound evenly to form continuous film. In accordance with manufacturer's requirements.

3.6. **Linseed Oil Treatment**

1. After concrete has cured for specified curing time and when surface of concrete is dry, apply two coats of linseed oil mixture uniformly to surfaces of curbs, walks and gutters.

3.7. **Backfill**

1. Allow concrete to cure for 7 days prior to backfilling.
2. Backfill to designated elevations with material approved by Consultant. Compact and shape to required contours as indicated or as directed by Consultant.

3.8. **Defective Concrete**

1. Concrete is defective when:
    1. Containing excessive honeycombing or embedded debris.
    2. Concrete damaged by freezing or which is unsatisfactory due to placement at too high a temperature.
    3. Average 28-day strength of any three consecutive strength tests is less than specified minimum 28-day strength.
    4. Any 28-day strength test result is more than 3.5 MPa below the specified minimum 28-day strength.
2. Repair of defective concrete work:
    1. Repair defective areas while concrete is still plastic, otherwise wait until curing is completed. Use repair methods approved by Consultant.
    2. Grind off high surface variations where directed by Consultant.
3. Remove and replace defective concrete where directed by Consultant:
    1. Remove between joints by sawing through concrete across full width.
    2. Replace with new concrete to this Section as directed by Consultant.
    3. Construct contraction joint between sawn face of existing concrete and face of new concrete.
    4. Install tie bars between old and new concrete as directed by Consultant.

3.9. **Field Quality Control**

1. Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by Consultant in accordance with CAN/CSA-A23.1.
2. Consultant may take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 32 12 16 – Asphalt Paving

1.2 QUALITY ASSURANCE

.1 The Contractor must have at least 3 years' experience in the painting of pavement markings

1.3 INSPECTION

.1 Obtain the approval of the Owner of pavement markings before proceeding.

2 Products

2.1 MATERIALS

.1 Traffic paint: alkyd type to CGSB 1-GP-74M + Amdt-May-81:

.1 Colours:

.1 White: Traffic paint white 9011 by ICI or equivalent product by other manufacturer approved by Consultant.

.2 Yellow: Traffic paint yellow 36419 by ICI or equivalent product by other manufacturer approved by Consultant.

.3 Blue: Traffic paint Blue by ICI or equivalent product by other manufacturer approved by Consultant.

.2 Paint applicator: approved pressure type mobile equipment, capable of depositing paint uniformly, at rates required.

3 Execution

3.1 PREPARATION

.1 Substrates shall be dry, free from water, frost, ice, dust, oil, grease and any other foreign substance which would impair proper bonding and performance of paint.

.2 Lay out traffic markings prior to paint application. Space control points at intervals to ensure accurate spacing and direction of lines.

3.2 APPLICATION

.1 Spray paint parking zone lines and other pavement markings required, including but not limited to, hatch marks for no parking areas, direction arrows and accessible parking symbols.

.2 Apply paint in two coats at rate of 3 m²/L. Allow first coat to fully cure prior to application of second coat.

.3 Apply paint only when ambient temperature is above 10 deg. C and wind speed is less than 15 km/h, and no rain is forecast within the next 12 hours.

.4 Use templates for symbols, arrows, lettering.

.5 Unless otherwise indicated, paint lines 100 mm wide.

.6 Paint lines straight or uniformly curved, with well defined, sharp edges.

.7 Paint speed bumps.

.8 Paint curb depressions for the disabled in accordance with OBC 1997.

.9 Unless otherwise shown provide the following colours:

.1 White: stop bars, arrows and driving lane designation lines separating traffic traveling in same direction.

.2 Yellow: centre lines, parking stall lines, hatch marks, painted medians and barrier free curb depressions.

.3 Blue: barrier free parking symbols.

END OF SECTION

1 General

1.1 RELATED SECTIONS

None

1.2 QUALITY ASSURANCE

.1 The Contractor must have 5 minimum years' experience in chain link fence installation work.

1.3 INSPECTION

.1 Obtain the approval of the Owner of fence location (stake out) before proceeding.

2 Products

2.1 MATERIALS

.1 The contractor and be responsible for the manufacture of chain link fences and gates according to the drawing details and this specification section.

.2 Fence Fabric: No 9 gauge steel wire woven in a 38mm mesh, hot dipped galvanized after weaving and knuckled finish top and bottom selvage edges. Galvanized fabric to have a minimum zinc application of 450g per square meter of surface area. Fabric to be black vinyl coated.

.3 Posts: Standard butt-welded Schedule 40, ASTM 120, galvanized pipe, electrostatic painted black. Supply according to the following height schedule:

Line posts	60mm O.D., 3.7mm wall thickness 850mm longer than fabric height
End, corner & gate posts	89mm O.D., 3.9mm wall thickness 1075mm longer than fabric height

No tubing, conduit or open seam material will be accepted.

.4 Post Tops: Non-decorative aluminum caps or approved equal, securely attached to eliminate removal by hand and allowing for the insertion of 43mm top rail in a horizontal position for fencing over 2.0m height and 43mm top rail for fences under 2.0m height. Electrostatic painted black.

.5 Top and Bottom Rail: 43mm O.D, top rail, and 43mm O.D. bottom rail, 3.5mm wall thickness standard butt-welded, galvanized pipe or high strength hollow structural steel, 2.5mm (0.1") wall, pipe with mechanical properties similar to ASTM A-36. No tubing, conduit or open seam material will be accepted. Electrostatic painted black.

.6 Gates: 1.0m wide unless specified otherwise with frames constructed of 43mm O.D., 3.5mm wall thickness standard butt-welded, all joints electrically welded, and hot dipped galvanized after fabrication, complete with galvanized malleable iron hinges, and three piece drop latch. Hinges must allow gate to swing back against fence. Gate braces to be 43mm O.D., 3.2mm wall thickness galvanized pipe, if required. Electrostatic painted black.

.7 Concrete: 25MPa strength at 28 days; slump 75mm maximum at point of deposit ready mixed at plant and transported to the site by truck in accordance with CSA CAN A23. I-M77. Concrete mixed on site will not be accepted unless approved in writing by the Owner prior to use.

3 Execution

3.1 INSTALLATION

.1 Fence height to be as noted on drawings and details.

.2 Provide all new material unless directed otherwise.

.3 Post spacing to be a maximum of 3.0m on centre.

.4 Provide post footings according to the following schedule (minimum dimensions):

	Under 2.0m fence height		Over 2.0m fence height	
	Diameter	Depth	Diameter	Depth
Line posts	250mm	1200mm	300mm	1200mm
End, corner & gate posts	300mm	1200mm	350mm	1500mm

.5 Set posts in concrete footings to the height required. Top of footings is to be 150mm below finished grade.

.6 Join adjacent pieces of top rail with outside sleeve type coupling at least 175mm long, to form a continuous top rail. Secure top rail at corner and gate posts using a receptacle coupler.

.7 Install bottom rail, and secure to posts, top rail and tension wire with No. 16 gauge galvanized wire twists.

.8 Install fabric, stretch taut, and secure to posts and top rail with 9 gauge aluminum hog ties.

.9 Ensure space between bottom of fabric and ground is no greater than 50mm in any location. Where required by abrupt changes in grade, bottom edge of fence may be buried up to 50mm.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 32 92 23 – Sodding

1.2 TESTING

.1 Imported Topsoil: Submit nutrient analysis, acidity analysis, and herbicide residue analysis for topsoil obtained off site. The Contractor is to warrant that the topsoil supplied to the site is that from which representative samples were taken.

2 Products

2.1 TOPSOIL FOR SODDED OR SEEDED AREAS

.1 The topsoil is to be imported to the site. The topsoil supply is subject to inspection, at the source, by the consultant.

.2 Topsoil is to be sandy loam, unshredded, unscreened, uncontaminated with subsoil, roots, stones of any size, and any organic matter which is not decomposed.

.3 Topsoil intended for use on the project is subject to rejection based on the results of the testing for nutrients, acidity and herbicide residue, and if it is not of suitable consistency, i.e. sandy loam.

.4 Sandy loam consists of between 15 and 20% clay; between 0 and 50% silt, and between 45 and 70% sand.

3 Execution

3.1 SITE CONDITIONS

.1 Do not proceed with any work under this section without the consultant's prior approval of the rough grading.

.2 Fine grade the bulk rough graded surface, eliminate uneven areas and filling low spots to achieve the sub-base elevation required for the specified topsoil thickness.

.3 Do not proceed with spreading or fine grading of topsoil when the site or material is saturated and clodding or rutting would occur.

3.2 SURFACE PREPARATION

.1 Scarify the rough grade, to a depth of 100mm prior to placement of topsoil.

3.3 TOPSOIL PLACEMENT

.1 Place topsoil on areas to be sodded or seeded in sufficient quantity to allow for a finished and compacted depth of 150mm.

.2 Compaction for sodded areas is to be 85% S.P.D., consistent throughout the areas.

.3 Keep topsoil 25mm below finished walkway and paved areas to allow for placement of sod.

3.4 FINE GRADING

.1 Fine grade to create a finished surface which is smooth and even, with no ruts, clods or contaminants.

3.5 FERTILIZING

.1 Apply fertilizer of the ratio and rate determined from the soil analysis and work into the top 50mm.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 32 91 19 – Topsoil Placement

1.2 DELIVERY AND STORAGE

.1 Schedule deliveries in order to keep storage at job site to minimum without causing delays.

.2 Deliver sod to site within 24 hours of being lifted and lay sod within 36 hours of being lifted. Sod which has yellowed and/or heated in the roll will be rejected.

.3 Do not deliver small, irregular or broken pieces of sod.

.4 During hot weather protect sod from drying and water sod rolls as necessary to ensure its vitality and prevent dropping of soil in handling. Dry sod rolls will be rejected.

1.2 SCHEDULING

.1 Schedule sod laying to coincide with topsoil operations.

2 Products

2.1 MATERIALS

.1 Nursery Sod: Quality and source to comply with standards outline in Metric Guide Specifications for Nursery Stock, Section 17, 1984 Edition, published by Canadian Nursery Trades Association. Number One Kentucky Bluegrass sod grown from minimum mixture of Kentucky Bluegrass cultivars.

.2 Water: Potable.

3 Execution

3.1 LAYING OF SOD

.1 Obtain approval of topsoil grade and depth before sodding.

.2 Hand rake to eliminate minor surface irregularities.

.3 Lay sod during growing season.

.4 Lay sod in rows, perpendicular to slopes, smooth and even with adjoining areas, and with joints staggered. Butt sections closely without overlapping or leaving gaps between sections. Cut out irregular or thin sections with a sharp knife.

.5 Provide close contact between sod and soil by means of light roller immediately after laying. Heavy rolling to correct irregularities in grade is not permitted, nor is rolling after watering.

.6 Water immediately after sod laying and rolling to obtain moisture penetration through sod into top 100mm of topsoil.

.7 Water as often thereafter as necessary to establish rooting.

3.2 PROTECTION

.1 Provide and install Modu-loc style protective fencing to enclose play field area. Allow for maintenance access.

.2 Protective fencing to remain in place for minimum 6 months.

.3 Periodically inspect the protective fence and repair as required.

.4 When directed by the owner, remove the protective fence.

3.3 ACCEPTANCE

.1 Sodded areas will be accepted and turned over to the Owner only if:

a) Sodded areas are established by being completely rooted and knit with the underlying soil.

b) Sod is free of bare and dead spots without weeds.

c) No surface soil is visible when grass has been cut to height of 50mm.

d) Sodded areas have been cut on a regular basis, as part of this contract, for as long as is necessary until acceptance for maintenance by owner. A minimum of two cuts will be required.

e) Sod is to be watered by the Contractor on an ongoing basis until acceptance by the Owner, to ensure a minimum of 25mm of water per week, to augment rainfall if necessary.

END OF SECTION

1 General

1.1 RELATED SECTIONS

None

1.2 SOURCE QUALITY CONTROL

.1 Obtain approval of plant material at source.

.2 Notify consultant of source of material at least seven (7) days in advance of shipment. No work under this section is to proceed without approval.

.3 Acceptance of plant material at its source does not prevent rejection on site prior to or after planting operations.

.4 Imported plant material must be accompanied by necessary permits and import licenses. Conform to Federal and Provincial regulations.

1.3 SHIPMENT & PRE-PLANTING CARE

.1 Coordinate shipping of plants and excavation of holes to ensure minimum time lapse between digging and planting.

.2 Tie branches of trees and shrubs securely and protect plant material against abrasion, exposure and extreme temperature change during transit. Avoid binding of planting stock with rope or wire which would damage bark, break branches or destroy natural shape of plant. Give full support to root ball of large trees during lifting.

.3 Cover plant foliage with tarpaulin, and protect bare roots by means of dampened straw, peat moss, sawdust or other acceptable material to prevent loss of moisture during transit and storage.

.4 Remove broken and damaged roots with sharp pruning shears.

.5 Keep roots moist and protected from sun and wind. Heel in trees and shrubs, which cannot be planted immediately, in shaded areas and water well.

1.4 GUARANTEE

.1 The Contractor hereby warrants that plant material as itemized on plant list will remain free of defects for two years.

.2 End-of Warranty inspections will be conducted.

1.5 REPLACEMENTS

.1 During warranty period, remove from site any plant material that has died or failed to grow satisfactorily as determined by consultant.

.2 Replace plant material in the next planting season.

.3 Extend warranty on replacement plant material for a period equal to the original warranty period.

.4 Continue such replacement and warranty until plant material is acceptable.

2 Products

2.1 MATERIALS

.1 Water: Potable and free of minerals which may be detrimental to plant growth.

.2 Stakes: Wood 50 x 50 x 2400mm.

.3 Accessories: Factory galvanized cables, wire tighteners.

.4 Guy wires: Fabric (burlap or approved equal)

.5 Shrubs and trees under 75mm caliper use 2.4mm wire.

.6 Trees 75 to 150mm caliper use 3mm wire.

.7 Tree rings: Green arborite or approved equal, secured using 1” galvanized rofing nail.

.8 Root ball burlap: 150g Hessian burlap.

.9 Wire baskets: to be ungalvanized metal.

.10 Mulch: Submit samples prior to shipping to site: Shredded bark mulch.

.12 Topsoil: Triple mix for all shrub beds and tree pits.

.13 Antidesiccant: Wax like emulsion to provide film over plant surfaces, reducing evaporation but permeable enough to permit transpiration.

2.2 PLANT MATERIAL

.1 Quality and source: Comply with Metric Guide Specifications for Nursery Stock, 1984 Edition of Canadian Nursery Trades Association referring to size and development of plant material and root ball. Measure plants when branches are in their natural position. Height and spread dimensions refer to main body of plant and not branch tip to branch tip. Use trees and shrubs of Number 1 Grade.

.2 Additional plant material qualifications:

.1 Plant material obtained from areas with milder climatic conditions from those of site are acceptable only when moved to site prior to the breaking of buds in their original location and heeled-in, in a protected area, until conditions suitable for planting.

.2 Use trees and shrubs with strong fibrous root system, free of disease, insects, defects or injuries, and structurally sound. Use trees with straight trunks, well and characteristically branched for species. Plants must have been root pruned regularly, but not later than one growing season prior to arrival on site.

.3 Cold storage: Written approval from the consultant is required for use of plant material which has been held in cold storage.

.4 Container grown stock: Acceptable if containers are large enough for root development. Trees and shrubs must have been grown in container for minimum of one growing season, but not longer than two. Root systems must be able to “hold” soil when removed from container. Plants that have become root bound are not acceptable. Container stock must have been fertilized with slow releasing fertilizer.

.5 Balled and burlapped: Coniferous and broad-leafed evergreens over 500mm tall must be dug with soil ball. Deciduous trees in excess of 3m height must have been dug with large ball. Root balls must include 75% of fibrous and feeder root system. Secure root balls with burlap and heavy twine, rope or a wire basket.

.6 Collected plant material: Will not be permitted.

.7 Substitutions to plant material, as indicated on planting plan, are not permitted unless written approval has been obtained as to type, variety and size. Plant substitutions must be of similar species and of equal size as those originally specified.

3 Execution

3.1 WORKMANSHIP

.1 Stake out location of trees and planting beds as per planting plan. Obtain approval prior to excavating.

.2 Apply antidesiccant in accordance with material manufacturer's instructions.

.3 Coordinate operations. Keep site clean and planting holes drained. Immediately remove soil or debris spilled onto pavement.

3.2 PLANTING TIME

.1 Plant deciduous plant material during dormant period, before buds have broken. Plant material noted for spring planting only, must be planted in dormant period.

.2 Plant material imported from region with warmer climate conditions may only be planted in early spring.

.3 When permission has been obtained to plant deciduous plant material after buds have broken, spray plants with antidesiccant to slow down transpiration prior to transplanting.

.4 Plant evergreens in spring before bud break. Apply antidesiccant to evergreens before digging.

.5 When permission has been obtained, trees, shrubs and ground covers growing in containers may be planted throughout growing season.

.6 Plant only under conditions that are conducive to health and physical conditions of plants.

.7. Provide planting schedule. Extending planting operations over long period using limited crew will not be accepted.

3.3 EXCAVATION

.1 Shrub beds: Excavate entire bed area to the extent shown on plans, 450mm deep. Excavation to sub-grade and sub-grade clean up are included.

.2 Small trees up to 3.0.m: Excavate holes 600mm deep with diameter of 300mm greater that root spread or root ball. Excavation to sub-grade and sub-grade clean up are included. Refer to planting details.

.3 Large trees: Excavate to depth of a least 150mm deeper than height of root ball, minimum 1m depth, with width minimum 3 times diameter of root ball. In heavy soils, increase planting

holes by 50mm for each 100mm of root ball diameter. Excavation to sub-grade and sub-grade clean up are included. Refer to planting details.

.4 Provide drainage for planting holes in heavy soil if natural drainage does not exist. Have method approved.

.5 Protect bottom of excavation against freezing.

.6 Remove water which enters excavation prior to planting. Ensure source of water is not ground water.

3.4 PLANTING

.1 Loosen bottom of planting hole to depth of 150 to 200mm.

.2 Plant trees and shrubs vertically with roots placed straight out in hole. Orient plant material to give best appearance in relation to roads and walks.

.3 With balled and burlapped root balls, loosen burlap and cut away minimum top 1/3 without disturbing root ball. Do no pull burlap or rope from under root ball. With container stock, remove entire container without disturbing root ball. Non-biodegradable wrappings must be removed.

.4 Place plant material to depth equal to depth they were originally growing in nursery.

.5 During planting of bare rooted stock, first shake backfill of planting soil among the roots.

.6 Tramp planting soil around root system in layers of 150mm eliminating air voids. Frozen or saturated planting soil is unacceptable. When 2/3 of planting soil had been placed, fill hole with water. After water has completely penetrated into soil, complete backfilling.

.7 Build 100mm deep saucer around outer edge of hole to assist with maintenance watering.

.8 When planting is complete, give surface of planting saucer dressing of organic 1:2:2 fertilizer at rate of 12kg/100m² for shrub beds, or 40 to 50g/mm of caliper for trees. Mix fertilizer thoroughly with top layer of planting soil and water in well.

3.5 PROTECTIVE WRAPPING

.1 Protective wrapping installed by the nursery to prevent damage during shipping is to be removed upon planting to allow for inspection of the trunk.

3.6 TREE SUPPORT

.1 Tree support is shown on planting details.

.2 Where guy wires are used close to pedestrian ways, fasten flags to wires to make them clearly visible.

3.7 PRUNING

.1 Prune trees and shrubs after planting, as directed, to compensate for loss of roots suffered during transplanting. Postpone pruning of those trees where heavy bleeding may occur until in full leaf. Employ clean sharp tools and make cuts flush with main branch, smooth dead and injured branches and branches that rub, causing damage to bark. Trim out crown of trees and shrubs without changing their natural shape. Do not damage lead branches or remove smaller twigs along main branches.

3.8 MULCHING

.1 Obtain approval of planting beds before mulching material is applied. Loosen soil in planting beds and pits and remove debris and weeds. Spread mulch to minimum thickness of 50mm. Mulch material susceptible to blowing must be moistened and mixed with topsoil before applying. When mulching is placed in fall, place immediately after planting. When mulch is placed in spring, wait until soil has warmed up.

3.9 MAINTENANCE

.1 Water once a week for the first four weeks, and then sufficiently thereafter to maintain optimum growing conditions during the warranty period. Ensure adequate moisture in root zone at freeze-up.

.2 Keep soil within confines of planting saucer around trees and planting beds; shallowly cultivated and free from weeds.

.3 Spray plants to combat pests and diseases. Do no use DDT or sprays prohibited by Agriculture Canada.

.4 Keep guy wires in proper repair.

.5 Provide adequate protection against winter damage, including damage caused by rodents.

.6 Maintain plant material from date of planting up to end of warranty period.

.7 Remove tree stakes and guy wires at end of warranty period.

3.10 PRIOR TO ACCEPTANCE

.1 Remove from site all rubbish and debris.

.2 Maintain all areas neat and tidy at all times until acceptance.

END OF SECTION

1. GENERAL

1.1. General Requirements

1. Conform to the requirements stated in the General Conditions, Supplementary General Conditions of this Specification and all addenda for all work, including work outside the property line including work within Regional and Municipal right of way unless otherwise noted.

1.2. Related Work

1.	Site Grading	Section 31 23 13
2.	Excavating, Trenching and Backfilling	Section 31 23 10
3.	Storm Sewers	Section 33 44 00
4.	Aggregates: General	Section 31 05 17

1.3. References

1. ASTM A48/A48M-03 (2016), Specification for Gray Iron Castings.
2. ASTM C139-18 (1989), Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes.
3. ASTM C478M-90, Specification for Precast Reinforced Concrete Manhole Sections
4. CSA A3000, Portland Cement.
5. CSA A3000, Masonry Cement.
6. CAN/CSA-A23.1-M90, Concrete Materials and Methods for Concrete Construction.
7. CSA A82.56-M1976, Aggregate for Masonry Mortar.
8. CAN3-A165 Series-M85, CSA Standards on Concrete Masonry Units.
9. CAN/CSA-G30.18-M92, Billet Steel Bars for Concrete Reinforcement.
10. CAN/CSA-G164-M92, Hot Dip Galvanizing of Irregularly Shaped Articles.
11. Ontario Provincial Standard Specification 407.

2. PRODUCTS

2.1. Materials

1. Precast manhole units: to ASTM C478M, circular or oval. Top sections eccentric cone or flat slab top type with opening offset for vertical ladder installation. Monolithic bases to be approved by Consultant and set on concrete slabs cast in place.
    1. 1200 mm diameter manhole as per OPSD 701.010.
2. Precast catch basins: to ASTM C478M.
    1. Catch basins as per OPSD 705.010
3. Joints: to be made watertight using rubber rings or cement mortar.
4. Mortar:
    1. Aggregate: to CSA A82.56.
    2. Cement: to CAN/CSA-A8.
5. Ladder rungs: to CAN/CSA-G30.18, No. 25M billet steel deformed bars, hot dipped

galvanized to CAN/CSA G164 Rungs to be safety pattern (drop step type).

6. Adjusting rings: to ASTM C478M.
7. Concrete Brick: to CAN3-A165 Series.
8. Frames, gratings, covers to dimensions as indicated and following requirements:
    1. Metal gratings and covers to bear evenly on frames. A frame with grating or cover to constitute one unit. Assemble and mark unit components before shipment.
    2. Gray iron castings: to ASTM A48, strength class 30B.
    3. Castings: coated with two applications of asphalt varnish.
    4. Storm manhole frames and covers: heavy duty municipal type for road service. Cover cast without perforations and complete with two 25 mm square lifting holes, as per OPSD 400.010, unless otherwise specified.
    5. Catchbasin frame and cover: as per OPSD 400.010.
    6. Manhole frame and cover as per OPSD 401.010 Type A.
9. Granular bedding and backfill: Granular B Type I: to OPSD 1010 and Section 02701 – Aggregates: General and to Section 02315 – Excavating, Trenching and Backfilling.
10. Unshrinkable fill: to Section 02315 – Excavating, Trenching and Backfilling.

3. EXECUTION

3.1. Excavation and Backfill

1. Excavate and backfill in accordance with Section 31 23 10 – Excavating, Trenching and Backfilling.
2. Obtain approval of Consultant before installing manholes or catch basins.

3.2. Installation

1. Construct units in accordance with details indicated, plumb and true to alignment and grade.
2. Complete units as pipe laying progresses. Maximum of three units behind point of pipe laying will be allowed.
3. Dewater excavation free of standing water or as directed by Consultant and remove soft and foreign material before placing concrete base.
4. Set precast concrete base on 150 mm minimum of granular bedding compacted to 100% Corrected Maximum Dry Density.
5. Precast units.
    1. Set bottom section of precast unit in bed of cement mortar and bond to concrete slab or base. Make each successive joint watertight with rubber ring gaskets, cement mortar, or combination thereof.
    2. Clean surplus mortar and joint compounds from interior surface of unit as work progresses.
    3. Plug lifting holes with precast concrete plugs set in cement mortar or mastic compound.
6. For sewers:

1. Place stub outlets and bulkheads at elevations and in positions indicated.

2. Bench to provide a smooth U-shaped channel in manholes.

7. Compact granular backfill to 98% Corrected Maximum Dry Density.

8. Place frame and cover on top section to elevation as indicated. If adjustment required use concrete ring.

9. Clean units of debris and foreign materials. Remove fins and sharp projections. Prevent debris from entering system.

3.3. **Leakage Test**

1. Visual inspection of leakage will be carried out. If any leakage is observed, correct leakage as directed by Consultant at no additional cost.

END OF SECTION

1. GENERAL

1.1. General Requirements

1. Conform to the requirements stated in the General Conditions, Supplementary General Conditions of this Specification and all addenda for all work, including work outside the property line including work within Regional and Municipal right of way unless otherwise noted.

1.2. Description

1. The work included in this Section includes for all labour, equipment and materials required for the watermain construction within the site, and watermain construction within the municipal right of way connecting to existing municipal servicing.
2. Included in the work is coordination and cooperation with Municipal forces as required to complete the work including providing temporary blow offs, isolation valves, pressure testing and chlorination as required by Municipal forces.

1.3. Related Work

1. Excavating, Trenching and Backfilling — Section 31 23 10

1.4. References

1. The Municipality Standards and Specifications for watermain construction.

1.5. Scheduling Of Work

1. Schedule work to minimize interruptions to existing services.

2. PRODUCTS

1. All products utilized within the water system to comply with the Municipality Standards and Specifications.

3. EXECUTION

3.1. Preparation

1. Clean pipes, fittings, and appurtenances of accumulated debris and water before installation. Carefully inspect materials for defects to approval of Consultant. Remove defective materials from site as directed by Consultant.

3.2. Trenching

1. Do trenching work in accordance with Section 31 23 10 – Excavating, Trenching and Backfilling.
2. Trench depth to provide cover over pipe of not less than 1.75 metres from finished grade or as indicated.
3. Trench alignment and depth require Consultants' approval prior to placing bedding material and pipe.

3.3. **Granular Bedding**

1. Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth of 300 mm below bottom of pipe or to depth as indicated.
2. Do not place material in frozen condition.
3. Shape bed true to grade to provide continuous uniform bearing surface for pipe.
4. Shape transverse depressions in bedding as required to suit joints.
5. Compact each layer full width of bed to at least 95% of corrected maximum dry density.
6. Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Section 31 23 10 – Excavating, Trenching and Backfilling with compacted bedding material.

3.4. **Pipe Installation**

1. Lay pipes to ANSI/AWWA C600 Manual of Practice and manufacturer's standard instructions and specifications. Do not use blocks except as permitted in 3.3.2.
2. Join pipes in accordance with ANSI/AWWA C600, ANSI/AWWA C206, AWWA Manual of Practice and manufacturer's recommendations.
3. Bevel or taper ends of PVC pipe to match fittings.
4. Handle pipe by methods approved by Engineer recommended by pipe manufacturer. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.
5. Lay pipes on prepared bed, true to line and grade. Ensure barrel of each pipe is in contact with shaped bed throughout its full length. Take up and replace defective pipe. Correct pipe which is not in true alignment or grade or pipe which shows differential settlement after installation greater than 10 mm in 3 m.
6. Face socket ends of pipe in direction of laying. For mains on a grade of 2% or greater, face socket ends upgrade.
7. Do not exceed permissible deflection at joints as recommended by pipe manufacturer.
8. Keep jointing materials and installed pipe free of dirt and water and other foreign materials. Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
9. Position and join pipes with equipment and methods approved by Consultant.
10. Cut pipes in an approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
11. Align pipes carefully before jointing.
12. Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
13. Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed or contaminated shall be removed, cleaned, lubricated and replaced before jointing is attempted again.
14. Complete each joint before laying next length of pipe.
15. Minimize deflection after joint has been made.
16. Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.

17. Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by the Consultant.

18. Provide necessary fittings and adaptors as required between existing watermain pipe materials and proposed watermain pipe materials.

19. When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.

20. Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.

21. Do not lay pipe on frozen bedding.

22. Contractor responsible for satisfactory completion of hydrostatic and leakage testing to Consultant's approval. Contractor also responsible for degree of backfilling complete prior to hydrostatic and leakage testing as well as isolation and correction of any leaks resulting in failed tests.

23. Backfill remainder of trench.

3.5. **Cathodic Protection And Tracer Wire**

1. Install as per Municipal Standards,

3.6. **Hydrostatic And Leakage**

1. Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described as required by the Municipality standards.

2. Notify Consultant at least 24 h in advance of all proposed tests. Perform tests in presence of Consultant.

3. Where any section of system is provided with concrete thrust blocks, conduct tests at least 5 days after placing concrete or 2 days if high early strength concrete is used.

4. Test pipeline in sections not exceeding 365 m in length, unless otherwise authorized by Consultant.

5. Upon completion of pipe laying and after Consultant has inspected work in place, surround and cover pipes between joints with approved granular material placed to dimensions indicated or directed by Consultant.

6. Leave hydrants, valves, backflow preventer, water meter, joints and fittings exposed.

7. When testing is done during freezing weather, protect hydrants, valves, backflow preventer, water meter, joints and fittings from freezing.

8. Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied.

9. Open valves.

10. Expel air from main by slowly filling main with potable water. Install corporation stops at high points in main where no air-vacuum release valves are installed. Remove stops after satisfactory completion of test and seal holes with plugs.

11. Thoroughly examine exposed parts and correct for leakage as necessary.

12. Examine exposed pipe, joints, fittings and appurtenances while system is under pressure.

13. Remove joints, fittings and appurtenances found defective and replace with new sound material and make watertight.

14. Repeat hydrostatic test until all defects have been corrected.

15. Apply a leakage test pressure of equal to design pressure after complete backfilling of

trench, based on elevation of lowest point in main and corrected to elevation of gauge, for period of 2 h.

16. Define leakage as amount of water supplied from water meter in order to maintain test pressure for 2 h.

17. Do not exceed allowable leakage of 0.03 L/mm diameter per 300 m of pipe, including lateral connections, per hour.

18. Locate and repair defects if leakage is greater than amount specified.

19. Repeat test until leakage is within specified allowance for full length of water main.

Pipe Surround

20. Upon completion of pipe laying and after Consultant has inspected work in place, surround and cover pipes as indicated.

21. Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated. Do not dump material within 5 m of pipe.

22. Place layers uniformly and simultaneously on each side of pipe.

23. Do not place material in frozen condition.

24. Compact each layer from pipe invert to mid height of pipe to at least 95% of SPMDD to ASTM D698.

25. Compact each layer from (mid height) of pipe to underside of backfill to at least 95% of SPMDD and in accordance with Geotechnical Report for site.

3.7. **Backfill**

1. Place backfill material above pipe surround in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.

2. Do not place backfill in frozen condition.

3. Compact native backfill to at least 95% of SPMDD.

3.8. **Flushing And Disinfecting**

1. The Municipality shall perform all chlorination works.

2. Flush water mains through available outlets with a sufficient flow of potable water to produce a velocity of 1.5 m/s, within pipe for 10 min., or until foreign materials have been removed and flushed water is clear.

3. Flushing flows shall be as follows:

Pipe Size NPS	Flow (L/s) Minimum
6 and below	38
8	75

4. Provide connections and pumps for flushing as required.

5. Open and close valves, hydrants and service connections to ensure thorough flushing.

6. Complete flushing to satisfaction of Consultant and The Municipal forces.

END OF SECTION

1. GENERAL

1.1. General Requirements

1. Conform to the requirements stated in the General Conditions, Supplementary General Conditions of this Specification and all addenda for all work, including work outside the property line including work within Regional and Municipal right of way unless otherwise noted.

1.2. Related Work

1.	Site Grading	Section 31 23 13
2.	Excavating, Trenching and Backfilling	Section 31 23 10
3.	Manholes and Catchbasins	Section 33 05 14
4.	Aggregates: General	Section 31 05 17

1.3. References

1. ASTM D3034, Specification for Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and fittings.
2. CAN/CSA-B182.2, PVC Sewer Pipe and Fittings (PSM Type),
3. CAN/CSA-B182.11, Recommended Practice for the Installation of Plastic Crain and Sewer Pipe and Pipe Fittings.
4. Ontario Provincial Standard Specification 410.

1.4. Material Certification

1. Submit manufacturer's test data and certification at least 2 weeks prior to commencing work.
2. Certification to be marked on pipe.

1.5. Scheduling of Work

1. Schedule work to minimize interruptions to existing services and to maintain existing flow during construction.

2. PRODUCTS

2.1. PVC Pipe

Poly Vinyl Chloride pipe as specified in the Contract Drawings shall be in accordance with OPSS 410, Pipe Sewer Installation in Open Cut.

2.2. Pipe Bedding, Surround and Cover Materials

1. Granular embedment materials to Section 31 05 17 – Aggregates.

2.3. Backfill Material

1. Backfill to Section 31 23 10 – Excavation, Trenching and Backfilling
2. Backfill within the public right of way to be un-shrinkable fill.

2.4. Joint Mortar

1. Portland cement: to CAN/CSA-A5, normal type 10.
2. Mortar: one part Portland cement to two parts clean sharp sand mixed with minimum amount of water to obtain optimum consistency for use intended. Do not use additive..

3. EXECUTION

3.1. Preparation

1. Clean pipes and fittings of debris and water before installation, and remove defective materials from site.

3.2. Trenching

1. Do trenching work in accordance with Section 31 23 10 – Excavating, Trenching and Backfilling.
2. Do not allow contents of any sewer or sewer connection to flow into trench.
3. Trench alignment and depth to approval of Consultant prior to placing bedding material and pipe.

3.3. Granular Bedding

1. Place granular bedding material to details indicated in bedding detail OPSD 802.010 to OPSD 802.054, depending on type of soil and pipe. Use Class B bedding and place bedding in unfrozen condition. Type of soil to be defined in the field as Type 1, 2, 3, or 4 as per Health and Safety Act and Regulations for Construction Projects.
2. Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness.
3. Compact each layer full width of bed to at least 95% corrected maximum dry density.
4. Shape bed true to grade and to provide continuous, uniform bearing surface for pipe. Do not use blocks when bedding pipes.
5. Shape transverse depressions as required to suit joints.
6. Fill excavation below bottom of specified bedding adjacent to manholes or catch basins with compacted common backfill.

3.4. Installation of Sanitary Sewer Pipes

1. Lay and join pipe in accordance with manufacturer's recommendations and to approval of Consultant.
2. Handle pipe using methods approved by Consultant. Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.
3. Commence laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.
4. Do not exceed maximum joint deflection recommended by pipe manufacturer.
5. Do not allow water to flow through pipes during construction except as may be permitted by Consultant.
6. Whenever work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
7. PVC Pipe as specified in the Contract Drawings shall be installed in accordance with OPSS 410, Pipe Sewer Installation in Open Cut.
8. When any stoppage of work occurs, restrain pipes as directed by Consultant, to prevent "creep" during down time.
9. Cut pipes as required for special inserts, fittings or closure pieces, as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right

angles to axis of pipe.

10. Make watertight connections to manholes and catch basins. Use shrinkage compensating grout when suitable gaskets are not available. Support connections as per OPSD 708.020.

11. Use prefabricated saddles or approved field connections for connecting pipes to existing sewer pipes. Joint to be structurally sound and watertight.

12. Temporarily plug open upstream ends of pipes with removable watertight concrete, steel or plastic bulkheads.

3.5. **Pipe Surround**

1. Place surround material in unfrozen condition.

2. Upon completion of pipe laying, and after Consultant has inspected pipe joints, surround and cover pipes as indicated.

3. Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated. Pipe surround material to extend 300 mm above crown of pipe.

4. Place layers uniformly and simultaneously on each side of pipe.

5. Compact each layer from pipe invert to mid height of pipe to at least 95% corrected maximum dry density.

3.6. **Backfill**

1. Place backfill material in unfrozen condition.

2. Place backfill material above pipe surround in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.

3.7. **Field Testing**

1. Repair or replace pipe, pipe joint or bedding found defective.

2. When directed by Consultant, draw tapered wooden plug with diameter of 50 mm less than nominal pipe diameter through sewer to ensure that pipe is free of obstruction.

3. Remove foreign material from sewers and related appurtenances by flushing with water.

END OF SECTION

1. GENERAL

1.1. General Requirements

1. Conform to the requirements stated in the General Conditions, Supplementary General Conditions of this Specification and all addenda.

1.2. Related Work

1.	Excavating, Trenching and Backfilling	Section 31 23 10
2.	Manholes and Catchbasins	Section 33 05 14
3.	Aggregates: General	Section 31 05 17

1.3. References

1. ASTM C14, Specification for Concrete Sewer, Storm Drain and Culvert Pipe.
2. ASTM C76, Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe
3. ASTM C443M-85a (1990), Specification for Joints for Circular Concrete Sewer and Culvert Pipe, using Rubber Gaskets.
4. CSA A3000, Portland Cement.
5. CAN/CSA-A257, Series M92, Standards for Concrete Pipe.
6. CAN3-G401-M81, Corrugated Steel Pipe products.
7. Ontario Provincial Standard Specification 410.

1.4. Material Certification

1. Certification to be marked on pipe.

1.5. Scheduling of Work

1. Schedule work to minimize interruptions to existing services and to maintain existing flow during construction.

2. PRODUCTS

2.1. Concrete Pipe

1. Non-reinforced circular concrete pipe and fittings: to CAN/CSA-A-257-2, ASTM C14M, Class 3 designed for flexible rubber gasket joints to ASTM C443 M and CAN/CSA A257.
2. Reinforced circular concrete pipe and fittings: to CAN/CSA-A257, ASTM C76M, strength classification as indicated in the Contract Drawings, designed for flexible rubber gasket joints to ASTM C443M and CAN/CSA A257.
3. Manufactured tees for pipe to pipe connections.
4. Lifting holes:
    1. Pipe 900 mm and less diameter: no lift holes.
    2. Pipe greater than 900 mm diameter: lift holes not to exceed two in piece of pipe.

3. Provide pre-fabricated plugs to effectively seal lift holes after installation of pipe.

2.2. PVC Pipe

Poly Vinyl Chloride pipe as specified in the Contract Drawings shall be in accordance with OPSS 410, Pipe Sewer Installation in Open Cut.

2.3. Pipe Embedment, Surround and Cover Materials

1. Granular material to Section 31 05 17 – Aggregates.
2. Granular A to Section 31 23 13 – Site Grading
3. Pipe embedment shall be in accordance with OPSD 802.010

2.4. Backfill Material

1. Backfill shall be granular material as specified in Section 31 23 10 – Excavation, Trenching and Backfilling.

2.5. Joint Mortar

1. Portland cement: to CAN/CSA-A5, normal type 10.
2. Mortar: one part Portland cement to two parts clean sharp sand mixed with minimum amount of water to obtain optimum consistency for use intended. Do not use additives.

3. EXECUTION

3.1. Preparation

1. Clean pipes and fittings of debris and water before installation, and remove defective materials from site.

3.2. Trenching

1. Do trenching work in accordance with Section 31 23 10 – Excavating, Trenching and Backfilling.
2. Do not allow contents of any sewer or sewer connection to flow into trench.
3. Trench alignment and depth to approval of Consultant prior to placing bedding material and pipe.

3.3. Granular Bedding

1. Place granular bedding material to details indicated in bedding detail OPSD 802.010 to OPSD 802.054, depending on type of soil and pipe. Use Class B bedding and place bedding in unfrozen condition.

Type of soil to be defined in the field as Type 1, 2, 3, or 4 as per Health and Safety Act and Regulations for Construction Projects.

2. Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness.
3. Compact each layer full width of bed to at least 95% corrected maximum dry density.

4. Shape bed true to grade and to provide continuous, uniform bearing surface for pipe. Do not use blocks when bedding pipes.
5. Shape transverse depressions as required to suit joints.
6. Fill excavation below bottom of specified bedding adjacent to manholes or catch basins with compacted granular backfill.

3.4. Installation of Storm Drainage Pipes

1. Lay and join pipe in accordance with manufacturer's recommendations and to approval of Consultant.
2. Handle pipe using methods approved by Consultant. Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.
3. Commence laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.
4. Do not exceed maximum joint deflection recommended by pipe manufacturer.
5. Do not allow water to flow through pipes during construction except as may be permitted by Consultant.
6. Whenever work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
7. Joints

1. Poly Vinyl Chloride Pipe

PVC Pipe as specified in the Contract Drawings shall be installed in accordance with OPSS 410, Pipe Sewer Installation in Open Cut.

8. When any stoppage of work occurs, restrain pipes as directed by Consultant, to prevent "creep" during down time.
9. Cut pipes as required for special inserts, fittings or closure pieces, as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
10. Make watertight connections to manholes and catch basins. Use shrinkage compensating grout when suitable gaskets are not available. Support connections as per OPSD 708.020.
11. Use prefabricated saddles or approved field connections for connecting pipes to existing sewer pipes. Joint to be structurally sound and watertight.
12. Temporarily plug open upstream ends of pipes with removable watertight concrete, steel or plastic bulkheads.

3.5. Pipe Surround

1. Place surround material in unfrozen condition.
2. Upon completion of pipe laying, and after Consultant has inspected pipe joints, surround and cover pipes as indicated.
3. Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated. Pipe surround material to extend 300 mm above crown of pipe.
4. Place layers uniformly and simultaneously on each side of pipe.
5. Compact each layer from pipe invert to mid height of pipe to at least 95% corrected maximum dry density.

3.6. Backfill

1. Place backfill material in unfrozen condition.
2. Place backfill material above pipe surround in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
3. Trench backfill shall be imported granular material consisting of Granular B Type I, or reclaimed granulars free of organics.
4. Trench backfill within the public right of way is to be un-shrinkable fill.

3.7. Field Testing

1. Repair or replace pipe, pipe joint or bedding found defective.
2. When directed by Consultant, draw tapered wooden plug with diameter of 50 mm less than nominal pipe diameter through sewer to ensure that pipe is free of obstruction.
3. Remove foreign material from sewers and related appurtenances by flushing with water.

END OF SECTION

1. GENERAL

1.1. General Requirements

1. Conform to the requirements stated in the General Conditions, Supplementary General Conditions of this Specification and all addenda.

1.2. Related Work

1. Excavating, Trenching and Backfilling — Section 31 23 10
2. Aggregates: General — Section 31 05 17

1.3. References

1. OPSS 1801 – Corrugated Steel Pipe Products
2. OPSS 1840 – Polyethylene Pipe Products
3. OPSS 1860 – Geotextiles
4. CSA G164-M1981 – Hot Dip Galvanizing of Irregularly Shaped Articles.
5. CGSB 41-GP-29Ma-1983 - Tubing, Plastic, Corrugated, Drainage

1.4. Material Certification

1. Certification to be marked on pipe.

1.5. Scheduling of Work

1. Schedule work to minimize interruptions to existing services and to maintain existing flow during construction.

2. PRODUCTS.

2.1. PVC Pipe

Poly Vinyl Chloride pipe as specified in the Contract Drawings shall be in accordance with OPSS 410, Pipe Sewer Installation in Open Cut.

2.2. Pipe Embedment, Surround and Cover Materials

1. Granular material to Section 31 05 17 – Aggregates.
2. Pipe embedment shall be in accordance with OPSD 802.010

2.3. Backfill Material

1. Backfill shall be granular material as specified in Section 31 23 10 – Excavation, Trenching and Backfilling.

3. EXECUTION

3.1. Preparation

1. Clean pipes and fittings of debris and water before installation, and remove defective materials from site.

3.2. Trenching

1. Do trenching work in accordance with Section 31 23 10 –

Excavating, Trenching and Backfilling.

2. Do not allow contents of any sewer or sewer connection to flow into trench.

3. Trench alignment and depth to approval of Consultant prior to placing bedding material and pipe.

3.3. Granular Pipe Surround

1. Granular materials surrounding the pipe shall be in accordance with OPSS 1010.

3.4. Installation of Subdrains

1. Installation of subdrains is to be in accordance with OPSS 405.

3.5. Pipe Surround

1. Place surround material in unfrozen condition.

2. Pipe surround material shall be HL-8 Coarse Bedding Stone

3.6. Backfill

1. Place backfill material in unfrozen condition.

2. Place backfill material above pipe surround in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.

3. Trench backfill shall be imported granular material consisting of Granular B Type I, or reclaimed granulars free of organics.

4. Trench backfill within the public right of way is to be un-shrinkable fill.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for foundation and underslab drainage.

1.2 RELATED SECTIONS

.1 Section 31 23 10 - Excavating, Trenching and Backfilling.

.2 Section 03 30 00 – Cast-in-Place Concrete.

1.3 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)

.1 ASTM D698-[00a], Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-34.22-[94], Asbestos-Cement Drain Pipe.

.3 Canadian Standards Association (CSA International)

.1 CSA-A23.1/A23.2-[00(June 2001)], Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.

.2 CSA B1800-[02], Plastic Non-pressure Pipe Compendium - B1800 Series (Consists of B181.1, B181.2, B181.3, B181.5, B182.1, B182.2, B182.4, B182.6, B182.7, B182.8 and B182.11).

.1 CSA B182.2-[02], PVC Sewer Pipe and Fittings (PSM Type).

.3 CSA-G401-[01], Corrugated Steel Pipe Products.

.4 Department of Justice Canada (Jus)

.1 Canadian Environmental Protection Act, 1999 (CEPA)

.5 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act, 1992 (TDGA)

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal packaging material for recycling.

.3 Divert unused concrete materials from landfill to local facility.

.4 Divert unused aggregate materials from landfill to facility for reuse.

.5 Divert unused metal materials from landfill to metal recycling facility for disposal approved by Consultant.

□

.6 Divert unused geotextiles from landfill to plastic recycling facility for disposal approved by Consultant.

.7 Place materials defined as hazardous or toxic in designated containers.

.8 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.

.9 Dispose of unused asbestos cement pipe in accordance with regulations governing the disposal of hazardous materials.

1.5 SITE CONDITIONS

.1 Examine sub-surface investigation report which is bound into specifications.

.2 Known underground utility lines and buried objects are as indicated on plans.

Part 2 Products

2.1 BEDDING AND SURROUND MATERIALS

.1 Coarse filter aggregate: to CSA-A23.1/A23.2, Group 1, 15 mm.

.2 Fine filter aggregate: to CSA-A23.1/A23.2.

.3 Flexible plastic tubing and fittings. Corrugated, Non-perforated, nominal inside diameter 100 and 150 mm. Type 1 for discharge lines, Type 2 perforated and wrapped with filter fabric for collector lines.

.4 Geodrains: “Terradrain” 600 by Terrafix or approved equal.

.5 Filter Fabric: “Terrafix” 270R or Mirafi 140.

2.2 BACKFILL MATERIAL

.1 In accordance with Section 31 23 10 - Excavating, Trenching and Backfilling and as indicated on drawings.

.2 Excavated or graded material existing on site may be suitable to use if approved by Engineer.

Part 3 Execution

3.1 EXAMINATION

.1 Ensure graded subgrade conforms with required drainage pattern before placing bedding material.

.2 Ensure improper slopes, unstable areas, areas requiring additional compaction or other unsatisfactory conditions are corrected to approval of Consultant.

.3 Ensure foundation wall have been installed and approved by Consultant before placing bedding material.

3.2 BEDDING PREPARATION

.1 Cut trenches in subgrade and place bedding material in uniform layers not exceeding 150 mm compacted thickness to depth as indicated.

.2 Shape bed true to grade and to provide continuous, uniform bearing surface for tubing.

.3 Shape transverse depressions, as required, to suit joints.

.4 Compact each layer full width of bed to at least 95% of corrected maximum dry density.

.5 Fill excavation below design elevation of bottom of specified bedding with compacted bedding material.

3.3 INSTALLATION AT PERIMETER OF BUILDING AND AREAS WITHIN FOUNDATION PERIMETER

.1 If drain is not on footing, place a min. 100 mm of coarse filter material.

.2 At planter locations, install geodrain against wall from finish grade to weeping tile invert elevation – temporary hold it in place until backfilled.

.3 Lay wrapped perforated pipe directly on coarse filter material. Invert of pipe to be minimum of 250 mm below underside of floor slab. Provide pipes sloping to drains as shown on drawings. Minimum slope 1%.

.4 Install minimum 150 mm of coarse filter material to sides and top of perforated pipe for perimeter drainage.

.5 Install minimum 300 mm Granular "B" all around coarse filter material (sides and top).

.6 Install minimum 150 mm coarse filter material cover on all sides of non-perforated pipe.

.7 Ensure pipe interior and coupling surfaces are clean before laying.

.8 Do not use concrete, masonry, stones, wood or any type of shim to establish pipe slope.

.9 Connect pipes using manufacturer's recommended fittings and seal joints with sewer compound.

.10 Protect pipe ends from damage and ingress of foreign material at each end of each day's work or work stoppage.

.11 Place filter material after pipe installation has been inspected.

□

.12 Place filter material by hand in 150 mm lifts. Consolidate by tamping lightly. Prevent displacement of pipe.

.13 Backfill trench (1 m wide minimum) with Granular "B" lightly compacted to 95% standard density (except under paved and slab on grade areas: 98%) up to 700 mm below finished grade.

.14 In landscaped areas place 600 mm of impermeable backfill seal compacted clay prior to the placing of top soil.

3.4 INSTALLATION UNDER PAVED AREAS

.1 Install weeping tile around parking perimeter at concrete curbs and at drains were indicated.

.2 Trench for weeping tile will be 300 mm wide and extend to a depth of 350 mm minimum in the subgrade below granular base.

.3 Line trench with filter cloth. Filter cloth shall be wide enough to overlap 150 mm minimum after backfilling.

.4 Place 40 mm of clear crushed aggregate and compact to 98% standard proctor maximum dry density.

.5 Lay 150 mm diameter perforated pipe directly on compacted granular material. Minimum slope 0.5%.

.6 Where weeping tile pipe joins into other piping or material at storm drains or catch basins and at all direction changes, use specifically designed fittings and seal joints with sewer compound in accordance with manufacturer's instructions.

.7 Fold filter cloth over compacted granular. Overlap 150 mm minimum.

.8 Backfill trench up to subgrade elevation with clear crushed aggregate compacted to 98% standard proctor maximum dry density.

3.5 BACKFILL MATERIAL

.1 Place backfill material above tubing surround in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.

.2 Under paving and walks, compact backfill to at least 95% corrected maximum dry density. In other areas, compact to at least 90% corrected maximum dry density.

END OF SECTION

□

PROJECT: MILTON #13 ELEMENTARY SCHOOL
AND CHILDCARE FACILITY
HDSB PROJECT NO. RFT 26-031

CLIENT: HALTON DISTRICT SCHOOL BOARD

PROJECT No.: 22124

DATE: JANUARY 2026

BINDER: B MECHANICAL & ELECTRICAL



ARCHITECT & CONSULTANTS:

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- Development Consulting
- Urban Transformation
- Urban Design
- Urban Engineering

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DEI Consulting Engineers
MECHANICAL | ELECTRICAL | AQUATIC

KALOS ENGINEERING

Division 20 Common Requirements for Mechanical

Common Contract Requirements for Mechanical

20 02 21 Mechanical Supplemental Tender Form
20 02 51 Mechanical Contract Requirements

Common Work Results for Mechanical

20 05 11 Mechanical Work Requirements
20 05 31 Expansion Fittings and Loops
20 05 32 Thermometers and Pressure Gauges
20 05 34 Bases, Hangers and Supports
20 05 48 Seismic Restraint
20 05 49 Vibration Control Measures
20 05 53 Identification of Mechanical Services

Testing, Adjusting, and Balancing

20 06 11 Testing, Adjusting, and Balancing (TAB) of Mechanical Systems

Commissioning for Mechanical

20 08 11 Mechanical Contractor Commissioning Requirements
20 08 12 System Commissioning by Agent

Division 21 Fire Suppression

Fire-Suppression Sprinkler Systems

21 13 13 Wet Pipe Fire Suppression

Division 22 Plumbing

Common Work Results for Plumbing

22 05 33 Heat Tracing for Plumbing & Drainage

Plumbing Insulation

22 07 19 Plumbing Piping Insulation

Facility Water Distribution

22 11 11 Site Services - Water Mains
22 11 16 Domestic Water Piping - Copper
22 11 20 Backflow and Cross Connection Measures
22 11 31 Potable Water Auxiliary Equipment

Facility Sanitary Sewerage

22 13 11 Site Services - Sanitary Sewers
22 13 13 Sanitary Drains
22 13 16 Sanitary Waste and Vent Piping – Cast Iron and Copper
22 13 17 Sanitary Waste and Vent Piping – Plastic
22 13 23 Sanitary Interceptors
22 13 29 Sanitary Sewage Pumps

Facility Storm Drainage

22 14 11 Site Services - Storm Sewers
22 14 15 Storm Drainage Piping – Cast Iron and Copper
22 14 16 Strom Drainage Piping - Plastic
22 14 26 Storm Drains

Electric Domestic Water Heaters

22 33 34 Air Source Heat Pump Domestic Water Heaters and Trim
22 34 36 Domestic Water Heaters

Plumbing Auxiliary Equipment

22 36 13 Plumbing Auxiliary Equipment

Fire Extinguishers

22 37 13 Portable Fire Extinguishers

Plumbing Fixtures

22 44 13 Plumbing Fixtures Combined with Drawing Schedules

Division 23 Heating, Ventilating, and Air Conditioning (HVAC)

Operation and Maintenance of HVAC Systems

23 05 11 Variable Frequency Drives

Common Work Results for HVAC

23 05 81 Pipe Welding

HVAC Insulation

23 07 13 Duct Insulation
23 07 19 HVAC Piping Insulation

Building Automation System

23 09 23 Direct Digital Controls System for HVAC
23 09 23A Schedule A
23 09 93 Sequences of Operation for HVAC Control

Facility Fuel Piping

23 11 23 Facility Natural-Gas & Propane Piping

Hydronic Piping and Pumps

23 21 11 Hydronic Accessories
23 21 13 Hydronic Piping (Welded)
23 21 23 Pumps Hydronic

Refrigerant Piping

23 23 13 Refrigerant Piping and Specialties

HVAC Water Treatment

23 25 13 Water Treatment for Closed-Loop Hydronic Systems

HVAC Ducts and Casings

23 31 13 Metal Ducts

Air Plenums and Chases

23 32 13	Fabricated, Metal Air Plenums
	Air Duct Accessories
23 33 13	Duct Accessories
23 33 13.13	Volume Control Dampers
23 33 16	Fire Dampers
23 33 17	Smoke Control Dampers
23 33 18	Operating Dampers
23 33 46	Flexible Ducts
23 33 53	Duct Liners
	HVAC Fans
23 34 23	Packaged Exhausters
	Special Exhaust Systems
23 35 15	Dust Extractor Exhaust Systems
	Air Terminal Units
23 36 16	Variable Air Volume Units
	Air Outlets and Inlets
23 37 13	Diffusers, Registers, and Grilles
23 37 23	Louvres and Vents for Intake and Exhaust
	Ventilation Hoods
23 38 13	Commercial Kitchen Hood Systems
	Breeching, Chimneys, and Stacks
23 51 33	Insulated Sectional Chimneys
	Heating Boilers
23 52 13	Stainless Steel Condensing Boilers
	Fuel-Fired Heaters
23 55 33	Gas Fired Unit Heaters
	Cooling Towers
23 65 13	Closed-Circuit, Forced-Draft Cooling Towers
	Packaged Outdoor HVAC Equipment
23 74 45	Packaged Air Source Rooftop HVAC Units with Back-Up Gas Heat
	Custom Outdoor HVAC Equipment
23 75 12	Semi-Custom Outdoor Heating and Cooling Air Handling Units
	Decentralized Unitary HVAC Equipment
23 81 26	Split System Air Conditioning
23 81 46	Water Source Unitary Heat Pumps
23 81 47	Modular Scroll Air to Water Heat Pump (High Temp)
	Radiant Heating Units
23 83 12	Electric Duct Heaters

END OF SECTION

Part 1 General

1.1 INSTRUCTIONS TO BIDDERS

.1 The Mechanical Supplemental Tender Form must be submitted to the architect (admin@hossackarch.com) and consultant (dei@deiassociates.ca) via email on or before 2:00pm local time the following day of the tender close, or the next business day. Mechanical contractors shall identify all sub-contractors he/she intends to use and must complete all information requested. The requisite information shall be given at the office of the Consultant. Contractor shall sign and date this page and initial and date each page thereafter.

.2 Should the Mechanical Supplemental Form not be submitted then the contractor shall use Base Bid manufacturers as listed.

.3 CONTRACTOR

I/We certify that I/We have the authority to bind the company.

COMPANY NAME	AUTHORIZED SIGNATURE
ADDRESS	PRINTED SIGNATURE
CITY	TITLE
TELEPHONE NUMBER	DATE
FAX	

SUB-CONTRACTORS

The Contractor shall state below the name of the Site Services, Insulation, Fire Protection, Sheet Metal, Temperature Controls and TAB Sub-contractor he intends to use, which shall not be changed without the consent of the Consultant.

Site Services _____

Insulation _____

Fire Protection _____

Piping (Plumbing & HVAC) _____

Sheet Metal _____

Temperature Controls _____

TAB _____

.4 The Stipulated Bid Sum shall be for the base bid manufacturer or supplier equipment only, unless otherwise indicated. Where a choice of this equipment is given, this Contractor shall indicate the supplier or manufacturer he intends to use. Where no choice is indicated, the base bid supplier or equipment shall be used.

.5 Equipment or materials manufactured by firms named in the following listing only shall be deemed equal to the equipment or material specified, provided the equipment or material will have capacity, performance, rating, construction, physical dimensions, accessories and features which, in the opinion of the Consultant, are equal to those of the specified equipment or material. The Mechanical Contractor shall not indicate equipment, materials or suppliers which are not listed. If this is done, the base bid supplier shall be used.

.6 Where modifications to the work of other trades are required as a result or part of the alternative offered, include the cost of said modifications in the work.

.7 Submit the following list of Base Bid and alternative suppliers in accordance with the bid requirements:

Spec. Reference Section	**Equipment**	**Base Bid**	**Acceptable Alternate Manufacturer Or Supplier**	**Indicate Manufacturer Or Supplier**
20 05 31	Flexible Connectors, Expansion Joints, Guides	Metraflex HP	Flexonics Mark David Canada	
20 05 32	Thermometers Pressure Gauges	Trerice	Wiess Winters	
20 05 34	Hangers and Supports	Grinnell	Myatt Anvil	
20 05 48	Seismic Restraint	Kinetics Noise Control Inc.	Cooper 'B' Line Unistrut Building Systems Mason Industries	
20 05 49	Vibration Control	Vibro Acoustics	Vibron Korfond IAC Acoustics	
21 12 13	F.D. Connections	Wilson & Cousins	National	
21 13 13	Sprinkler Heads	Reliable	Globe Central Viking	
22 07 19	Thermal Insulation for Plumbing Piping	Fibreglass Canada	Knauf Manson Pittsburg Corning	
22 11 20	Backflow Devices	Watts	Wilkins Conbraco	
22 11 31	Water Make-up Assembly	Watts	Conbraco	
22 11 31	Water Meter	Neptune		
22 11 31	Strainers	Watts	Crane/Powers Colton Wilkins	

22 11 31	Water Filters	Aqua Puro		
22 11 31	Solenoid Valves	Asco		
22 13 11	Plastic Sanitary Sewer	Ipex		
22 13 11	Forced Mains	Ipex		
22 13 13	Drainage Supplies	Zurn	Ancon Smith Mifab Watts Contour Enpoco	
22 13 23	Interceptor	Zurn	Ancon Mifab Smith	
22 34 36	Fuel Fired Domestic Water Heaters	A.O. Smith	Ruud Bradford White	
22 37 13	Fire Extinguishers	Wilson & Cousins	National	
22 37 13	Cabinets	Wilson & Cousins	National	
22 44 13	Plumbing Fixtures	American Standard	Kohler Crane	
22 44 13	Flush Valves	Zurn	Cambridge Brass Sloan Delta Moen Commercial	
22 44 13	Water Closet Seats	Bemis Centoco	Moldex Olsonite	
22 44 13	Stainless Steel Lavs/Sinks	Kindred	Steel Queen Elkay Novanni	
22 44 13	Waste and Water Pipe Insulation	McGuire	Truebro	

22 44 13	Mop Basin	Fiat	Zurn Stern Williams	
22 44 13	Mop Basin Supply	Fiat	Zurn Stern Williams Delta	
22 44 13	Faucet Supplies	Delta	Sloan Moen Chicago Zurn	
22 44 13	Drinking Fountains	Haws	Aquarius Elkay	
22 44 13	Thermostic Mixing Valves	Symmons Powers		
22 44 13	Emergency Eyewash/Shower	Bradley	Haws Guardian	
22 44 13	Fixture Traps/Waste	Delta	McGuire	
22 44 13	Fixture Stops	Delta	McGuire	
22 44 13	Fixture Carriers	Zurn	Ancon Smith	
23 07 13	Thermal Duct Insulation	Fibreglass Canada Johns Manville	Knauf Manson Roxul	
23 07 19	Thermal Insulation for HVAC Piping	Fibreglass Canada	Knauf Manson Pittsburg Corning	
23 11 23	Regulator	Singer	Schlumberger	
23 21 11	Closed Expansion Tank	Bell & Gossett	Armstrong	

23 21 13	Valves	Newman Hattersley	Jenkins/Crane Milwaukee Toyo Kitz	
23 21 13	Balancing Valves	Bell & Gossett	Taco Armstrong Tour & Anderson	
23 21 13	Air Vents	Maidomist	Spirax Sarco	
23 21 23	Pumps Hydronic	Bell & Gossett	Armstrong	
23 22 16	Pipe Line Strainers	Braukmann	Kunkle Spirax Sarco	
23 23 13	Filter Drier	Mueller	Parker Sporlan Vriginia	
23 23 13	Expansion Valves	Henry	Mueller Parker Sporlan	
23 23 13	Flexible Connectors	Anamet	Packless Superior Vibration Mountings	
23 25 13	Pot Feeder	Rochester Midland	Chem Aqua	
23 32 13	Acoustic Plenums	Vibron	BVA VAV Systems IAC Acoustics E.H. Price	
23 33 13	Access Doors	Nailor	E.H. Price Titus	

23 33 13	Ductwork Accessories	Duro Dyne	Ductmate	
23 33 16	Fire Dampers	Ruskin	Ruskin Nailor National Controlled Air (NCA) Ventox T.A. Morrison Greenheck	
23 33 18	Operating Dampers	Honeywell	Johnson T.A. Morrison Nailor Ventex National Controlled Air (NCA) Trane Tamco	
23 33 46	Flexible Ductwork	Flexmaster	Ductmate	
23 33 53	Acoustic Duct Lining	Duro Dyne Johns Manville	Ductmate Owen Corning	
23 34 23	Packaged Exhausters	Penn-Barry	Greenheck Cook Jenn Zonex	
23 34 23	Range Hoods	Broan	Nutone	
23 37 13	Grilles and Diffusers	Krueger	Nailor Titus E.H. Price Carnes Seiho Metalaire	
23 37 23	Louvres/Brick Vents	Ventex	Construction Specialties Airolite Co. Krueger Greenheck Ruskin Ventmaster Nailor	

23 38 13	Fire Suppression System	Spring Air	Garland Pyro-Chem	
23 52 13	Stainless Steel Condensing Boilers	Viessmann	Cleaver Brooks Patterson-Kelley	
23 55 33	Gas Fired Unit Heaters	Reznor	Lennox	
23 65 16	Closed-Circuit Forced Draft Cooling Tower	Baltimore Air Coil	Evapco	
23 74 45	Packaged Air Source Rooftop HVAC Units with Back-up Gas Heat	Carrier	Lennox Trane	
23 75 12	Semi-Custom Outdoor Heating and Cooling Air Handling Units	Daikin	Engineered Air HAAKON	
23 81 26	Split-System Air Conditioning	LG	Carrier Trane Lennox Daikin	
23 81 46	Water Source Heat Pumps	Daikin	Carrier Trane Bosch/Florida Heat Pumps	
23 81 47	Modular Scroll Air to Water Heat Pump	Aermec	Transom	
23 83 12	Electric Duct Heaters	Neptronic	PM Wright Chromalox Thermolec Hazloc	

1.2 LABOUR RATES

.1 The following labour rates shall apply for calculating the cost of credit or extras on Change Notices. The rates shall include any employee benefits. The labour rates do not include overhead and profit.

Superintendent	$_____/hr
Journeymen	$_____/hr
Labourers	$_____/hr
Plumbers	$_____/hr
Sheet Metal	$_____/hr
Insulation	$_____/hr
Other	$_____/hr

1.3 UNIT PRICES

.1 Add one wet system sprinkler head $ ———— Extra

.2 Delete one wet system sprinkler head $ ———— Credit

1.4 MECHANICAL TENDER PRICE (EXCLUDING HST)

.1 Having carefully examined all Drawings and Specifications and the Addenda to the Drawings and Specifications, and having carefully examined the sites and all conditions affecting the work, we, the undersigned thereby offer to provide all plant, labour, materials and incidentals required to complete the work of all trades for: All the work specified for herein for

the Total Stipulated Price of: $_____

_____

(in writing)

in lawful money of Canada; included in which are all applicable excise taxes, custom duties, freight, exchange, and all other charges. HST is not included.

Part 2 Products

2.1 NOT USED

Part 3 Products

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 GENERAL PROVISIONS

.1 This section covers items common to all sections of Mechanical Division.

.2 Conform to Division 1 General Conditions.

.3 Furnish labour, materials, and equipment necessary for completion of work as described in contract documents.

.4 Unless specifically indicated, all materials and equipment provided under this contract shall be new and shall be manufactured in the project year.

1.2 INTENT

.1 Mention herein or indication on Drawings of articles, materials, operations or methods requires: supply of each item mentioned or indicated, of quality, or subject to qualifications noted; installation according to conditions stated: and, performance of each operation prescribed with furnishing of necessary labour, equipment, and incidentals for mechanical work.

.2 Where used, words “Section” and “Division” shall also include other Subcontractors engaged on site to perform work to make building and site complete in all respects.

.3 Where used, word “supply” shall mean furnishing to site in location required or directed complete with accessory parts.

.4 Where used, word “install” shall mean secured in place and connected up for operation as noted or directed.

.5 Where used, word “provide” shall mean supply and install as each is described above.

1.3 TENDERS & BONDING

.1 Complete Supplemental Tender Form including list of equipment and materials to be used on this project and forming part of tender documents.

.2 Submit Supplemental Tender Form as noted.

.3 Submit tender based on specified described equipment or Alternates listed.

.4 State in Tender, names of all Subcontractors proposed for work under this Division.

1.4 REGULATIONS, PERMITS AND FEES

.1 All materials and quality of work shall meet all current and latest Provincial, Municipal and Fire Marshall requirements, regulations, codes and by-laws in force in the area of the project.

.2 Each contractor shall give all necessary notices, obtain all necessary permits, and pay all fees in order that the work shown or specified may be carried out. Each contractor shall furnish any certificates necessary as evidence that the work installed conforms with the laws and regulations of all authorities having jurisdiction.

.3 In the event that changes, or alterations are required on completed work by authorized inspectors, these changes shall be made at the contractor’s expense.

.4 Special equipment which does not have a standard CSA label shall be inspected by the local electrical authority having jurisdiction and the Approval Certificate shall be submitted to the Consultant as soon as possible. All costs and fees for inspections shall be borne by this contractor.

.5 Submit a copy of all final certificates in the maintenance manuals.

1.5 DRAWINGS

.1 Mechanical Drawings do not show structural and related details. Take information involving accurate measurement of building from building drawings, or at building. Make, without additional charge, any necessary changes or additions to runs of piping, conduits and ducts to accommodate structural conditions. Location of pipes, ducts, conduits and other equipment may be altered by Consultant without extra charge provided change is made before installation and does not necessitate major additional material.

.2 As work progresses and before installing piping, ductwork, heating units, registers, diffusers, fixtures and any other fittings and equipment which may interfere with interior treatment and use of building, provide detail drawings or obtain directions for exact location of such equipment and fitments.

.3 Mechanical Drawings indicate general location and route of pipes, ducts and conduits which are to be installed. Where required work is not shown or only shown diagrammatically, install same at maximum height in space to conserve head room (minimum 2200 mm (88") clear) and interfere as little as possible with free use of space through which they can pass. Follow building lines, conceal piping, conduits and ducts in furred spaces, ceilings and walls unless specifically shown otherwise. Install work close to structure so furring will be small as practical.

.4 Install piping and ductwork to clear structural members and any fireproofing. Locate mechanical work to permit installation of specified insulation. Do not remove or damage structural fireproofing. Leave space to permit fireproofing and insulation to be inspected and repaired.

.5 Before commencing work, check and verify all sizes, locations, grade and invert elevations, levels and dimensions to ensure proper and correct installation. Verify existing/municipal services.

.6 Locate all mechanical and electrical equipment in such a manner as to facilitate easy and safe access to and maintenance and replacement of any part.

.7 In every place where there is indicated space reserved for future or other equipment, leave such space clear, and install piping and other work so that necessary installation and connections can be made for any such apparatus. Obtain instructions whenever necessary for this purpose.

.8 Relocate equipment and/or material installed but not coordinated with work of other Sections and/or installed incorrectly as directed, without extra charge.

.9 Where drawings are done in metric and product not available in metric, the corresponding imperial trade size shall be utilized.

1.6 INTERFERENCE AND CO-ORDINATION DRAWINGS

.1 Prepare interference and equipment placing drawings to ensure that all components will be properly accommodated within the constructed spaces provided.

.2 Prepare drawings to indicate co-ordination and methods of installation of a system with other systems where their relationship is critical. Ensure that all details of equipment apparatus, and connections are coordinated.

.3 Ensure that clearances required by jurisdictional authorities and clearances for proper maintenance are indicated on drawings.

.4 Upon consultant's request submit copies of interference drawings to consultant.

.5 Due to the nature of the building and the complexity of the building systems provide the following:

.1 Interference drawings, showing coordination of architectural, structural, mechanical and electrical systems for the consultant's review prior to fabrication.

.2 Detailed layout drawings, clearly showing fasteners and hangers.

.6 Provide CAD drawings (minimum release AutoCAD 2007) in addition to hard copies.

1.7 QUALITY ASSURANCE

.1 Perform work in accordance with applicable provisions of local Plumbing Code, Gas Ordinances, and adoptions thereof for all mechanical systems. Provide materials and labor necessary to comply with rules, regulations, and ordinances.

.2 In case of differences between building codes, provincial laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern. Promptly notify Consultant in writing of such differences.

1.8 ALTERNATES AND SUBSTITUTIONS

.1 Throughout Mechanical Division are lists of "Alternate Equipment" manufacturers acceptable to Consultant if their product meets characteristics of specified described equipment. Submitted Bids shall be based on the supply of named articles and or products as specified in the Bid Documents.

.2 Each bidder may elect to use "Alternate Equipment" from lists of Alternates where listed. Include for any additional costs including all costs for revisions to electrical contract to suit Alternate used. Prices are not required in Tender for Alternates listed except where specifically noted as "Separate Price". Complete the Supplementary Tender Form.

.3 When two or more suppliers/manufacturers are named in the Bid Documents, only one supplier/manufacturer of the products named will be acceptable; however, it is the responsibility of this Division to ensure "Alternate Equipment" fits space allocated and gives performance specified. If an "Alternate Equipment" nor "equal" specified product unit is proposed and does not fit space alloted in Consultant's opinion, supply of specified described equipment will be required without change in Contract amount. Should electrical characteristics for "alternate" or "equal" equipment differ from equipment specified it shall be the responsibility of the equipment manufacturer to pay all costs associated with the revisions to the electrical contract. Only manufacturers listed will be accepted for their product listing. All other manufacturers shall be quoted as substitution stating conditions and credit amount.

.4 If item of material specified is unobtainable, state in Tender proposed substitute and amount added or deducted for its use. Extra monies will not be paid for substitutions after Contract has been awarded.

.5 If pipe or item, of size or weight indicated, is unobtainable, supply next larger size or heavier weight without additional charge.

1.9 EXAMINATION

.1 Site Inspection

.1 Examine premises to understand conditions, which may affect performance of work of this Division before submitting proposals for this work.

.2 No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.

.2 Drawings:

.1 Mechanical Drawings show general arrangement of piping, ductwork, equipment, etc. Follow as closely as actual building construction and work of other trades will permit.

.2 Consider Architectural and Structural Drawings part of this work insofar as these drawings furnish information relating to design and construction of building. These drawings take precedence over Plumbing, Mechanical, and Fire Protection Drawings.

.3 Because of small scale of Drawings, it is not possible to indicate all offsets, fittings, and accessories, which may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions.

.3 Ensure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents. If approval is received by Addendum or Change Order to use other than originally specified items, be responsible for specified capacities and for ensuring that items to be furnished will fit space available.

1.10 SEQUENCING SCHEDULING AND COORDINATION

.1 It is understood that while Drawings are to be followed as closely as circumstances permit, this Division will be held responsible for installation of systems according to the true intent and meaning of Contract Documents. Anything not clear or in conflict will be explained by making application to Consultant. Should conditions arise where certain changes would be advisable, secure Consultant's approval of these changes before proceeding with work.

.2 Coordinate work of various trades in installing interrelated work. Before installation of mechanical items, make proper provision to avoid interferences in a manner approved by Consultant. Each Contractor shall refer to all sections of the specification for their responsibilities with other trades. Changes required in work specified in Mechanical Division caused by neglect to do so shall be made at no cost to Owner.

.3 Arrange pipes, ducts, and equipment to permit ready access to valves, unions, traps, starters, motors, control components, and to clear openings of doors and access panels.

.4 Furnish and install inserts and supports required by Mechanical Division unless otherwise noted. Furnish sleeves, inserts, supports, and equipment that are an integral part of other Divisions of the Work to Sections involved in sufficient time to be built into construction as the Work proceeds. Locate these items and see that they are properly installed. Expense resulting from improper location or installation of items above shall be borne by Mechanical Division.

.5 Be responsible for required excavation, backfilling, cutting, and patching incident to work of this Division and make required repairs afterwards to satisfaction of Consultant. Cut carefully to minimize necessity for repairs to existing work. Do not cut beams, columns, or trusses.

.1 Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown. Surface finishes shall exactly match existing finishes of same materials.

.2 Each Section of this Division shall bear expense of cutting, patching, repairing, and replacing of work of other Sections required because of its fault, error, tardiness, or because of damage done by it.

.3 Cutting, patching, repairing, and replacing pavements, sidewalks, roads, and curbs to permit installation of work of this Division is responsibility of Section installing work.

.6 Adjust locations of pipes, ducts, equipment, fixtures, etc, to accommodate work from interferences anticipated and encountered. Determine exact route and location of each pipe and duct prior to fabrication.

.1 Make offsets, transitions, and changes in direction of pipes, ducts, and electrical raceways as required to maintain proper head room and pitch of sloping lines whether or not indicated on Drawings.

.2 Furnish and install traps, air vents, sanitary vents, pull boxes, etc, as required to effect these offsets, transitions, and changes in direction.

.7 Slots and openings through floors, walls, ceilings, and roofs shall be provided by this contractor but performed by a trade specializing in this type of work. This Division shall see that they are properly located and do any cutting and patching caused by its neglect to do so.

1.11 CONTRACT BREAKDOWN

.1 Provide breakdown of contract exclusive of HST to acceptance of consultants prior to first draw submission.

.2 Provide labour and material cost for each item.

.3 Breakdown shall indicate total contract amount.

.4 Contract breakdown shall be as follows as a minimum.

Mobilization and shop drawings (max. $2000.00)
Inside buried plumbing and drainage
Above grade rough-in plumbing and drainage
Roof drainage system
Plumbing Fixtures
Sprinkler system and heads
Boilers
Split A/C systems/refrigerant piping
Circulation pumps
Heat pumps
Heating piping
Piping Insulation
Ductwork
Duct Insulation
Grilles & Diffusers
Dust extractor system
Fire Stopping
Cooling Tower
Fans & Equipment
Building Automation Systems
Testing Adjusting and Balancing
HVAC system commissioning
Mechanical contractor closeout requirements (min. of 3% but not less than $5,000.00)

.5 Progress claims, when submitted are to be itemized against each item of the contract breakdown, this shall be done in table form showing contract amount, work complete to date, previous draw, amount this draw and balance.

1.12 COMMISSIONING CONTRACT BREAKDOWN

.1 This contractor shall work with the HVAC system commissioning contractor as specified elsewhere. The following commissioning breakdown shall be indicated on the contract breakdown draw.

1.13 SHOP DRAWINGS AND PRODUCT DATA

.1 Furnish complete catalog data for manufactured items of equipment to be used in the Work to Consultant for review within 30 days after award of Contract.

.2 Provide a complete list of shop drawings to be submitted prior to first submission.

.3 Before submitting to the Consultant, review all shop drawings to verify that the products illustrated therein conform to the Contract Documents. By this review, the Contractor agrees that it has determined and verified all field dimensions, field construction criteria, materials, catalogue numbers, and similar data and that it has checked and coordinated each shop drawing with the requirements of the work and of the Contract Documents. The Contractor's review of each shop drawings shall be indicated by stamp, date and signature of a qualified and responsible person possessing by the appropriate authorization.

.4 If material or equipment is not as specified or submittal is not complete, it will be rejected by Consultant.

.5 Additional shop drawings required by the contractor for maintenance manuals, site copies etc., shall be photocopies of the "reviewed" shop drawings. All costs to provide additional copies of shop drawings shall be borne by the contractor.

.6 Submit all shop drawings for the project as a package. Partial submittals will not be accepted.

.7 Catalog data or shop drawings for equipment, which are noted as being reviewed by Consultant or his Engineer shall not supersede Contract Documents.

.8 Review comments of Consultant shall not relieve this Division from responsibility for deviations from Contract Documents unless Consultant's attention has been called to such deviations in writing at time of submission, nor shall they relieve this Division from responsibility for errors in items submitted.

.9 Check work described by catalog data with Contract Documents for deviations and errors.

.10 Shop drawings and product data shall show:

- .1 Mounting arrangements.
- .2 Operating and maintenance clearances. e.g. access door swing spaces.

.11 Shop drawings and product data shall be accompanied by:

- .1 Detailed drawings of bases, supports, and anchor bolts.
- .2 Acoustical sound power data, where applicable.
- .3 Points of operation on performance curves.
- .4 Manufacturer to certify as to current model production.
- .5 Certification of compliance to applicable codes.

.12 State sizes, capacities, brand names, motor HP, accessories, materials, gauges, dimensions, and other pertinent information. List on catalog covers page numbers of submitted items. Underline applicable data.

.13 Shop drawings shall be submitted electronically as per the following directions:

- .1 Electronic Submissions:
  - .1 Electronically submitted shop drawings shall be prepared as follows:
    - .1 Use latest software to generate PDF files of submission sheets.
    - .2 Scanned legible PDF sheets are acceptable. Image files are not acceptable.
    - .3 PDF format shall be of sufficient resolution to clearly show the finest detail.

.4 PDF page size shall be standardized for printing to letter size (8.5"x11"), portrait with no additional formatting required by the consultant. Submissions requiring larger detail sheets shall not exceed 11"x17".

.5 Submissions shall contain multiple files according to section names as they appear in Specification.

.6 File names shall include consultant project number and description of shop drawing section submitted.

.7 Each submission shall contain an index sheet listing the products submitted, indexed in the same order as they appear in the Specification. Include associated PDF file name for each section.

.8 On the shop drawing use an "electronic mark" to indicate what is being provided.

.9 **Each file shall bear an electronic representation of the "company stamp" of the contractor. If not stamped the file submission will not be reviewed.**

.2 Email submissions shall include subject line to clearly identify the consultants project number and the description of the shop drawings submitted.

.3 Electronic attachments via email shall not exceed 10MB. For submissions larger than 10MB, multiple email messages shall be used. Denote related email messages by indicating "1 of 2" and "2 of 2" in email subject line for the case of two messages.

.4 Electronic attachments via web links (URL) shall directly reference PDF files. Provide necessary access credentials within link or as username/password clearly identified within body of email message.

.5 On site provide one copy of the "reviewed" shop drawings in a binder as noted above.

.6 Contractor to print **3** copies of "reviewed" shop drawings and compile into maintenance manuals.

1.14 OPERATION AND MAINTENANCE MANUAL

.1 Provide operation and maintenance data for incorporation into manual as in submittals' requirements.

.2 Operation and maintenance manual to be approved by, and final copies deposited with, Consultant before final inspection.

.3 Operation data to include:

.1 Control schematics for each system including environmental controls.

.2 Description of each system and its controls.

.3 Description of operation of each system at various loads together with reset schedules and seasonal variances.

.4 Operation instruction for each system and each component.

.5 Description of actions to be taken in event of equipment failure.

.6 Valves schedule and flow diagram.

.7 Colour coding chart.

.8 Spare parts equipment list.

.9 Manufacturers standard or extended warranty information.

.4 Maintenance data shall include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

.2 Data to include schedules of tasks, frequency, tools required and task time.

.5 Performance data to include:

.1 Equipment manufacturer's performance data sheets with point of operation as left after commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified elsewhere.

.4 Testing, adjusting and balancing reports as specified in Testing, Adjusting and Balancing Section.

.6 Miscellaneous data to include:

.1 Letter of contractors warranty and guarantee.

.2 Index sheet.

.3 Tabbed format for each section.

.4 Manufacturers approved shop drawings.

.5 Spare parts list and source.

.6 List of Manufacturers and suppliers address for each piece of equipment.

.7 Approvals:

.1 Submit 1 copy of draft Operation and Maintenance Manual to Consultant for approval. Submission of individual data will not be accepted unless so directed by Consultant.

.2 Make changes as required and re-submit as directed by Consultant.

.3 Provide two (2) copies of final operation maintenance manuals, as well as a PDF file of the entire approved manual on a USB stick. Only one USB stick is to be provided containing both the approved manual and Record drawings.

.8 Additional data:

.1 Prepare and insert into operation and maintenance manual when need for same becomes apparent during demonstrations and instructions specified above.

1.15 AS-BUILT DRAWINGS

.1 Site records:

.1 Contractor shall provide 2 sets of reproducible mechanical drawings. Provide sets of white prints as required for each phase of the work. Mark thereon all changes as work progresses and as changes occur. This shall include changes to existing mechanical systems, control systems and low voltage control wiring.

.2 On a weekly basis, transfer information to reproducible, revising reproducible to show all work as actually installed.

.3 Use different colour waterproof ink for each service.

.4 Make available for reference purposes and inspection at all times.

.2 As-built drawings:

.1 Prior to start of Testing, Adjusting and Balancing (TAB), finalize production of record drawings.

.2 Identify each drawing in lower right-hand corner in letters at least 3 mm (1/8") high as follows: - "AS-BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (date).

.3 TAB to be performed using record drawings.

.1 Submit hard copy to Consultant for approval. When returned, make corrections as directed.

.2 Once approved, submit completed reproducible paper record drawings as well as a scanned pdf file copy on USB stick with Operating and Maintenance Manuals.

1.16 WARRANTIES

.1 In addition to guarantee specified in General Conditions, guarantee heating, cooling, and plumbing systems to be free from noise in operation that may develop from failure to construct system in accordance with Contract Documents.

.2 Provide certificates of warranty for each piece of equipment made out in favor of Owner. Clearly record "start-up" date of each piece of equipment on certificate. Include certificates as part of Operation & Maintenance Manual.

.3 If mechanical sub-contractor with offices located more than 80 km (50 miles) from Project site is used, provide service/warranty work agreement for warranty period with local mechanical sub-contractor approved by Consultant. Include copy of service/warranty agreement in warranty section of Operation & Maintenance Manual.

.4 Contractor shall rectify any installation deficiencies in the boiler or pressurized other systems identified by a TSSA Inspector for a period of three (3) years from substantial completion.

.5 Warranty period shall start from date of substantial completion.

1.17 SUBSTANTIAL PERFORMANCE

.1 Complete the following to the satisfaction of the consultant prior to request for submission of substantial performance.

.1 Record Drawings.

.2 Maintenance Manuals

.3 System Start up

.4 TAB Reports

.5 HVAC System Commissioning

.6 Instructions to Owners

.7 Final Certificates (required prior to consultant's release of conformance letter).

.1 Potable Water Test (Refer to domestic water piping – Copper section – Part 3)

.2 Backflow Test Certificate (for all testable devices)

.3 Mandatory TSSA Gas Pressure Test (CSA B149.1)

.4 NFPA-13 Contractors Material and Test Certificate (sprinkler)

.5 NFPA-13 Fire Protection Bypass Flow Test.

.6 Sprinkler/Standpipe Design Engineers' Letter.

.7 Fire Protection Engineers Inspection/Confirmation Letter.

.8 NFPA-96 Kitchen Hood Fire Suppression System Test.

.9 TSSA Certificate of Authorization for Split Refrigeration Systems (exceeding 3 or 5 tons).

.10 TSSA report for new boiler/pressure vessel installation or written confirmation from TSSA that they opted to not inspect the system.

1.18 OCCUPANCY REQUIREMENTS

.1 The contractor shall provide the following documentation to the consultant prior to receiving occupancy. Failure to provide the proper documentation will result in the occupancy not being granted. List of required documentation:

.1 Final Certificates (required prior to consultant's release of conformance letter).

.1 Potable Water Test (Refer to domestic water piping – Copper section – Part 3)

.2 Backflow Test Certificate (for all testable devices)

.3 Mandatory TSSA Gas Pressure Test (CSA B149.1)

.4 NFPA-13 Contractors Material and Test Certificate (sprinkler)

.5 NFPA-13 Fire Protection Bypass Flow Test.

.6 Sprinkler/Standpipe Design Engineers' Letter.

.7 Fire Protection Engineers Inspection/Confirmation Letter.

.8 NFPA-96 Kitchen Hood Fire Suppression System Test.

.9 TSSA Certificate of Authorization for Split Refrigeration Systems (exceeding 3 or 5 tons).

.10 TSSA report for new boiler/pressure vessel installation or written confirmation from TSSA that they opted to not inspect the system.

1.19 REVISION TO CONTRACT

.1 Provide the following:

.1 Itemized list of material with associated costs.

.2 Labour rate and itemized list of labour for each item.

.3 Copy of manufacturers/supplier's invoice if requested.

1.20 DELIVERY STORAGE & HANDLING

.1 Follow Manufacturer's directions in delivery, storage, and protection, of equipment and materials.

.2 Deliver equipment and material to site and tightly cover and protect against dirt, water, and chemical or mechanical injury but have readily accessible for inspection. Store items subject to moisture damage (such as controls) in dry, heated space.

1.21 TSSA INSPECTION

.1 Prior to final completion of the project, this contractor shall make application, arrange, and pay for a TSSA inspection of all piping systems and equipment installations, including, but not limited to medical gasses, refrigeration, fuel piping, compressed air, heating plant, cooling plant, and associated equipment installed under the contract.

.2 Provide a copy of the TSSA report in the maintenance manuals for each system.

1.22 CONFINED SPACES

.1 Certain areas of the building may be defined as a “Confined Space”. Any personnel working in these areas must have confined space training, appropriate equipment and undertake all work in conformance with appropriate codes and standards.

.2 Refer to building documentation for any spaces deemed “Confined Space”.

1.23 ENERGY EFFICIENCY

.1 The mechanical systems of this building must achieve the energy efficiency levels by conforming to ANSI/ASHRAE/IESNA 90.1 “Energy Standard for Buildings Except Low-Rise Residential Buildings” and Chapter 2 of Division 3 of SB-10 prescriptive method from the Ontario Building Code.

.2 All equipment, products, and installations must conform to the Codes and Standards.

END OF SECTION

Part 1 General

1.1 TESTS

.1 Give 48 hours written notice of date for tests.

.2 Insulate or conceal work only after testing and approval by Consultant.

.3 Conduct tests in presence of Consultant.

.4 Bear costs including retesting and making good.

.5 Piping:

- .1 General: maintain test pressure without loss for 4 h unless otherwise specified.
- .2 Hydraulically test steam and hydronic piping systems at 1-1/2 times system operating pressure or minimum 860 kPa, whichever is greater.
- .3 Test natural gas systems to CSA-B149.1-00, TSSA requirements and requirements of authorities having jurisdiction.
- .4 Test drainage, waste and vent piping to Ontario Building Code and authorities having jurisdiction.
- .5 Test domestic hot, cold and recirculation water piping at 1-1/2 times system operating pressure or minimum 860 kPa (124.8 psi), whichever is greater.
- .6 Test fire systems in accordance with authorities having jurisdiction and as specified elsewhere.

.6 Equipment: test as specified in relevant sections.

.7 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures or test medium.

1.2 SYSTEM START UP

.1 Provide adjusting testing and startup of all equipment prior to testing and balancing (TAB) specified elsewhere.

.2 Provide consultant with written notice verifying all equipment operation and installation is complete.

.3 Startup shall be in presence of the following: owner or representative, contractor, building automation systems (BAS) contractor, and manufacturer's representative. Each person shall witness and sign off each piece of equipment. Consultant's attendance will be determined by consultant.

.4 Simulate system start up and shut down and verify operation of each piece of equipment.

.5 Arrange with all parties and provide 72 hours notice for startup procedure.

.6 Arrange with building automation systems contractor to sequence all components and ensure system operation.

1.3 COMMISSIONING

.1 Co-ordinate and direct each step of the commissioning process and recommend acceptance or non-acceptance to the Owner/Owner's Representative.

.2 Prepare, in writing, documentation of any deficiencies discovered during the commissioning process. Submit to consultant and Owner/Owner's Representative.

.3 The Commissioning Process is detailed in *ASHRAE Guideline 1-1996 HVAC Commissioning Process.* The commissioning plan may be modified to reflect the actual construction schedule and design.

.4 Provide a pre-functional test of all HVAC mechanical system and sub-system elements, including control devices, shall be checked for the following:

.1 Verify that each element has been properly installed, properly identified, and that all connections (including electrical) have been made correctly.

.2 Verify that each element has been checked for proper lubrication, drive rotation, belt tension, control sequence, flow direction, or other conditions which may cause damage or reduce system performance.

.3 Verify that tests, meter readings, and specific mechanical/electrical performance characteristics agree with those required by equipment or system manufacturer.

.4 Controls calibration to be completed in accordance with the specification.

.5 The TAB shall be done in accordance with the specifications.

.5 A functional performance testing shall be done during two separate periods – one during the cooling season and one during the heating season. The first (cooling) testing period shall occur as soon after completion of installation as practical. The heating testing period shall occur as soon as weather conditions make it practical to test warm-up, zone heating and economizer functions. These tests ensure that all equipment and systems operate in accordance with design intent. The tests are dynamic tests and test the systems through all possible modes of operation.

.6 Reports:

.1 The contractor shall be responsible for recording, documenting, and maintaining detailed inspection and testing data on the test documentation reports. The data record shall be comprehensive and concise.

.2 All data must be recorded as soon as possible during the course of the inspection and testing.

.3 All documentation shall have the date, time, and names of persons participating in the inspection and testing.

.4 All test instruments shall be documented for valid calibration.

.5 The recording work sheets, inspection check lists, and Performance Testing plans must all be approved by the Engineer and the owner's representative prior to the start of the testing.

.6 Include all commissioning documentation in the maintenance manuals.

.7 Mechanical System Execution:

.1 Operate equipment and systems shall be tested in the presence of the owner's representative and the consultant to demonstrate compliance with specified requirements. To minimize the time of Commissioning Team members, testing shall be done in four seasonal single blocks of time insofar as possible.

.2 Notify the consultant, in writing, fourteen (14) days prior to tests scheduled under requirements of this Section.

.3 Testing shall be conducted under specified design operating conditions as recommended or approved by the consultant.

.4 All elements of systems shall be tested to demonstrate that total systems satisfy all requirements of these Specifications. Testing shall be accomplished on hierarchical basis. Test each piece of equipment for proper operation, followed by each sub-system, followed by entire system, followed by any inter-ties of other major systems.

.5 All special testing materials and equipment shall be provided by the appropriate contractor.

.6 Provide three copies of all test reports and records to the consultant.

.8 The verification testing procedures shall address all operating characteristics of all mechanical equipment and systems, including:

Equipment Checklist	**System Checklist**
Boiler(s)	Boiler(s)
Cooling Tower	Cooling Tower
Rooftop Heating/Cooling Unit(s)	Pumps
Makeup Air Unit(s)	Makeup Air Unit(s)
Rooftop Heating/Cooling Unit(s)	
Exhaust Fans	
Pumps	
Heat Pumps	
Controllers/Valves/Dampers	
Relays/Sensors/Transducers	

1.4 DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTION

.1 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, troubleshooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.2 Mechanical contractor to schedule and coordinate the demonstration all on the same day, starting at a pre-approved time and continuing consequently until complete.

.3 Where specified elsewhere in Mechanical Division, qualified manufacturers' representatives who are knowledgeable about the project to provide demonstrations and instructions.

.4 Use operation and maintenance manual, record drawings, audio visual aids, etc. as part of instruction materials.

.5 Instruction duration time requirements as specified in appropriate sections.

.6 Where deemed necessary, Consultants may record these demonstrations on video tape for future reference.

1.5 TRIAL USAGE

.1 Consultant or owner may use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 Trial usage to apply to following equipment and systems:

.1 HVAC

.2 Exhaust air

.3 Domestic water

.4 Plumbing and drainage.

1.6 DEFICIENCIES

.1 During the course of construction, the consultants will monitor construction and provide written reports of work progress, discussions, and instruction to correct work.

.2 Instruction to correct work shall be done within the work period before the next review.

.3 The contractor shall not conceal any work until inspected.

.4 The contractor shall expedite 100% complete rough-in work and have inspected prior to concealing services and equipment especially above ceiling.

.5 Upon completion of the project the consultant will do a final review. Upon receiving the final inspection report, the contractor must correct and sign back the inspection report indicating the deficiencies are completed. A re-inspection will only be done once consultant receives this in writing.

1.7 EQUIPMENT INSTALLATIONS

.1 Unions or flanges: provide for ease of maintenance and disassembly.

.2 Space for servicing, disassembly and removal of equipment and components: provide as recommended by manufacturer or as indicated.

.3 Equipment drains: pipe to floor drains.

.4 Install equipment, rectangular cleanouts and similar items parallel to or perpendicular to building lines.

1.8 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to equipment unless specified or indicated otherwise. Coordinate with block coursing (if applicable).

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install mechanical equipment at following heights unless indicated otherwise.

.1	Standard water closets	350 (14") to top of bowl
.2	Barrier-free water closets	400 (16") to top of bowl
.3	Barrier-free water closets	450 (18") to top of seat lid
.4	Wall hung lavatory	787 (31") to rim
.5	Barrier-free wall hung lavatory	840 (33") max to top of rim 737 (29") min underside of rim front
.6	Urinals (Senior Elementary) Urinals (Junior Elementary)	475 (19") to rim 425 (17") to rim
.7	Hose bibbs	+/- 600 (24")
.8	Shower heads (Standard)	2.0 m (6' – 6") to bottom of head Shower heads (Barrier-free) adjustable from 1200 (48") to 2030 (80")
.9	Barrier-free shower seat	+/- 470 (18.5")
.10	Barrier-free drinking fountains	840 mm (33") to rim Not less than 686 (27") under unit
.11	Fire extinguisher	1350 (4'– 0") to hanger
.12	Fire extinguisher cabinets	1500 (5'– 0") to top of cabinet
.13	Backflow preventors	900 – 1200 (3'– 4') to centerline of unit
.14	Thermostats: Barrier Free (operable) Non-Barrier Free	1200 mm (47.25") 1500 mm (59")

Also follow direction of architectural drawings and where discrepancies occur clarify prior to rough-in.

1.9 ANCHOR BOLTS AND TEMPLATES

.1 Supply anchor bolts and templates for installation by other divisions.

1.10 PROTECTION OF OPENINGS

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

1.11 ELECTRICAL

.1 Electrical work to conform to Electrical Division including the following:

.1 Supplier and installer responsibility and related mechanical responsibility is indicated in Equipment Schedule on mechanical and/or electrical drawings

.2 Control wiring and conduit is specified in Electrical Division except for conduit, wiring and connections below 50 V which are related to control systems specified in Mechanical Division. Refer to Electrical Division for quality of materials and workmanship.

.3 Electrically operated equipment shall be C.S.A. approved label. Special Inspection Label of Provincial Authority having jurisdiction will be accepted in lieu of C.S.A. approval. Each motor shall have an approved starter. Starter will be supplied and installed by Electrical Division unless otherwise indicated.

1.12 CONTROL WIRING

.1 Furnish and install all components, devices, and control wiring for all plumbing, fire protection, HVAC equipment, HVAC systems, lighting, and other electrical loads to make all equipment operable to satisfaction of owner and consultant and to manufacturer's requirements and recommendations.

.2 All electrical wiring, mechanical wiring and installations shall comply with local and national electrical and mechanical codes.

.3 Supply and install wiring as required for all devices and systems. Install wiring in EMT conduit and otherwise comply with all requirements of the Electrical Division. Approved plenum wire may be used for sensor and network communication wiring where it complies with appropriate building codes and regulatory authorities.

.4 All wiring concealed in walls and chases, and all exposed wiring shall be run in conduit.

.5 Provide recessed conduit and backer boxes where controls are wall mounted. Surface mounted boxes and conduit are acceptable in mechanical or service rooms.

.6 Free-run plenum rated cable shall be run in cable hangers where provided by electrical division or tied neatly to pipe and duct hangers in the ceiling. Avoid wiring that droops. Follow building lines and do not run wiring "as the crow flies".

1.13 MOTORS

.1 Provide high efficiency motors for mechanical equipment as specified.

.2 If delivery of specified motor will delay delivery or installation of any equipment, install motor approved by Consultant for temporary use. Final acceptance of equipment will not occur until specified motor is installed.

.3 Motors under 373 W, (1/2 hp): speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, voltage as indicated.

.4 Motors 373 W, (1/2 hp) and larger: EEMAC Class B, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 40°C (72°F), 3 phase, voltage as indicated.

1.14 BELT DRIVES

.1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.

.2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise specified.

.3 For motors under 7.5 kW 10 hp: standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.

.4 For motors 7.5 kW 10 hp and over: sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size to suit balancing.

.5 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.

.6 Motor slide rail adjustment plates to allow for centre line adjustment.

.7 Provide sheave changes as required for final air balancing.

1.15 GUARDS

.1 Provide guards for unprotected devices.

.2 Guards for belt drives:

.1 Expanded metal screen welded to steel frame.

.2 Minimum 1.2 mm (18 gauge) thick sheet metal tops and bottoms.

.3 40 mm (1 1/2") diameter holes on both shaft centres for insertion of tachometer.

.4 Removable for servicing.

.3 Provide means to permit lubrication and use of test instruments with guards in place.

.4 Install belt guards to allow movement of motors for adjusting belt tension.

.5 Guard for flexible coupling:

.1 "U" shaped, minimum 1.6 mm (16 gauge) thick galvanized mild steel.

.2 Securely fasten in place.

.3 Removable for servicing.

.6 Unprotected fan inlets or outlets:

.1 Wire or expanded metal screen, galvanized, 20 mm (3/4") mesh.

.2 Net free area of guard: not less than 80% of fan openings.

.3 Securely fasten in place.

.4 Removable for servicing.

.7 Duct Openings in Floor

.1 Provide reinforced expanded mesh grating, style 3 (3 lbs/sq.ft.) cover on accessible unprotected duct openings over 300 mm (12”) wide and as indicated. This includes all ductwork terminating in air handling units and plenums.

.2 Securely Fasten in place.

.3 Removable for servicing.

1.16 PIPING AND EQUIPMENT SUPPORTS

.1 Equipment supports supplied by equipment manufacturer: specified elsewhere in Mechanical Division.

.2 Piping and equipment supports not supplied by equipment manufacturer: fabricate from structural grade steel meeting requirements of - Structural Steel Section. Submit structural calculations with shop drawings.

.3 Mount base mounted equipment on chamfered edge housekeeping pads, minimum of 100 mm (4") high and 150 mm (6") larger than equipment dimensions all around. Concrete specified elsewhere.

.4 Where housekeeping pads incorporate existing pads provide 10 mm dowels into existing pads. New pad height shall match existing.

1.17 SLEEVES

.1 Pipe sleeves: at points where pipes pass through masonry, concrete or fire rated assemblies and as indicated. Grout sleeves in place.

.2 Schedule 40 steel pipe.

.3 Sleeves with annular fin continuously welded at midpoint:

.1 Through foundation walls.

.2 Where sleeve extends above finished floor.

.3 Through fire rated walls and floors.

.4 Sizes: minimum 6 mm (1/4") clearance all around, between sleeve and uninsulated pipe or between sleeve and insulation.

.5 Terminate sleeves flush with surface of concrete and masonry walls, concrete floors on grade and 25 mm (1") above other floors.

.6 Fill voids around pipes:

.1 Caulk between sleeve and pipe in foundation walls and below grade floors with waterproof fire retardant non-hardening mastic.

.2 Where sleeves pass through walls or floors, provide space for firestopping. Where pipes/ducts pass through fire rated walls, floors, and partitions, maintain fire rating integrity.

.3 Ensure no contact between copper tube or pipe and ferrous sleeve.

.4 Fill future-use sleeves with lime plaster or other easily removable filler.

.5 Coat exposed exterior surfaces of ferrous sleeves with heavy application of zinc rich paint to CGSB 1-GP-181M+Amdt-Mar-78.

.7 Provide minimum 20 gauge duct sleeves where ducts pass through masonry concrete or fire rated assemblies. Maintain minimum 25 mm clearance all around or to the requirements of the authority having jurisdiction. Seal at wall as indicated.

1.18 FIRE STOPPING

.1 This contractor shall work with all other contractors on the project in providing one common method of fire stopping all penetrations made in fire rated assemblies.

.2 Approved fire stopping and smoke seal material in all fire separations and fire ratings within annular space between pipes, ducts, insulation and adjacent fire separation and/or fire rating.

.3 Do not use cementious or rigid seals around penetrations for pipe, ductwork, or other mechanical items.

.4 Insulated pipes and ducts: ensure integrity of insulation and vapour barrier at fire separation.

.5 Provide materials and systems capable of maintaining effective barrier against flame, smoke and gases. Ensure continuity and integrity of fire separation.

.6 Comply with the requirements of CAN4-S115-M35, and do not exceed opening sized for which they have been tested.

.7 Systems to have an F or FT rating (as applicable) not less than the fire protection rating required for closures in a fire separation. Provide “fire wrap” blanket around services penetrating fire walls. Extent of blanket must correspond to ULC recommendations.

.8 The fire stopping materials are not to shrink, slump or sag and to be free of asbestos, halogens and volatile solvents.

.9 Firestopping materials are to consist of a component sealant applied with a conventional caulking gun and trowel.

.10 Fire stop materials are to be capable of receiving finish materials in those areas which are exposed and scheduled to receive finishes. Exposed surfaces are to be acceptable to consultant prior to application of finish.

.11 Firestopping shall be inspected and approved by local authority prior to concealment or enclosure.

.12 Install material and components in accordance with ULC certification, manufacturers instructions and local authority.

.13 Submit product literature and installation material on fire stopping in shop drawing and product data manual. Maintain copies of these on site for viewing by installers and consultant.

.14 Manufacturer of product shall provide certification of installation. Submit letter to the consultant.

.15 Acceptable Manufacturer:

- .1 Minnesota Mining and Manufacturing

.16 Acceptable Alternate Manufacturers to approval of local authority:

- .1 Fryesleeve Industries Inc.
- .2 General Electric Pensil Firestop Systems
- .3 International Protective Coatings Corp.
- .4 Rectorseal Corporation (Metacaulk)
- .5 Proset Systems
- .6 3M
- .7 AD Systems
- .8 Hilti

1.19 ROOF MOUNTED PIPE SUPPORT

.1 Provide zero penetration pipe support on roof where indicated.

.2 Base shall be made of high-density polypropylene with UV protection. Maximum loading shall be 50 lb/sq.ft.

.3 Frames shall be galvanized. All fastenings, rods, nuts, washers, hangers, etc. shall be stainless steel.

.4 Provide shop drawings as specified. Install to manufacturers recommendations.

.5 Acceptable material:

.1 Portable pipe hanger

.2 Bigfoot systems

.3 Miro rooftop supports

.4 Trikon Systems

1.20 ESCUTCHEONS

.1 On pipes and ductwork passing through walls, partitions, floors and ceilings in exposed finished areas and on water and drain pipes inside millwork and cabinets.

.2 Chrome or nickel plated brass or Type 302 stainless steel, one piece type with set screws.

.3 Outside diameter to cover opening or sleeve.

.4 Inside diameter to fit around finished pipe.

1.21 PAINTING

.1 Refer to Section Interior Painting and specified elsewhere.

.2 Apply at least one coat of corrosion resistant primer paint to ferrous supports and site fabricated work.

.3 Apply two coats of paint to exposed piping service in mechanical room, base colour as specified in Mechanical Identification Section.

.4 Prime and touch up marred finished paintwork to match original.

.5 Restore to new condition, or replace equipment at discretion of consultant, finishes which have been damaged too extensively to be merely primed and touched up.

1.22 SPARE PARTS

.1 Furnish spare parts in accordance with general requirements and as follows:

.1 One set of packing for each pump.

.2 One casing joint gasket for each size pump.

.3 One glass for each gauge glass.

.4 One set of belts for each type or each size of machinery.

.5 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.

.2 Provide list of equipment in maintenance manuals indicating corresponding spare parts required. List of spare parts to be signed off by receiving personnel.

1.23 SPECIAL TOOLS

.1 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Maintenance Materials Special Tools and Spare Parts.

1.24 DIELECTRIC COUPLINGS

.1 General:

.1 To be compatible with and to suit pressure rating of piping system.

.2 Where pipes of dissimilar metals are joined.

.2 Pipes NPS 50 mm (2") and under: isolating unions.

.3 Pipes NPS 65 mm (2 1/2") and over: isolating flanges.

1.25 ACCESS DOORS

.1 Provide access doors to concealed mechanical equipment for operating, inspecting, adjusting and servicing.

.2 Flush mounted 600 x 600 mm (24" x 24") for body entry and 300 x 300 mm (12" x 12") for hand entry unless otherwise noted. Doors to open 180°, have rounded safety corners, concealed hinges, screwdriver latches and anchor straps.

.3 Material:

.1 Special areas such as tiled or marble surfaces: use stainless steel with brushed satin or polished finish as directed by Consultant.

.2 Remaining areas: use prime coated steel.

.3 Fire rated areas: provide ULC listed access doors.

.4 Washrooms or high moisture area ceilings: Aluminum with mill finish suitable for painting.

.4 Installation:

.1 Locate so that concealed items are accessible.

.2 Locate so that hand or body entry (as applicable) is achieved.

.5 Acceptable materials:

.1 Le Hage

.2 Zurn

.3 Acudor

.4 Nailor Industries Inc.

1.26 DIELECTRIC COUPLINGS

.1 General:

.1 To be compatible with and to suit pressure rating of piping system.

.2 Where pipes of dissimilar metals are joined.

.2 Pipes NPS 50 mm (2") and under: isolating unions.

.3 Pipes NPS 65 mm (2 1/2") and over: isolating flanges.

1.27 DRAIN VALVES

.1 Locate at low points and at section isolating valves unless otherwise specified.

.2 Minimum NPS 20 mm (3/4") unless otherwise specified: bronze, with hose end male thread and complete with cap and chain.

.3 Drain valves on potable water systems shall be complete with vacuum breaker.

1.28 CLEANING

.1 Clean interior and exterior of all systems including strainers.

.2 In preparation for final acceptance, clean and refurbish all equipment and leave in operating condition including replacement of all filters in all air and piping systems.

1.29 OWNER SUPPLIED EQUIPMENT

.1 Connect to equipment supplied by the owner and make operable.

1.30 VIDEO RECORDING OF NEW & EXISTING UNDERGROUND SERVICES

.1 Prior to final acceptance of the new underground plumbing system and prior to pouring the floor this contractor shall retain a qualified contractor to video tape the new, existing and revised sanitary and storm drainage piping and branch piping. Transfer all videotape information to DVD.

.2 This contractor shall flush the new and existing storm and sanitary system to remove all debris prior to final video taping of systems.

.3 Provide 3 copies of DVD.

.4 Identify video routing on Record drawings.

1.31 EXCAVATING AND BACKFILLING

.1 Provide all excavating and backfilling inside and outside the building for plumbing pipes, drains and equipment. All backfilling shall be new clean granular ‘A’ fill brought in specifically for the purpose of backfilling to the underside of floor slab. All backfilling shall be compacted at intervals not more than 150 mm (6") layer to the satisfaction of the Consultant.

.2 Provide excavating and backfilling outside the building with granular A brought in specifically for backfilling to a minimum of 450 mm (18") over the pipe. Backfilling outside building over and above the 450 mm (18") backfill as previously specified herein shall be by the Mechanical Contractor as specified under Division 2. Where backfilling outside the building is not specified under Division 2 the mechanical contractor shall provide new clean granular 'A' fill to grade level.

.3 Bottoms of trenches shall be excavated so that the pipe will be supported on a 150 mm (6") compacted bed of clean granular 'A' fill. Provide all necessary pumping to maintain excavation free of water.

.4 Should water be encountered during excavation, the mechanical contractor shall provide all labour and material, including all equipment required for dewatering the excavation. After the water has been removed, this Contractor shall install a 300 mm (12") base of compacted 50 mm (2") clear stone covered with filter cloth before installing backfill as detailed and/or as specified.

.5 Be responsible for all weather protection required to install piping and/or equipment to the satisfaction of the Consultant.

.6 Be responsible for providing all clear stone or granular 'A' material suitable for application to replace existing soil not suitable for backfilling above the 450 mm (18") bedding material.

1.32 INTEGRATED LIFE SAFETY SYSTEMS TESTING

.1 Mechanical systems in this building, including but not limited to smoke control dampers, smoke control fans, high speed low velocity ceiling fans, makeup air units, heat tracing for fire protection systems and fire protection system components may be subject to Integrated Life Safety Systems testing.

.2 The Mechanical Contractor shall co-ordinate with the Integrated Life Safety Systems Testing Agent as follows:

.1 Confirm which mechanical systems are to be included as part of the testing process.

.2 Verify in writing to the Integrated Life Safety Systems Testing Agent that mechanical commissioning of the affected systems/devices is complete prior to the scheduled testing date(s).

.3 Participate in the Integrated Life Safety Systems Testing to confirm proper operation of all associated systems.

.4 This contractor shall work with the Integrated Life Safety Systems Testing Agent to reset all systems back to normal operating mode after the testing is complete.

.3 Include all costs associated with Integrated Life Safety System Testing in the tender value.

Refer to Division 1/Division 26 Integrated Life Safety Systems Testing specifications for additional information/requirements.

1.33 CONFINED SPACES

.1 Certain areas of the building may be defined as a “Confined Space”. Any personnel working in these areas must have confined space training, appropriate equipment and undertake all work in conformance with appropriate codes and standards.

.2 Refer to building documentation for any spaces deemed “Confined Space”.

1.34 TSSA INSPECTION

.1 Prior to final completion of the project, this contractor shall make application, arrange, and pay for a TSSA inspection of all piping systems and equipment installations, including, but not limited to medical gasses, refrigeration, fuel piping, compressed air, heating plant, cooling plant, and associated equipment installed under the contract.

.2 Provide a copy of the TSSA report in the maintenance manuals for each system.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 American Society for Testing and Materials

.1 ASTM A53/A53M, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 ASTM A105/A105M, Specification for Carbon Steel Forgings for Piping Applications.

1.2 PRODUCT DATA

.1 Submit product data in accordance with general requirements.

.2 Indicate for each item as applicable:

.1 Manufacturer, model number, line contents, pressure and temperature rating.

.2 Movement handled; axial, lateral, angular and the amounts of each.

.3 Nominal size and dimensions including details of construction and assembly.

1.3 CLOSEOUT SUBMITTALS

.1 Submit maintenance data in accordance with general requirements.

.2 Data to include:

.1 Servicing requirements, including any special requirements, stuffing box packing, lubrication and recommended procedures.

Part 2 Products

2.1 SLIP TYPE EXPANSION JOINTS

.1 Application: for axial pipe movement, as indicated.

.2 Repacking: under full line pressure.

.3 Body and packing housings: Class 150, 1Mpa carbon steel pipe to ASTM A53/A53M, Grade B. Wall thickness to match pipe and with raised face slip-on flanges to match pipe.

.4 Slip or traverse sleeves: carbon steel pipe to ASTM A53/A53M, Grade B, [hard chrome plated].

.5 Anchor base: construction steel, welded to body.

.6 Guides (internal and external): embody into packing housing with concentric alignment of slip or traverse sleeve with packing housing.

.7 Extension limit stop: stainless steel, to prevent over-extension with accessible and removable pins.

.8 Packing rings: 6 minimum, teflon or graphite impregnated asbestos.

.9 Thermal plastic packing: teflon or graphite impregnated asbestos slug supplied loose.

.10 Lubricating fittings: pet cocks with grease nipple.

.11 Plunger body and plunger:

.1 Plunger body: heavy wall carbon steel welded to body.

.2 Plunger: carbon steel with hex head for use with socket wrench.

.12 Lubricant: to manufacturer's recommendations.

.13 Lubricant gun: complete with hose assembly.

.14 Drip connection: 20 MPa (2900 psi) forged steel to ASTM A105. Include half coupling with drain plug.

2.2 BELLOWS TYPE EXPANSION JOINTS

.1 For axial, lateral or angular movements, as indicated.

.2 Maximum operating pressure: 1034 kPa (150 psi).

.3 Maximum operating temperature: 200°C (392°F).

.4 Type A: free flexing, factory tested to 1½ times maximum working pressure. Furnish test certificates.

.5 Type B: externally pressurized, constant volume, pressure balanced, designed to eliminate pressure thrust, factory tested to 1.5 times maximum working pressure. Furnish test certificates.

.6 Bellows:

.1 Multiple bellows, hydraulically formed, two ply, austenitic stainless steel for specified fluid, pressure and temperature, water treatment and pipeline cleaning procedures.

.7 Reinforcing or control rings:

.1 2 piece nickel iron.

.8 Ends:

.1 Slip-on flanges to match pipe.

.9 Liner:

.1 Austenitic stainless steel in direction of flow.

.10 Shroud:

.1 Carbon steel, painted.

2.3 FLEXIBLE CONNECTION

.1 Application: to suit motion.

.2 Minimum length in accordance with manufacturer's recommendations to suit offset.

.3 Inner hose: stainless steel corrugated.

.4 Braided wire mesh stainless steel outer jacket.

.5 Diameter and type of end connection: as indicated.

.6 Operating conditions:

.1 Working pressure: 1034 kPa (150 psi).

.2 Working temperature: 250°C (482°F).

.3 To match system requirements.

2.4 ANCHORS AND GUIDES

.1 Anchors:

.1 Provide as indicated.

.2 Alignment guides:

.1 Provide as indicated.

.2 To accommodate specified thickness of insulation.

.3 Vapour barriers, jackets to remain uninterrupted.

Part 3 Execution

3.1 INSTALLATION

.1 Install expansion joints with cold setting, as indicated as instructed by Consultant. Make record of cold settings.

.2 Install expansion joints and flexible connections in accordance with manufacturer's instructions.

.3 Install pipe anchors and guides as indicated. Anchors to withstand 150% of axial thrust.

3.2 APPLICATION

.1 Provide on all vibration isolated equipment.

.2 Provide where requested by equipment manufacturers installation manuals.

.3 Install in accordance with manufacturer’s recommendations.

3.3 THERMAL EXPANSION

.1 Provide in long runs of heating mains exceeding 100 ft. in length.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ANSI/ASME B40.100, Pressure Gauges and Gauge Attachments.

.3 CAN/CGSB-14.4, Thermometers, Liquid-in-Glass, Self Indicating, Commercial/Industrial Type.

.4 CAN/CGSB-14.5, Thermometers, Bimetallic, Self-Indicating, Commercial/Industrial Type.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with general requirements.

.2 Submit manufacturer's product data for following items:

- .1 Thermometers.
- .2 Pressure gauges.
- .3 Stop clocks.
- .4 Syphons.
- .5 Wells.

Part 2 Products

2.1 GENERAL

.1 Design point to be at midpoint of scale or range.

.2 Ranges: suitable for application.

2.2 DIRECT READING THERMOMETERS

.1 Industrial, variable angle type, liquid filled, 225 mm (9") scale length: to CAN/CGSB 14.4.

- .1 Acceptable materials:
  - .1 Trerice
  - .2 Winters 91T
  - .3 Wiess

2.3 THERMOMETER WELLS

.1 Copper pipe: copper or bronze.

.2 Steel pipe: brass or stainless steel.

2.4 PRESSURE GAUGES

.1 115 mm (4 1/2"), dial type: to ANSI/ASME B40.100, Grade 2A, stainless steel phosphor bronze bourdon tube having 0.5% accuracy full scale unless otherwise specified.

.1 Acceptable materials:

.1 Winters

.2 Trerice

.3 Wiess

.2 Provide:

.1 Siphon for steam service.

.2 Snubber for pulsating operation.

.3 Diaphragm assembly for corrosive service.

.4 Gasketted pressure relief back with solid front.

.5 Bronze stop cock.

Part 3 Execution

3.1 GENERAL

.1 Install so they can be easily read from floor or platform. If this cannot be accomplished, install remote reading units.

.2 Install between equipment and first fitting or valve.

3.2 THERMOMETERS

.1 Install in wells on all piping. Provide heat conductive material inside well.

.2 Install in locations as indicated and on inlet and outlet of:

.1 Water heating and cooling coils.

.2 Water Boilers

.3 Cooling towers.

.4 DHW tanks.

.5 Boiler Room HWS and HWR.

.6 In other locations indicated.

.3 Install wells as indicated only for balancing purposes.

.4 Use extensions where thermometers are installed through insulation.

3.3 PRESSURE GAUGES

.1 Install in following locations:

.1 Suction and discharge of pumps.

.2 Upstream and downstream of PRV's.

.3 Upstream and downstream of control valves.

.4 Inlet and outlet of coils.

.5 Outlet of boilers.

.6 Inlet and outlet of water meters.

.7 Inlet and outlet of backflow prevention.

.8 In other locations as indicated.

.2 Install gauge cocks for balancing purposes, elsewhere as indicated.

.3 Use extensions where pressure gauges are installed through insulation.

3.4 NAMEPLATES

.1 Install engraved lamicoid nameplates as specified in elsewhere identifying medium.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 American National Standards Institute/ American Society of Mechanical Engineers (ANSI/ASME)

.1 ANSI/ASME B31.1, Power Piping, (SI Edition).

.3 American Society for Testing and Materials (ASTM)

.1 ASTM A 125, Specification for Steel Springs, Helical, Heat-Treated.

.2 ASTM A 307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.3 ASTM A 563, Specification for Carbon and Alloy Steel Nuts.

.4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)

.1 MSS SP-58, Pipe Hangers and Supports - Materials, Design, Manufacture Selection, Application, and Installation.

1.2 DESIGN REQUIREMENTS

.1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.

.2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP-58.

.3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.

.4 Design hangers and supports to support systems under all conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.

.5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment to be in accordance with MSS SP-58.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with general requirements.

.2 Submit shop drawings and product data for following items:

.1 All bases, hangers and supports.

.2 Connections to equipment and structure.

.3 Structural assemblies.

1.4 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

Part 2 Products

2.1 GENERAL

.1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS-SP-58.

.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.2 PIPE HANGERS

.1 Finishes:

.1 Pipe hangers and supports to ANSI & ULC requirements

.2 Ensure steel hangers in contact with copper piping are copper plated.

.2 Upper attachment structural: Suspension from upper flange of I-Beam or joist.

.1 Cold piping NPS 50 mm (2") maximum: Ductile iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.

.1 Rod: 10 mm (3/8") UL listed

.2 Cold piping NPS 65 mm (2 1/2") or greater, all hot piping: Malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed AND FM approved.

.3 Upper attachment structural: Suspension from upper flange of I-Beam.

.1 Cold piping NPS 50 mm (2") maximum: Ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed.

.2 Cold piping NPS 65 mm (2 1/2") or greater, all hot piping: Malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nuts.

.4 Upper attachment to concrete.

.1 Ceiling: Carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm (1/4") minimum greater than rod diameter.

.2 Concrete inserts: wedge shaped body with knockout protector plate ULC listed. Note: Rapidex and Siporex are not considered concrete. Should one of these systems be encountered, piping/ductwork and/or equipment shall be supported from adjacent walls or from supplemental steel provided by this contractor attached to the adjacent walls/structure.

.5 Shop and field-fabricated assemblies.

.1 Trapeze hanger assemblies: ASME B31.1.

.2 Steel brackets: ASME B31.1.

.6 Hanger rods: threaded rod material to MSS SP-58.

.1 Ensure that hanger rods are subject to tensile loading only.

.2 Provide linkages where lateral or axial movement of pipework is anticipated.

.7 Pipe attachments: material to MSS SP-58.

.1 Attachments for steel piping: carbon steel.

.2 Attachments for copper piping: copper plated black steel.

.3 Use insulation shields for all piping.

.4 Oversize pipe hangers and supports to accommodate thermal insulation. Provide 1.5 mm (16 gauge) saddles.

.8 Adjustable clevis: material to MSS SP-58 UL listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.

.1 Ensure "U" has hole in bottom for riveting to insulation shields.

2.3 RISER CLAMPS

.1 Steel or cast iron pipe: black carbon steel to MSS-SP-58, type 42, UL listed.

.2 Copper pipe: carbon steel copper plated to MSS-SP-58, type 42.

.3 Bolts: to ASTM A 307.

.4 Nuts: to ASTM A 563.

2.4 INSULATION PROTECTION SHIELDS

.1 Insulated cold piping:

.1 64 kg/m² (13.12 lbs/ft²) density insulation plus insulation protection shield to: MSS SP-69, galvanized sheet carbon steel. Length designed for maximum 3 m (10') span.

.2 Insulated hot piping:

.1 Curved plate 300 mm (12") long, with edges turned up, welded-in center plate for pipe sizes NPS 300 mm (12") and over, carbon steel to comply with MSS SP-58.

2.5 EQUIPMENT SUPPORTS

.1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of miscellaneous metals, specified herein. Submit calculations with shop drawings.

2.6 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

.1 Provide templates to ensure accurate location of anchor bolts.

2.7 ROOF MOUNTED EQUIPMENT

.1 Install as per manufacturers' instructions on roof curbs provided by manufacturer as indicated.

.2 Provide all necessary continuous pressure treated wood blocking and 24 gauge metal liner on all exposed wood as required to install roof curb level.

2.8 OTHER EQUIPMENT SUPPORTS

.1 From structural grade steel meeting requirements of structural steel section specified herein.

.2 Submit structural calculations with shop drawings.

2.9 MANUFACTURER

.1 Acceptable materials:

.1 Grinnell

.2 Anvil

.3 Myatt

.4 Taylor

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with:

.1 Manufacturer's instructions and recommendations.

.2 Vibration Control Devices:

.1 Install on piping systems at pumps, boilers, chillers, cooling towers, elsewhere as indicated.

.3 Clamps on riser piping:

.1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.

.2 Bolt-tightening torques to be to industry standards.

.3 Steel pipes: Install below coupling or shear lugs welded to pipe.

.4 Cast iron pipes: Install below joint.

.4 Clevis plates:

.1 Attach to concrete with 4 minimum concrete inserts at each corner.

.5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

3.2 HANGER SPACING

.1 Plumbing piping: most stringent requirements of Canadian Plumbing Code, Provincial Code, or authority having jurisdiction.

.2 Fire protection: to applicable fire code.

.3 Gas and fuel oil piping: up to NPS 15 mm (1/2"): every 1.8 m (6').

.4 Copper piping: up to NPS 15 mm (1/2"): every 1.5 m (5').

.5 Within 300 mm (12") of each elbow and:

Maximum Pipe Size: NPS	Spacing Steel	Maximum Spacing Copper
up to 32 mm (1 1/4")	2.1 m (7')	1.8 m (6')
40 mm (1 1/2")	2.7 m (9')	2.4 m (8')
50 mm (2")	3.0 m (10')	2.7 m (9')
65 mm (2 1/2")	3.6 m (12')	3.0 m (10')
80 mm (3")	3.6 m (12')	3.0 m (10')
90 mm (3 1/2")	3.9 m (13')	3.3 m (11')
100 mm (4")	4.2 m (14')	3.6 m (12')
125 mm (5")	4.8 m (16')	
150 mm (6")	5.1 m (17')	
200 mm (8")	5.7 m (19')	
250 mm (10")	6.6 m (22')	
300 mm (12")	6.9 m (23')	

.6 Pipework greater than NPS 300 mm (12"): to MSS SP-69.

3.3 HANGER INSTALLATION

.1 Install hanger so that rod is vertical under operating conditions.

.2 Adjust hangers to equalize load.

.3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

.4 Do “NOT” support piping, ductwork and equipment from roof deck, on bottom chord of floor and/or roof joist and/or from OWSJ bridging. Provide structural member between joist.

3.4 HORIZONTAL MOVEMENT

.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4mm (5/32") from vertical.

.2 Where horizontal pipe movement is less than 15 mm (1/2"), offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.5 FINAL ADJUSTMENT

.1 Adjust hangers and supports:

.1 Ensure that rod is vertical under operating conditions.

.2 Equalize loads.

.2 Adjustable clevis:

.1 Tighten hanger load nut securely to ensure proper hanger performance.

.2 Tighten upper nut after adjustment.

.3 C-clamps:

.1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

.4 Beam clamps:

.1 Hammer jaw firmly against underside of beam.

END OF SECTION

Part 1 General

1.1 APPLICATION

.1 Seismic restraint is becoming more prominent with improved soil testing equipment. Seismic requirement is not site specific by geographical area but determined by site soil conditions.

.2 Where the structural engineer or architect documents have Ie*Sa(0.2)*Fa<3.5 seismic is not required on the mechanical, electrical, or plumbing systems.

.3 Where the structural engineer or architect documents have Ie*Sa(0.2)*Fa≥3.5 seismic is required on the mechanical, electrical, plumbing, or fire protection systems.

.4 Seismic will always be required on fire protection systems when required by NFPA codes.

.5 Seismic will always be required on any “Disaster Relief Building.” For example, hospitals, police stations, ambulance building, etc.

.6 When it is unclear in the tender documents request information from the structural engineer or architect for clarification.

1.2 SECTION INCLUDES

.1 Seismic Requirements for single rod hanger support for conduit, pipe and other similar systems.

.2 Seismic Requirements for trapeze type supports for cable tray, conduit, pipe and other similar systems.

.3 Seismic requirements for all mechanical equipment and piping.

1.3 RELATED WORK SPECIFIED ELSEWHERE

.1 Vibration Isolation Measures.

1.4 REFERENCE STANDARDS

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 National Building Code of Canada (NBC).

.3 Canadian Standards Association

.1 CSA S832, Seismic Risk Reduction of Operation and Functional Components (OFCs) of Buildings.

.2 CAN/CSA-S16.1 Limit States Design of Steel Structures

.3 CAN3-S136 Design of Cold Steel Structural Members

.4 CSA W47.1 Certification of Companies for Fusion Welding of Steel

.5 CSA W59 Welded Steel Construction

.4 SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems

.5 Canadian Institute of Steel Construction

.6 Canadian General Standards Board

.7 Underwriter Laboratories of Canada

.8 Workers Compensation Board of BC

.9 American Society of Testing and Materials

.1 ASTM A653/S653M, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (galvannealed) by the Hot Dip Process.

.2 ASTM A879M Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface.

.3 ASTM A307 Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.4 ASTM A325M Specification for Structural Bolts, Heat Treated 830MPa Minimum Tensile Strength.

.10 All local codes.

.11 NFPA-13: Installation of Fire Sprinkler Systems.

.12 FEMA: Federal Emergency Management Activity.

.13 FEMA: Seismic Restraint Installation Manuals 412. 413. & 414

.1 FEMA 412: Installing Seismic Restraints for Mechanical Equipment

.2 FEMA 413: Installing Seismic Restraints for Electrical Equipment

.3 FEMA 414: Installing Seismic Restraints for Duct and Pipe

.14 ASHRAE (American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc.).

.15 ASHRAE Applications Handbook; Seismic and Wind Restraint Design Chapter.

1.5 DEFINITIONS

.1 A_v: Effective peak velocity related acceleration coefficient BOCA, SBC Code.

.2 S_1: Mapped Long Period Seismic Acceleration Coefficient IBC, TI-809-04, ASCE7.

.3 S_s: Mapped Short Period Seismic Acceleration Coefficient IBC, TI-809-04, ASCE7.

.4 v: Zonal Velocity Coefficient NBC-Canada.

.5 VISCMA: The Vibration Isolation and Seismic Control Manufacturers Association has developed Testing and Rating Standards for Seismic Restraint Components that comply with Code and ASHRAE based requirements.

.6 VISCMA 102-2007: Static Qualification Standards for Obtaining a VISCMA Compliant Seismic Component Rating.

.7 Z: Seismic Zone defines Seismic Coefficient C_a used by UBC Code.

1.6 PERFORMANCE REQUIREMENTS

.1 Design Ground Acceleration Coefficient (A_v, S_s, v, or Z depending on Code = X.XX).

.2 (If IBC or TI-809-04) Design Long Period Ground Acceleration Coefficient (S_1 = X.XX).

.3 Design Soil Type = (S_a, S_b, S_c, S_d) as appropriate. (If NBC Canada, the Foundation Factor).

.4 Importance or Performance Factor appropriate to structure = I_p = X.XX.

.5 If UBC Zone 4, Proximity to Fault and, if less than 10km, Fault Type.

.6 Schedule or drawings indicating critical (Ip = 1.5) Duct/Piping systems, including systems whose importance factor may be increased by proximity to critical components.

1.7 DESCRIPTON OF SYSTEM

.1 It shall be understood that the requirements of this seismic restraint section are in addition to other requirements as specified elsewhere for the support and attachment of equipment and mechanical services, and for the vibration isolation of same equipment. Nothing on the project drawings or specifications shall be interpreted as justification to waive the requirements of this seismic restraint section.

.2 The work under this section shall include furnishing all labour, materials, tools, appliances, and equipment, and performing all operations necessary for the complete execution of the installation of seismic snubber restraint assemblies as shown, detailed, and/or scheduled on the drawing and/or specified in this section of the specifications.

.3 All seismic snubber restraint assemblies shall meet the following minimum requirements:

.1 The snubber/restrained isolator for isolated equipment shall include a resilient element that will ensure that no un-cushioned shock can occur (this does not include cable restraints).

.2 It shall be possible to visually inspect the resilient material for damage and allow for replacement, if necessary.

.3 All snubbers are to include a maximum air gap of 0.25 in (6 mm).

.4 Seismic restraint systems shall be designed to offer seismic restraint in all directions, unless otherwise noted.

.5 Seismic restraint capacities to be verified by an independent test laboratory or certified by a registered Professional Engineer to ensure that the design intent of this specification is realized. Verification shall be by one of the following methods:

.1 An NRTL (National Recognized Testing Laboratory), or laboratory recommended by VISCMA.

.2 Certified by a Professional Engineer with at least 5 years of experience, using industry standard methods of analysis, which employ common engineering practices. Adherence to the ratings standard within ASHRAE SPC171 and VISCMA 102-2007 is required.

.3 By a nationally recognized agency, such as VISCMA, that has reviewed and approved the restraint.

1.8 SYSTEM DESIGN

.1 Seismic restraint manufacturer shall be responsible for the structural design of attachment hardware as required to attach snubbers/restraints to both the equipment and supporting structure on vibration isolated equipment, or to directly attach equipment to the building structure for non-isolated equipment.

.2 The contractor shall furnish, to the seismic restraint manufacturer, a complete set of approved shop drawings of all equipment that is to be restrained, from which the selection and design of seismic restraint devices and/or attachment hardware will be completed. The shop drawings furnished shall include, at a minimum, basic equipment layout, length, and width dimensions, and installed operating weights of the equipment to be restrained.

.3 All piping, ductwork and equipment is to be restrained to meet code requirements. At a minimum, the seismic restraint manufacturer shall provide documentation on maximum restraint spacing for various restraint sizes and anchors, as well as “worst case” reaction loads for each restraint and/or anchor size.

.4 The contractor shall ensure that all housekeeping pads used are adequately reinforced and are properly dowelled to the building structure, so as to withstand calculated seismic forces. In addition, the size or the housekeeping pad is to be coordinated with the seismic restraint manufacturer to ensure that adequate edge distances exist in order to obtain the desired equipment anchor capacities.

1.9 SEISMIC BRACING AND SUPPORT DESIGN REQUIREMENTS

.1 Seismic restraint designer shall co-ordinate all attachments with the structural engineer of record.

.2 Design analysis shall include calculated dead loads, static seismic loads, and capacity of materials utilized for the connection of the equipment or system to the structure.

.3 Analysis shall detail anchoring methods, bolt diameter, and embedment depth.

.4 All seismic restraint devices shall be designed to accept without failure the forces calculated per the applicable building code and as summarized in Section 3.01.

.5 Friction from gravity loads shall not be considered resistance to seismic forces.

.6 Fire protection systems shall meet the requirements of NFPA-13 and NFPA-14. Sway bracing used for seismic restraint purposes must be fitted with provisions to resist the vertical force component of the diagonal brace. Single diagonal brace for seismic restraint will not be approved.

1.10 ALTERNATE SYSTEMS

.1 Provisions of the General Conditions and Supplemental Conditions of the specifications shall govern the use of alternate systems to those specified.

.2 Manufacturers not listed as approved in “Part 2 Materials” of this section must secure approval to bid a minimum of ten (10) days prior to the project bid date.

.3 Uncertified internal equipment seismic restraint systems are disallowed for use on this project.

1.11 QUALITY ASSURANCE

.1 The contractor shall provide pre-engineered seismic restraint systems to meet total design lateral force requirements for support and restraint of piping, conduit, cable trays and other similar systems and equipment where required by the applicable building code.

.2 System Supports/Restraints: Firms regularly engaged in the manufacture of products of the types specified in this section, whose products have been in satisfactory use in similar service for not less than 5 years.

.3 Bolted framing channels and fittings shall have the manufacturers name, part number, and material heat code identification number stamped in the part itself for identification. Material certification sheets and test reports must be made available by the manufacturer upon request.

.4 Only companies experienced in performing the work of this section shall do the installation.

.5 All seismic restraint installations shall be independently reviewed by the Owners Representative for compliance with project specifications.

1.12 SUBMITTALS

.1 Product Data: Include Seismic Rating Curve for each seismically rated isolator or restraint component.

.2 Samples: The contractor shall submit samples of specified seismic snubber devices for approval.

.3 Shop Drawings shall include the following:

.1 Design Calculations: Calculate requirements for selecting seismically rated vibration isolators and seismic restraints. Certification documents to be signed and sealed by a qualified Professional Engineer with at least 5 years of experience in the design of seismic restraints. Professional engineer shall have local jurisdiction and provide periodic field review and final certification upon completion of the project. All costs and fees associated with the engineering shall be the responsibility of this contractor.

.2 Vibration Isolation Bases: Dimensional drawings including anchorage and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads.

.3 Seismic-Restraint Details: Detailed submittal drawings of seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors. Include ratings for loads.

.4 Equipment Manufacturer Seismic Qualification Certification: The Equipment Manufacturer must submit certification that each piece of provided equipment will withstand seismic forces identified in “Performance Requirements” Article above. Include the following:

.1 Basis for Certification: Indicate whether the “withstand” certification is based on actual test assembled components or on calculations.

.2 Indicate the equipment is certified to be durable enough to:

.1 structurally resist the design forces and/or

.2 will remain functional after the seismic event.

.5 Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

.6 Detailed description of the assumed equipment anchorage devices on which the certification is based.

1.13 DELIVERY, STORAGE, AND HANDLING

.1 Deliver strut systems, pipe hangers and components carefully to avoid breakage, denting, and scoring finishes. Do not install damaged equipment.

.2 Store strut systems, pipe hangers and components in original cartons and in clean dry space; protect from weather and construction traffic.

1.14 WORK FURNISHED BUT NOT INSTALLED

.1 The materials and systems specified in this section shall be purchased by the mechanical contractor from a single seismic snubber restraint materials manufacturer to assure sole source responsibility for the performance of the seismic restraints used.

.2 The materials and systems specified in this section can, at the contractor's option, be installed by the subcontractor who installs the mechanical equipment, piping, or ductwork.

1.15 COORDINATION

.1 Coordinate size, shape, reinforcement and attachment of all housekeeping pads supporting seismically rated equipment. Concrete shall have a minimum compressive strength of 3,000 psi or as specified by the consultant.

.2 Coordinate with seismic restraint manufacturer to locate and size structural supports underneath seismically restrained equipment (e.g. roof curbs, cooling towers, and other similar equipment).

1.16 INSTALLATION

.1 Installation of all seismic restraint materials specified herein shall be accomplished following the manufacturer's written instructions. Installation instructions shall be submitted to the engineer for approval prior to the beginning of the work.

Part 2 Products

2.1 MATERIALS

.1 Unless otherwise specified materials used in the Work shall conform to the following:

.1 All steel rolled sections and steel plates shall conform to CAN/CSA G40.21M-300W

.2 All steel hollow structural steel sections shall conform to CAN/CSA G40.21-350W Class C

.3 Structural steel bolts, nuts and washers shall conform to ASTM A325M

.4 Weld electrodes shall be SMAW-E-E480XX and SAW-F480-EXXX.

2.2 ACCEPTABLE MANUFACTURERS

.1 All seismic snubbers and combination restraint/vibration isolation materials specified herein shall be provided by a single manufacturer to assure sole source responsibility for the proper performance of the materials used. Manufacturer is to be a member of VISCMA.

.2 Anchor types and sizes are to be per the design data as provided by the seismic restraint manufacturer.

.3 Materials and systems specified herein and detailed or scheduled on the drawings are based upon materials manufactured by Kinetics Noise Control Inc. Materials and systems provided by other manufacturers are acceptable, provided that they meet all requirements as listed in this specification.

.4 Kinetics Noise Control Inc.

.5 Cooper 'B' Line.

.6 Unistrut Building Systems.

.7 Mason Industries.

2.3 SEISMIC SNUBBER TYPES

GENERAL
(Isolator/Snubber Types contained herein are per ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.) Handbook, HVAC Applications, Seismic and Wind Restraint Design)

.1 Type A, Coil Spring Isolator Incorporated Within a Ductile Iron or Cast Aluminum Housing.

.1 Cast iron or aluminum housings are brittle when subjected to shock loading and are therefore not approved for seismic restraint applications.

.2 Type B, Coil Spring Isolator Incorporated Within A Steel Housing

.1 Spring isolators shall be seismic control restrained spring isolators, incorporating a single or multiple coil spring element, having all of the characteristics of free standing coil spring isolators as specified in the vibration isolation portion of this specification. Springs shall be restrained using a housing engineered to limit both lateral and vertical movement of the supported equipment during an earthquake without degrading the vibration isolation capabilities of the spring during normal equipment operating conditions.

.2 Vibration isolators shall incorporate a steel housing and neoprene snubbing grommet system designed to limit motion to no more than ¼" (6 mm) in any direction and to prevent any direct metal-to-metal contact between the supported member and the fixed restraint housing. The restraining system shall be designed to withstand the seismic design forces in any lateral or vertical direction without yield or failure. Where the capacity of the anchorage hardware in concrete is inadequate for the required seismic loadings, a steel adapter base plate to allow the addition of more or larger anchors will be fitted to fulfill these requirements. In addition to the primary isolation coil spring, the load path will include a minimum ¼" (6 mm) thick neoprene pad.

.3 Spring elements shall be colour coded or otherwise easily identified. Springs shall have a lateral stiffness greater than 1.2 times the rated vertical stiffness and shall be designed to provide a minimum of 50% overload capacity. Non-welded spring elements shall be epoxy powder coated and shall have a minimum of a 1000-hour rating when tested in accordance with ASTM B-117.

.4 To facilitate servicing, the isolator will be designed in such a way that the coil spring element can be removed without the requirements to lift or otherwise disturb the supported equipment.

.5 Spring isolators shall be Model FHS as manufactured by Kinetics Noise Control, or by other manufacturers who can meet the requirements as listed in sections 1.04 through 1.09 inclusive, and sections 2.01, 2.02, and 2.03 (2).

.3 Type C, Coil Spring Isolator Incorporated Within a Steel Housing

.1 Spring isolators shall be seismic control restrained spring isolators, incorporating one or more coil spring elements, having all the characteristics of free standing coil spring isolators per the vibration isolation section of this specification, for equipment which is subject to load variations and/or large external forces. Isolators shall consist of one or more laterally stable steel coil springs assembled into fabricated welded steel housings designed to limit movement of the supported equipment in all directions.

.2 Housing assembly shall be made of fabricated steel members and shall consist of a top load plate complete with adjusting and leveling bolts, adjustable vertical restraints, isolation washers, and a bottom load plate with internal non-skid isolation pads and holes for anchoring the housing to the supporting structure. Housing shall be hot dipped galvanized for outdoor corrosion resistance. Housing shall be designed to provide a constant free and operating height within ⅛" (3 mm).

.3 The isolator housing shall be designed to withstand the project design seismic forces in all directions.

.4 Coil spring elements shall be selected to provide static deflections as shown on the vibration isolation schedule or as indicated or required in the project documents. Spring elements shall be colour coded or otherwise easily identified. Springs shall have a lateral stiffness greater than 1.2 times the rated vertical stiffness and shall be designed to provide a minimum of 50% overload capacity. Non-welded spring elements shall be epoxy powder coated and shall have a minimum of a 1000-hour rating when tested in accordance with ASTM B-117.

.5 Spring isolators shall be Model FLS and FLSS as manufactured by Kinetics Noise Control, or by other manufacturers who can meet the requirements as listed in sections 1.04 through 1.09 inclusive, and sections 2.01, 2.02, and 2.03 (3).

.4 Type D, Coil Spring Isolator Incorporated with Integral Seismic Restraint

.1 Spring isolators shall be single or multiple coil spring elements which have all of the characteristics of freestanding coil spring isolators as specified in the vibration isolation portion of this specification, incorporating lateral and vertically restrained seismic housing assemblies. Spring elements shall be readily replaceable without the need to list or remove the supported equipment.

.2 Restraint housing shall be sized to meet or exceed the force requirements of the application and shall have the capability of accepting coil springs of various sizes, capabilities, and deflections as required to meet the required isolation criteria. All spring forces shall be contained within the coil/housing assembly, and the restraint anchoring hardware shall not be exposed to spring generated forces under conditions of no seismic force. Spring element leveling adjustment shall be accessible from above and suitable for use with a conventional pneumatic or electric impact wrench.

.3 Restraint element shall incorporate a steel housing with elastomeric elements at all dynamic contact points. Elastomeric elements shall be replaceable. Restraint shall allow ¼" (6 mm) free motion in any direction from the neutral position. Restraint shall have an overturning factor (ratio of effective lateral snubber height to short axis anchor spacing) of 0.33 or less to ensure optimum anchorage capacity.

.4 Spring isolators shall be Model FMS as manufactured by Kinetics Noise Control, or by other manufacturers who can meet the requirements as listed in sections 1.04 through 1.09 inclusive, and sections 2.01, 2.02, and 2.03 (4).

.5 Type E, All Direction Neoprene Isolator

.1 Vibration Isolators shall be neoprene, molded from oil resistant compounds, designed to operate within the strain limits of the isolator so to provide the maximum isolation and longest life expectancy possible using neoprene compounds. Isolators shall include encapsulated cast-in-place top steel load transfer plate for bolting to equipment and a steel base plate with anchor holes for bolting to the supporting structure. Ductile iron or cast aluminum components are not acceptable alternatives and shall not be used due to brittleness when subjected to shock loading.

.2 Isolator shall be capable of withstanding the design seismic loads in all directions with no metal-to-metal contact.

.3 Isolator shall have minimum operating static deflections as shown on the project Vibration Isolation Schedule or as otherwise indicated in the project documents and shall not exceed published load capacities.

.4 Neoprene isolators shall be Model RQ as manufactured by Kinetics Noise Control, or by other manufacturers who can meet the requirements as listed in sections 1.04 through 1.09 inclusive, and sections .2.01, 2.02 and 2.03 (5).

.6 Type F, Light Capacity All Direction 3-Axis External Seismic Snubber Assembly

.1 Equipment shall be restrained against excessive movement during a seismic event by the use of 3-axis resilient snubbers, designed to withstand the project required seismic forces. A minimum of two (2) snubbers are to be used at each equipment installation, oriented to effectively restrain the isolated equipment in all three directions, and additional snubbers shall be used as required by seismic design conditions.

.2 Snubbers shall be of interlocking steel construction and shall be attached to the equipment structure and equipment in a manner consistent with anticipated design loads. Snubbers shall limit lateral and vertical equipment movement at each snubber location to a maximum of ¼" (6 mm) in any direction.

.3 Snubbers shall include a minimum ¼" (6 mm) thick resilient neoprene pads to cushion any impact and to avoid any potential for metal-to-metal contact. Maximum neoprene bearing pressure shall not exceed 1500 pounds / sq. inch (10.4 N / sq. mm). Snubber shall be capable of withstanding an externally applied seismic force of up to 3,000 pounds (1360 kg) in any direction. Snubber shall be installed only after the isolated equipment is mounted, piped, and operating so as to ensure that no contact occurs during normal equipment operation.

.4 Three-axis seismic snubbers shall be Model HS-5 as manufactured by Kinetics Noise Control, or by other manufacturers who can meet the requirements as listed in sections 1.04 through 1.09 inclusive, and 2.01, 2.02, and 2.03 (6).

.7 Type G, Lateral 2-Axis External Seismic Snubber Assembly

.1 Equipment shall be restrained against excessive lateral movement during a seismic event by the use of 2-axis horizontal resilient snubbers, designed to withstand the project required seismic forces. A minimum of two (2) snubbers are to be used at each equipment installation, oriented to effectively restrain the isolated equipment in all horizontal directions, and additional snubbers shall be used as required by seismic design conditions.

.2 Snubbers shall be interlocking steel construction and shall be attached to the equipment structure and equipment in a manner consistent with anticipated design loads. Snubbers shall limit lateral equipment movement at each snubber location to a maximum of ¼" (6 mm).

.3 Snubbers shall include a minimum of ¼" (6 mm) thick resilient neoprene pads to cushion any impact and to avoid any potential for metal-to-metal contact. Snubber shall be installed only after the isolated equipment is mounted, piped, and operating so as to ensure that no contact occurs during normal equipment operation.

.4 Two-axis lateral seismic snubbers shall be Model HS-2 as manufactured by Kinetics Noise Control, or by other manufacturers who can meet the requirements as listed in sections 1.04 through 1.09 inclusive, and sections 2.01, 2.02, and 2.03 (7).

.8 Type H, Heavy Capacity All Direction 3-Axis External Seismic Snubber Assembly

.1 Equipment shall be restrained against excessive vertical and horizontal movement during a seismic event by the use of 3-axis resilient snubbers, designed to withstand the project required seismic forces. A minimum of two (2) snubbers are to be used at each equipment installation, oriented to effectively restrain the isolated equipment in all three directions, and additional snubbers shall be used as required by seismic design conditions.

.2 Snubbers shall be of welded interlocking steel construction and shall be attached to the equipment structure and equipment in a manner consistent with anticipated design loads. Snubbers shall limit lateral and vertical equipment movement at each snubber location to a maximum of ¼" (6 mm) in any direction.

.3 Snubbers shall include resilient neoprene pads with a minimum thickness of ¼" (6 mm) to cushion any impact and to avoid any potential for metal-to-metal contact. Snubber shall be capable of withstanding an externally applied seismic force up to 10,000 pounds (4,540 kg) in any direction. Snubber shall be installed only after the isolated equipment is mounted, piped, and operating so as to ensure that no contact occurs during normal equipment operation.

.4 Three-axis seismic snubbers shall be Model HS-7 as manufactured by Kinetics Noise Control, or by other manufacturers who can meet the requirements as listed in sections 1.04 through 1.09 inclusive, and sections 2.01, 2.02, and 2.03 (8).

.9 Type I, Horizontal 1-Axis External Seismic Snubber Assembly

.1 Equipment shall be restrained against excessive horizontal one-axis movement during a seismic event by the use of single-axis resilient snubbers, designed to withstand the project required seismic forces. A minimum of four (4) snubbers are to be used at each equipment installation, oriented to effectively restrain the isolated equipment in all lateral directions.

.2 Snubbers shall be of steel construction and shall be attached to the equipment structure and equipment in a manner consistent with anticipated design loads. Snubbers shall limit lateral equipment movement at each snubber location in the direction of impact to a maximum of ¼" (6 mm).

.3 Snubbers shall include resilient neoprene pads with a minimum thickness of ¼" (6 mm) to cushion any impact and to avoid any potential for metal-to-metal contact. Snubber shall be installed only after the isolated equipment is mounted, piped, and operating so as to eliminate any contact during normal equipment operation.

.4 Single-axis seismic snubbers shall be Model HS-1 as manufactured by Kinetics Noise Control, or by other manufacturers who can meet the requirements as listed in sections 1.04 through 1.09 inclusive, and sections 2.01, 2.02, and 2.03 (9).

.10 Type J, Cable Restraints for Suspended Piping and Ductwork

.1 Seismic wire rope cable restraints shall consist of steel wire strand cables, sized to resist project seismic loads, arranged to offer seismic restraint capabilities for piping, ductwork, and suspended equipment in all lateral directions.

.2 Building and equipment attachment brackets at each end of the cable shall be designed to permit free cable movement in all directions up to a 45-degree misalignment. Protective thimbles shall be used at sharp connection points as required to eliminate potential for dynamic cable wear and strand breakage.

.3 Restraints shall be sized to the capacity of the cable or to the capacity of the anchorage, whichever is lesser.

.4 Seismic wire rope connections shall be made using overlap wire rope “U” clips or seismically rated tool-less wedge insert lock connectors.

.5 Vertical suspension rods shall be braced as required to avoid potential for buckling due to vertical “up” forces. Braces shall be structural steel angle uniquely selected to be of sufficient strength to prevent support rod bending. Brace shall be attached to the vertical suspension rod by a series of adjustable straps. Clips shall be capable of securely locking brace to suspension rod without the need for hand tools.

.6 Where clevis hanger brackets are used for seismic restraint attachment, they will be fitted with clevis internal braces to prevent buckling of the hanger brackets.

.7 Seismic cable shall be as manufactured by Kinetics Noise Control, or by other manufacturers who can meet the requirements as listed in sections 1.03 through 1.07 inclusive, and sections 2.01, 2.02, and 2.03 (10).

.8 Seismic cable building and equipment attachment brackets shall be Model KSCA, KSCU, or KSCC as manufactured by Kinetics Noise Control, or by other manufacturers who can meet the requirements as listed in sections 1.04 through 1.09 inclusive, and sections 2.01, 2.02, and 2.03 (10).

.9 Seismic cable concrete anchor bolts shall be Model KCAB Wedge, Model KCCAB Cracked Concrete, or Model KUAB Undercut, as manufactured by Kinetics Noise Control, or by other manufacturers who can meet the requirements as listed in sections 1.04 through 1.09 inclusive, and sections 2.01, 2.02, and 2.03 (10).

.10 Seismic wire rope connectors shall be (Model KWRC - 'U’ clamp) / (Model KWGC - Tool-less wedge lock) as manufactured by Kinetics Noise Control, or by other manufacturers who can meet the requirements as listed in sections 1.04 through 1.09 inclusive, and sections 2.01, 2.02, and 2.03 (10).

.11 Seismic vertical suspension stiffener rod clips shall be Model KHRC as manufactured by Kinetics Noise Control, or by other manufacturers who can meet the requirements as listed in sections 1.04 through 1.09 inclusive, and sections 2.01, 2.02, and 2.03 (10).

.12 Clevis Internal Braces shall be Model KCHB as manufactured by Kinetics Noise Control, or by other manufacturers who can meet the requirements as listed in sections 1.04 through 1.09 inclusive, and sections 2.01, 2.02, and 2.03 (10).

2.4 SEISMIC BRACING COMPONENTS

.1 Steel strut shall be 1-5/8 wide in varying heights and mig-welded combinations as required to meet load capacities and designs. A material heat code, part number, and manufacturer’s name shall be stamped on all strut and fittings to maintain traceability to material test reports.

.2 Material for epoxy painted strut: ASTM A1011, SS, Grade 33.

.3 Material for pre-galvanized strut: ASTM A653, SS, Grade 33.

.4 Material for hot-dip galvanized strut: ASTM A1011, SS, Grade 33 and hot-dip galvanized after fabrication in accordance with ASTM A123.

.5 Material for fittings and accessories: ASTM A907, Grade 33, Structural Quality or ASTM A1011, SS, Grade 33.

.6 Fittings and accessories: Products shall be of the same manufacturer as strut and designed for use with that product.

2.5 UNIFORM BUILDING CODE REQUIREMENTS

.1 Seismic Zone Factor to Table 16-I for area of jurisdiction.

.2 Soil Profile Type to Table 16-J for area of jurisdiction.

.3 Seismic Importance Factor to Table 16-K for area of jurisdiction.

.4 Component Amplification Factor to Table 16-O for area of jurisdiction.

.5 Component Response Mod. Factor to Table 16-O for area of jurisdiction.

.6 Seismic Coefficient to Table 16-Q for area of jurisdiction.

.7 The total height of the structure (h_r) and the height of the system to be restrained within the structure (h_x) shall be determined in co-ordination with architectural plans and the General Contractor.

.8 Forces shall be calculated for individual supports using the above information. Exceptions to Table 16-O may be utilized. However, all use of exceptions shall be noted on submitted seismic bracing plan documents.

Part 3 Execution

3.1 GENERAL INSTALLATION

.1 Installation of all seismic restraint materials specified in this section shall be accomplished as per the manufacturer's written instructions.

.2 Refer to FEMA Manuals 412, 413, and 414 for typical industry standard installation guidelines.

.3 Upon completion of installation of all seismic restraint materials and before start-up of restrained equipment, all debris shall be cleaned from beneath all protected equipment, leaving equipment free to contact snubbers/restraints.

.4 Torque anchor bolts according to anchor manufacturer's written instructions to resist seismic forces.

.5 All seismic restraint systems shall be installed in strict accordance with the manufacturer's seismic restraint guidelines manual and all certified submittal data.

.6 Prior to installation, bring to the architect's/engineer's attention any discrepancies between the specifications and the field conditions, or changes required due to specific equipment selection.

.7 Brace support rods when necessary to accept compressive loads. Welding of compressive braces to the vertical support rods is not acceptable.

.8 Seismic restraints shall be mechanically attached to the system. Looping restraints around the system is not acceptable.

.9 Do not brace a system to two independent structures such as ceiling and wall.

.10 Provide appropriately sized openings in walls, floors, and ceilings for anticipated seismic movement. Provide fire seal systems in fire-rated walls.

.11 Seismic restraint cables shall be adjusted such that they are not visibly slack, or the flexibility is approximately 25mm under thumb pressure for a 1500mm cable length (equivalent ratio for other cable lengths).

.12 All seismic restraint cables shall be at least 25mm clear of all other equipment and services.

3.2 EQUIPMENT INSTALLATION

.1 All external utility connections to restrained equipment shall be designed to allow differential seismic motion without damage to the equipment or utility connections.

.2 Adjust isolators and restraints after piping systems have been filled and equipment is at its operating weight, following the manufacturer's written instructions.

.3 After equipment installation is completed, adjust limit stops following manufacturer's written instructions so that they are out of contact during normal operation.

.4 Adjust snubbers according to manufacturer's written instructions.

.5 Installation of seismic restraints shall not cause any change in position of equipment, resulting in stresses or misalignment.

.6 No rigid connections between equipment and the building structure shall be made that degrade the noise and vibration isolation system specified.

.7 Do not install any seismic restraint for equipment, cable trays or conduit that compromises isolation specified.

3.3 PIPING INSTALLATION

.1 Hold down clamps must be used to attach pipe to all trapeze members before applying restraints.

.2 Branch lines may not be used to restrain main lines.

.3 Piping crossing building seismic or expansion joints, passing from building to building, or supported from different portions of the building shall be installed to allow differential support displacements without damaging the pipe, equipment connections, or support connections. Pipe offsets, loops, anchors, and guides shall be installed as required to provide specified motion capability and limit motion of adjacent piping.

.4 Attach piping to the trapeze per seismic restraint manufacturer's design. Install cables so they do not bend across sharp edges of adjacent equipment or building structures.

3.4 FASTENING TO STRUCTURE

.1 Bracing may occur from flanges of structural beams, upper truss cords of bar joists, cast in place inserts, or wedge-type concrete anchors. Consult structural engineer of record.

.2 Overstressing of the building structure shall not occur from overhead support of equipment. Bracing attached to structural members may present additional stresses. The contractor shall submit loads to the structural engineer of record for approval in this event.

.3 Coring is not permitted for the installation of concrete anchors. Use ground penetrating radar or equivalent method of embedment item detection to locate all embed items including reinforcing steel and electrical conduits. Concrete reinforcing steel and electrical conduits shall not be cut or damaged under any circumstances.

.4 Install vertical braces to stiffen hanger rods and prevent buckling per seismic restraint manufacturer's design. Clamp vertical brace to hanger rods. Requirements apply equally to hanging equipment. Do not weld vertical braces to hanger rods.

.5 If mounting hole diameter exceeds bolt diameter by more than 0.125" (3 mm), reduce clearance in hole with epoxy grout, flanged elastomeric bushings or welded washer.

.6 Housekeeping Pads must be adequately reinforced and adequately sized for proper installation of equipment anchors. Refer to seismic restraint manufacturer's written instructions.

3.5 INSPECTION

.1 The contractor shall notify the local representative of the seismic restraint materials manufacturer prior to installing any seismic restraint devices. The contractor shall seek the representative's guidance in any installation procedures with which he/she is unfamiliar.

.2 Upon completion of the installation of all seismic restraint devices herein specified, the local representative of the seismic restraint manufacturer shall, at the contractor's request, inspect the completed system and report in writing any installation errors, improperly selected snubber devices, or other fault in the system which could affect the performance of the system.

.3 The installing contractor shall submit a report upon request to the building architect and/or engineer, including the manufacturer's representative's final report, indicating that all seismic restraint material has been properly installed, or steps that are to be taken by the contractor to properly complete the seismic restraint work as per the specifications.

3.6 PIPING

.1 Seismically restrain all piping listed below. Use Type J Cable Restraints for all piping supported by vibration isolation hanger assemblies, including:

.1 Natural gas piping, medical gas piping, vacuum piping, petroleum based liquid piping, and compressed air piping equal to or greater than 1" (25 mm) in inside diameter.

.2 Brace remainder of piping to code requirements (IBC or TI-809-04) on in conformance with SMACNA (Sheet Metal and Air Conditioning Contractors National Association, Inc.) “Seismic Restraint Manual Guidelines for Mechanical Systems”, Second Edition (Remaining Codes).

3.7 DUCTWORK

.1 Seismically restrain all ductwork listed below. Use Type J Cable Restraints for all ductwork supported by vibration isolation hanger assemblies, including:

.1 All rectangular and oval ducts with cross sectional area equal to or greater than 6 sq. ft. (0.55 sq. meters).

.2 All round ducts with diameters equal to or greater than 32" (812 mm).

.3 Brace remaining ductwork to code requirements (IBC or TI-809-04) or in conformance with SMACNA (Sheet Metal and Air Conditioning Contractors National Association, Inc.) “Seismic Restraint Manual Guidelines for Mechanical Systems”, Second Edition (Remaining Codes).

3.8 CONDUIT

.1 Seismically restrain all electrical conduit listed below. Use Type J Cable Restraints for all conduit supported by vibration isolation hanger assemblies, including:

.1 All round ducts with diameters equal to or greater than 32" (812 mm).

.2 Brace all conduit to code requirements (IBC or TI-809-04) or in conformance with SMACNA (Sheet Metal and Air Conditioning Contractors National Association, Inc.) “Seismic Restraint Manual Guidelines for Mechanical Systems”, Second Edition (Remaining Codes).

3.9 FIRE PROTECTION PIPING

.1 Fire protection, sprinkler piping, and related equipment is considered as “Life Safety Equipment” and is to be seismically restrained per guidelines as published by NFPA (National Fire Protection Association).

3.10 ROOF MOUNTED EQUIPMENT

.1 Provide seismic restraint for all isolated and non-isolated roof curbs and associated equipment.

.2 Provide seismically restrained steel coil spring isolation systems where isolation curbs are indicated and non-isolated seismic restraints for all other roof curb systems.”

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS

.1 Submit shop drawings in accordance with general requirements.

.2 Provide separate shop drawings for each isolated system complete with performance and product data.

Part 2 Products

2.1 GENERAL

.1 Size and shape of bases type and performance of vibration isolation to be as indicated.

.2 To be of the same manufacturer for all isolation.

.3 Acceptable materials:

.1 Korfund

.2 Vibro-Acoustics

.3 Vibron

2.2 ELASTOMERIC PADS

.1 Type EP1 - neoprene waffle or ribbed; 10 mm (3/8") minimum thick; 50 durometer; maximum loading 350 kPa (50.8 psi).

.2 Type EP2 - rubber waffle or ribbed; 10 mm (3/8") minimum thick; 30 durometer natural rubber; maximum loading 415 kPa (60.2 psi).

.3 Type EP3 - neoprene-steel-neoprene; 10 mm (3/8") minimum thick neoprene bonded to 1.5 mm (16 gauge) steel plate; 50 durometer neoprene, waffle or ribbed; holes sleeved with isolation washers; maximum loading 350 kPa (50.8 psi).

.4 Type EP4 - rubber-steel-rubber; 10 mm (3/8") minimum thick rubber bonded to 1.5 mm (16 gauge) steel plate; 30 durometer natural rubber, waffle or ribbed; holes sleeved with isolation washers; maximum loading 415 kPa (60.2 psi).

.5 Acceptable materials:

.1 Korfund

.2 IAC Acoustics

.3 Vibro-Acoustics

.4 Vibron

2.3 ELASTOMERIC MOUNTS

.1 Type M1 - colour coded; neoprene in shear; maximum durometer of [60]; threaded insert and two bolt-down holes; ribbed top and bottom surfaces.

.1 Acceptable materials:

.1 Vibro-Acoustics

.2 Korfund

.3 IAC Acoustics

.4 Vibron

2.4 SPRINGS

.1 Design stable springs so that ratio of lateral to axial stiffness is equal to or greater than 1.2 times the ratio of static deflection to working height. Select for 50% travel beyond rated load. Units to be complete with levelling devices.

.2 Ratio of height when loaded to diameter of spring to be between 0.8 to 1.0.

.3 Cadmium plate for all installations.

.4 Colour code springs.

2.5 SPRING MOUNT

.1 Zinc or cadmium plated hardware; housings coated with rust resistant paint.

.2 Type M2 - stable open spring: support on bonded 6 mm (1/4") minimum thick ribbed neoprene or rubber friction and acoustic pad.

.3 Type M3 - stable open spring: 6 mm (1/4") minimum thick ribbed neoprene or rubber friction and acoustic pad, bonded under isolator and on isolator top plate; leveling bolt for rigidly mounting to equipment.

.4 Type M4 - restrained stable open spring: supported on bonded 6 mm (1/4") minimum thick ribbed neoprene or rubber friction and acoustic pad; built-in resilient limit stops, removable spacer plates.

.5 Type M5 - enclosed spring mounts with snubbers for isolation up to 950 kg (2100 lbs) maximum.

.6 Performance: as indicated.

.7 Acceptable materials:

.1 Korfund

.2 IAC Acoustics

.3 Vibron

.4 Vibro-Acoustics

2.6 HANGERS

.1 Colour coded springs, rust resistant, painted box type hangers. Arrange to permit hanger box or rod to move through a 30° arc without metal to metal contact.

.2 Type H1 - neoprene - in-shear, molded with rod isolation bushing, which passes through hanger box.

.3 Type H2 - stable spring, elastomeric washer, cup with molded isolation bushing which passes through hanger box.

.4 Type H3 - stable spring, elastomeric element with pre-compression washer and nut [with deflection indicator].

.5 Performance as indicated.

.6 Acceptable materials:

.1 Vibron

.2 IAC Acoustics

.3 Korfund

.4 Vibro-Acoustics

2.7 STRUCTURAL BASES

.1 Type B1 - Prefabricated steel base: integrally welded on sizes up to 2400 mm (96") on smallest dimension, split for field welding on sizes over 2400 mm (96") on smallest dimension and reinforced for alignment of drive and driven equipment; without supplementary hold down devices; complete with isolation element attached to base brackets arranged to minimize height; pre-drilled holes to receive equipment anchor bolts; and complete with adjustable built-in motor slide rail where indicated.

.2 Type B2 - Steel rail base: structural steel, positioned for alignment of drive and driven equipment; without supplementary hold down devices; complete with isolation element attached to base brackets arranged to minimize height; and pre-drilled holes to receive equipment anchor bolts.

.3 Bases to clear housekeeping pads by 25 mm (1") minimum.

.4 Acceptable materials:

.1 Korfund

.2 IAC Acoustics

.3 Vibron

.4 Vibro-Acoustics

2.8 INERTIA BASE

.1 Type B3 - Full depth perimeter structural or formed channels, frames: welded in place reinforcing rods running in both directions; spring mounted, carried by gussetted height-saving brackets welded to frame; and clear housekeeping pads by 50 mm (2") minimum.

.2 Pump bases: "T" shaped, where applicable, to provide support for elbows.

.3 Concrete: to Section Cast-in-Place Concrete.

.4 Acceptable materials:

.1 Korfund

.2 IAC Acoustics

.3 Vibron

.4 Vibro-Acoustics

2.9 ROOF CURB ISOLATION RAIL

.1 General: complete factory assembled without need for sub-base.

.2 Lower member: continuous extruded aluminum channel.

.3 Upper member: continuous extruded aluminum channel to provide continuous support for equipment, complete with all-directional neoprene rubber bushings 6 mm (1/4") thick to resist wind [and seismic] forces.

.4 Springs: steel, adjustable, removable, selected for 25 mm (1") maximum static deflection plus 50% additional travel to solid, cadmium plated, sized and positioned to ensure uniform deflection.

.5 High frequency isolation: 6 mm (1/4") minimum thick [continuous gasket on top and bottom of complete assembly] [or] [pads on top and bottom of each spring]. Material: closed cell neoprene.

.6 Weatherproofing: continuous flexible counterflashing to curb and providing access to springs. Material: [aluminum] [neoprene].

.7 Hardware: cadmium plated or galvanized.

Part 3 Execution

3.1 INSTALLATION

.1 Install vibration isolation equipment in accordance with manufacturers instructions and adjust mountings to level equipment.

.2 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.

.3 Unless indicated otherwise, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm (1") minimum static deflection as follows:

.1 Up to NPS 100 mm (4"): first 3 points of support. NPS 125 mm (5") to NPS 200 mm (8"): first 4 points of support. NPS 250 mm (10") and Over: first 6 points of support.

.2 First point of support shall have a static deflection of twice deflection of isolated equipment, but not more than 50 mm (2").

.4 Where isolation is bolted to floor use vibration isolation rubber washers.

.5 Block and shim level bases so that ductwork and piping connections can be made to a rigid system at the operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

3.2 SITE VISIT

.1 Manufacturer to visit site and provide written certification that installation is in accordance with manufacturer's instructions and submit report to Consultant.

.2 Provide Consultant with notice 24 h in advance of visit.

.3 Make adjustments and corrections in accordance with written report.

3.3 TESTING

.1 Experienced and competent sound and vibration testing professional engineer to take vibration measurement for HVAC systems after start up and TAB of systems to Testing Adjusting and Balancing Section.

.2 Vibration measurements shall be taken for equipment-listed below:

.3 Provide Consultant with notice 48 h in advance of commencement of tests.

.4 Establish adequacy of equipment isolation and acceptability of noise levels in occupied areas and where appropriate, remedial recommendations including sound curves.

.5 Submit complete report of test results including sound curves.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-1.60, Interior Alkyd Gloss Enamel.

.2 CAN/CGSB-24.3, Identification of Piping Systems.

.3 Canadian Standards Association (CSA).

.1 Natural Gas and Propane Installation Code CSA B149.1.

.4 National Fire Protection Association

.1 NFPA 13, Installation of Sprinkler Systems.

.2 NFPA 14, Standpipe and Systems.

1.2 PRODUCT DATA

.1 Submit product data in accordance with General Requirements.

.2 Product data to include paint colour chips, all other products specified in this section.

1.3 PRODUCT LITERATURE

.1 Submit product literature in accordance with General Requirements.

.2 Product literature to include nameplates, labels, tags, lists of proposed legends.

Part 2 Products

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

.1 Metal or plastic lamicoid nameplate mechanically fastened to each piece of equipment by manufacturer.

.2 Lettering and numbers to be raised or recessed.

.3 Information to include, as appropriate:

.1 Equipment: Manufacturer's name, model, size, serial number, capacity.

.2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM NAMEPLATES

.1 Colours:

.1 Hazardous: red letters, white background.

.2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).

.3 Construction:

.4 3 mm (1/8") thick laminated plastic, matte finish, with square corners, letters accurately aligned, and machine engraved into core.

.2 Sizes:

.1 Conform to following table:

Size	No. of Sizes mm (")	Height of Line mm (")	Letters mm (")
1	10 x 50 (3/8" x 2")	1 (3/64")	3 (1/8")
2	15 x 75 (1/2" x 3")	1 (3/64")	6 (1/4")
3	15 x 75 (1/2" x 3")	2 (5/64")	3 (1/8")
4	20 x 100 (3/4" x 4")	1 (3/64")	10 (3/8")
5	20 x 100 (3/4" x 4")	2 (6/64")	6 (1/4")
6	20 x 200 (3/4" x 8")	1 (3/64")	10 (3/8")
7	25 x 125 (1" x 5")	1 (3/64")	15 (1/2")
8	25 x 125 (1" x 5")	2 (5/64")	10 (3/8")
9	32 x 200 (1¼" x 8")	1 (3/64")	20 (3/4")

.2 Use maximum of 25 letters/numbers per line.

.3 Locations:

.1 Terminal cabinets, control panels: Use size #5.

.2 Equipment in Mechanical Rooms: Use size #9.

.3 Roof top equipment: use size #9.

.4 Equipment above ceiling: use size #1 riveted to ceiling suspension system.

2.3 FIRE DAMPER/FIRE STOP FLAP NAMEPLATES

.1 Colours:

.1 Black letters, yellow background.

.2 Construction:

.1 Self adhesive 50 mm x 25 mm, matte finish, with round corners.

.3 Locations:

.1 Install on adjacent ceiling grid. Where fire stop flap is installed in gypsum ceiling install on diffuser/grille frame. Where fire damper is installed above gypsum ceiling install on adjacent wall.

2.4 PIPING SYSTEMS GOVERNED BY CODE

.1 Identification:

.1 Natural and propane gas: To CSA B149.1-00 and authority having jurisdiction and as indicated elsewhere.

.2 Sprinklers: To NFPA 13.

.3 Standpipe and hose systems: To NFPA 14.

2.5 IDENTIFICATION OF PIPING SYSTEMS

.1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.

.2 Legend:

.1 Block capitals to sizes and colours listed in CAN/CGSB-24.3.

.3 Arrows showing direction of flow:

.1 Outside diameter of pipe or insulation less than 75 mm (3"): 100 mm (4") long x 50 mm (2") high.

.2 Outside diameter of pipe or insulation 75 mm (3") and greater: 150 mm (6") long x 50 mm (2") high.

.3 Use double-headed arrows where flow is reversible.

.4 Extent of background colour marking:

.1 To full circumference of pipe or insulation.

.2 Length to accommodate pictogram, full length of legend and arrows.

.5 Materials for background colour marking, legend, arrows:

.1 Pipes and tubing 20 mm (3/4") and smaller: Waterproof and heat-resistant pressure sensitive plastic marker tags.

.2 All other pipes: Pressure sensitive vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150°C (300°F) and intermittent temperature of 200°C (395°F).

.6 Colours and Legends:

.1 Where not listed, obtain direction from Consultant.

.2 Colours for legends, arrows: To following table:

Background colour:	Legend:	Arrows:
Yellow	White	Black
Green	White	Black
Red	White	Black

.7 Background colour marking and legends for piping systems:

CONTENTS	BACKGROUND COLOUR MARKING	LEGEND
Make-up water	Yellow	MAKE-UP WTR
Continuous blow-off	Yellow	CONT. BLOW-OFF
Glycol heat pump supply	Yellow	GLYCOL HEAT PUMP SUPPLY
Glycol heat pump return	Yellow	GLYCOL HEAT PUMP RETURN
Hot water heating supply	Yellow	HEATING SUPPLY
Hot water heating return	Yellow	HEATING RETURN
Domestic hot water supply	Green	DOM. HW SUPPLY
Dom. HW recirculation	Green	DOM. HW CIRC
Domestic cold water supply	Green	DOM. CWS
Domestic tempered supply	Green	DOM. TEMPERED
Trap Primer	Green	TRAP PRIMER
Storm water	Green	STORM
Sanitary	Green	SAN
Plumbing vent	Green	SAN. VENT
Condensate	Green	CONDENSATE
Refrigeration suction	Yellow	REF. SUCTION
Refrigeration liquid	Yellow	REF. LIQUID
Refrigeration hot gas	Yellow	REF. HOT GAS
Natural gas	Yellow	NATURAL GAS
Gas regulator vents		to Codes
Fire protection water	Red	FIRE PROT. WTR
Sprinklers	Red	SPRINKLERS
Conduit for low voltage Control wiring	White	CONTROL WIRING___VOLTS

2.6 IDENTIFICATION DUCTWORK SYSTEMS

.1 50 mm (2") high stencilled letters and directional arrows 150 mm (6") long x 50 mm (2") high.

.2 Colours: Black, or co-ordinated with base colour to ensure strong contrast.

2.7 VALVES, CONTROLLERS

.1 Brass tags with 15 mm (1/2") stamped identification data filled with black paint.

.2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

.3 Provide adhesive coloured tab (max. size 15 mm) indication on ceiling to locate valves/equipment above. Same applies to grid. Colour to be approved by consultant.

2.8 CONTROLS COMPONENTS IDENTIFICATION

.1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.

.2 Inscriptions to include function and (where appropriate) fail-safe position.

.3 Provide equipment identification and/or indication on ceiling to locate devices/equipment above ceiling. Install identification on grid. Colours to be approved by consultant.

2.9 LANGUAGE

.1 Identification to be in English.

Part 3 Execution

3.1 TIMING

.1 Provide identification only after all painting specified has been completed.

3.2 INSTALLATION

.1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.

.2 Provide ULC and/or CSA registration plates as required by respective agency.

3.3 NAMEPLATES

.1 Locations:

.1 In conspicuous location to facilitate easy reading and identification from operating floor.

.2 Standoffs:

.1 Provide for nameplates on hot and/or insulated surfaces.

.3 Protection

.1 Do not paint, insulate or cover in any way.

3.4 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

.1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels not more than 1.7 m (5'-8") intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.

.2 Adjacent to each change in direction.

.3 At least once in each small room through which piping or ductwork passes.

.4 On both sides of visual obstruction or where run is difficult to follow.

.5 On both sides of separations such as walls, floors, partitions.

.6 Where system is installed in pipe chases, ceiling spaces, galleries, other confined spaces, at entry and exit points, and at each access opening.

.7 At beginning and end points of each run and at each piece of equipment in run.

.8 At point immediately upstream of major manually operated or automatically controlled valves, dampers, etc. Where this is not possible, place identification as close as possible, preferably on upstream side.

.9 Identification to be easily and accurately readable from usual operating areas and from access points.

.1 Position of identification to be approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.5 VALVES, CONTROLLERS

.1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.

.2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Consultant. Provide one copy (reduced in size if required) in each operating and maintenance manual.

.3 Number valves in each system consecutively. Where existing numbering system is installed start new numbering system at 100.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do all other work as specified in this section including all air handling systems and equipment, all plumbing systems and equipment and all temperature controls system, building automation systems and equipment.

1.2 QUALIFICATIONS OF TAB AGENCIES

.1 Names of all personnel it is proposed to perform TAB to be submitted to and approved by Consultant within 30 days of start of work.

.2 Provide documentation confirming qualifications, successful experience.

.3 Only the following NEBB (National Environmental Balancing Bureau) TAB contractors may quote:

.1 Air Audit Inc.
110 Turnbull Court, Unit 11
Cambridge, Ontario
N1T 1K6
(519) 740-0871

.2 Air Velocities Control Ltd.
100 Premium Way
Mississauga, Ontario
L5B 1A2
(905) 279-4433

.3 Flowset Balancing Ltd.
431 Willis Dr.
Oakville, Ontario
L6L 4V6
(416) 410-9793

.4 Dynamic Flow Balancing Ltd.
1200 Speers Road, Unit 36
Oakville, Ontario
L6L 4V6
(905) 338-0808

.5 Air Adjustments & Balancing Inc.
P.O. Box 176,
Schomberg, Ontario
L0G 1T0
(416) 254-3004

1.3 PURPOSE OF TAB

.1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average (95% design) and low (75% of design) loads using actual or simulated loads. TAB contractor to perform equipment evaluation upon start up and once during each season in the first year of operation.

.2 Adjust and regulate equipment and systems so as to meet specified performance requirements and to achieve specified interaction with all other related systems under all normal and emergency loads and operating conditions. Confirm all equipment interlocks and functions of associated systems.

.3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges and temperatures. Refer to BAS for system operating functions.

1.4 EXCEPTIONS

.1 TAB of systems and equipment regulated by codes, standards to be to satisfaction of authority having jurisdiction.

1.5 CO-ORDINATION

.1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule so as to ensure completion before acceptance of project.

.2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems. Co-ordinate with other trades to ensure all systems are interlocked as indicated elsewhere prior to TAB.

1.6 PRE-TAB REVIEW

.1 Review contract documents before project construction is started and confirm in writing to Consultant adequacy of provisions for TAB and all other aspects of design and installation pertinent to success of TAB.

.2 Review specified standards and report to Consultant in writing all proposed procedures which vary from standard.

.3 During construction, co-ordinate location and installation of all TAB devices, equipment, accessories, measurement ports and fittings.

.4 During construction indicate all tolerances of piping, ductwork etc conforms to specifications.

1.7 START-UP

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

.2 Follow special start-up procedures specified elsewhere in the Mechanical Division.

1.8 OPERATION OF SYSTEMS DURING TAB

.1 Operate systems for length of time required for TAB and as required by Consultant for verification of TAB reports.

1.9 START OF TAB

.1 Notify Consultant in writing 3 days prior to start of TAB.

.2 Start TAB only when building is essentially completed, including:

.1 Installation of ceilings, doors, windows, other construction affecting TAB.

.2 Application of weather-stripping, sealing, caulking.

.3 All pressure, leakage, other tests specified elsewhere in the Mechanical Division.

.4 All provisions for TAB installed and operational.

.5 Start-up, verification for proper, normal and safe operation of all mechanical and associated electrical and control systems affecting TAB including but not limited to:

.1 Proper thermal overload protection in place for electrical equipment.

.2 Air systems:

.1 Filters in place, clean.

.2 Duct systems clean.

.3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.

.4 Correct fan rotation.

.5 Fire, smoke, volume control dampers installed and open.

.6 Coil fins combed, clean.

.7 Access doors, installed, closed.

.8 All outlets installed, volume control dampers open.

.3 Liquid systems:

.1 Flushed, filled, vented.

.2 Correct pump rotation.

.3 Strainers in place, baskets clean.

.4 Isolating and balancing valves installed, open.

.5 Calibrated balancing valves installed, at factory settings.

.6 Chemical treatment systems complete, operational.

.7 Control valves are properly piped.

.8 Coils and radiation are properly piped.

.9 BAS in operation.

1.10 APPLICATION TOLERANCES

.1 Do TAB to following tolerances of design values:

.1 HVAC systems: plus 10%, minus 5%.

.2 Hydronic systems: plus or minus 10%.

1.11 ACCURACY TOLERANCES

.1 Measured values to be accurate to within plus or minus 2% of actual values.

1.12 INSTRUMENTS

.1 Prior to TAB, submit to Consultant list of instruments to be used together with serial numbers.

.2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.3 Calibrate within 3 months of TAB. Provide certificate of calibration to Consultant.

1.13 SUBMITTALS

.1 Submit, prior to commencement of TAB:

.1 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.14 PRELIMINARY TAB REPORT

.1 Submit for checking and approval of Consultant, prior to submission of formal TAB report, sample of rough TAB sheets. Include:

.1 Details of instruments used.

.2 Details of TAB procedures employed.

.3 Calculations procedures.

.4 Summaries.

1.15 TAB REPORT

.1 Format to be in accordance with NEBB, AABC, or SMACNA.

.2 TAB report to show all results in SI or imperial units as indicated on plans and to include:

.1 Project record drawings.

.2 System schematics.

.3 Submit copy of TAB Report to consultant for verification and approval, in English in D-ring binders, complete with index tabs.

1.16 VERIFICATION

.1 All reported results subject to verification by Consultant.

.2 Provide manpower and instrumentation to verify up to 30% of all reported results.

.3 Number and location of verified results to be at discretion of Consultant.

.4 Bear costs to repeat TAB as required to satisfaction of Consultant.

1.17 SETTINGS

.1 After TAB is completed to satisfaction of Consultant, replace drive guards, close all access doors, lock all devices in set positions, ensure sensors are at required settings. Replace all ceiling tile etc.

.2 Permanently mark all settings to allow restoration at any time during life of facility. Markings not to be eradicated or covered in any way.

1.18 COMPLETION OF TAB

.1 TAB to be considered complete only when final TAB Report received and approved by Consultant.

1.19 AIR SYSTEMS

.1 Standard: TAB to be to most stringent of TAB standards of NEBB, AABC, SMACNA, ASHRAE.

.2 Do TAB of all systems, equipment, components, controls specified in the Mechanical Division including but not limited to following:

.1 Air handling systems and equipment

.2 Duct testing to SMACNA standards.

.3 Qualifications: personnel performing TAB to be current member in good standing of NEBB.

.4 Quality assurance: Perform TAB under direction of qualified supervisor.

.5 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.

.6 Locations of equipment measurements: To include, but not be limited to, following as appropriate:

.1 Inlet and outlet of each damper, filter, coil, humidifier, fan, and other equipment causing changes in conditions.

.2 At each controller, controlled device.

.7 Locations of systems measurements to include, but not be limited to, following as appropriate: Each main duct, main branch, sub-branch, grille, register or diffuser.

1.20 HYDRONIC SYSTEMS

.1 Definitions: for purposes of this section, to include low pressure hot water heating, chilled water, condenser water, glycol systems.

.2 Standard: TAB to be the most stringent of TAB standards of [NEBB] [AABC] [SMACNA] [ASHRAE]].

.3 Do TAB of all systems, equipment, components, controls specified in Mechanical Division including but not limited to hydronic equipment testing.

.4 Qualifications: personnel performing TAB to be current member in good standing of NEBB.

.5 Quality assurance: perform TAB under direction of qualified supervisor.

.6 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls: Flow rate, static pressure, pressure drop (or loss), temperature, specific gravity, density, RPM, electrical power voltage, noise, vibration.

.7 Locations of equipment measurement: To include, but not be limited to, following as appropriate:

.1 Inlet and outlet of each heat exchanger (primary and secondary sides), boiler, chiller, coil, humidifier, cooling tower, condenser, pump, PRV, control valve, other equipment causing changes in conditions.

.2 At each controller, controlled device.

.8 Locations of systems measurements to include, but not be limited to, following as appropriate: Supply and return of each primary and secondary loop (main, main branch, branch, sub-branch of all hydronic systems, inlet connection of make-up water.

1.21 DUCT LEAKAGE TESTING

.1 Co-ordinate leakage testing with the sheet metal contractor. TAB contractor will be responsible for all duct testing.

.2 Duct to be tested in accordance with SMACNA HVAC Duct Leakage Test Manual and as indicated.

1.22 DOMESTIC HWC SYSTEMS

.1 Meet all requirements as specified for hydronic systems.

.2 Locations of equipment measurements: To include, but not be limited to, following as appropriate: Inlet and outlet of each heater, tank, pump, circulator, at each controller, controlled device.

.3 Locations of systems measurements to include, but not be limited to, following as appropriate: main, main branch, branch, sub-branch.

1.23 OTHER SYSTEMS

.1 Plumbing systems:

.1 TAB procedures:

.2 Pumped sanitary and storm water systems: test for proper operation at all possible flow rates.

1.24 OTHER TAB REQUIREMENTS

.1 General requirements applicable to all work specified this paragraph:

.1 Qualifications of TAB personnel: as for air systems specified this section.

.2 Quality assurance: as for air systems specified this section.

.3 Building pressure conditions:

.1 Adjust HVAC systems, equipment, controls to ensure specified pressure conditions [during [winter] [summer] design conditions] [at all times].

.2 TAB procedures:

Positive	Negative
Corridors	Washrooms
Cafeteria	Cafeteria Kitchen
Corridors	Industrial Areas

.4 Provide duct testing as specified.

.5 Provide AHU testing as specified.

.6 Provide plenum testing as specified.

.7 Changing of air handling equipment sheave and belts as required for specified air flow sheaves and belts supplied by unit manufacturer. Retest equipment after sheave change.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 The Mechanical Contractor shall provide the labour and material to conduct the closeout process as outlined in this specification section.

.2 The mechanical contractor shall perform the closeout requirements specified in conjunction with the independent commissioning consultant (CC) retained by the owner.

Part 2 Products

2.1 GENERAL

.1 The mechanical contractor and manufacturers shall provide all instrumentation and equipment necessary to conduct the tests specified. The Mechanical Contractor shall advise the Mechanical Consultant of instrumentation to be used and the dates the instruments were calibrated.

Part 3 Execution

3.1 THE CONTRACT CLOSE OUT PROCESS

.1 The mechanical contractor close out process shall consist of:

- Shop Drawings and Record Drawings
- Installation inspection and equipment verification
- Plumbing and drainage system testing
- Testing of piping systems
- Independent contractor balancing of water systems
- Testing of air systems
- Independent contractor balancing of air systems
- Testing of equipment and systems
- BAS Commissioning
- Commissioning Consultant performance testing
- Commissioning meetings
- Operating and maintenance manuals
- Training
- Systems Demonstration and turnover
- Testing forms
- Warranties
- Contractor to provide list of equipment maintenance including schedule of maintenance parts, quantities, and model fixtures, etc.

3.2 SHOP DRAWINGS AND RECORD DRAWINGS

.1 Conform to General Requirements Section for shop drawings and record drawings requirements.

3.3 INSTALLATION INSPECTION AND EQUIPMENT VERIFICATION

.1 The Mechanical Contractor shall co-ordinate with the Consultant who will inspect the mechanical installation.

.2 The Mechanical Contractor shall complete the equipment verification forms for each piece of equipment. The forms shall be included in the operating and maintenance manual. The equipment data shall include:

- Manufacturers name, address and telephone number
- Distributors name, address and telephone number
- Make, model number and serial number
- Pumps - RPM, impeller sizes, rated flow
- Fans - belt type and size, shive type and size
- Electrical - volts, amps, fuse size, overload size
- Any other special characteristics.

3.4 PLUMBING AND DRAINAGE SYSTEM TESTING

.1 The plumbing and drainage system shall be tested in accordance with the Plumbing Code under the Ontario Water Resources Act and the specification.

.2 The Mechanical Contractor shall notify the Building Inspector when systems are available for testing. The Mechanical Contractor shall document all tests performed and shall arrange for the Building Inspector to sign for tests completed. The forms shall be forwarded to the Consultant.

3.5 THE CONTRACTOR'S TESTING OF PIPING SYSTEMS

.1 Test all piping systems in accordance with all applicable plumbing codes and General Requirements section.

.2 All tests for the systems shall be performed in the presence of the Consultant or Commissioning Consultant. Complete the testing forms and forward to the Consultant.

3.6 THE INDEPENDENT CONTRACTORS TESTING AND BALANCING OF WATER SYSTEMS

.1 Conform with the specification section, Testing, Adjusting and Balancing.

.2 The Independent Contractor shall be hired by The Mechanical Contractor and shall report to the Commissioning Consultant.

3.7 THE CONTRACTORS TESTING OF AIR SYSTEMS

.1 Conform with the specification section, Testing, Adjusting and Balancing.

.2 All tests shall be performed in the presence of the Mechanical Consultant or the Commissioning Consultant. Complete the testing forms and forward to the Consultant.

3.8 THE INDEPENDENT CONTRACTORS TESTING AND BALANCING OF AIR SYSTEMS

.1 Conform with specification section, Testing, Adjusting and Balancing.

.2 The Independent Contractor shall be hired by The Mechanical Contractor and shall report to the Commissioning Consultant.

3.9 TESTING OF EQUIPMENT AND SYSTEMS

.1 General:

.1 The Mechanical Contractor shall hire the services of the manufacturers technicians to test the equipment and associated systems. The technician shall record the results of the tests on the testing forms. The tests shall be witnessed by the Consultant or Owners representative. When the tests have been completed satisfactorily the technician and witnessing authority shall sign the forms. A copy of the forms shall be forwarded to the Consultant. The original shall be inserted into the operating and maintenance manual.

.2 Should equipment or systems fail a test, the test shall be repeated after repairs or adjustments have been made. The additional tests shall be witnessed.

.3 Tests which have not been witnessed shall not be accepted and shall be repeated.

.4 The equipment and systems to be tested shall include:

- Heat Pumps
- Boilers and Pumps
- Air Handling Units
- Cooling Tower
- Life Safety and Fire Protection Systems
- Water Treatment Systems
- Building Automation Systems (BAS)

.2 BAS Testing:

.1 The BAS Contractor shall test the system as described in General Requirements and/or Controls Sections.

.2 Co-ordinate with the Consultant and submit completed test forms monthly.

.3 Demonstrate to the Owner and Consultant the operation of the BAS when all tests have been completed.

3.10 CLOSEOUT SCHEDULE

.1 The Mechanical Contractor shall include the schedule for all tests and equipment start-up tests in the construction schedule.

.2 All testing forms and reports associated with the mechanical systems shall be directed to the Consultant with copies to the Owner and Consultant.

.3 The forms and reports to be issued shall include:

- Shop drawings, issued and accepted
- Equipment verification forms
- Testing forms
- Reports resulting from tests
- Testing schedule
- Equipment Start-up Forms

3.11 OPERATION AND MAINTENANCE MANUAL

.1 Conform to General Requirements section for the Operating and Maintenance Manual requirements.

3.12 OPERATOR TRAINING

.1 Conform to General Requirements section for requirements for Instruction to Operating Staff.

.2 The training shall be conducted in a classroom and at the equipment or system.

.3 Training will begin when the operating and maintenance manuals have been delivered to The Owner and approved by the Consultant.

.4 Each training session shall be structured to cover:

The operating and maintenance manual
- Operating procedures
- Maintenance procedures
- Trouble-shooting procedures
- Spare parts required
- Submit a course outline to the Mechanical Consultant before training commences. Provide course documentation for up to eight people.

.5 The training sessions shall be scheduled and co-ordinated by the Mechanical Contractor.

.6 Training shall be provided for the following systems:

System	Minimum Training Times
Condensing Units	2 hours
Boilers	2 hours
Air Handling Units	2 hours
Life Safety & Fire Protection Systems	2 hours
Water Treatment Systems	2 hours
The Mechanical System	8 hours
Boilers	½ hour

.7 The minimum training for the BAS shall be 16 hours. The training shall include:

- A walk through of the installation for the Building Owner to review the installation and equipment
- Operation of the central computer
- Operation of portable terminals
- Control sequences
- Report set-up and generation
- Managing the system
- Maintenance requirements

Refer to Controls specification section for further information.

.8 The training requirement for the mechanical system shall include a walk-through of the building by the Mechanical Contractor. During the walk through the Mechanical Contractor shall:

- Identify equipment
- Identify starters associated with equipment
- Identify valves and balancing dampers
- Identify access doors
- Review general maintenance of equipment
- Review drain points in pipework systems
- Identify maintenance items

.9 When each training session has been completed The Owner shall sign the associated form to verify completion.

3.13 COMMISSIONING CONSULTANT

.1 A Commissioning Consultant (CC) reports to the Owner.

.2 The CC responsibilities shall include:

- preparing the commissioning plan
- co-ordinating with the contractor to schedule tests
- preparing a test form manual
- witnessing selected tests
- receiving all test forms
- conducting performance test
- co-ordinating the contractors training
- chair commissioning meetings

.3 The Mechanical Contractor shall co-operate with the CC.

.4 The Mechanical Contractor shall provide assistance to the CC and have personnel available during the performance testing procedure. Each mechanical system shall be tested in the operational mode.

.5 Performance testing shall begin when all systems have been completed, tested by the Mechanical Contractor and the Consultant has completed their final review.

.6 Commissioning Agent will work for the owner from the cash allowance. Refer to Cash Allowance section in the Architectural documents.

3.14 MECHANICAL SYSTEM DEMONSTRATION AND TURNOVER

.1 Refer to General Requirements section, Mechanical Project Completion.

.2 The system demonstration and turnover to The Owner shall occur when:

- The installation is complete
- The acceptance test conducted by the Mechanical Consultant has been completed successfully
- The Commissioning Consultant system performance testing has been completed successfully
- Training has been completed
- Operating and Maintenance Manuals have been accepted
- Shop-drawings have been updated
- As-built drawings have been completed

.3 The systems demonstration shall be conducted by the Mechanical Contractor and the manufacturers. The demonstration shall cover a demonstration of equipment installation and operation.

3.15 TESTING FORMS

.1 The Mechanical Contractor and manufacturers shall provide forms for testing. The forms must be approved by the Consultant and The Owner before they are used.

3.16 WARRANTIES

.1 Equipment and system warranties shall not begin until the system demonstration and turnover has been conducted successfully and accepted by The Owner.

.2 The Mechanical Contractor shall fill out the warranty form listing the equipment and systems and the start and finishing dates for warranty.

.3 Refer to the general conditions specification section for the requirements during the warranty period.

3.17 CLOSEOUT PROCESS ALLOCATION

.1 The mechanical contractor closeout process shall be allocated a value equal to min. of 3% but not less than $5,000.00.

.2 The Mechanical Contractor shall submit all test and verification forms. The Consultant will use these forms to calculate percentage complete.

.3 The monies shall not be paid out until the performance testing, O & M manuals, systems demonstration, and training including all required paperwork have been completed to the satisfaction of the consultant. Refer to General Requirements section for contract breakdown.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 The work shall be coordinated between the mechanical contractor and commissioning agent.

1.2 CONTRACT REQUIREMENTS

.1 Commissioning Agent will work for the Owner from the cash allowance. Refer to Cash Allowance section in the Architectural documents.

1.3 GENERAL REQUIREMENTS

.1 Definition:

.1 This section describes HVAC System Commissioning. HVAC System Commissioning is to be a joint team effort to:

.1 Ensure that all HVAC equipment, controls and systems function together properly and meet design intent.

.2 Ensure that system performance parameters are documented for fine-tuning of control sequences and operational procedures.

.2 The commissioning process shall encompass and co-ordinate the following areas:

.1 System documentation.

.2 Equipment start-up and Performance Testing (Pre-Functional Testing).

.3 Testing and balancing.

.4 Control system calibration.

.5 System start-up and Performance Testing (Function Testing).

.6 Training.

.7 Deficiency Documentation and Resolution.

.2 Commissioning Team:

.1 The Commissioning Team shall consist of:

.1 Owner/Owner's Representative

.2 Commissioning Authority

.3 Consultant, as required

.4 Architect, as required

.5 Prime Contractor

.6 Specialty or Sub-Contractors, as required by Prime Contractor

.7 Equipment Suppliers, as required by Prime Contractor

.2 The trades represented on the Commissioning Team may include sheet metal, piping and fitting, controls, and balancing, as required.

.3 The lead hand for each trade who will perform or supervise the commissioning work is to be designated as a Representative to the Commissioning Team.

1.4 RESPONSIBILITIES

.1 Commissioning Authority:

.1 Verify Pre-Functional and Functional performance of HVAC systems for compliance with design intent as specified in the appropriate Specification sections.

.2 Provide the documentation with standard Pre-Functional and Functional performance reports on completion of the testing.

.3 Verify submissions for HVAC system operation and maintenance manuals, as-built (record) documents, spare parts listing, special tools listing, and other items as may be specified.

.4 Co-ordinate and direct training of personnel for operation and maintenance of HVAC systems and equipment.

.5 Co-ordinate and direct each step of the commissioning process and recommend acceptance or non-acceptance to the Owner/Owner's Representative.

.6 Prepare, in writing, documentation of any deficiencies discovered during the commissioning process. Submit to Prime Contractor and Owner/Owner's Representative.

.7 The Commissioning Authority is not responsible for:

.1 Contracting methods.

.2 Contracting safety.

.3 Product liability/warranties.

.4 Maintenance/long-term building operation.

.5 System functions which have changed since Commissioning.

.6 Problems which arise out of recommended resolutions which are not implemented.

.7 Testing the operation of each and every component (e.g., shutoff valve, breaker, etc.).

.8 Normal wear and tear on equipment and systems.

.2 Prime Contractor:

.1 The Prime Contractor shall verify completeness of the building envelope, perimeter and interior items which affect proper operation and control of HVAC equipment and systems.

.2 The Prime Contractor shall be responsible for appointing the commissioning team members from the Sub and Specialty trades.

.3 The Prime Contractor will assure participation and co-operation of Sub-Contractors and Specialty Contractors (mechanical, electrical, TAB, building management, etc.) under the Prime Contractor's jurisdiction as required for the commissioning process.

.4 The Prime Contractor shall be responsible for the actual system Pre-Functional (Section 2.5) and Functional Performance Testing (Section 2.8). Any changes to the supplied test procedures must be approved by the Commissioning Agent.

.5 The Prime Contractor shall be responsible for correcting deficiencies.

.3 Sub- and Specialty Contractors:

.1 The Sub- and/or Specialty Contractors will be responsible for providing labour, material, equipment, etc., required within the scope of the respective sub-trade or specialty trade to facilitate the commissioning process.

.2 The Sub- and/or Specialty Contractor will perform Pre-Functional and Functional Performance Tests as required by the commissioning process.

.4 Consultant:

.1 The Consultant shall provide the Design Intent Documentation for commissioning.

.2 The Consultant shall observe (Pre-Functional and Functional Performance Testing), where specified, and sign-off reports when required.

.3 The Consultant shall provide technical capabilities for resolution of deficiencies, where required.

Part 2 Commissioning Process

2.1 GENERAL REQUIREMENTS

.1 The Commissioning Process is detailed in ***ASHRAE Guideline 1-1996 HVAC Commissioning Process.*** The commissioning plan will be modified to reflect the actual construction schedule.

2.2 COMMISSIONING SCOPE MEETING

.1 After the contract award and before HVAC system construction begins, a commissioning scope meeting of all members of the Commissioning Team shall be held at a time and place designated by the Owner/Owner's Representative. The purpose of the meeting will be to familiarize all parties with the requirements of the commissioning process, and to ensure that the responsibilities of each party are clearly understood. The Prime Contractor shall ensure that the appropriate Speciality and Sub-Contractors are in attendance.

2.3 OPERATIONS AND MAINTENANCE MANUALS FOR HVAC EQUIPMENT AND SYSTEMS

.1 Furnish Final, reviewed Operation and Maintenance Manuals to the Commissioning Authority and Owner/Owner's Representative fourteen (14) days prior to scheduled Functional Performance Tests.

2.4 START-UP, PRE-FUNCTIONAL PERFORMANCE TEST

.1 The Prime Contractor shall be responsible for the Pre-Functional Performance Tests. These tests ensure that all equipment and systems are installed in accordance with the Specifications, Drawings and manufacturers' requirements.

.2 The Prime Contractor shall be responsible for co-ordinating schedule for Pre-Functional tests of various equipment and systems.

.3 In the Pre-Functional Test, all HVAC mechanical system and sub-system elements, including control devices, shall be checked for the following:

.1 Verify that each element has been properly installed, properly identified, and that all connections (including electrical) have been made correctly.

.2 Verify that the hydronic piping system has been cleaned and flushed.

.3 Verify that each element has been checked for proper lubrication, drive rotation, belt tension, control sequence, flow direction, or other conditions which may cause damage or reduce system performance.

.4 Verify that tests, meter readings, and specific mechanical/electrical performance characteristics agree with those required by equipment or system manufacturer.

.5 Test format shall be supplied by the Commissioning Authority.

.6 Pre-Functional Performance Tests shall be completed prior to starting Functional Performance Tests.

.7 Pre-Functional Performance Tests need to be performed once only, if there are no deficiencies, as determined by the Commissioning Authority. Re-testing of corrected items shall be the responsibility of the Prime Contractor.

.8 Completion of the Pre-Functional Performance Tests shall be the responsibility of the Prime Contractor who shall sign and date each Test.

.9 Notify the Commissioning Authority, in writing, at least fourteen (14) days prior to the date of Pre-Functional Performance Testing. Schedule the Pre-Functional performance tests over a period of consecutive business days.

2.5 TESTING, ADJUSTING AND BALANCING (TAB)

.1 The TAB shall be done in accordance with the Construction Schedule.

.2 The TAB agency shall submit two (2) copies of the TAB reports to the Commissioning Authority.

2.6 CONTROLS CALIBRATION

.1 To be completed in accordance with the specification.

2.7 FUNCTIONAL PERFORMANCE TESTS

.1 The Prime Contractor shall be responsible for the Functional Performance Tests. These tests ensure that all equipment and systems operate in accordance with design intent. The tests are dynamic tests and test the systems through all possible modes of operation.

.2 The Functional Performance Testing shall be done during two separate periods – one during the cooling season and one during the heating season. The first (cooling) testing period shall occur as soon after completion of installation as practical. The heating testing period shall occur as soon as weather conditions make it practical to test warm-up, zone heating and economizer functions.

.3 The Prime Contractor shall be responsible for coordinating the Functional Performance Tests for the HVAC mechanical systems and sub-systems.

.4 In the Functional Performance Tests, all HVAC mechanical systems, including control systems, shall be checked for the following:

.1 Verify that each system and sub-system is operating and complies with Contract Specifications and the Design Intent Document through the entire range of operating conditions.

.2 Test format shall be supplied by the Commissioning Agent.

.3 Notify the Commissioning Agent and Consultant, in writing, at least fourteen (14) days prior to date of Functional Performance Tests. Schedule each of the two seasonal Functional Performance Test periods over a period of consecutive business days.

.4 Re-testing of corrected items shall be the responsibility of the Prime Contractor.

.5 The following personnel are to be present during Functional Performance Testing:

.1 The Prime Contractor and mechanical and controls specialty or sub-contractors as relevant to specific test.

.2 The Commissioning Agent

.3 Owner/Owner's Representative (operation personnel), Consultant and Architect may be present for some or all of Functional Performance Testing.

.4 Deficiencies in system, sub-system, or element performance will be brought to the attention of the Commissioning Team. Deficiencies will be resolved on a case-by-case basis.

2.8 CONTROLS COMMISSIONING

.1 Controls commissioning shall be done in accordance with the specification.

2.9 TRAINING

.1 HVAC training shall be done in accordance with the Commissioning Plan Schedule.

2.10 REPORTS

.1 Documentation, General:

.1 The Commissioning Authority shall be responsible for recording and maintaining detailed inspection and testing data on the test documentation reports. The data record shall be comprehensive and concise.

.2 All data must be recorded as soon as possible during the course of the inspection and testing.

.3 All documentation shall have the date, time, and names of persons participating in the inspection and testing.

.4 All test instruments shall be documented for valid calibration.

.5 The recording work sheets, inspection check lists, and Performance Testing plans must all be approved by the Consultant and the Commissioning Agent prior to the Start of Functional Performance Testing.

.2 The Commissioning Authority shall prepare and submit the following reports:

.1 Interim Report. Submit after completion of first functional seasonal commissioning period. Report shall document tests performed, any modifications to tests, comparison to TAB and other agency tests, and verification of compliance with design intent for ambient conditions under which initial commissioning was performed.

.2 Final Report. Submit after completion of last functional seasonal commissioning period. Report shall verify performance of HVAC equipment and systems during each seasonal commissioning process. Document any field modifications to the testing process and why these modifications were made.

Part 3 Execution

3.1 GENERAL REQUIREMENTS

.1 HVAC commissioning Pre-Functional and Functional Performance Tests shall begin after HVAC equipment and systems, along with related equipment, systems, structures and areas are complete.

.2 The testing and balancing Contractor shall perform the TAB after the Pre-Functional Tests have been completed and documented. The TAB agency shall submit two (2) TAB reports to the Commissioning Authority.

3.2 MECHANICAL SYSTEM COMMISSIONING

.1 General Requirements:

.1 Operating equipment and systems shall be tested in the presence of the Commissioning Authority (and the Consultant – at the Consultant's option) to demonstrate compliance with specified requirements. To minimize the time of Commissioning Team members, testing shall be done in four seasonal single blocks of time insofar as possible.

.2 The Prime Contractor shall notify the Commissioning Authority, in writing, fourteen (14) days prior to tests scheduled under requirements of this Section.

.3 Testing shall be conducted under specified design operating conditions as recommended or approved by the Commissioning Authority and Consultant, and outlined in the Pre-Functional and Functional Performance Tests.

.4 All elements of systems shall be tested to demonstrate that total systems satisfy all requirements of these Specifications. Testing shall be accomplished on hierarchical basis. Test each piece of equipment for proper operation, followed by each sub-system, followed by entire system, followed by any inter-ties of other major systems.

.5 All special testing materials and equipment shall be provided by the appropriate Contractor, as determined by the Prime Contractor.

.6 Provide three copies of all test reports and records to the Commissioning Authority.

.2 Test Procedure and Test Documentation:

.1 The Commissioning Authority will provide the Prime Contractor with Pre-Functional and Functional test procedures and test documentation reports. The Prime Contractor may propose alternate documentation and may alter the test procedures and test documentation to suit as-built conditions. However, the Prime Contractor will be expected to co-operate to the level of detail and general approach of the provided test procedures and test documentation.

.2 The Commissioning Authority shall verify test and air balance (TAB) readings for at least 20 percent (20%) of the supply (maximum and minimum primary air), return, and exhaust diffusers, registers and grilles. If more than one-fifth of these readings differ from the documented TAB readings by more than 15 percent, then the TAB shall be repeated in entirety. The TAB agency shall pay the extra costs.

.3 The verification testing procedures shall address all operating characteristics of all mechanical equipment and systems, including:

Equipment Checklist	**System Checklist**
Boiler(s)	Boiler(s)
Cooling Tower	Cooling Tower
Rooftop Heating/Cooling Unit(s)	Rooftop Heating/Cooling Unit(s)
Exhaust Fans	Pumps
Pumps	
Controllers/Valves/Dampers	
Relays/Sensors/Transducers	

.3 Pre-Functional Performance Test Checklist:

.1 The Prime Contractor shall be responsible for completing and submitting Pre-Functional Performance Testing.

.2 Pre-Functional Performance Test Checklist:
Perform and submit one (1) Pre-Functional Performance Test for each of the following:
- boiler(s)
- cooling tower
- rooftop heating/cooling units
- pump(s)

.4 Testing, Adjusting, and Balancing (TAB):

.1 Comply with the Specification.

.5 Functional Performance Test Checklist:

.1 The Prime Contractor shall be responsible for completing and submitting Functional Performance Testing.

.2 Functional Performance Test Checklist:
Perform and submit one (1) Functional Performance Test for each of the following:
- boiler(s)
- cooling tower
- rooftop heating/cooling unit(s)
- pump(s)

.6 Training:

.1 General:
Each of the following manufacturers/suppliers shall deliver training to the Owners appointed staff and management who will provide operating services:

.1 Heating hot water boiler

.2 Domestic hot water boiler

.3 Cooling Tower

.4 Water Treatment

.5 Controls

.6 Fire/life safety controls

.2 Each of the manufacturers required to deliver training as part of this Specification shall comply with training schedules, formats and structures designed and provided by the commissioning contractor. The commissioning contractor is the final authority on the substance, content and quality of the instruction to be delivered.

.3 Submittals:

.1 Manufacturer/Suppliers shall submit lesson plans to the commissioning contractor three (3) weeks prior to the scheduled training session.

.2 Each manufacturer/supplier shall revise the lesson plan according to the direction and assistance of the commissioning contractor.

.3 If requested the commissioning contractor, the revised lesson plan shall be re-submitted one (1) week prior to the scheduled training sessions.

.4 Quality Assurance:

.1 The Owner reserves the right to videotape each training session.

.2 Each manufacturer/supplier required to deliver training shall use the following tools to facilitate learning:

.1 Visual aids: use of overhead projectors, flipcharts, videos and/or slides.

.2 Printed material: each participant shall receive a copy of the material to be reviewed at the commencement of each session.

.7 Deficiency Resolution for HVAC Mechanical System Commissioning:

.1 If acceptable performance cannot be achieved, then the necessary corrective measures should be carried out. The Consultant and/or the Prime contractor should issue appropriate directions in this regard.

.2 The allocation of cost of deficiency resolution shall be determined by the Commissioning Team, on a case-by-case basis.

END OF SECTION

Part 1 General

.1 The fire protection drawings are issued for building permit and general information only. It is the responsibility of the successful sprinkler contractor to provide the engineering design criteria indicated for their sprinkler system.

1.2 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 NFPA 13 latest edition, Installation of Sprinkler Systems.

.3 Ontario Fire Code.

.4 Ontario Building Code.

.5 Factory Mutual guidelines.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with general requirements in accordance with NFPA 13, working plans and design requirements.

.2 Shop drawings shall be approved by authority having jurisdiction prior to submission

.3 Submit to consultant for general review and information only.

.4 Submitted drawings shall be reproducible. Do not submit marked up prints.

.5 Drawings shall be in AutoCad format.

1.4 SAMPLES

.1 Submit samples in accordance with general requirements.

.2 Submit samples of following:

- .1 Each type of sprinkler head.
- .2 Signs.

1.5 ENGINEERING DESIGN CRITERIA

.1 Design system in accordance with Ontario Fire Marshall, local authority having jurisdiction, owner's underwriters as required, and NFPA 13, NFPA 20, and NFPA 45 using following parameters:

- .1 To suit occupancy as indicated.
- .2 Pipe size and layout: Hydraulic design.
- .3 Conduct flow and pressure test of water supply in vicinity of project to obtain criteria for bases of design in accordance with NFPA 13. Indicate location and flow on shop drawings.

.4 System zoning as indicated in accordance with NFPA 13.

.5 Provide complete drawings and calculations stamped by a qualified professional engineer registered in the Province of Ontario.

.6 Professional Engineer shall provide on site review and certification for local building code review.

.2 System shall be approved by Ontario Fire Marshall, local authority, and owner's underwriter prior to shop drawing submission.

1.6 COMMISSIONING & INTEGRATED TESTING OF FIRE PROTECTION & LIFE SAFETY SYSTEMS

.1 Sprinkler contractor to perform services with the Fire Commissioning Agent (FCA) to meet their requirements for administration, verification, and final sign-off.

.2 The Fire Commissioning Agent (FCA) is being retained by the electrical contractor, however; this contractor's work to satisfy the FCA requirements shall be included in the tender price.

.3 The sprinkler contractor at a minimum must include for:

.1 Providing FCA all documentation of design and shop drawings.

.2 Provide documents for sequence of operation and maintenance of system.

.3 Movement of all valves and accessories to confirm Alarm/Supervisory/Trouble at the fire panel.

.4 Create flow at all initiating devices to verify detection at the fire panel.

.5 Testing and operation of any fire pumps.

.6 Other items that may be requested by the FCA.

.7 Re-commissioning of any items that may have failed.

.8 Putting the system back into proper operation after tests are completed.

.4 All work to be performed in accordance with NFPA 3 2010 Edition. Special consideration to be given to Figure A3.3.16 (b) for Sequence of Operation Form required to be completed in conjunction with the FCA and submitted to the consultants prior to occupancy.

.5 The work to be performed by this contractor is also described in NFPA 3 table A.5.1.1 as labelled "Construction Stage" and "Occupancy Stage".

1.7 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

1.8 MAINTENANCE MATERIALS

.1 Provide maintenance materials in accordance with general requirements.

.2 Provide spare sprinklers and tools as required by NFPA 13.

1.9 QUALIFICATIONS

.1 Contractor to be specialist in performing work of this section and have at least 3 years successful experience in this size and type of project.

1.10 PERMITS AND FEES

.1 Obtain and pay for all permits, fees, and inspections as required by authority having jurisdiction.

1.11 EQUIPMENT

.1 ULC listed and labeled.

1.12 STORAGE

.1 Store in original packaging with manufacturers' labels and seals intact.

.2 Store in dry secure location.

.3 Damaged material and/or equipment shall be replaced.

Part 2 Products

2.1 PIPE, FITTINGS, AND VALVES

.1 Pipe and Fittings:

- .1 25 mm (1"): Schedule 40 steel pipe with screwed fittings.
- .2 32 mm (1¼") to 50 mm (2"):
  - .1 Schedule 40 steel pipe with screwed fittings or,
  - .2 Schedule 10 steel pipe with roll grooved fittings.
- .3 65 mm (2½") and larger: Schedule 10 steel pipe with roll grooved fittings.

.2 Valves:

- .1 ULC listed for fire protection service.
- .2 Up to NPS 2: bronze, screwed ends, OS&Y gate.
- .3 NPS 2 1/2 and over: cast iron, flanged, or roll grooved ends, indicating butterfly valve.
- .4 Swing check valves.
- .5 Ball drip.

.3 Pipe hangers:

- .1 ULC listed for fire protection services.

.4 End switches:

- .1 Provide on all isolating valves.
- .2 Coordinate voltage and location with fire alarm contractor.

.5 Flow switches:

.1 Provide where indicated and required.

.2 Coordinate voltage and location with fire alarm contractor.

2.2 SPRINKLER HEADS

.1 General: to NFPA 13 and ULC listed for fire services.

.2 Indicate type and location of sprinkler heads on drawings. Co-ordinate sprinkler heads location with other trades.

.3 Locate sprinkler heads in acoustic tile ceiling in center of tile.

.4 Provide sprinkler heads as follows:

.1 Upright bronze: exposed with no ceilings.

.2 Concealed fusible link type brass pendent with ring and cup in ceiling and brass coverplate. Coverplate finish selected by consultant. Concealed heads installed in unsupervised areas (corridors, washrooms) and all classrooms.

.3 White semi-recessed fusible link type brass pendent with adjustable, recessed escutcheon ring and cup. Sprinkler and escutcheon cup. Finish selected by consultant. Semi-recessed heads installed in supervised areas (offices, seminar rooms etc.).

.4 Sprinkler heads with O-ring design shall not be used.

.5 Provide guards on upright sprinkler heads in all storage rooms, in the gymnasium and on heads below 1800 mm AFF.

.5 Provide sprinkler heads under all equipment/ductwork over 1200 mm wide.

2.3 SUPERVISORY SWITCHES

.1 General: to NFPA 13 and ULC listed for fire service.

.2 Valves:

.1 Mechanically attached to valve body, with normally open and normally closed contacts and supervisory capability.

.3 Flow switch type:

.1 With normally open and normally closed contacts and supervisory capability.

.4 Pressure alarm switch:

.1 With normally open and normally closed contacts and supervisory capability.

2.4 FIRE DEPARTMENT CONNECTION

.1 To NFPA 13 and ULC listed, siamese type, location as indicated. Thread specifications to be compatible with local fire department.

.2 Polished chrome plated recessed with identifying sign cast on plate. Threaded metal caps and chains.

2.5 PRESSURE GAUGES

.1 ULC listed

.2 Shall have maximum limit of not less than twice normal working pressure at point where installed.

2.6 SIGNS

.1 Signs for control drain and test valves: to NFPA 13.

.2 Provide exterior signage for Fire Department connection. Location of signage and text shall be to the approval of the local authority having jurisdiction.

2.7 SPARE PARTS CABINET

.1 For storage of maintenance materials, spare sprinkler heads and special tools.

.2 Include all types and temperature ratings of sprinkler heads installed.

.3 Construct to sprinkler head manufacturers standard.

.4 Install where directed on site or next to alarm valve.

2.8 DOUBLE CHECK VALVE ASSEMBLY (DCVA)

.1 The double check backflow preventer shall be ASSE 1015 approved and supplied with full port gate valves. The main body and access covers shall be epoxy coated cast iron (ASTM A126 Class B), the seat ring and check valve shall be cast bronze (ASTM B584), the stem shall be stainless steel (ASTM A276) and the seat disc elastomers shall be EPDM.

.2 The checks shall be accessible for maintenance without removing the device from the line.

.3 Complete with supervisory switches for connection and monitoring by the fire alarm.

.4 Install to manufacturer's requirements and not higher than 1200 mm (4'-0") AFF.

.5 Acceptable materials:

.1 Watts 709 2½" - 10"

.2 Wilkins 950 2" - 10", 350 4" - 6"

.3 Conbraco 40-100 Series

2.9 INSPECTORS TEST CONNECTIONS

.1 Provide where indicated and to requirements of local authority.

.2 Discharge to building exterior to acceptance of consultant.

.3 Provide suitable signage to satisfaction of authority having jurisdiction and consultant.

2.10 DOCUMENTATION

.1 Prepare documentation as indicated.

.2 Provide documentation based on tender documents. Coordinate sprinkler drawings with all trades.

.3 Provide one hard copy and one electronic copy of As Built drawings acceptable to consultant prior to final payment.

2.11 UNIT PRICES

.1 Provide unit prices as follows.

.1 Additional sprinkler head including hangers, 3.6 M piping and two elbows.

.2 Delete sprinkler head including hangers, 3.6 M piping and two elbows.

2.12 UNDERWRITERS APPROVED GATE VALVE

.1 NPS 65 – 350 mm (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 A 126 Class B. Wall thicknesses to ANSI B 16.1 and ULC 262(B).

.4 Bonnet bushing, yoke sleeve: bronze, to FM requirements.

.5 Packing gland: bronze.

.6 Stem: manganese bronze. Diameter to ULC C-262(B).

.7 Stuffing box dimensions, gland bolt diameter: to ULC C 262(B).

.8 Bosses for bypass valve, drain on NPS 100 mm (4") and over.

.9 Disc: solid taper wedge. Up to NPS 80 mm (3"): bronze. NPS 100 mm (4") and over: cast iron with bronze disc rings.

.10 Disc seat ring: self-aligning, Milwood undercut on NPS 80 mm (3").

.11 Pressure rating:

.1 NPS 65 – 300 mm (2-1/2" - 12"): 1.7 MPa (250 psi) CWP

.2 NPS 350 mm (14"): 1.2 MPa (175 psi) CWP

.12 Operator: Handwheel.

Part 3 Execution

3.1 INSTALLATION

.1 Install, inspect, and test to acceptance in accordance with NFPA 13 and FC 403.

.2 Install excess pressure pump across alarm valve in accordance with manufacturer's instructions.

.3 Pipe a bypass complete with indicating valve, between Fire department connection and sprinkler main downstream of DCVA. Bypass shall be sized to allow flow test of system demand as per NFPA 13 forward flow test thru the backflow preventor.

.4 Testing to be witnessed by authority having jurisdiction.

.5 Space hangers and support of sprinkler piping in accordance with N.F.P.A. regulations.

.6 Hydrostatically test systems at 350kPa in excess of normal working pressure, but not less than 1.4 MPA for two hours without loss under supervision of authority having jurisdiction and NFPA requirements.

.7 Provide hydraulic pump, temporary connections and labour required for tests.

.8 Protect exposed work, in accordance with 'Painting' section.

.9 Do not cover or conceal piping accessories or work prior to inspection and approval by authorities having jurisdiction.

.10 Adjust equipment to satisfaction of authority having jurisdiction and consultant.

.11 Protect equipment during painting. Replace damaged and painted components.

.12 Co-ordinate the sprinkler piping and equipment with that of other trades on the job. Mains and branches shall be run so as not to interfere with building's structure, mechanical, or electrical installations. Branch piping above ceilings is to run in joist space or minimum 300 mm above ceiling. Provide drops at head locations only. All exposed piping to run in joist space.

.13 Guarantee that the systems and equipment be installed in accordance with all Local and Provincial by-laws and the rules and regulations of the Insurance Underwriters and the Building Code of Ontario.

.14 Provide a flow test for each system on the remote inspectors test connection using methods approved by the local fire department and local water commission. Report the test results in writing to the consultant.

3.2 WATER FLOW TEST

.1 Provide a flow test to approval of local fire department and local water commission at nearest fire hydrant adjacent to building to determine water flow rate and pressure. Provide written test results with shop drawing submission.

.2 Provide a forward flow test thru the bypass to prove system demand can be provided thru the backflow preventer.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 This section must be read in association with the following: Division 1, Mechanical and Electrical General Requirements Sections.

1.2 REFERENCES

.1 Heating cable must conform to CSA 22.2 No.130-03 (latest edition).

1.3 PRODUCT DATA

.1 Submit product data in accordance with General Requirements Section.

.2 Product data to include:

- .1 Suspension of heating element.
- .2 Physical size.
- .3 Thermostat control if integral.
- .4 Finish.
- .5 kW rating, voltage, phase.
- .6 Cabinet thickness.
- .7 Cabinet surface temperature.
- .8 Mounting methods.
- .9 Auxiliary controls.
- .10 Replacement data for motor element, thermostat, and switch.

1.4 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for all heating system components for incorporation into manual as specified in General Requirements Section.

Part 2 Products

2.1 HEAT TRACING CABLE

.1 The equipment and all related devices specified herein shall be self-regulating SRF. All sizes, types and lengths of heat trace shall be as per the drawings. (Any alternates proposed by the Contractor must have the same operating characteristics to those of SRF self-regulating cable).

Products	8XL	Heat Trace
	XLK-PC	Power connection and end seal kit
	XLK-SET	Splice, End and Tee Kit

8XL (8 watts per feet)

.2 The self-regulating heat trace shall be a self-regulating polymer core with 2-16AWG nickel copper bus wires embedded in core. The polymer core will allow its resistance to vary - thus regulating its power output for temperature response. The entire heater shall be covered by a radiation cross linked modified polyolefin dielectric jacket.

.3 Self-regulating heating cable shall be designed for a useful life of 20 years or more with "power on" continuously, based on the following useful life criteria:

.1 Retention of at least 75% of nominal rated power after 20 years of operation at the maximum published continuous exposure (maintain) temperature.

.2 Retention of at least 90% of nominal rated power after 1,000 hours of operation at the maximum published intermittent exposure temperature.

.4 The heat trace system shall operate on a 120V system.

.5 All power connection, end seal, splice, and tee kits shall be installed in the field with a complete inspection performed by a representative of the product company inspecting all installations prior to power up of the system. (Thus, preventing any installation from being watertight). An inspection and system approval certificate shall be issued by the Contractor guaranteeing the installations.

.6 Heat trace wire and components shall be warranted for against manufacturer defects for a period of 5 years.

2.2 APPROVED MANUFACTURERS

.1 Approved manufacturers shall be:

.1 Chromalox

.2 Raychem

.3 3M

.4 Serge Baril

.5 Heron Cable Ind.

.6 Easy Heat (Emerson)

Part 3 Execution

3.1 INSTALLATION

.1 All heat trace cable shall be fastened to the steel pipes with plastic cable ties or fibreglass tape.

.2 The cable shall run the entire length of each pipe linearly.

.3 Power connection kits shall be installed in a weatherproof surface mounted junction box (suitable to house the connection kit) in the location shown on the drawings.

.4 A manufacturer supplied sign reading "electric traced" shall be installed on the outside of the thermal insulation at intervals of 6 m (20 ft) spacing.

.5 Provide two runs of cable along the length of piping for all piping greater than or equal to 150mm (6" diameter). Run cable along top and bottom of entire pipe length or as per manufacturer's recommendations.

.6 Electrical division shall provide power to junction box adjacent to heat trace circuit power connection. All other wiring shall be by this contractor to the standards of the electrical division.

3.2 TESTS

.1 Following cable installation on pipe, heat trace shall be subject to a test using a 1000V DC MEGGAR prior to and following installation of thermal insulation. Insulation resistance should be 20-1000 MEGA OHMS regardless of length.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Electrical General Requirements Section.

.2 Ensure that heating cable and controls operate correctly.

.3 On fan powered units:

.1 Test cut-out protection when air movement is obstructed.

.2 Test fan delay switch to assure dissipation of heat after element shut down.

.3 Test unit cut-off when fan motor overload protection has operated.

.4 On heat tracing cable, test operation before concealing with insulation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 Canadian General Standards Board (CGSB)

.1 ASTM C553, Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.2 CGSB 51-GP-52Ma, Vapour Barrier Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.3 CAN/CGSB-51.53, Poly (Vinyl Chloride) Jacketing Sheet, for Insulating Pipes, Vessels and Round Ducts.

.3 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.4 American Society for Testing and Materials (ASTM)

.1 ASTM C 335, Test Method for Steady State Heat Transfer Properties of Pipe Insulation.

.2 ASTM C 921, Practice for Determining the Properties Jacketing Materials for Thermal Insulation.

.3 ASTM B 209M, Specification for Aluminum and Aluminum Alloy Sheet and Plate.

.4 ASTM C 411, Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.5 ASTM C 449M, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.6 ASTM C 795, Specification for Thermal Insulation for Use with Austenitic Stainless Steel.

.5 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).

.1 ASHRAE Standard 90.1.

.6 Manufacturer's Trade Associations

.1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with general requirements.

.2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for pipe, fittings, valves and jointing recommendations.

1.3 INSTALLATION INSTRUCTIONS

.1 Submit manufacturer's installation instructions in accordance with general requirements.

.2 Installation instructions to include procedures to be used, installation standards to be achieved.

1.4 QUALIFICATIONS

.1 Installer to be specialist in performing work of this section and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.2 Protect from weather, construction traffic.

.3 Protect against damage from any source.

.4 Store at temperatures and conditions required by manufacturer.

1.6 DEFINITIONS

.1 For purposes of this section:

.1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.

.2 "EXPOSED" - will mean "not concealed" as defined herein.

Part 2 Products

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre as specified herein includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C (75°F) mean temperature when tested in accordance with ASTM C 335.

.3 Type A-1: Rigid moulded mineral fibre with factory applied vapour retarder jacket.

.1 Mineral fibre: to ASTM C553.

.2 Jacket: to CGSB 51-GP-52 Ma.

.3 Maximum "k" factor: to ASTM C553.

.4 Type A-2: Mineral fibre faced with factory applied vapour retarder jacket.

.1 Mineral fibre: to ASTM C553.

.2 Jacket: to CGSB 51-GP-52 Ma.

.3 Maximum "k" factor: to ASTM C553.

.5 Materials:

.1 All materials must be supplied by the same manufacturer.

.2 Acceptable Materials:

.1 Fibreglass Canada

.2 Knauf

.3 Manson

.4 Pittsburgh Corning

2.3 INSULATION SECUREMENT

.1 Tape: Self-adhesive, aluminum, reinforced, 50 mm (2") wide minimum.

.2 Contact adhesive: Quick setting.

.3 Canvas adhesive: Washable.

2.4 CEMENT

.1 Thermal insulating and finishing cement:

.1 To ASTM C553.

.2 Hydraulic setting or Air drying on mineral wool, to ASTM C 449M.

2.5 VAPOUR RETARDER LAP ADHESIVE

.1 Water based, fire retardant type, compatible with insulation.

2.6 INDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

2.7 JACKETS

.1 Polyvinyl Chloride (PVC):

.1 One-piece moulded type [and sheet] to CAN/CGSB-51.53 with pre-formed shapes as required.

.2 Colours: white.

.3 Minimum service temperatures: -20°C (-4°F).

.4 Maximum service temperature: 65°C (150°F).

.5 Moisture vapour transmission: 0.02 perm.

.6 Fastenings:

.1 Use solvent weld adhesive compatible with insulation to seal laps and joints.

.2 Tacks.

.3 Pressure sensitive vinyl tape of matching colour.

2.8 CAULKING FOR JACKETS

.1 Caulking: Silicone clear caulking.

Part 3 Execution

3.1 PRE-INSTALLATION REQUIREMENT

.1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.

.2 Surfaces to be clean, dry, free from foreign material.

3.2 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturers' instructions and this specification.

.3 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Hangers, supports to be outside vapour retarder jacket.

.4 Supports, Hangers:

.1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.3 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

.1 Application: At expansion joints, valves, primary flow measuring elements, flanges, and unions at equipment.

.2 Design: To permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.

.3 Insulation:

.1 Insulation, fastenings and finishes: same as system.

.2 Jacket: As per adjacent insulation.

3.4 INSTALLATION OF ELASTOMERIC INSULATION

.1 Insulation to remain dry at all times. Overlaps to manufacturers instructions. Ensure tight joints.

.2 Provide vapour retarder as recommended by manufacturer.

3.5 PIPING INSULATION SCHEDULES

.1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.

.2 Install insulator and jackets to applicable TIAC codes.

.3 Insulate ends of capped piping with type and thickness indicated for capped service.

.4 Thickness of insulation to be as listed in following table.

.1 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

.2 All storm piping including all vertical and horizontal piping shall be insulated.

Application	Type	Pipe sizes through (NPS) and insulation thickness mm (")				
		to 25 (1")	32 (1¼") 40 (1½")	50 (2") 80 (3")	105 (4") 150 (6")	200 (8") & over
Domestic Water Piping	A-1	25 (1")	25 (1")	40 (1½")	40 (1½")	40 (1½")
Storm Piping	A-1	25 (1")	25 (1")	25 (1")	25 (1")	25 (1")
Cooling Coil cond. Drain	A-1	25 (1")	25(1")	25 (1")	25 (1")	25 (1")
Roof Drain sumps	A-2	25 (1")	25 (1")	25 (1")	25 (1")	25 (1")
Horizontal Cast Iron Sanitary Piping	A-1	N/A	N/A	25 (1")	25 (1")	25 (1")
Trap Primer Piping	A-1	15 (½")	15 (½")	25 (1")		

.5 Finishes: Conform to the following table:

Application	**Piping**	**Valves & Fittings**
Exposed indoors	PVC	PVC
Exposed in mech. rooms	PVC	PVC
Concealed indoors	N/A	PVC

.6 Connection: To appropriate TIAC code.

.7 Finish attachments: SS bands, @ 150 mm (6") oc. seals: closed.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ANSI/AWWA B301, Liquid Chlorine.

.3 ANSI/AWWA C104/A21.4, Cement-Mortar Lining for Ductile Iron Pipe and Fittings for Water.

.4 ANSI/AWWA C205, Cement Mortar Protective Lining and Coating for Steel Water Pipe - 4 inch and larger - Shop Applied.

.5 ANSI/AWWA C207, Steel Pipe Flanges for Waterworks Service, 4 inch through 144 inch.

.6 ANSI/AWWA C500, Metal-seated Gate Valves for Water Supply Service.

.7 ANSI/AWWA C600, Installation of Ductile Iron Water Mains, and their Appurtenances.

.8 ANSI/AWWA C800, Underground Service Line Valves and Fittings.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with general division.

1.3 RECORD DRAWINGS

.1 Provide Data to produce record drawings, including directions for operating valves, list of equipment required to operate valves, details of pipe material, location of air and vacuum release valves, hydrant details, maintenance, and operating instructions in accordance with Submittals Section.

Part 2 Products

2.1 PIPES, JOINTS AND FITTINGS

.1 Ductile iron pipe: to ANSI/AWWA C151/A21.51, class 52 cement mortar lined to ANSI/AWWA C104/A21.4.

.1 Acceptable material: HYPROTEC

.2 P.V.C. pipe: to AWWA C900, CSA B137.2, ASTM, class 150 P.V.C. (DR18).

.1 Acceptable material: Blue Brute or Equal.

.3 Joints and fittings for ductile iron pipe:

.1 Joints:

.1 Rubber gasket for mechanical pipe joints: to ANSI/AWWA C111/A21.11.

.2 Rubber gasket for flange pipe joints 1.6 mm thick: to ANSI/AWWA C111/A21.11.

.3 Bolts, nuts, hex head with washers: to ASTM A307, heavy series.

.4 Ensure electrical conductivity across joints.

.2 Fittings:

.1 Mechanical joint cast iron and ductile iron fittings NPS 3 and larger: to ANSI/AWWA C110/A21.10.

.2 Flanged cast iron fittings NPS 3 and larger: to ANSI/AWWA C110/A21.10.

2.2 FITTINGS AND SPECIALTIES

.1 All fittings and specials shall be installed where shown or where ordered by the Engineer. Fittings subject to lateral thrust or "blow-out" shall be properly supported by cast-in-place thrust blocks of 25 Mpa concrete placed against undisturbed earth in accordance with the contract drawings. Where necessary, when working in unstable ground conditions or when installing vertical bends, the contractor shall use anchor blocks with anchor rods, or tie rods connected to the closest solid joint, to assure proper support against "blow-out".

2.3 PIPE BEDDING AND SURROUND MATERIAL

.1 Granular material to Aggregates: General and following requirements:

.1 Crushed or screened stone, gravel or sand.

.2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117 Sieve sizes to CAN/CGSB-8.1.

.2 Concrete mixes and materials required for bedding cradles, encasement, supports, thrust blocks: to Cast-in-Place Concrete Section.

2.4 BACKFILL MATERIAL

.1 As indicated.

.2 Type 3, in accordance with Excavating, Trenching and Backfilling.

2.5 PIPE DISINFECTION

.1 Liquid chlorine to ANSI/AWWA B301 to disinfect water mains.

Part 3 Execution

3.1 PREPARATION

.1 Clean pipes, fittings, valves, hydrants, and appurtenances of accumulated debris and water before installation. Carefully inspect materials for defects. Remove defective materials from site.

3.2 TRENCHING

.1 Do trenching work in accordance with Excavating Trenching and Backfilling Section.

.2 Trench depth to provide cover over pipe of not less than1.85 m from finished grade.

3.3 GRANULAR BEDDING

.1 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth of 150 mm below bottom of pipe to depth as indicated.

.2 Do not place material in frozen condition.

.3 Shape bed true to grade to provide continuous uniform bearing surface for pipe.

.4 Shape transverse depressions in bedding as required to suit joints.

.5 Compact each layer full width of bed to at least 95% of corrected maximum dry density and 95% maximum density to ASTM D698.

.6 Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Excavating Trenching and Backfilling Section.

3.4 PIPE INSTALLATION

.1 **Connect to domestic water and fire main piping installed by site services contractor.** Terminate building water service inside building and 450 mm above finish floor. Install coupling necessary for connection to building plumbing. If plumbing is already installed, make connection, otherwise cap or seal end of pipe.

.2 Lay pipes to ANSI/AWWA C600 and ANSI/AWWA Manual of Practice and manufacturer's standard instructions and specifications. Do not use blocks.

.3 Join pipes in accordance with ANSI/AWWA C600 ANSI/AWWA C602 ANSI/AWWA C206 AWWA Manual of Practice and manufacturer's recommendations.

.4 Handle pipe by methods recommended by pipe manufacturer. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.

.5 Lay pipes on prepared bed, true to line and grade. Ensure barrel of each pipe is in contact with shaped bed throughout its full length. Take up and replace defective pipe. Correct pipe, which is not in true alignment or grade or pipe, which shows differential settlement after installation greater than 10 mm.

.6 Face socket ends of pipe in direction of laying. For mains on a grade of 2% or greater, face socket ends up-grade.

.7 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.

.8 Keep jointing materials and installed pipe free of dirt and water and other foreign materials. Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.9 Position and join pipes with equipment and methods approved by Consultant.

.10 Cut pipes in an approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.

.11 Align pipes carefully before jointing.

.12 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.13 Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed or contaminated shall be removed, cleaned, lubricated, and replaced before jointing is attempted again.

.14 Complete each joint before laying next length of pipe.

.15 Minimize deflection after joint has been made.

.16 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.

.17 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by Engineer.

.18 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.

.19 Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.

.20 Do not lay pipe on frozen bedding.

.21 Do hydrostatic and leakage test and have results approved by Consultant before surrounding and covering joints and fittings with granular material.

.22 Backfill remainder of trench.

3.5 THRUST BLOCKS

.1 Install thrust blocks to OPS standards for roads and municipal services.

.2 Concrete shall be placed to within 50 mm of the face of the bell.

.3 Bond breaker shall be used between the fittings and concrete.

3.6 HYDROSTATIC AND LEAKAGE TESTING

.1 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.

.2 Notify Consultant at least 24 h in advance of all proposed tests. Perform tests in presence of Consultant.

.3 Where any section of system is provided with concrete thrust blocks, conduct tests at least 5 days after placing concrete or 2 days if high early strength concrete is used.

.4 Upon completion of pipe laying and after Consultant has inspected work in place, surround and cover pipes between joints with approved granular material placed to dimensions indicated or directed by Consultant.

.5 Leave hydrants, valves, joints, and fittings exposed.

.6 Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied.

.7 Open valves.

.8 Expel air from main by slowly filling main with potable water. Install corporation stops at high points in main where no air-vacuum release valves are installed. Remove stops after satisfactory completion of test and seal holes with plugs.

.9 Thoroughly examine exposed parts and correct for leakage as necessary.

.10 Examine exposed pipe, joints, fittings, and appurtenances while system is under pressure.

.11 Remove joints, fittings and appurtenances found defective and replace with new sound material and make watertight.

.12 Do not exceed allowable leakage of 0.03 L/mm diameter per 300 m of pipe, including lateral connections, per hour.

.13 Locate and repair defects if leakage is greater than amount specified.

.14 Repeat test until leakage is within specified allowance for full length of watermain.

3.7 PIPE SURROUND

.1 Upon completion of pipe laying and after Consultant has inspected work in place, surround and cover pipes as indicated.

.2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.

.3 Place layers uniformly and simultaneously on each side of pipe.

.4 Do not place material in frozen condition.

.5 Compact each layer from pipe invert to mid height of pipe to at least 95% of corrected maximum dry density.

.6 Compact each layer from mid height of pipe to underside of backfill to at least 90% of corrected maximum dry density.

3.8 BACKFILL

.1 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.

.2 Do not place backfill in frozen condition.

.3 Under paving and walks, compact backfill to at least 95% corrected maximum dry density. In other areas, compact to at least 90% corrected maximum dry density.

3.9 FLUSHING AND DISINFECTING

.1 Flush water mains through available outlets with a sufficient flow of potable water to produce a velocity of 1.5 m/s, within pipe for 10 min, or until foreign materials have been removed and flushed water is clear with backflow protection.

.2 Flushing flows shall be as follows:

Pipe Size NPS	Flow (L/s) Minimum

6 and below	38
8	75
10	115
12	150

.3 Provide connections and pumps for flushing as required.

.4 Open and close valves, hydrants and service connections to ensure thorough flushing.

.5 When flushing has been completed to satisfaction of Consultant, introduce a strong solution of chlorine as approved by authority having jurisdiction into watermain and ensure that it is distributed throughout entire system.

.6 Rate of chlorine application to be proportional to rate of water entering pipe.

.7 Chlorine application to be close to point of filling water main and to occur at same time.

.8 Operate valves, hydrants and appurtenances while main contains chlorine solution.

.9 Flush line to remove chlorine solution after 24 h.

.10 Measure chlorine residuals at extreme end of pipe-line being tested.

.11 Perform bacteriological tests on water main, after chlorine solution has been flushed out. Take samples daily for minimum of two days. Should contamination remain or recur during this period, repeat disinfecting procedure. Specialist contractor shall submit certified copy of test results.

.12 Take water samples at hydrants and service connections, in suitable sequence, to test for chlorine residual.

.13 After adequate chlorine residual not less than 50 ppm has been obtained leave system charged with chlorine solution for 24 h. After 24 h, further samples shall be taken to ensure that there is still not less than 10 ppm of chlorine residual remaining throughout system.

3.10 SURFACE RESTORATION

.1 After installing and backfilling over water mains, restore surface including all roads, curbs, sidewalks, landscaped areas etc. to original condition and to standards of local authority having jurisdiction.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ANSI/ASME B16.15, Cast Copper Alloy Threaded Fittings, Classes 125 and 250.

.3 ANSI B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.

.4 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

.5 ANSI B16.24, Cast Copper Alloy, Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500, and 2500.

.6 ASTM B88M, Specification for Seamless Copper Water Tube (Metric).

.7 MSS-SP-70, Cast Iron Gate Valves, Flanged and Threaded Ends.

.8 MSS-SP-71, Cast Iron Swing Check Valves, Flanged and Threaded Ends.

.9 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.

1.2 SHOP DRAWINGS

.1 Submit shop drawing data in accordance with general requirements.

1.3 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

Part 2 Products

2.1 PIPING

.1 Domestic hot, cold and recirculation systems, within building.

.1 Above ground: copper tube, hard drawn, type L: to ASTM B88M.

.2 Buried or embedded: copper tube, soft annealed, type K: to ASTM B88M, in long lengths and with no buried joints.

2.2 FITTINGS

.1 Bronze pipe flanges and flanged fittings, Class 150 and 300: to ANSI B16.24.

.2 Cast bronze threaded fittings, Class 125 and 250: to ANSI/ASME B16.15.

.3 Cast copper, solder type: to ANSI B16.18.

.4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.

.5 Tee drill NPS 25 mm (1") and larger.

NPS 80 mm (3") and larger: roll grooved to CSA B242.

2.3 JOINTS

.1 Solder: 95/5.

.2 Teflon tape: for threaded joints.

.3 Dielectric connections between dissimilar metals: dielectric fitting to ASTM F1545, complete with thermoplastic liner.

.4 Tee drill fittings shall be brazed with silver solder, 45% Ag - 15% Cu or copper phosphorous, 95% Cu, 5% P and non-corrosive flux.

.5 Rubber gaskets, 1.5 mm (16 gauge) thick: to ANSI/AWWA C111/A21.11.

.6 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.

.7 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM flush seal gasket.

2.4 VALVES

.1 All valves shall be of commercial grade and of same manufacturer, Lead-Free.

.2 Acceptable materials:

.1 Milwaukee

.2 Crane

.3 Kitz

2.5 BALL VALVES

.1 All valves shall be of commercial grade and of same manufacturer.

.2 NPS 80 mm (3") and under, soldered:

.1 To ANSI B16.18, Class 150.

.2 Bronze body, full port stainless steel ball, PTFE Teflon adjustable packing, brass gland and PTFE Teflon seat, steel lever handle, with NPT to copper adaptors.

2.6 GATE VALVES

.1 NPS 50 mm (2") and under, soldered:

.1 Rising stem: to MSS SP-80, Class 125, 860 kPa (125 psi), bronze body, screw-in bonnet, solid wedge disc.

.2 NPS 50 mm (2") and under, screwed:

.1 Rising stem: to MSS SP-80, Class 125, 860 kPa (125 psi), bronze body, screw-in bonnet, solid wedge disc.

.3 NPS 65 mm (2-1/2") and over, in mechanical rooms, flanged:

.1 Rising stem: to MSS SP-70, Class 125, 860 kPa (125 psi), flat flange faces, cast-iron body, OS&Y bronze trim.

.4 NPS 65 mm (2-1/2") and over, other than mechanical rooms, flanged:

.1 Non-rising stem: to MSS SP-70, Class 125, 860 kPa (125 psi), flat flange faces, cast-iron body, bronze trim, bolted bonnet.

2.7 GLOBE VALVES

.1 NPS 50 mm (2") and under, soldered:

.1 To MSS SP-80, Class 125, 860 kPa (125 psi), bronze body, renewable composition disc, screwed over bonnet.

.2 Lockshield handles: as indicated.

.2 NPS 50 mm (2") and under, screwed:

.1 To MSS SP-80, Class 150, 1.03 MPa (150 psi), bronze body, screwed over bonnet, renewable composition disc.

.2 Lockshield handles: as indicated.

2.8 SWING CHECK VALVES

.1 NPS 50 mm (2") and under, soldered:

.1 To MSS SP-80, Class 125, 860 kPa (125 psi), bronze body, bronze swing disc, screw in cap, regrindable seat.

.2 NPS 50 mm (2") and under, screwed:

.1 To MSS SP-80, Class 125, 860 kPa (125 psi), bronze body, bronze swing disc, screw in cap, regrindable seat.

.3 NPS 65 mm (2 1/2") and over, flanged:

.1 To MSS SP-71, Class 125, 860 kPa (125 psi), cast iron body, flat flange faces, [regrind] [renewable] seat, bronze disc, bolted cap.

2.9 BUTTERFLY VALVES

.1 Provide copper tubing grooved valves where indicated.

.2 NPS 100 mm (4") and over:

.1 Bronze body per CDA-836.

.2 EPDM/Bronze disk and trim.

.3 Two position handle.

.3 Acceptable material:

.1 Victaulic Series 608

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with Provincial Plumbing Code and local authority having jurisdiction.

.2 Cut square, ream and clean tubing and tube ends, clean recesses of fittings and assemble without binding.

.3 Assemble all piping using fittings manufactured to ANSI standards.

.4 Install tubing close to building structure to minimize furring, conserve headroom and space. Group exposed piping and run parallel to walls.

.5 Install CWS piping below and away from HWS and HWC and all other hot piping so as to maintain temperature of cold water as low as possible.

.6 Connect to fixtures and equipment in accordance with manufacturers instructions unless otherwise indicated.

.7 Bent tubing is not acceptable.

3.2 VALVES

.1 Isolate equipment, fixtures and branches with ball valves.

.2 Balance recirculation system using lockshield globe valves. Mark settings and record on record drawings on completion.

3.3 PRESSURE TESTS

.1 Conform to requirements of general requirements.

.2 Test pressure: greater of 1½ times maximum system operating pressure or 860 kPa (125 psi).

3.4 FLUSHING AND DISINFECTING

.1 Maintain testable RP backflow preventor between municipal water and new plumbing system.

.2 Ensure a minimum of 90% of plumbing fixtures are installed.

.3 Flush water mains through available outlets with a sufficient flow of potable water to produce a velocity of 1.5 m/s, within pipe for 10 min, or until foreign materials have been removed and flushed water is clear with backflow protection.

.4 Provide connections and pumps for flushing as required.

.5 Open and close valves and operate fixtures to ensure thorough flushing.

.6 When flushing has been complete to satisfaction of Consultant introduce a strong solution of Chlorine into water system and ensure that it is distributed throughout entire system.

.7 Rate of chlorine application to be proportional to rate of water entering pipe.

.8 Chlorine injection to be close to point of filling water main or at building water service and to occur simultaneously.

.9 Confirm adequate chlorine residual not less than 50 ppm has been obtained, leave system charged with chlorine solution for 24 h. After 24 h, further samples shall be taken to ensure that there is still not less than 10 ppm of chlorine residual remaining throughout system.

.10 Upon 10 ppm confirmation and 24 hr elapsed time flush line to remove chlorine solution.

.11 Measure chlorine residuals at extreme end of pipeline being tested.

.12 Perform bacteriological tests on water main, after chlorine solution has been flushed out. Take samples daily for minimum of two days. Should contamination remain or reoccur during this period, repeat disinfecting procedure. Specialist contractor shall submit certified copy of test results.

.13 Take water samples at remote fixtures and service connections.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 CAN/CSA – B64.10/B64.10.1 – Selection and Installation of Backflow Preventers/Maintenance and Field Testing of Backflow Preventers.

1.2 SUBMITTALS

.1 Complete the required cross connection survey form and submit to authority having jurisdiction. Provide a copy to the consultant.

.2 Incorporate data into maintenance manual.

Part 2 Products

2.1 GENERAL

.1 Provide backflow prevention devices in all new and existing fixtures and equipment as indicated and as required by the authority having jurisdiction.

.2 Acceptable materials:

.1 Watts

.2 Wilkins

Part 3 Execution

3.1 INSTALLATION

.1 Install devices in accordance with acceptable engineering practices, the requirements of the Ontario Building Code and the requirements of the authority having jurisdiction.

3.2 TESTING

.1 Provide testing to requirements of authority having jurisdiction.

.2 Provide copy of test report for each device in the maintenance manual.

.3 Provide tag on each device.

.4 Provide a list of devices complete with tag number on a framed chart. Locate chart in Water Entrance Room.

.5 Provide additional testing on all devices at one year warranty period. Provide documentation to owner and consultant.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASTM A126, Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.

.3 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.

.4 PDI-WH201, Water Hammer Arresters.

.5 CAN/CSA-B64 Series, Backflow Preventers and Vacuum Breakers.

1.2 SUBMITTALS

.1 Submit shop drawings and product data in accordance with general requirements.

.2 For shop drawings, indicate dimensions, construction details and materials.

.3 For product data, indicate dimensions, construction details and materials for all items specified herein.

1.3 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

.2 Data to include:

.1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year, and capacity.

.2 Details of operation, servicing, and maintenance.

.3 Recommended spare parts list.

Part 2 Products

2.1 NON-FREEZE WALL HYDRANTS (RECESSED, ENCASED) (HB-1)

.1 Recessed, encased, all bronze construction, anti-syphon, non freeze wall hydrant with non-turning operating rod, free floating compression valve, integral vacuum breaker, self draining, replaceable seat and seat washer. Nickel bronze box and hinged cover with operating key lock. NPS 20 mm (¾") hose outlet.

.2 Acceptable materials:

.1 Zurn Z-1300

.2 Mifab MHY-20

.3 Ancon HY-725

.4 Contour C7100

2.2 WATER HAMMER ARRESTORS

.1 Copper construction, bellows type: to PDI-WH 201.

.2 Acceptable material:

.1 Zurn Z-1700

.2 Mifab MWH-100

.3 Ancon No. 15

2.3 BACK FLOW PREVENTORS

.1 The backflow preventor shall prevent backflow by either backpressure or backsiphonage from a cross-connection between potable water lines and substances that are objectionable.

.2 To CAN/CSA-B64.

.3 Application: as indicated.

.4 Reduced pressure principle type up to 50 mm (2") (RP):
Rated to 180°F and supplied with full port ball valves. The main body and access covers shall be bronze (ASTM B584), the seat ring and all internal polymers shall be NSF® Listed Noryl™ and the seat disc elastomers shall be SILICONE. The first and second check shall be orientated at a 45° angle up-wards and accessible for maintenance without removing the relief valve. Supplied with an air gap adapter.

.1 Acceptable materials:

.1 Watts 009 ½" - 2"

.2 Wilkins 975 XL ½" - 2"

.3 Conbraco 40-200 Series

.5 Reduced pressure principle type from 65 mm (2½") to 250 mm (10") (RP):

The reduced pressure principle backflow preventer shall be ASSE 1013 approved, and supplied with full port gate valves. The main body and access covers shall be epoxy coated cast iron (ASTM A126 Class B), the seat ring and check valve shall be cast bronze (ASTM B584), the stem shall be stainless steel (ASTM A276) and the seat disc elastomers shall be EPDM. The first and second checks shall be accessible for maintenance without removing the relief valve or the entire device from the line.
If installed indoors, the installation shall be supplied with an air gap adapter, strainer, and integral monitor switch.

.1 Acceptable materials:

.1 Watts 909 2½" - 10"

.2 Wilkins 975 2½"- 10" or 375 4"- 6"

.3 Conbraco 40-200 Series

.6 Double check valve assembly (DCVA):
The double check type backflow preventer shall be ASSE 1015 approved and supplied with full port ball valves. The main body and access covers shall be bronze (ASTM B584), the seat rings and all internal polymers shall be NSF® Listed Noryl™ and the seat disc elastomers shall be silicone. The first and second checks shall be accessible for maintenance without removing the device from the line.

.1 Acceptable materials:

.1 Watts 007 ½"- 2"

.2 Wilkins 950XL ¾ "- 2"

.3 Conbraco 40-100 Series

.7 Double check valve assembly (DCVA)
The double check backflow preventer shall be ASSE 1015 approved and supplied with full port gate valves. The main body and access covers shall be epoxy coated cast iron (ASTM A126 Class B), the seat ring and check valve shall be cast bronze (ASTM B584), the stem shall be stainless steel (ASTM A276) and the seat disc elastomers shall be EPDM. The checks shall be accessible for maintenance without removing the device from the line.

.1 Acceptable materials:

.1 Watts 709 2½" - 10"

.2 Wilkins 950 2" - 10", 350 4" - 6"

.3 Conbraco 40-100 Series

.8 Back flow preventor with intermediate atmospheric vent:

.1 Acceptable material:

.1 Watts Series 9D

.2 Wilkins 750

.3 Conbraco 40-4A Series

2.4 VACUUM BREAKERS

.1 To CAN/CSA-B64 Series.

.2 Atmospheric vacuum breaker (A-VB):

.1 Acceptable materials:

.1 Watts 288A

.2 Conbraco 38-103 Series

.3 Wilkins 35

.3 Hose connection vacuum breaker (HCVB):

.1 Acceptable materials:

.1 Watts Series 8

.2 Conbraco 38-304-AS

.3 Wilkins BFP-8

.4 Laboratory faucet intermediate vacuum breaker (LFVB):

.1 Acceptable materials:

.1 Watts N-LF9

.2 Conbraco 38-502-01

2.5 PRESSURE REGULATORS

.1 Capacity: as indicated.

.1 Inlet pressure: 1034 kPa (150 psi).

.2 Outlet pressure: 41 kPa (5.9 psi).

.2 Up to NPS 40 mm (1 1/2") bronze bodies, screwed: to ASTM B62.

.1 Acceptable material:

.1 Watts Series 25AUB (1/2" - 2")

.3 NPS 50 mm (2") and over, semi-steel bodies, Class 125, flanged: to ASTM A126, Class [B].

.1 Acceptable materials:

.1 Watts PV-10

.2 Conbraco 36 Series

.4 Semi-steel spring chambers with bronze trim.

.1 Acceptable materials:

.1 Watts PV-10

.2 Conbraco 36 Series

2.6 HOSE BIBBS AND SEDIMENT FAUCETS

.1 Bronze construction complete with integral back flow preventer, hose thread spout, replaceable composition disc, and chrome plated in finished areas.

.1 Acceptable materials:

.1 Watts BD series

.2 Emco

.3 Chicago

.4 Zurn

2.7 WATER MAKE-UP ASSEMBLY

.1 Complete with backflow preventor, pressure gauge on inlet and outlet, pressure reducing valve to CSA B356, pressure relief valve on low pressure side and gate valves on inlet and outlet.

.1 Acceptable materials:

.1 Watts

.2 Conbraco

2.8 WATER METERS

.1 Pay all fees to receive main water meter from region/local authority

.2 Provide Tricon E3 transmitter for future BAS connection.

2.9 WATER METERS (BOILER & DAYCARE CHECK METERS)

.1 To latest AWWA Standard C700-77

.2 Direct reading registrar, cast bronze main case, positive displacement. Provide meter suitable for future BAS connection.

.3 Provide Tricon E3 transmitter for future BAS connection.

.4 Acceptable material:

.1 Neptune t-10

2.10 STRAINERS

.1 860 kPa (125 psi), Y type with 20 mm (3/4") mesh, bronze or stainless steel removable screen.

.2 NPS 50 mm (2") and under, bronze body, screwed ends, with brass cap.

.1 Acceptable materials:

.1 Watts Series 777SI

.2 Crane/Powers

.3 Colton 125 YTB

.4 Wilkins S Series

.3 NPS 65 mm (2½") and over, cast iron body, flanged ends, with bolted cap.

.1 Acceptable materials:

.1 Watts 77F-D (77F-D-FDA for water service)

.2 Crane/Powers

.3 Colton 125 YTB

.4 Wilkins FS Series

2.11 WATER FILTERS

.1 Five (5) micron filter assembly for taste/odour and dirt/rust.

.2 The unit shall be constructed of molded transparent plastic housing and a bottom pressure relief for cartridge change.

.3 Install as per manufacturer's recommendations

.4 Supply a spare set of cartridges.

.5 Acceptable material:

.1 Aqua Puro AP11B

2.12 SOLENOID VALVES

.1 Two (2) way normally closed all bronze construction.

.2 Voltage shall be suitable for controlling function.

.3 Acceptable material:

.1 Asco

2.13 MECHANICAL FLOAT VALVE

.1 Heavy duty mechanical float valve all bronze construction, serrated arm for easy adjustment, lever action, replaceable seals.

.2 Heavy duty, corrosion resistant, plastic float suitable for up to 140°F.

.3 Provide all necessary accessories for complete installation.

.4 Acceptable manufacturers:

.1 Watts Series 500 (1/2”), 750 (3/4”) and PX float.

.2 Wilkins

.3 Conbraco

2.14 OWNER SUPPLIED EQUIPMENT

.1 The mechanical contractor shall supply and install all water, gas, condensate and sanitary piping to the owner supplied equipment. Connection to equipment shall be by this contractor.

.2 Provide flexible riser stops to all sinks and ball valves to all other equipment.

.3 Provide backflow preventors on equipment required by the local plumbing inspector.

.4 Provide flexible gas piping to all gas equipment.

.5 All equipment in store equipment schedule will be supplied and set in place by Mechanical Contractor unless otherwise noted.

.6 Coordinate all rough-ins and connection with the supplier on site.

.7 Owner supplied equipment includes existing relocated equipment.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with provincial codes, and local authority having jurisdiction.

.2 Install in accordance with manufacturer's instructions and as specified.

3.2 NON-FREEZE WALL HYDRANTS

.1 Install 600 mm (24") above finished grade unless otherwise indicated.

3.3 WATER HAMMER ARRESTORS

.1 Install on branch supplies to each fixture or group of fixtures and where indicated.

3.4 BACK FLOW PREVENTORS

.1 Install in accordance with CAN/CSA-B64 Series, where indicated and elsewhere as required by code.

.2 Pipe discharge to terminate over nearest drain and or service sink.

.3 Provide test results in manual and leave tag with test results on device.

3.5 HOSE BIBBS AND SEDIMENT FAUCETS

.1 Install at bottom of all risers, at low points to drain systems, and as indicated.

3.6 STRAINERS

.1 Install with sufficient room to remove basket.

.2 Strainer size to match pipe size.

3.7 WATER METERS

.1 Install water meter provided by local water authority **and/or this contractor.**

.2 Install water meter as indicated.

.3 Install remote readout to acceptance of local water authority and as indicated.

.4 Install check meter(s) as indicated.

3.8 WATER MAKE-UP ASSEMBLY

.1 Install with valved bypass.

.2 Pipe discharge from relief valve to nearest floor drain.

3.9 COMMISSIONING

.1 In context of this paragraph, "verify" to include "demonstrate" to Consultant.

.2 Timing: commission only after start-up deficiencies rectified.

.3 Access doors: verify size and location relative to items to be services.

.4 Adjust to suit site conditions, including, but not necessarily limited to, following:

.1 Non-freeze wall, ground hydrants:

.1 Verify complete drainage.

.2 Verify operation of vacuum breaker.

.2 Water hammer arrestors:

.1 Verify accessibility.

.3 Backflow preventors, vacuum breakers:

.1 Verify installation of correct type to suit application.

.2 Adjust as necessary to ensure proper operation.

.3 Verify visibility of discharge.

.4 Pressure regulators:

.1 Adjust settings to suit installed locations, required flow rates.

.5 Hose bibbs, sediment faucets:

.1 Verify operation.

.6 Water make-up assembly:

.1 Verify operation.

.7 Water meters:

.1 Verify operation.

.8 Pipeline strainers:

.1 Verify accessibility of basket.

.2 Clean out during commissioning until system clean.

.5 Commissioning reports:

.1 Record all results on approved report forms.

.2 Include signature of tester and supervisor.

.3 To be countersigned by Consultant.

.6 Verification:

.1 Notify Consultant 48 h before commencing tests.

.2 All tests and procedures to be witnessed by Consultant.

.3 All reported results subject to verification by consultant.

.7 Training:

.1 Train O&M personnel in start-up, operation, monitoring, servicing, maintenance and shut-down procedures.

.8 Demonstrations:

.1 Demonstrate full compliance with Design Criteria.

.2 Demonstrations also to show completeness of O&M personnel training.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASTM C117, Test Method for Material Finer Than 0.075 mm (3 mil) Sieve in Mineral Aggregates by Washing.

.3 ASTM C136, Method for Sieve Analysis of Fine and Coarse Aggregates.

.4 ASTM D698, Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m3).

.5 ASTM D2680, Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.

.6 ASTM D3034, Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

.7 CAN/CSA-B182.1, Plastic Drain and Sewer Pipe and Pipe Fittings.

.8 CAN/CSA-B182.2, PVC Sewer Pipe and Fittings (PSM Type).

.9 CSA B182.11, Standard Practice for the Installation of Thermoplastic Drain and Sewer, Storm Pipe and Pipe Fittings.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Submittals Section.

1.3 MATERIAL CERTIFICATION

.1 Submit manufacturers test data and certification at least 2 weeks prior to commencing work.

Part 2 Products

2.1 PLASTIC PIPE

.1 Type PSM Polyvinyl Chloride (PVC): to ASTM D3034 or CAN/CSA-B182.2.

- .1 Standard Dimensional Ratio SDR 28 35 41.
- .2 Locked in gasket and integral bell system.
- .3 Nominal lengths: 6 m (20').

2.2 CEMENT MORTAR

.1 Portland cement: to CAN/CSA-A300 Series, normal type 10.

.2 Mix mortar one part by volume of cement to two parts of clean, sharp sand mixed dry. Add only sufficient water after mixing to give optimum consistency for placement. Do not use additives.

2.3 PIPE BEDDING AND SURROUND MATERIALS

.1 Granular material to Excavating, Trenching, and Backfilling Section: and following requirements:

.1 Crushed or screened stone, gravel or sand.

.2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117]. Sieve sizes to CAN/CGSB-8.1.

	Stone/Gravel	Gravel/Sand
200 mm (8")	-	-
75 mm (3")	-	-
50 mm (2")	-	-
40 mm (1 1/2")	-	-
25 mm (1")	100	-
20 mm (3/4")	-	-
15 mm (1/2")	65-90	100
10 mm (3/8")	-	-
5 mm (3/16")	35-55	50-100
2.00 mm (80 mil)	-	30-90
0.425 mm (16 mil)	10-25	10-50
0.180 mm (7 mil)	-	-
0.075 mm (3 mil)	0-8	0-10

.2 Concrete mixes and materials for cradles, encasement, and supports: to Cast-in-Place Concrete Section.

2.4 BACKFILL MATERIAL

.1 As indicated.

.2 Type 3, in accordance with Excavating, Trenching and Backfilling Section.

.3 Unshrinkable fill: to Excavating, Trenching and Backfilling Section.

2.5 FORCED MAINS

.1 Polyvinyl chloride (PVC) pipe: to CAN/CSA-B137.3 and ANSI/AWWA C900.

.1 Acceptable material: IPEX Series 125.

.2 SDR: 32.5

.3 Pressure Class: II

.4 Gasket bell end.

.5 Pipe joints: bell and spigot with rubber gaskets solvent welded joints or mechanical joints to ANSI/AWWA C111/A21.11, with transition gaskets to pipe manufacturers specifications.

.6 Rubber gaskets: to ANSI/AWWA C111/A21.11. [Gaskets for mechanical joints to be duck-tipped transition gaskets for PVC].

.7 Fittings: Moulded one piece construction with engineered ribs for 200 psig and gasket joints.

Part 3 Execution

3.1 PREPARATION

.1 Clean and dry pipes and fittings before installation.

3.2 TRENCHING

.1 Do trenching work in accordance with Excavating, Trenching and Backfilling Section.

.2 Do not allow contents of any sewer or sewer connection to flow into trench.

.3 Trench alignment and depth require approval of Consultant prior to placing bedding material and pipe.

3.3 GRANULAR BEDDING

.1 Place bedding in unfrozen condition.

.2 Place granular bedding materials in uniform layer(s) not exceeding 150 mm (6") compacted thickness to depth of 300 mm (12").

.3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe. Do not use blocks when bedding pipe.

.4 Shape transverse depressions as required to suit joints.

.5 Compact each layer full width of bed to at least 95% maximum density to ASTM D698.

.6 Fill excavation below bottom of specified bedding adjacent to manholes or structures with compacted bedding material.

3.4 INSTALLATION

.1 Lay and join pipes in accordance with manufacturer's recommendations.

.2 Handle pipe using methods approved. Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.

.3 Lay pipes on prepared bed, true to line and grade, with pipe invert smooth and free of sags or high points. Ensure barrel of each pipe is in contact with shaped bed throughout its full length.

.4 Commence laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.

.5 Do not exceed maximum joint deflection recommended by pipe manufacturer.

.6 Do not allow water to flow through pipe during construction.

.7 Whenever work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.8 Install plastic pipe and fittings in accordance with CSA B182.11.

.9 Pipe jointing:

.1 Install gaskets in accordance with manufacturer's recommendations.

.2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.3 Align pipes before joining.

.4 Maintain pipe joints free from mud, silt, gravel and other foreign material.

.5 Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed shall be removed, cleaned and lubricated and replaced before joining is attempted.

.6 Complete each joint before laying next length of pipe.

.7 Minimize joint deflection after joint has been made to avoid joint damage.

.8 At rigid structures, install pipe joints not more than 1.5 m (5') from side of structure.

.9 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.

.10 Cut pipes as required for special inserts, fittings or closure pieces as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.

.11 Make watertight connections to manholes. Use shrinkage compensating grout when suitable gaskets are not available.

.12 Use prefabricated saddles or field connections approved by Consultant, for connecting pipes to existing sewer pipes. Joints to be structurally sound and watertight.

3.5 PIPE SURROUND

.1 Place surround material in unfrozen condition.

.2 Upon completion of pipe laying, and after Consultant has inspected pipe joints, surround and cover pipes as indicated. Leave joints and fittings exposed until field testing is completed.

.3 Hand place surround material in uniform layers not exceeding 150 mm (6") compacted thickness as indicated. Do not dump material within 1.0 m (40") of pipe.

.4 Place layers uniformly and simultaneously on each side of pipe.

.5 Compact each layer from pipe invert to mid height of pipe to at least 95% maximum density to ASTM D698.

.6 Compact each layer from mid height of pipe to underside of backfill to at least 90% corrected maximum dry density and maximum density to ASTM D698.

.7 When field test results are acceptable to Consultant, place surround material at pipe joints.

3.6 BACKFILL

.1 Place backfill material in unfrozen condition.

.2 Place backfill material, above pipe surround in uniform layers not exceeding 150 mm (6") compacted thickness up to grades as indicated.

.3 Under paving and walks, compact backfill to at least 95% maximum density to ASTM D698. In other areas, compact to at least 90% maximum density to ASTM D698.

3.7 FIELD TESTING GRAVITY DRAINS

.1 Repair or replace pipe, pipe joint or bedding found defective.

.2 When directed by Consultant, draw tapered wooden plug with diameter of 50 mm (2") less than nominal pipe diameter through sewer to ensure that pipe is free of obstruction.

.3 Remove foreign material from sewers and related appurtenances by flushing with water.

.4 Perform infiltration and exfiltration testing as soon as practicable after jointing and bedding are complete, and service connections have been installed.

.5 Carry out tests on each section of sewer between successive manholes including service connections.

.6 Install watertight bulkheads in suitable manner to isolate test section from rest of pipeline.

.7 Exfiltration test:

.1 Fill test section with water in such a manner as to allow displacement of air in line. Maintain under nominal head for 24 h to ensure absorption in pipe wall is complete before test measurements are commenced.

.2 Immediately prior to test period add water to pipeline until there is a head of 1.0 m (40") over interior crown of pipe measured at highest point of test section or water in manhole is 1.0 m (40") above static ground water level, whichever is greater.

.3 Duration of exfiltration test: 2 h.

.4 Water loss at end of test period: not to exceed maximum allowable exfiltration over any section of pipe between manholes.

.8 Repair and retest sewer line as required, until test results are within limits specified.

.9 Repair visible leaks regardless of test results.

3.8 FIELD TESTING FORCED MAINS

.1 Testing of force main to be carried out in presence of Consultant.

.2 Strut and brace caps, bends and tees, to prevent movement when test pressure is applied.

.3 Expel air from force main, by slowly filling main with water. High points to be drilled and tapped and suitable cocks installed to vent air and to be shut when pressure is applied. Remove cocks after satisfactory completion of test and seal holes with tight fitting plugs.

.4 Apply hydrostatic test pressure of 861 kPa (125 psig) based on elevation of lowest point in line and corrected to elevation of test gauge for hydrostatic test and for leakage test.

.5 Apply pressure for 1 h for pressure test and 2 h for leakage test.

.6 Examine exposed pipe, joints and fittings while system is under pressure.

.7 Remove defective joints, pipe and fittings and replace with new sound material.

.8 Locate and repair defects if leakage is greater than amount specified in item 3.9.9.

.9 Repeat test until leakage is within specified allowance for full length of force main.

.10 Complete backfill.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASTM A126, Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.

.3 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.

.4 CAN/CSA-B79, Commercial and Residential Drains and Cleanouts.

1.2 SUBMITTALS

.1 Submit shop drawings and product data in accordance with general requirements.

.2 For shop drawings, indicate dimensions, construction details and materials.

.3 For product data, indicate dimensions, construction details and materials for all items specified herein.

1.3 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

.2 Data to include:

.1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.

.2 Details of operation, servicing and maintenance.

.3 Recommended spare parts list.

Part 2 Products

2.1 FLOOR DRAINS

.1 Floor drains and trench drains: to CAN/CSA-B79.

.2 Type FD-1: general duty; cast iron body, adjustable head, nickel bronze strainer, integral seepage pan, and clamping collar. Use square strainer in tiled areas and round strainer elsewhere.

.1 Refer to drawing schedule.

.3 Type FFD-1: combination funnel floor drain; cast iron body with integral seepage pan, clamping collar, nickel-bronze adjustable head strainer with integral funnel.

.1 Refer to drawing schedule.

.4 Type FD-2 (Elevator Sump Drain): general duty vertical wall drain, cast iron body, clamping collar, nickel-bronze strainer, complete with integral check valve.

.1 Refer to drawing schedule.

.5 Type FD-3: heavy duty cast iron body with sediment bucket, vent connection, 300 x 300 (12" x 12") cast iron hinged grate and bronze plug.

.1 Refer to drawing schedule.

.6 Type HD-1: General duty hub drain; cast iron body, clamping collar, nickel-bronze adjustable head hub.

.1 Refer to drawing schedule.

2.2 CLEANOUTS

.1 Cleanout plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.

.2 Wall access: face or wall type, stainless steel round cover with flush head securing screws, bevelled edge frame complete with anchoring lugs.

.1 Acceptable material:

.1 Zurn ZSS-1469

.2 Mifab C1400-RD

.3 Watts CO-480-RD-3

.4 Jay R. Smith 4710

.3 Floor access: rectangular, round, as indicated, cast iron body and frame with adjustable secured 15 mm (½") thick flush mounted heavy duty nickel bronze top and:
Plugs: bolted bronze with neoprene gasket.

.1 Cover for unfinished concrete floors: nickel bronze round, gasket, vandal-proof screws.

.1 Acceptable material:

.1 Zurn ZN-1400 – HD or Zurn ZXN-1612

.2 Mifab C1100-XR-6

.3 Watts CO-200-RX-1-6

.4 Jay R. Smith SQ-4-1753-XNBCO-SP-U

.2 Cover for VCT tile and linoleum floors: square polished nickel bronze with 15 mm (1/2") thick flush mounted heavy duty nickel bronze cover, complete with vandal-proof locking screws.

.1 Acceptable materials:

.1 Zurn ZN-1400-T – HD

.2 Mifab C1100-TS-6

.3 Watts CO-200-TS-1-6

.4 Jay R. Smith SQ-4-1753-NBR7-SP-U

.3 Cover for ceramic tile floors: 15 mm (½") thick heavy duty nickel bronze square, cover complete with gasket, vandal-proof screws, for flush finish.

.1 Acceptable material:

.1 Zurn ZN-1400 – T-HD or Zurn ZXN-1612

.2 Mifab C1100-S-6

.3 Watts CO-200-S-1-6

.4 Jay R. Smith 4200-U

.4 Cover for carpeted floors: round polished nickel bronze with flush cover, complete with stainless steel carpet marker, vandal-proof locking screws.

.1 Acceptable materials:

.1 Zurn ZN-1400-HD-CM or ZN-1612-CM

.2 Mifab C1100C-S-1-6

.3 Watts CO-200-RC-1-6

.4 Jay R. Smith SQ-4-1753-NBCO-SP-U-Y

2.3 BACKWATER VALVES

.1 Coated extra heavy cast iron body with bronze seat, revolving bronze flapper and threaded cover.

.1 Acceptable materials:

.1 Zurn Z-1090

.2 Mifab BV1200-R

.3 Ancon BV200

.4 Smith

.2 Access: Surface access.
Access pipe with cover: maximum 300 mm (12") depth.
Steel housing with gasketted steel cover.
Concrete access pit with cover, as indicated.

.1 Acceptable material:

.1 Ancon BV-230-R

2.4 TRAP SEAL PRIMERS

.1 All brass, with integral vacuum breaker, NPS 15 mm (1/2") solder ends, NPS 15 mm (1/2") drip line connection.

.2 Acceptable materials:

.1 Zurn Z-1022

.2 Mifab

.3 Ancon MS-810

.4 Smith

2.5 TRAP SEAL PRIMER STATIONS

.1 Provide trap primer stations where indicated complete with solenoid valve, backflow preventor, vacuum breaker, NPS 15 mm (1/2") solder ends, NPS 15 mm (1/2") drip line connections.

.2 Solenoid valve electric characteristics shall be suitable for controlling function.

.3 Coordinate location and number of trap primer stations with Building Automation System (BAS) contractor.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with provincial codes, and local authority having jurisdiction.

.2 Install in accordance with manufacturer's instructions and as specified.

3.2 CLEANOUTS

.1 In addition to those required by code, and as indicated, install at base of all soil and waste stacks.

.2 Bring cleanouts to wall or finished floor unless serviceable from below floor.

.3 Building drain cleanout and stack base cleanouts: line size to maximum NPS 100 mm (4").

3.3 BACKWATER VALVES

.1 Install where indicated.

3.4 TRAP SEAL PRIMERS

.1 Install for all floor, hub and trench drains and elsewhere, as indicated.

.2 Install on cold water supply to nearest frequently used plumbing fixture, in concealed space, to approval of Consultant.

.3 Install soft copper tubing to floor drains above grade and polyethylene piping to floor drains below grade.

3.5 TRAP SEAL PRIMER STATIONS

.1 Provide primer stations where indicated.

.2 Install for all floor drains and elsewhere, as indicated.

.3 Install copper piping to floor drains above grade. Install polypropylene piping to floor drains on grade.

3.6 COMMISSIONING

.1 In context of this paragraph, "verify" to include "demonstrate" to Consultant.

.2 Timing: commission only after start-up deficiencies rectified.

.3 Access doors: verify size and location relative to items to be services.

.4 Adjust to suit site conditions, including, but not necessarily limited to, following:

.1 Floor, hub and trench drains:

.1 Verify proper operation of trap primer, flushing features.

.2 Verify security and removability of strainers.

.2 Cleanouts:

.1 Verify covers are gastight, secure and easily removable.

.2 Verify that cleanout rods can probe as far as next cleanout.

.3 Backwater valves:

.1 Verify accessibility of cover, valve.

.4 Trap seal primers:

.1 Verify operation.

.2 Adjust flow rate to suit site conditions.

.5 Commissioning reports:

.1 Record all results on approved report forms.

.2 Include signature of tester and supervisor.

.3 To be countersigned by Consultant.

.6 Verification:

.1 Notify Consultant 48 h before commencing tests.

.2 All tests and procedures to be witnessed by Consultant.

.3 All reported results subject to verification by consultant.

.7 Training:

.1 Train O&M personnel in start-up, operation, monitoring, servicing, maintenance and shut-down procedures.

.8 Demonstrations:

.1 Demonstrate full compliance with Design Criteria.

.2 Demonstrations also to show completeness of O&M personnel training.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASTM B32, Specification for Solder Metal.

.3 ASTM B306, Specification for Copper Drainage Tube (DWV).

.4 ASTM C564, Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

.5 CAN/CSA-B70, Cast Iron Soil Pipe, Fittings and Means of Joining.

.6 CAN/CSA-B125.3, Plumbing Fittings.

Part 2 Products

2.1 COPPER TUBE AND FITTINGS

.1 Above ground sanitary, and vent, maximum 65 mm (2½") Type DWV copper to: ASTM B306.

- .1 Fittings.
  - .1 Cast brass: to CAN/CSA B125.3.
  - .2 Wrought copper: to CAN/CSA B125.3.
- .2 Solder: tin-lead, 50:50, to ASTM B32, type 50A.

2.2 CAST IRON PIPING AND FITTINGS

.1 Above ground sanitary, and vent, minimum NPS 80 mm (3"), cast iron to: CAN/CSA-B70.

- .1 Mechanical joints (vents)
  - .1 Neoprene or butyl rubber compression gaskets: to ASTM C564 or CAN/CSA-B70.
  - .2 Stainless steel clamps (2 band).
- .2 Mechanical joints (sanitary)
  - .1 Heavy duty neoprene or butyl rubber compression gaskets to: ASTM C1540.
  - .2 Stainless steel clamps (4 band min).

2.3 VENT FLASHINGS

.1 Thaler or equal spun aluminum complete with insulation, cap, and rubber gasket.

2.4 FORCED MAINS

.1 Above and below ground sewage pump discharge, size as indicated, type ‘L’ copper to ASTMB88M.

.2 Cast copper, solder fitting to ANSI B16.18.

.3 Cast bronze threaded fittings, class 125 to ANSI/ASME B16.15.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with Provincial Plumbing Code and local authority having jurisdiction.

.2 Install above ground piping parallel and close to walls and ceilings to conserve headroom and space, and to grade as indicated.

.3 Place Cleanouts

- .1 Where shown on Drawings and near bottom of each stack and riser.
- .2 At every 90 degree change of direction for horizontal lines.
- .3 Every 15 m (50') of horizontal run.
- .4 Extend clean out to accessible surface. Do not place cleanouts in carpeted floors. In such locations, use wall type cleanouts.

.4 Each fixture and appliance discharging water into sanitary sewer or building sewer lines shall have a seal trap in connection with a complete venting system so gases pass freely to atmosphere with no pressure or syphon condition on water seal.

.5 Vent entire waste system to atmosphere.

- .1 Discharge 500 mm (20") above roof. Join lines together in fewest practicable number before projecting above roof.
- .2 Set back vent lines so they will not pierce roof near an edge or valley.
- .3 Do not terminate vents within 3600 mm of any building intake and/or exhaust opening.
- .4 Provide copper vent piping through roof as per detail.

.6 Use torque wrench to obtain proper tension in cinch bands when using hubless cast iron pipe. Butt ends of pipe against centering flange of coupling.

.7 Flash pipes passing through roof with insulated Altra Vandal proof flashing with stainless steel breather.

.8 Flash pipes passing through roof with 453 g (16 oz) sheet copper flashing fitted snugly around pipes and caulk between flashing and pipe with flexible waterproof compound.

- .1 Flashing base shall be at least 600 mm (24") square.
- .2 Flashing may be a 24 kg/m^2 (5 lb/ft^2) lead flashing fitted around pipes and turned down into pipe 15 mm (½") with turned edge hammered against pipe wall.

.9 Before piping is covered, conduct tests in presence of Consultant and correct leaks or defective work. Conduct test prior to placing floor slab but after backfill is placed.

.1 Do not caulk threaded work.

.2 Fill waste and vent system to roof level [a minimum of 3,100 mm - (10')] with water and show no leaks for 2 hours.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASTM D2235, Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.

.3 ASTM D2564, Specification for Solvent Cements for Poly(Vinyl-Chloride) (PVC) Plastic Piping Systems.

.4 CAN/CSA-B181.1, ABS Drain, Waste and Vent Pipe and Pipe Fittings.

.5 CAN/CSA-B181.2, PVC and CPVC Drain, Waste and Vent Pipe and Pipe Fittings.

.6 CAN/CSA-B182.1, Plastic Drain and Sewer Pipe and Pipe Fittings.

Part 2 Products

2.1 PIPING AND FITTINGS

.1 Buried sanitary, and vent piping to:

- .1 80 mm (3”) and smaller: ABS drain waste and vent pipe to CAN/CSA-B181.1.
- .2 100 mm (4”) and larger: SDR-35 PVC drain waste and vent pipe to CAN/CSA-B181.2.
- .3 Vent piping: any size, PVC-DWV plastic drain and sewer pipe and fittings CAN/CSA-B181.2.

.2 Above grade sanitary and vent piping:

- .1 80 mm (3”) and smaller: IPEX: PVC-XFR drain waste and vent pipe to CAN/CSA-B181.2.
- .2 100 mm (4”) and larger: IPEX: PVC-XFR drain waste and vent pipe to CAN/CSA-B181.2.
- .3 Vent piping: any size, IPEX: PVC-XFR plastic drain and sewer pipe and fittings CAN/CSA-B181.2.

.3 Use plastic XFR – DWV in pipe chase for urinal piping to 1.5 M (5' –0") above finished floor.

.4 Where piping pierces a fire separation an approved fire stop system to the approval of authority having jurisdiction shall be used.

2.2 JOINTS

.1 Solvent weld for PVC: to ASTM D2564.

.2 Solvent weld for ABS: to ASTM D2235.

2.3 EXPANSION

.1 Provide solvent welded expansion joints as required by manufacturer's recommendations.

2.4 VENT FLASHINGS

.1 Thaler Stack Jack spun aluminum complete with insulation, cap, and rubber gasket.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with Provincial Plumbing Code and local authority having jurisdiction. Install in accordance with manufacturer's instructions.

.2 Installation of underground pipe

.1 Provide all excavation, bedding, backfill, and compaction.

.2 Install materials in accordance with Manufacturer's instructions.

.3 Use jacks to make-up gasketed joints.

.4 Stabilize unstable trench bottoms.

.5 Bed pipe true to line and grade with continuous support from firm base.

.1 Bedding depth - 100 mm to 150 mm (4" to 6").

.2 Material and compaction to meet ASTM standard noted above.

.6 Excavate bell holes into bedding material so pipe is uniformly supported along its entire length. Blocking to grade pipe is forbidden.

.7 Trench width at top of pipe -

.1 Minimum 450 mm (18") or diameter of pipe plus 300 mm (12"), whichever is greater.

.2 Maximum - Outside diameter of pipe plus 600 mm (24").

.8 Piping and joints shall be clean and installed according to manufacturer's recommendations. Break down contaminated joints, clean seats and gaskets and reinstall.

.9 Do not use back hoe or power equipment to assemble pipe.

.10 Initial backfill shall be 300 mm (12") above top of pipe with material specified in referenced ASTM standard.

.3 Place Cleanouts

.1 Where shown on Drawings and near bottom of each stack and riser.

.2 At every 90 degree change of direction for horizontal lines.

.3 Every 15 m (50 ft) of horizontal run.

.4 Extend clean out to accessible surface. Do not place cleanouts in carpeted floors. In such locations, use wall type cleanouts

.4 Each fixture and appliance discharging water into sanitary sewer or building sewer lines shall have a seal trap in connection with a complete venting system so gases pass freely to atmosphere with no pressure or syphon condition on water seal.

.5 Before piping is covered, conduct tests in presence of Consultant and correct leaks or defective work. Conduct test prior to placing floor slab but after backfill is placed.

.1 Fill waste and vent system a minimum of 1.8 m (6 ft) above finished floor with water and show no leaks for 2 hours.

.2 Conduct ball test in presence of consultant to ensure proper grade and clear of obstructions.

.6 Install solvent welded expansion joints as per manufacturer's recommendation. Care is to taken to accommodate ambient temperatures at time of install.

.7 Vent entire waste system to atmosphere.

.1 Discharge 350 mm (14") above roof. Join lines together in fewest practicable number before projecting above roof.

.2 Set back vent lines so they will not pierce roof near an edge or valley.

.3 Venting shall be 7.5 m (25'-0") from any outdoor air intakes.

.8 Flash pipes passing through roof with insulated Altra Vandal proof flashing with stainless steel breather.

.1 Flashing base shall be at least 600 mm (24") square.

.9 Install above ground piping parallel and close to walls and ceilings to conserve headroom and space, and to grade as indicated.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASTM A126, Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.

.3 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.

.4 CAN/CSA-B79, Commercial and Residential Drains and Cleanouts.

.5 PDI-WH201, Water Hammer Arresters.

.6 CAN/CSA-B64 Series, Backflow Preventers and Vacuum Breakers.

.7 PDI-G101, Testing and Rating Procedure for Grease Interceptors.

.8 CAN/CSA-B481 Senes12, Grease Interceptors.

1.2 SUBMITTALS

.1 Submit shop drawings and product data in accordance with general requirements.

.2 For shop drawings, indicate dimensions, construction details and materials.

.3 For product data, indicate dimensions, construction details and materials for all items specified herein.

1.3 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

.2 Data to include:

.1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.

.2 Details of operation, servicing and maintenance.

.3 Recommended spare parts list.

Part 2 Products

2.1 GREASE INTERCEPTOR #1 (STEEL)

.1 Enzymatic type interceptor, tested and rated in accordance with PDI G101, complete with acid resistant interior enamel finish for mounting flush with floor with non-skid covers on floor complete with flow control fitting suitably vented, and extension.

.2 Capacity: 0.6 l/s (10 gpm) 50$\varnothing$ inlet & outlet.

.3 Supply one (1) case of four 1 kg (2.2 lb) cans of enzyme activator with interceptors.

.4 Acceptable materials:

.1 Zurn Z-1170 (Canadian Market)

.2 Mifab (with confirmation of CSA compliance)

.3 Jay R Smith (with confirmation of CSA compliance)

.4 Ancon WD-CSA (-X if extension required / -E 2lbs of Biomix powder)

2.2 GREASE INTERCEPTOR #2 (STEEL)

.1 Enzymatic type interceptor, tested and rated in accordance with PDI G101, complete with acid resistant interior enamel finish for mounting flush with floor with non-skid covers on floor complete with flow control fitting suitably vented, and extension.

.2 Capacity: 2.2 l/s (35 gpm) 80$\varnothing$ inlet & outlet.

.3 Supply one (1) case of four 1 kg (2.2 lb) cans of enzyme activator with interceptors.

.4 Acceptable materials:

.1 Zurn Z-1170 (Canadian Market)

.2 Mifab (with confirmation of CSA compliance)

.3 Jay R Smith (with confirmation of CSA compliance)

.4 Ancon WD-CSA (-X if extension required / -E 2lbs of Biomix powder)

2.3 HAIR INTERCEPTORS

.1 Hair and solids type interceptor, tested and rated in accordance with industry standards. Dura-coated cast iron complete with satin finish. Perforated stainless steel basket removable from bottom, with flanged and gasketed cleanout cover with raised hex head.

.2 Capacity: 38mm (1-1/2") inlet and outlet.

.3 Acceptable materials:

.1 Zurn ZAB-1175

.2 Watts

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with provincial codes, and local authority having jurisdiction.

.2 Install in accordance with manufacturer's instructions and as specified.

3.2 INTERCEPTORS

.1 Install with sufficient space, as indicated, for ease of maintenance.

3.3 COMMISSIONING

.1 In context of this paragraph, "verify" to include "demonstrate" to Consultant.

.2 Timing: commission only after start-up deficiencies rectified.

.3 Access doors: verify size and location relative to items to be services.

.4 Adjust to suit site conditions, including, but not necessarily limited to, following:

.1 Grease interceptors:

.1 Activate, using manufacturer's recommended activation procedures and materials.

.5 Commissioning reports:

.1 Record all results on approved report forms.

.2 Include signature of tester and supervisor.

.3 To be countersigned by Consultant.

.6 Verification:

.1 Notify Consultant 48 h before commencing tests.

.2 All tests and procedures to be witnessed by Consultant.

.3 All reported results subject to verification by Consultant.

.7 Training:

.1 Train O&M personnel in start-up, operation, monitoring, servicing, maintenance, and shut-down procedures.

.8 Demonstrations:

.1 Demonstrate full compliance with Design Criteria.

.2 Demonstrations also to show completeness of O&M personnel training.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with general requirements.

.2 Indicate:

.1 Equipment, including connections, fittings, control assemblies and ancillaries, identifying factory and field assembled.

.2 Wiring and schematic diagrams.

.3 Dimensions and recommended installation.

.4 Pump performance and efficiency curves.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance and engineering data for incorporation into manual specified in general requirements

.2 Data to include:

.1 Manufacturer's name, type, model year, capacity, and serial number.

.2 Details of operation, servicing, and maintenance.

.3 Recommended spare parts list with names and addresses.

Part 2 Products

2.1 ELEVATOR SUMP AND SIMPLEX PUMP

.1 Pump shall be of the centrifugal type and submersible type motor. The unit shall be capable of 2" solid capacity for normal grey water and 2" discharge pipe.

.2 Pump shall have a capacity of 50 GPM at a total head of 27 feet.

.3 Pump Motor:

.1 Pump motor shall be of the submersible type rated 1.0 horsepower at 3450 RPM. Motor shall be for 60 Hz., three phase, 575 volts (575/3/60). Motor shall be capacitor start, capacitor run type for high starting torque. Motors rated for VFD/continuous duty operation.

.2 Starter winding shall be of the open type with Class F insulation, good for 155°C (311°F) maximum operating temperature. Winding housing shall be filled with a clean, high dielectric oil that lubricates bearings and seals and transfers heat from windings and rotor to outer shell. Air-filled motors which do not have the superior heat dissipating capabilities of oil-filled motors shall not be considered equal.

.3 Motor shall have two heavy-duty ball bearings to support pump shaft and take radial and thrust loads. Ball bearings shall be designed for 50,000 hours B-10 life. Stator shall be bolted to seal plate for easy motor replacement.

.4 The motor shall have a heat sensor thermostat and overload attached to the top end of the motor windings to stop the motor if the motor winding temperature reaches 200°F. The high temperature shutoff will cause the pump to cease operation, should a control failure cause the pump to run in a dry wet well. The thermostat shall reset automatically when the motor cools to a safe operating temperature.

.5 The common motor pump shall be of #416 stainless steel threaded to take pump impeller and impeller.

.6 Motor shall be protected by one rotary mechanical seal. Seal face shall be carbon and ceramic and lapped to a flatness of one light band.

.4 The pump impeller shall be of the recessed type to provide an open unobstructed passage through the volute for the solids. Impeller shall be engineered thermoplastic (MC/MGF) or ductile iron (MGH) and shall be threaded onto stainless steel shaft.

.5 All iron castings shall be pre-treated with phosphate and chromic rinse and to be painted before machining, and all machined surfaces exposed to the sewage water to be re-painted. All fasteners to be 302 stainless steel.

.6 The motor power cord shall be 14 GA SJOW/SJOWA or SOOW. The cable jacket shall be sealed at the motor entrance by means of a rubber compression washer and compression nut. A heat shrink tube filled with epoxy shall seal the outer cable jacket and the individual leads to prevent water from entering the motor housing.

.7 The pump shall be complete with integral float and power cord.

.8 High level alarm system with audible signal and test button suited for 120/1/60 with plug. Supply sufficient cord length to nearest plug.

.9 Sump System

.1 Factory assembled 750 mm (30") diameter basin.

.2 Packaged basin units with basin and cover designed for off-set mounting.

.3 System includes fiberglass basin with anti-floatation ring, epoxy coated steel cover with separate cover for access to each pump and controls, control panel mounting sleeve, galvanized lifting chain and 100 mm (4") inlet.

.4 Depth of sump to be as indicated on drawings but not less than 750 mm (30") below inlet pipe.

.10 Acceptable manufacturers:

.1 Myers WHR5H-53

.2 Barnes

.3 Grundfos

Part 3 Execution

3.1 SEWAGE SUMPS AND PUMPS

.1 Install in accordance with manufacturers recommendations.

.2 Clean sump upon completion.

.3 Confirm operation of pumps, controls, and high-level alarms.

3.2 FIELD QUALITY CONTROL

.1 Check power supply.

.2 Check starter protective devices.

.3 Start up, check for proper and safe operation.

.4 Check settings and operation of all hand-off-auto selector switch, operating, safety and limit controls, audible and visual alarms, over-temperature and other protective devices.

.5 Adjust flow from water-cooled bearings.

.6 Adjust impeller shaft stuffing boxes, packing glands.

.7 Demonstrate equipment operation as directed by consultant.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASTM C14M, Specification for Non-reinforced Concrete Sewer, Storm Drain and Culvert Pipe.

.3 ASTM C76M, Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.

.4 ASTM C117, Test Method for Material Finer Than 0.075 mm (3 mil) Sieve in Mineral Aggregates by Washing.

.5 ASTM C136, Method for Sieve Analysis of fine and Coarse Aggregates.

.6 ASTM C443M, Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.

.7 ASTM D2680, Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.

.8 ASTM D3034, Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

.9 CAN/CSA-A3001, Cementitious Materials for Use in Concrete.

.10 ASTM C700, Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated.

.11 CAN/CSA-A257, Standards for Concrete Pipe and Manhole Sections.

.12 CAN/CSA-B182.1, Plastic Drain and Sewer Pipe and Pipe Fittings.

.13 CAN/CSA-B182.2, PVC Sewer Pipe and Fittings (PSM Type).

.14 CSA B182.11, Standard Practice for the Installation of Thermoplastic Drain, Storm, and Sewer Pipe and Pipe Fittings.

.15 CAN/CGSB-8.1, Sieves Testing, Woven Wire.

.16 CAN/CGSB-8.2, Sieves Testing, Woven Wire, Metric.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Submittals Section.

1.3 MATERIAL CERTIFICATION

.1 Submit manufacturers test data and certification at least 2 weeks prior to commencing work.

1.4 SCHEDULING OF WORK

.1 Schedule work to minimize interruptions to existing services and to maintain existing flow during construction.

.2 Submit schedule of expected interruptions for approval and adhere to approved schedule.

1.5 STANDARDS

.1 To local Municipal Standards.

.2 To Ontario Provincial Standards (OPS) for Roads and Municipal Services.

Part 2 Products

2.1 PLASTIC PIPE

.1 Large diameter, ribbed PVC sewer pipe and fittings: to CAN/CSA B182.4 ASTM F794.

.1 Standard dimension ratio SDR 35

.2 Gasket and integral bell system

.3 Nominal length 6 m (20').

2.2 PIPE BEDDING AND SURROUND MATERIAL

.1 Granular material to Excavating, Trenching, and Backfilling Section and following requirements:

.1 Crushed or screened stone, gravel or sand.

.2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1.

	Stone/Gravel	Gravel/Sand
200 mm (8")	-	-
75 mm (3")	-	-
50 mm (2")	-	-
40 mm (1 1/2")	-	-
25 mm (1")	[100]	-
20 mm (3/4")	-	-
15 mm (1/2")	[65-90]	[100]
10 mm (3/8")	-	-
5 mm (3/16")	[35-55]	[50-100]
2.00 mm (80 mil)	-	[30-90]
0.425 mm (16 mil)	[10-25]	[10-50]
0.180 mm (7 mil)	-	-
0.075 mm (3 mil)	[0-8]	[0-10]

.2 Concrete mixes and materials for bedding, cradles, encasement, and supports: to Cast-in-Place Concrete Section.

2.3 BACKFILL MATERIAL

.1 As indicated.

.2 Type 3 to Excavating Trenching and Backfilling Section.

Part 3 Execution

3.1 PREPARATION

.1 Clean pipes and fittings of debris and water before installation and remove defective materials from site to approval of Consultant.

3.2 TRENCHING

.1 Do trenching work in accordance with Excavating, Trenching and Backfilling Section.

.2 Do not allow contents of any sewer or sewer connection to flow into trench.

.3 Trench alignment and depth to approval of Consultant prior to placing bedding material and pipe.

3.3 GRANULAR BEDDING AND PIPE SURROUND

.1 Place bedding in unfrozen condition.

.2 Place granular bedding material in uniform layers not exceeding 150 mm (6") compacted thickness to depth of as indicated.

.3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe. Do not use blocks when bedding pipes.

.4 Shape transverse depressions as required to suit joints.

.5 Compact each layer full width of bed to at least 95% maximum density to ASTM D698.

.6 Fill excavation below bottom of specified bedding adjacent to manholes or catch basins with compacted bedding material.

.7 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated. Do not dump material within 1.0 m of pipe.

.8 Compact each layer from native material to 300 mm (12") above pipe to at least 95% corrected maximum dry density.

3.4 INSTALLATION

.1 Lay and join pipe in accordance with manufacturer's recommendations and to approval of Consultant.

.2 Handle pipe using methods approved by Consultant. Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.

.3 Lay pipes on prepared bed, true to line and grade with pipe inverts smooth and free of sags or high points. Ensure barrel of each pipe is in contact with shaped bed throughout its full length.

.4 Commence laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.

.5 Do not exceed maximum joint deflection recommended by pipe manufacturer.

.6 Do not allow water to flow through pipes during construction.

.7 Install plastic pipe and fittings in accordance with CSA B182.11.

.8 Cut pipes as required for special inserts, fittings or closure pieces, as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.

.9 Make watertight connections to manholes and catch basins. Use shrinkage compensating grout when suitable gaskets are not available.

.10 Use prefabricated saddles or approved field connections for connecting pipes to existing sewer pipes. Joint to be structurally sound and watertight.

.11 Temporarily plug open upstream ends of pipes with removable watertight concrete, steel or plastic bulkheads.

3.5 PIPE SURROUND

.1 Place surround material in unfrozen condition.

.2 Upon completion of pipe laying, and after Consultant has inspected pipe joints, surround and cover pipes as indicated. Leave joints and fittings exposed until field testing is completed.

.3 Hand place surround material in uniform layers not exceeding 150 mm (6") compacted thickness as indicated. Do not dump material within 1.0 m (40") of pipe.

.4 Place layers uniformly and simultaneously on each side of pipe.

.5 Compact each layer from pipe invert to mid height of pipe to at least 95% corrected maximum dry density.

.6 Compact each layer from mid height of pipe to underside of backfill to at least 90% corrected maximum dry density.

.7 When field test results are acceptable to Consultant, place surround material at pipe joints.

3.6 BACKFILL

.1 Place backfill material in unfrozen condition.

.2 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm (6") compacted thickness up to grades as indicated.

.3 Under paving and walks, compact backfill to at least 95% corrected maximum dry density maximum density to ASTM D698. In other areas, compact backfill to at least 90% maximum density to ASTM D698.

3.7 FIELD TESTING

.1 Repair or replace pipe, pipe joint or bedding found defective.

.2 When directed by Consultant, draw tapered wooden plug with diameter of 50 mm (2") less than nominal pipe diameter through sewer to ensure that pipe is free of obstruction.

.3 Remove foreign material from sewers and related appurtenances by flushing with water.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASTM B32, Specification for Solder Metal.

.3 ASTM B306, Specification for Copper Drainage Tube (DWV).

.4 ASTM C564, Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

.5 CAN/CSA-B70, Cast Iron Soil Pipe, Fittings and Means of Joining.

.6 CAN/CSA-B125.3, Plumbing Fittings.

Part 2 Products

2.1 COPPER TUBE AND FITTINGS

.1 Above ground storm maximum 65 mm (2½") Type DWV copper to: ASTM B306.

- .1 Fittings.
  - .1 Cast brass: to CAN/CSA B125.3.
  - .2 Wrought copper: to CAN/CSA B125.3.
- .2 Solder: tin-lead, 50:50, to ASTM B32, type 50A.

2.2 CAST IRON PIPING AND FITTINGS

.1 Above ground storm minimum NPS 80 mm (3"), cast iron to: CAN/CSA-B70.

- .1 Mechanical joints (storm)
  - .1 Heavy duty neoprene or butyl rubber compression gaskets to: ASTM C1540.
  - .2 Stainless steel clamps (4 band min).

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with Provincial Plumbing Code and local authority having jurisdiction.

.2 Install above ground piping parallel and close to walls and ceilings to conserve headroom and space, and to grade as indicated.

.3 Place Cleanouts

- .1 Where shown on Drawings and near bottom of each stack and riser.
- .2 At every 90 degree change of direction for horizontal lines.

.3 Every 15 m (50') of horizontal run.

.4 Extend clean out to accessible surface. Do not place cleanouts in carpeted floors. In such locations, use wall type cleanouts.

.4 Use torque wrench to obtain proper tension in cinch bands when using hubless cast iron pipe. Butt ends of pipe against centering flange of coupling.

.5 Before piping is covered, conduct tests in presence of Consultant and correct leaks or defective work. Conduct test prior to placing floor slab but after backfill is placed.

.1 Do not caulk threaded work.

.2 Fill waste and vent system to roof level [a minimum of 3,100 mm - (10')] with water and show no leaks for 2 hours.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASTM D2235, Specification for Solvent Cement for Acrylonitrille-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.

.3 ASTM D2564, Specification for Solvent Cements for Poly(Vinyl-Chloride) (PVC) Plastic Piping Systems.

.4 CAN/CSA-B181.1, ABS Drain, Waste and Vent Pipe and Pipe Fittings.

.5 CAN/CSA-B181.2, PVC and CPVC Drain, Waste and Vent Pipe and Pipe Fittings.

.6 CAN/CSA-B182.1, Plastic Drain and Sewer Pipe and Pipe Fittings.

Part 2 Products

2.1 PIPING AND FITTINGS

.1 Buried storm piping to:

.1 80 mm (3”) and smaller: ABS drain pipe to CAN/CSA-B181.1.

.2 100 mm (4”) and larger: SDR-35 PVC drain pipe to CAN/CSA-B181.2.

.2 Above grade storm piping:

.1 80 mm (3”) and smaller: IPEX: PVC-XFR fire rated drain storm pipe to CAN/CSA-B181.1.

.2 100 mm (4”) and larger: IPEX: PVC-XFR storm pipe to CAN/CSA-B181.2.

.3 Where piping pierces a fire separation an approved fire stop system to the approval of authority having jurisdiction shall be used.

2.2 JOINTS

.1 Solvent weld for PVC: to ASTM D2564.

.2 Solvent weld for ABS: to ASTM D2235.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with Provincial Plumbing Code and local authority having jurisdiction.

.2 Installation of underground pipe

.1 Provide all excavation, bedding, backfill, and compaction.

.2 Install materials in accordance with Manufacturer's instructions.

.3 Use jacks to make-up gasketed joints.

.4 Stabilize unstable trench bottoms.

.5 Bed pipe true to line and grade with continuous support from firm base.

.1 Bedding depth - 100 mm to 150 mm (4" to 6").

.2 Material and compaction to meet ASTM standard noted above.

.6 Excavate bell holes into bedding material so pipe is uniformly supported along its entire length. Blocking to grade pipe is forbidden.

.7 Trench width at top of pipe -

.1 Minimum 450 mm (18") or diameter of pipe plus 300 mm (12"), whichever is greater.

.2 Maximum - Outside diameter of pipe plus 600 mm (24").

.8 Piping and joints shall be clean and installed according to manufacturer's recommendations. Break down contaminated joints, clean seats and gaskets and reinstall.

.9 Do not use back hoe or power equipment to assemble pipe.

.10 Initial backfill shall be 300 mm (12") above top of pipe with material specified in referenced ASTM standard.

.3 Place Cleanouts

.1 Where shown on Drawings and near bottom of each stack and riser.

.2 At every 90 degree change of direction for horizontal lines.

.3 Every 15 m (50 ft) of horizontal run.

.4 Extend clean out to accessible surface. Do not place cleanouts in carpeted floors. In such locations, use wall type cleanouts

.4 Before piping is covered, conduct tests in presence of Consultant and correct leaks or defective work. Conduct test prior to placing floor slab but after backfill is placed.

.1 Fill waste and vent system a minimum of 1.8 m (6 ft) above finished floor with water and show no leaks for 2 hours.

.2 Conduct ball test in presence of consultant to ensure proper grade and clear of obstructions.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASTM A126, Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.

.3 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.

.4 CAN/CSA-B79, Commercial and Residential Drains and Cleanouts.

1.2 SUBMITTALS

.1 Submit shop drawings and product data in accordance with general requirements.

.2 For shop drawings, indicate dimensions, construction details and materials.

.3 For product data, indicate dimensions, construction details and materials for all items specified herein.

1.3 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

.2 Data to include:

.1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.

.2 Details of operation, servicing and maintenance.

.3 Recommended spare parts list.

Part 2 Products

2.1 ROOF DRAINS

.1 Type RD-1: controlled flow; cast iron body, under deck clamp and sump receiver to suit roof construction, flashing clamp ring with integral gravel stop, bearing pan, flow control weir assembly, aluminum dome.

.1 Refer to drawing schedule.

.2 Type RD-2: standard roof drain with cast iron body with aluminum dome, under-deck clamp to suit roof construction, roof sump receiver, flashing clamp ring with integral gravel stop.

.1 Refer to drawing schedule.

2.2 CLEANOUTS

.1 Cleanout plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.

.2 Wall access: face or wall type, stainless steel round cover with flush head securing screws, bevelled edge frame complete with anchoring lugs.

.1 Acceptable material:

.1 Zurn ZSS-1469

.2 Mifab C1400-RD

.3 Watts CO-480-RD-3

.4 Jay R. Smith SQ-4-1753-XNBCO-SP-U

.3 Floor access: rectangular, round, as indicated, cast iron body and frame with adjustable secured 15 mm (½") thick flush mounted heavy duty nickel bronze top and:
Plugs: bolted bronze with neoprene gasket.

.1 Cover for unfinished concrete floors: nickel bronze round, gasket, vandal-proof screws.

.1 Acceptable material:

.1 Zurn ZN-1400 – HD or Zurn ZXN-1612

.2 Mifab C1100-XR-6

.3 Watts CO-200-RX-1-6

.4 Jay R. Smith SQ-4-1753-XNBCO-SP-U

.2 Cover for VCT tile and linoleum floors: square polished nickel bronze with 15 mm (1/2") thick flush mounted heavy duty nickel bronze cover, complete with vandal-proof locking screws.

.1 Acceptable materials:

.1 Zurn ZN-1400-T – HD

.2 Mifab C1100-TS-6

.3 Watts CO-200-TS-1-6

.4 Jay R. Smith SQ-4-1753-NBRT-SP-U

.3 Cover for ceramic tile floors: 15 (½") thick heavy duty nickel bronze square, cover complete with gasket, vandal-proof screws, for flush finish.

.1 Acceptable material:

.1 Zurn ZN-1400 – T-HD or Zurn ZXN-1612

.2 Mifab C1100-S-6

.3 Watts CO-200-S-1-6

.4 Jay R. Smith 4200-U

.4 Cover for carpeted floors: round polished nickel bronze with flush cover, complete with stainless steel carpet marker, vandal-proof locking screws.

.1 Acceptable materials:

.1 Zurn ZN-1400-HD-CM or ZN-1612-CM

.2 Mifab C1100C-S-1-6

.3 Watts CO-200-RC-1-6

.4 Jay R. Smith SQ-4-1753-NBCO-SP-U-Y

2.3 BACKWATER VALVES

.1 Coated extra heavy cast iron body with bronze seat, revolving bronze flapper and threaded cover.

.1 Acceptable materials:

.1 Zurn Z-1090

.2 Mifab BV1200-R

.3 Watts BV200

.4 Jay R. Smith 7012

.2 Access: Surface access.
Access pipe with cover: maximum 300 mm (12") depth.
Steel housing with gasketted steel cover.
Concrete access pit with cover, as indicated.

.1 Acceptable material:

.1 Watts BV-230-R

.2 Jay R. Smith SQ-7-4680-20-LXH420

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with provincial codes, and local authority having jurisdiction.

.2 Install in accordance with manufacturer's instructions and as specified.

.3 Install roof drains in lowest point of roof. Co-ordinate location with architectural, structural, and mechanical drawings.

3.2 CLEANOUTS

.1 In addition to those required by code, and as indicated, install at base of all soil and waste stacks, and rainwater leaders.

.2 Bring cleanouts to wall or finished floor unless serviceable from below floor.

.3 Building drain cleanout and stack base cleanouts: line size to maximum NPS 100 mm (4").

3.3 BACKWATER VALVES

.1 Install where indicated.

3.4 COMMISSIONING

.1 In context of this paragraph, "verify" to include "demonstrate" to Consultant.

.2 Timing: commission only after start-up deficiencies rectified.

.3 Access doors: verify size and location relative to items to be services.

.4 Adjust to suit site conditions, including, but not necessarily limited to, following:

.1 Roof drains:

.1 Verify installation at low points in roof.

.2 Verify security and removability of dome.

.3 Adjust weirs to suit actual roof slope and meet requirements of design.

.4 Verify provision for movement of roof and integrity of roof drain piping system.

.2 Cleanouts:

.1 Verify covers are gastight, secure and easily removable.

.2 Verify that cleanout rods can probe as far as next cleanout.

.3 Backwater valves:

.1 Verify accessibility of cover, valve.

.5 Commissioning reports:

.1 Record all results on approved report forms.

.2 Include signature of tester and supervisor.

.3 To be countersigned by Consultant.

.6 Verification:

.1 Notify Consultant 48 h before commencing tests.

.2 All tests and procedures to be witnessed by Consultant.

.3 All reported results subject to verification by consultant.

.7 Training:

.1 Train O&M personnel in start-up, operation, monitoring, servicing, maintenance and shut-down procedures.

.8 Demonstrations:

.1 Demonstrate full compliance with Design Criteria.

.2 Demonstrations also to show completeness of O&M personnel training.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code.

.3 CAN/CSA C22.2 No. 110, Construction and Test of Electric Storage Tank Water Heaters.

.4 CAN/CSA-C191, CSA Standards on Performance of Electric Storage Tank Water Heaters for Domestic Hot Water.

.5 National Sanitation Foundation NSF-5.

.6 ASHRAE 118.1/NRCan equivalent.

.7 C.1 CSA B52-2023, Mechanical Refrigeration Code

.8 C.2 CAN/CSA-C22.2 No 60335 Safety of Household and similar electrical appliances – Heat Pumps, Air-conditioners and dehumidifiers

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with general requirements.

.2 Indicate:

.1 Equipment, including connections, fittings, control assemblies and ancillaries, identifying factory and field assembled.

.2 Wiring and schematic diagrams.

.3 Dimensions and recommended installation.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance and engineering data for incorporation into manual specified in general requirements

.2 Data to include:

.1 Manufacturer’s name, type, model year, capacity, and serial number.

.2 Details of operation, servicing, and maintenance.

.3 Recommended spare parts list with names and addresses.

Part 2 Products

2.1 AIR SOURCE HEAT PUMP WATER HEATER (WH-1 & WH-2)

.1 Capacity:

.1 Tank storage: refer to schedule.

.2 Heat pump: refer to schedule.

.3 Electric resistance: refer to schedule.

.2 Electric:

.1 Single point connection.

.3 Working pressure: 160 psig.

.4 Controls:

.1 Built in LCD display with diagnostic and troubleshooting information.

.2 Selection of air source only, electric only, or combined heating operation.

.3 Provide BACNet integration card for BAS monitoring.

.5 Tanks:

.1 Glass-lined with alkaline borosilicate composition that is fused to steel by firing at a temperature range of 1,400 °Fahrenheit to 1,600°Farenheit.

.2 Provide commercial grade annode.

.3 Tank shall be insulated.

.6 Efficiency:

.1 Heat pump cycle: COP of 4.2

.2 Overall system, including standby losses shall meet ASHRAE 118-1.

.7 Refrigerant:

.1 Refrigerant shall be an A1 or an A2L classified refrigerant.

.2 Refrigerant charge shall not exceed 3 kg (6.6 lbs.)

.8 Acceptable Manufacturers:

.1 AO Smith CAHP Series

.2 Rheem

.3 Bradford White

2.2 WATER HEATER TRIM AND INSTRUMENTATION

.1 Drain valve: NPS 25 mm (1") with hose end.

.2 Thermometer: 100 mm (4") dial type with red pointer and thermowell filled with conductive paste.

.3 Thermowell filled with conductive paste for control valve temperature sensor.

.4 ASME rated temperature and pressure relief valve sized for full capacity of heater, having discharge terminating over floor drain and visible to operators.

.5 Magnesium anodes adequate for 20 years of operation and located for easy replacement.

Part 3 Execution

3.1 WATER HEATER

.1 Install in accordance with manufacturer's recommendations and authority having jurisdiction.

.2 Provide structural steel for horizontal (vertical) mounted tanks.

.3 Provide insulation between tank and supports.

3.2 FIELD QUALITY CONTROL

.1 Manufacturer's factory trained, certified Engineer to start up and commission DHW heaters.

.2 Check power supply.

.3 Check starter protective devices.

.4 Start up, check for proper and safe operation.

.5 Check settings and operation of all hand-off-auto selector switch, operating, safety and limit controls, audible and visual alarms, over-temperature and other protective devices.

.6 Demonstrate equipment operation as directed by consultant.

3.3 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.2 Warranty Duration:

.1 Water heater tank: three (3) years.

.2 Compressor, refrigeration circuit, and other components: one (1) year.

.3 Warranty Coverage:

.1 Applies to parts and labour.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ANSI Z21.10.1/CSA 4.1, Gas Water Heaters Volume I, Storage Water Heaters with Inputs Ratings of 75,000 Btuh, or less.

.3 ANSI Z21.10.3/CSA 4.3, Gas Water Heaters Volume III; Storage Water Heaters with Input Ratings above 75,000 Btuh, circulating and Instantaneous.

.4 CSA-B149.1, Natural Gas and Propane Installation Code.

.5 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code.

.6 CAN/CSA-B139, Installation Code for Oil Burning Equipment.

.7 CAN/CSA-B140.0, Oil Burning Equipment: General Requirements.

.8 CSA B140.12, Oil Burning Equipment: Service Water Heaters for Domestic Hot Water, Space Heating, and Swimming Pools.

.9 CAN/CSA-C309, Performance Requirements for Glass-Lined Storage Tanks for Household Hot Water Service.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with general requirements.

.2 Indicate:

- .1 Equipment, including connections, fittings, control assemblies and ancillaries, identifying factory and field assembled.
- .2 Wiring and schematic diagrams.
- .3 Dimensions and recommended installation.
- .4 Pump performance and efficiency curves.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance and engineering data for incorporation into manual specified in general requirements

.2 Data to include:

- .1 Manufacturer’s name, type, model year, capacity, and serial number.
- .2 Details of operation, servicing, and maintenance.
- .3 Recommended spare parts list with names and addresses.

Part 2 Products

2.1 ELECTRIC HIGH EFFICIENCY WATER HEATER (WH-3)

.1 The heater(s) shall be Gold Series Commercial Electric Model as indicated on drawings and manufactured by A. O. Smith.

.2 Heater(s) shall be listed by Underwriters' Laboratories and approved to the NSF Standard 5 by UL.

.3 Tanks shall have 160 psi working pressure and be equipped with extruded high density anode.

.4 All internal surfaces of the heater(s) exposed to water shall be glass lined with an alkaline borosilicate composition that has been fused to steel by firing at a temperature range of 1400°F to 1600°F.

.5 Electric heating elements shall be low watt density. Each element shall be controlled by an individually mounted thermostat and high temperature cut-off switch. All internal circuits shall be fused.

.6 The outer jacket shall be of baked enamel finish and shall be provided with fullsize control compartment for performance of service and maintenance through hinged front panel and shall enclose the tank with foam insulation.

.7 Electrical junction box with heavy duty terminal block shall be provided. The drain valve shall be located in the front for ease of servicing.

.8 Heater tank shall have a three year limited warranty as outlined in the written warranty. Manufacturer shall supply ASME-rated temperature and pressure relief valve. Fully illustrated instruction manual to be included.

.9 Meets standby loss requirements of the U. S. Department of Energy and current edition of ASHRAE/IES 90.1.

.10 Acceptable materials:

- .1 A. O. Smith Gold DRE-120-30
- .2 Ruud
- .3 Bradford White

Part 3 Execution

3.1 WATER HEATER

.1 Install in accordance with manufacturer's recommendations and authority having jurisdiction.

.2 Provide structural steel for horizontal (vertical) mounted tanks.

.3 Provide insulation between tank and supports.

.4 Provide neutralizing cartridge on each vent drain.

.5 Install oil burning domestic water heaters in accordance with CAN/CSA B139.

.6 Install natural gas or propane gas fired domestic water heaters in accordance with CSA-B149.1-00.

3.2 FIELD QUALITY CONTROL

.1 Manufacturer's factory trained, certified Engineer to start up and commission DHW heaters.

.2 Check power supply.

.3 Check starter protective devices.

.4 Start up, check for proper and safe operation.

.5 Check settings and operation of all hand-off-auto selector switch, operating, safety and limit controls, audible and visual alarms, over-temperature and other protective devices.

.6 Demonstrate equipment operation as directed by consultant.

3.3 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.2 Warranty Duration:

.1 Gas fired high efficiency water heater: three (3) year warranty certificate.

.2 Gas fired water heater (power vent): three (3) year warranty certificate.

.3 Gas fired water heater (atmospheric): three (3) year warranty certificate.

.4 Domestic hot water heater and storage tank: extended warranty: ten (10) years. Provide certificate.

.3 Warranty Coverage:

.1 Applies to parts and labour.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with general requirements.

.2 Indicate:

.1 Equipment, including connections, fittings, control assemblies and ancillaries, identifying factory and field assembled.

.2 Wiring and schematic diagrams.

.3 Dimensions and recommended installation.

.4 Pump performance and efficiency curves.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance and engineering data for incorporation into manual specified in general requirements

.2 Data to include:

.1 Manufacturer's name, type, model year, capacity, and serial number.

.2 Details of operation, servicing, and maintenance.

.3 Recommended spare parts list with names and addresses.

Part 2 Products

2.1 DOMESTIC HOT WATER EXPANSION TANK

.1 Pre-charged 6.4 gal (3.2 gal accept volume) hydropneumatic steel expansion tank complete with internal butyl diaphragm.

.2 Tank construction shall be in accordance with Section VIII of the ASME Boiler and Pressure Vessel Code, with all welds conforming to ASME Section IX. The tank must be stamped with a maximum working pressure of 150 psi and a maximum working temperature of 250°F.

.3 Tank volume: 24 l (4.5 gallons) with 0.73 acceptance factor.

.4 Acceptable material:

.1 Amtrol ST-12C

.2 Well-X-Trol

2.2 DOMESTIC HOT WATER CIRCULATING PUMPS (ELEMENTARY SCHOOL) (RP-1)

.1 Capacity: 0.6 l/s (9.5 gpm) against total differential head of 10 kPa (1.45 psi or 3.35 ft. wc.) as indicated.

.2 Construction: closed-coupled, in-line centrifugal, all bronze construction, stainless steel shaft, stainless steel or bronze shaft sleeve, two oil lubricated bronze sleeves or ball bearings. Design for 105°C (220°F) continuous service.

.3 Motor: 124 W (1/6 hp), drip-proof, with thermal overload protection. Provide multi-speed motor.

.4 Supports: provide as recommended by manufacturer.

.5 Acceptable materials:

.1 Bell & Gossett

.2 Armstrong

.3 Taco

2.3 DOMESTIC HOT WATER CIRCULATING PUMPS (CHILDCARE) (RP-2)

.1 Capacity: 0.18 l/s (3.0 gpm maximum) against total differential head of 10 kPa (1.45 psi or 3.35 ft. wc.) as indicated.

.2 Construction: closed-coupled, in-line centrifugal, all bronze construction, stainless steel shaft, stainless steel or bronze shaft sleeve, two oil lubricated bronze sleeves or ball bearings. Design for 105°C (220°F) continuous service.

.3 Motor: 124 W (1/6 hp), drip-proof, with thermal overload protection. Provide multi-speed motor.

.4 Supports: provide as recommended by manufacturer.

.5 Acceptable materials:

.1 Bell & Gossett

.2 Armstrong

.3 Taco

2.4 THERMOSTATIC WATER CONTROLLER (3 Port) (TMV-1)

.1 3/4" inlets 1" outlet thermostatic controller with swivel action check stops, removable cartridge with strainer, stainless steel piston and liquid fill thermal motor with bellows mounted out of water. Volume control shut off valve, bimetal dial thermometer (3" face, range 20° – 240°F), brass pipe, fittings and unions. Standard valve and piping finish is rough bronze.

.2 Acceptable materials:

.1 Symmons 7-400A-ASB-W

.2 Powers

2.5 THERMOSTATIC WATER CONTROLLER (3 Port) (TMV-2)

.1 ¾” inlets 3/4" outlet thermostatic controller with swivel action check stops, removable cartridge with strainer, stainless steel piston and liquid fill thermal motor with bellows mounted out of water. Volume control shut off valve, bimetal dial thermometer (3" face, range 20° – 240°F), brass pipe, fittings, and unions. Standard valve and piping finish is rough bronze.

.2 Acceptable materials:

.1 Symmons 7-200A-ASB-W

.2 Powers

2.6 FLAMMABLE STORAGE CABINET

.1 For storage of flammable liquids.

.2 Non-vented ULC and FM approved.

.3 Capacity: 1150 mm high x 1120 mm wide x 480 mm deep.

.4 Install where indicated on drawings.

.5 Non-vented storage cabinets shall conform to the Fire Code 4.2.10.6 (1)(A).

.6 Acceptable material:

.1 Metric Storage Systems Model 30FM

Part 3 Execution

3.1 RECIRCULATING PUMP

.1 Make piping and electrical connections to pump and motor assembly and controls as indicated.

.2 Ensure pump and motor assembly do not support piping.

3.2 DOMESTIC HOT WATER EXPANSION TANK

.1 Adjust expansion tank pressure to suit system pressure.

.2 Provide an expansion tank on the cold water feed to each water heater complete with lockshield type shutoff valve at inlet to tank.

.3 Provide an expansion tank at the water entrance.

3.3 FIELD QUALITY CONTROL

.1 Manufacturer's factory trained, certified Engineer to start up and commission DHW heaters.

.2 Check power supply.

.3 Check starter protective devices.

.4 Start up, check for proper and safe operation.

.5 Check settings and operation of all hand-off-auto selector switch, operating, safety and limit controls, audible and visual alarms, over-temperature, and other protective devices.

.6 Adjust flow from water-cooled bearings.

.7 Adjust impeller shaft stuffing boxes, packing glands.

.8 Demonstrate equipment operation as directed by consultant.

.9 Demonstrate water softener regeneration controls.

3.4 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.2 Warranty Duration:

.1 One (1) year warranty period applies.

.3 Warranty Coverage:

.1 Applies to parts and labour.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 Conform to Sections of Division 1 and to General Mechanical Requirements Section.

1.2 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 Perform work in accordance with the recommendations of and the requirements of:

- .1 Local and district bylaws and regulations.
- .2 N.F.P.A.14 “Installation of Standpipe and Hose Systems".
- .3 The Ontario Building Code.
- .4 U.L.C. or Factory Mutual approval for hose, valve and extinguisher requirements.
- .5 N.F.P.A.10 “Standard for Portable Fire Extinguishers”.
- .6 The Ontario Fire Code.

1.3 SUBMITTALS

.1 Submit shop drawings and maintenance data in accordance with general requirements.

1.4 COORDINATION

.1 Confirm fire extinguisher cabinet locations and quantities from both architectural and mechanical drawings and report any discrepancies to consultant prior to bid close.

.2 Coordinate location of cabinet with other trades and provide protection against damage during construction.

Part 2 Products

2.1 MULTI-PURPOSE DRY CHEMICAL EXTINGUISHERS (CLASS ABC)

.1 Stored pressure rechargeable type with hose and shut off nozzle, ULC labelled for A, B and C class protection as indicated. Size of extinguishers shall be as follows:

- .1 Kitchen Type ‘K’ 10 lb 20BC rating
- .2 Servery Areas Type ‘K’ 10 lb 20 BC rating
- .3 Mechanical Rooms 10 lb ABC rating
- .4 Storage Rooms 10 lb ABC rating
- .5 Corridor/Gym/Finished Areas 5 lb ABC rating complete with cabinet
- .6 Acceptable materials:
  - .1 Wilson & Cousins
  - .2 National

2.2 CABINETS

.1 Recessed mounted type of a size sufficient to contain all necessary components. Tub to be constructed of 1.5 mm (16 gauge) steel and finished with Wilco "Pro-Tech" Premier white painted finish. Adjustable frame comprising of 180° opening door and trim to be separate assembly adaptable to any type of finished wall. Trim to have 6 mm (1/4") return on outer edges with full length semi-concealed piano hinge, and Corbin style latching device.

.2 Doors and trim to be 1.5 mm (16 gauge) white painted finish. Door glass to be 6 mm (1/4") Duo Lite Safety Glass.

.3 Cabinet to maintain fire resistive rating of construction in which they occur.

.4 Do not provide cabinets for mechanical room and service area fire extinguishers unless indicated.

.5 Acceptable material:

.1 National Fire 102F (5 and 10 lb. Class)

.2 Wilson & Cousins

2.3 IDENTIFICATION

.1 Identify extinguishers in accordance with recommendations of NFPA 10.

.2 Attach tag or label to extinguishers indicating month and year of installation and provide space for the addition of recording service dates.

2.4 FIRE BLANKET

.1 100% non-combustible fire retardant glass fibre, non-toxic, non-conductor, cleanable complete with straps.

.2 Size: 1 m x 1 m (40" x 40").

.3 Cabinet to be surface mounted, 400 mm x 300 mm (16" x 12").

.4 Mount on wall in kitchen area where indicated or directed on site by consultant.

.5 Install in locations as indicated.

.6 Manufacturer:

.1 National FB 4040 blanket

.1 FB 6078 MC cabinet.

Part 3 Execution

3.1 INSTALLATION

.1 Provide portable fire extinguisher cabinets and mount in wall during construction. Cabinet to be surface or recessed mounted as indicated on the drawings. Install cabinets so that the door will not obstruct normal traffic when open.

.2 Hang extinguishers in cabinets with wall mounting bracket.

.3 Prior to installing the extinguisher cabinets, confirm the mounting height and exact location with the Consultant. Mount extinguisher so top of unit is not more than 1.5 m (5').

.4 Install wall mounted fire extinguishers complete with wall mounting bracket where indicated and/or directed on site by consultant.

.5 Caulk perimeter of fire extinguisher cabinets after acceptance.

3.2 TESTS

.1 Fire protection equipment shall be tested to the requirements of NFPA10, NFPA13, NFPA14 and comply with the requirements of the authorities having jurisdiction.

3.3 NFPA 96 HOOD

.1 10 BC rated fire extinguisher next to each NFPA 96 hood.

3.4 FIRE BLANKET

.1 Hang blanket on wall in cabinet as indicated, to manufacturers' recommendations.

.2 Fire blanket next to each NFPA 96 hood mounted on wall.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 CAN/CSA B45S1, Supplement #1 to CAN/CSA B-45 Series Plumbing Fixtures.

.3 CAN/CSA-B45 Series, CSA Standards on Plumbing Fixtures.

.4 CAN/CSA-B125.3, Plumbing Fittings.

.5 CAN/CSA-B651, Accessible Design for the Built Environment.

1.2 SHOP DRAWINGS

.1 Submit shop drawings and product data in accordance with general requirements.

.2 Indicate, for all fixtures and trim:

.1 Dimensions, construction details, roughing-in dimensions.

.2 Factory-set water consumption per flush at recommended pressure.

.3 For water closets, urinals: minimum pressure required for flushing.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data including monitoring requirements for incorporation into manual specified in general requirements.

.2 Include:

.1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.

.2 Details of operation, servicing, maintenance.

.3 List of recommended spare parts.

1.4 PRODUCTS INSTALLED BUT NOT SUPPLIED UNDER THIS SECTION

.1 Install rough-in for equipment supplied by others, complete with valves on hot and cold water supplies, waste and vent.

.2 Equipment installed by others.

.1 Connect with unions.

.3 Equipment not installed.

.1 Capped with valves for future connection by others.

Part 2 Products

2.1 MANUFACTURED UNITS

.1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.

.2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.3.

.3 Exposed plumbing brass to be chrome plated.

.4 Number, locations: Architectural drawings to govern.

.5 Fixtures in any one location to be product of one manufacturer and of same type.

.6 Trim in any one location to be product of one manufacturer and of same type.

2.2 FIXTURE CARRIERS

.1 Provide factory manufactured floor-mounted carrier systems for all wall-mounted fixtures.

.2 Acceptable materials:

.1 Zurn

.2 Smith

.3 Ancon

2.3 PLUMBING FIXTURES

.1 Refer to plumbing fixture schedule on the drawings for fixture type, manufacturer, trim, drainage supply, and accessories.

2.4 FIXTURE PIPING

.1 Hot and cold water supplies to each fixture/faucet:

Chrome plated flexible supply pipes each with screwdriver stop, reducers, escutcheon and chrome plated nipple.

.1 Acceptable materials:

.1 Delta 47T900 Series

.2 McGuire

.2 Waste:
Open grid strainer, or pop up as indicated, offset open grid strainer on Barrier-Free fixtures, cast brass fittings with tubular piping, chrome plated, rubber gasket compression fitting, and overflow flange.

.1 Acceptable materials:

.1 Delta 33T200 Series

.2 McGuire

.3 'P' Traps:

Cast brass P trap with cleanout on each fixture not having integral trap.

Chrome plated in all exposed places.

.1 Acceptable materials:

.1 Delta 33T300 Series

.2 McQuire

Part 3 Execution

3.1 INSTALLATION

.1 Mounting heights:

.1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified. Confirm mounting height(s) with consultant prior to rough-in.

.2 Wall-hung fixtures: measured from finished floor.

.3 Physically Barrier-Free: to comply with most stringent of either NBCC or CAN/CSA B651.

.2 Drinking fountains:

.1 In accordance with CAN/CSA B45S1.

3.2 ADJUSTING

.1 Conform to water conservation requirements specified this section.

.2 Adjustments.

.1 Adjust water flow rate to design flow rates.

.2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.

.3 Adjust flush valves to suit actual site conditions.

.4 Adjust urinal flush timing mechanisms.

.5 Adjust water cooler, drinking fountain flow stream to ensure no spillage.

.6 Automatic flush valves for water closets and urinals: set controls to prevent unnecessary flush cycles during silent hours.

.3 Checks.

.1 Water closets, urinals: flushing action.

.2 Aerators: operation, cleanliness.

.3 Vacuum breakers, backflow preventors: operation under all conditions.

.4 Wash fountains: operation of flow-actuating devices.

.5 Refrigerated water coolers: operation, temperature settings.

.4 Thermostatic controls.

.1 Verify temperature settings, operation of control, limit and safety controls.

.5 Floor and wall mounted fixtures: caulk to floor or wall using silicone caulking to make water tight, colour to match fixture.

.6 Counter mounted fixtures: lay fixtures into bead of caulking to ensure excess moisture does not reach the cut edge of the countertop. Clean excess caulking off outside the sink.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 This section is to read in conjunction with Division 1, the general condition, and the General Requirements of the mechanical trades.

1.2 REFERENCES

.1 Tested to ANSI/UL Standard 508.

.2 UL-508 certified for the building and assembly.

.3 CSA or C-UL stickers shall be applied to both the VFD and option panels.

.4 Manufacturers shall be ISO 9001 certified facilities.

1.3 SUBMITTALS

.1 Submit manufacturer's performance data including dimensional drawings, power circuit diagrams, installation and maintenance manuals, warranty description, VFD's FLA rating, certification agency file numbers and catalogue information.

.2 The specification lists the minimum VFD performance requirements for this project. Each supplier shall list any exceptions to the specification. If no departures from the specification are identified, the supplier shall be bound by the specification.

.3 Harmonic filtering. The manufacturer shall, with the aid of the buyer's electrical power single line diagram, providing the data required by IEEE-519, perform an analysis to initially demonstrate the supplied equipment will met the IEEE standards after installation. If, as a result of the analysis, it is determined that additional filter equipment is required to meet the IEEE recommendations, then the cost of such equipment shall be included in the bid. A harmonic analysis shall be submitted with the approval drawings to verify compliance with the latest version of IEEE-519 voltage and current distortion limits as shown in table 10.2 and 10.3 at the point of common coupling (PCC). The PCC shall be defined as the consumer–utility interface or primary side of the main distribution transformer.

1.4 WARRANTY

.1 The VFD shall be warranted by the manufacturer for a period of five (5) years from date of substantial completion. The warranty shall include parts, labour, travel costs and living expenses incurred by the manufacturer to provide factory authorized on-site service. The warranty shall be provided by the VFD manufacturer.

Part 2 Products

2.1 ACCEPTABLE MANUFACTURERS

.1 Danfoss Graham.

.2 ABB.

2.2 GENERAL

.1 The VFD shall convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed of three-phase AC motors. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for centrifugal pump and fan control and to eliminate the need for motor derating.

.2 With the motor's rated voltage applied to the VFD input, the VFD shall allow the motor to produce full rated power at rated amps, RMS fundamental volts, and speed without using the motor's service factor. VFD's utilizing sine weighted/coded modulation (with or without 3rd harmonic injection) must provide data verifying that the motors will not draw more than full load current during full load and full speed operation.

.3 Include an input full-wave bridge rectifier and maintain a fundamental power factor near unity regardless of speed or load.

.4 Provide DC link reactors on both the positive and negative rails of the DC bus to minimize power line harmonics. VFD's without DC link reactors shall provide a minimum 5% impedance line reactor.

.5 Full load amp rating shall meet or exceed NEC Table 430-150. The VFD shall be able to provide full rated output current continuously, 110% of rated current for 60 seconds and 160% of rated current for up to 0.5 second while starting.

.6 Provide full torque at any selected frequency from 28 Hz to base speed to allow driving direct drive fans without derating.

.7 An automatic energy optimization selection feature shall be provided in the VFD. This feature shall automatically and continually monitor the motor's speed and load and adjust the applied voltage to maximize energy savings and provide up to an additional 3% to 10% energy savings.

.8 Input and output power circuit switching shall be able to be accomplished without interlocks or damage to the VFD. Switching rate may be up to 1 time per minute on the input and unlimited on the output.

.9 An automatic motor adaptation test algorithm shall measure motor stator resistance and reactance to optimize performance and efficiency. It shall not be necessary to run the motor or de-couple the motor from the load to run the test.

.10 Galvanic and/or optical isolation shall be provided between the VFD's power circuitry and control circuitry to ensure operator safety and to protect connected electronic control equipment from damage caused by voltage spikes, current surges, and ground loop currents. VFD's not including either galvanic or optical isolation on both analog I/O and discrete I/O shall include additional isolation modules.

.11 VFD shall minimize the audible motor noise through the use of an adjustable carrier frequency. The carrier frequency shall be automatically adjusted to optimize motor and VFD efficiencies while reducing motor noise.

.12 VFD's operating 600/3/60 motors not designed to meet Nema MG1 Part 31 should include Output dv/dt (LC) Reactors.

2.3 PROTECTIVE FEATURES

.1 VFD shall be provided with an integral disconnect and Integral Fast Blow Semi-Conductor fuses sized as specified by ULC. Fuses shall be Bussman JJS type or equivalent.

.2 A minimum of Class 20 I2t electronic motor overload protection for single motor applications and thermal-mechanical overloads for multiple motor applications shall be provided.

.3 Protection against input transients, loss of AC line phase, output short circuit, output ground fault, over-voltage, under-voltage, VFD over-temperature and motor over-temperature. The VFD shall display all faults in plain English. Codes are not acceptable.

.4 Protect VFD from sustained power or phase loss. The VFD shall provide full rated output with an input voltage as low as 90% of the nominal.

.5 The VFD shall incorporate a motor preheat circuit to keep the motor warm and prevent condensation build up in the stator.

.6 To prevent breakdown of the motor winding insulation, the VFD shall be designed to comply with IEC Part 34-17. Motors shall have inverter rated insulation (1600V).

.7 VFD shall include a “signal loss detection” circuit to sense the loss of an analog input signal such as 4 to 20 mA or 2 to 10 V DC, and shall be programmable to react as desired in such an instance.

.8 VFD shall function normally when the keypad is removed while the VFD is running and continue to follow remote commands. No warnings or alarms shall be issued as a result of removing the keypad.

.9 VFD shall catch a rotating motor operating forward or reverse up to full speed.

.10 VFD shall be rated for 100,000 amp interrupting capacity (AIC).

.11 VFD shall have externally mounted EMI electromagnetic suppressor to limit the EMI and RFI output from the VFD. VFD to be mounted in an all metal cabinet to limit radiated RFI.

.12 VFD shall include current sensors on all three output phases to detect and report phase loss to the motor. The VFD will identify which of the output phases is low or lost.

.13 VFD shall continue to operate without faulting until input voltage reaches 300 V AC on 208/230 volt VFD’s, and 701V AC on 575 volt VFD’s.

.14 For remote VFD installations, provide an output filter (load side reactor) at each VFD to protect the equipment motor. Coordinate installation with equipment manufacturer.

2.4 INTERFACE FEATURES

.1 Hand/Start, Off/Stop and Auto/Start selector switches shall be provided to start and stop the VFD and determine the speed reference.

.2 The VFD shall be able to be programmed to provide a 24 V DC output signal to indicate that the VFD is in Auto/Remote mode.

.3 The VFD shall provide digital manual speed control. Potentiometers are not acceptable.

.4 Lockable, alphanumeric backlit display keypad can be remotely mounted up to 10 feet away using standard 9-pin cable.

.5 The keypads for all sizes of VFD's shall be identical and interchangeable.

.6 To set up multiple VFD's, it shall be possible to upload all set-up parameters to the VFD's keypad, place that keypad on all other VFD's in turn and download the set-up parameters to each VFD. To facilitate setting up VFD's of various sizes, it shall be possible to download from the keypad only size independent parameters.

.7 Display shall be programmable to display in 9 languages including English, Spanish and French.

.8 The display shall have four lines, with 20 characters on three lines and eight large characters on one line.

.9 A red FAULT light, a yellow WARNING light and a green POWER-ON light shall be provided. These indications shall be visible both on the keypad and on the VFD when the keypad is removed.

.10 A quick set-up menu with factory preset typical HVAC parameters shall be provided on the VFD eliminating the need for macros.

.11 The VFD shall include a standard RS-485 communications port for connection to a Johnson Controls N2 and Siemens FLN serial communication system. The connection shall be software selectable and addressable by the user. The option for Lonworks and BacNet communication must also be available.

.12 As a minimum, the following points shall be controlled and/or accessible:

VFD Start/Stop, Speed reference, Fault diagnostics, and Meter points as follows;

Motor power in HP, Motor power in kW, Motor kW-hr, Motor current, Motor voltage, Hours run, Feedback signal #1, Feedback signal #2, DC link voltage, Thermal load on motor, and Thermal load on VFD, Heat sink temperature.

.13 Four additional Form C 230 volt programmable relays shall be available for factory or field installation within the VFD.

.14 Two set-point control interface (PID control) shall be standard in the unit. VFD shall be able to look at two feedback signals, compare with two set-points and make various process control decisions.

.15 Floating point control interface shall be provided to increase/decrease speed in response to contact closures.

.16 Four simultaneous displays shall be available. They shall include frequency or speed, run time, output amps and output power. VFD's unable to show these four displays simultaneously shall provide panel meters.

.17 Sleep mode shall be provided to automatically stop the VFD when its speed drops below set "sleep" level for a specified time. The VFD shall automatically restart when the speed command exceeds the set "wake" level.

.18 The sleep mode shall be functional in both follower mode and PID mode.

.19 Run permissive circuit shall be provided to accept a "system ready" signal to ensure that the VFD does not start until dampers or other auxiliary equipment are in the proper state for VFD operation. The run permissive circuit shall also be capable of sending an output signal as a start command to actuate external equipment before allowing the VFD to start.

.20 The following displays shall be accessible from the control panel in actual units: Reference Signal Value in actual units, Output Frequency in Hz or percent, Output Amps, Motor HP, Motor kW, kWhr, Output Voltage, DC Bus Voltage, VFD Temperature in degrees, and Motor Speed in engineering units per application (in GPM, CFM, etc.). VFD will read out the selected engineering unit either in a linear, square or cubed relationship to output frequency as appropriate to the unit chosen.

.21 The display shall be programmed to read in inches of water column (in-wg) for an air handler application, pressure per square inch (psi) for a pump application, and temperature (oF) for a cooling tower application.

.22 VFD shall be able to be programmed to sense the loss of load and signal a no load/broken belt warning or fault.

.23 If the temperature of the VFD's heat sink rises to 80°C, the VFD shall automatically reduce its carrier frequency to reduce the heat sink temperature. If the temperature of the heat sink continues to rise the VFD shall automatically reduce its output frequency to the motor. As the VFD's heat sink temperature returns to normal, the VFD shall automatically increase the output frequency to the motor and return the carrier frequency to its normal switching speed.

.24 The VFD shall have temperature controlled cooling fans for quiet operation and minimized losses.

.25 The VFD shall store in memory the last 10 faults and related operational data.

.26 Eight programmable digital inputs shall be provided for interfacing with the systems control and safety interlock circuitry.

.27 Two programmable relay outputs, one Form C 240 V AC, one Form A 30 V AC, shall be provided for remote indication of VFD status.

.28 Three programmable analog inputs shall be provided and shall accept a direct-or-reverse acting signal. Analog reference inputs accepted shall include two voltage (0 to 10 V DC, 2 to 10 V DC) and one current (0 to 20 mA, 4 to 20 mA) input.

.29 Two programmable 0 to 20 mA analog outputs shall be provided for indication of VFD status. These outputs shall be programmable for output speed, frequency, current and power. They shall also be programmable to provide a selected 24 V DC status indication.

.30 Under fire mode conditions, the VFD shall be able to be programmed to automatically default to a preset speed.

2.5 ADJUSTMENTS

.1 VFD shall have an adjustable carrier frequency in steps of not less than 0.1 kHz to allow tuning the VFD to the motor.

.2 Sixteen preset speeds shall be provided.

.3 Four acceleration and four deceleration ramps shall be provided. Accel and decel time shall be adjustable over the range from 0 to 3,600 seconds to base speed. The shape of these curves shall be automatically contoured to ensure no-trip acceleration and deceleration.

.4 Four current limit settings shall be provided.

.5 If the VFD trips on one of the following conditions, the VFD shall be programmable for automatic or manual reset: under-voltage, over-voltage, current limit and inverter overload.

.6 The number of restart attempts shall be selectable from 0 through 20 or infinitely and the time between attempts shall be adjustable from 0 through 600 seconds.

.7 An automatic “on delay” may be selected from 0 to 120 seconds.

2.6 SERVICE CONDITIONS

.1 Unit shall operate in ambient temperature of -10 to 40°C (14 to 104°F).

.2 Unit shall operate in 0 to 95% relative humidity, non-condensing.

.3 Operate in elevation up to 3,300 feet without derating.

.4 Maximum AC line voltage variation, -10 to +10% of nominal with full output.

.5 No side clearance shall be required for cooling of any units. All power and control wiring shall be done from the bottom.

2.7 FACTORY TESTING

.1 To ensure quality and minimize infantile failures at the jobsite, the manufacturer shall test the complete VFD. The VFD shall operate a dynamometer at full load and speed and shall be cycled during the test.

.2 All optional features shall be functionally tested at the factory for proper operation.

2.8 BYPASS SWITCH

.1 Bypass Controller - Automatic transfer to line power via contactors. When in the “Drive” mode, the bypass contactor is open and the drive output contactor is closed. In the “Bypass” position, the drive output contactor is open, and the bypass contactor is closed via Start/stop command. Start/stop via customer supplied maintained contact shall be Dry type 115V compatible and shall function in both the “Drive” and “Bypass” modes. The design shall include single-phase protection in both the VFD and bypass modes.

Part 3 Execution

3.1 START-UP SERVICE

.1 The manufacturer shall provide start-up and commissioning of the VFD and its optional circuits by a factory certified service technician who is experienced in start-up and repair services. Sales personnel and other agents who are not factory certified shall not be acceptable as commissioning agents. Start-up services shall include checking for verification of proper operation and installation for the VFD, its options and its interface wiring to the building automation system.

3.2 EXAMINATION

.1 Contractor to verify that job site conditions for installation meet factory recommended and code-required conditions for VFD installation prior to start-up, including clearance spacing, temperature, contamination, dust, and moisture of the environment. Separate conduit installation of the motor wiring, power wiring, and control wiring, and installation per the manufacturer's recommendations shall be verified.

3.3 INSTALLATION

.1 Install to manufacturer’s recommendations.

.2 Install to the requirements of the local Hydro codes. Obtain hydro permits and pay all fees.

.3 Install in an accessible location and proper service height from floor.

.4 Install in clean, dry, and conditioned environment.

.5 The VFD is to be covered and protected from installation dust and contamination until the environment is cleaned and ready for operation. The VFD shall not be operated while the unit is covered.

.6 Wiring of devices to be to the standards of Electrical Division.

.7 Provide one manufacturer of VFD’s throughout the project.

3.4 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.2 Warranty Duration:

.1 The VFD shall be warranted by the manufacturer for a period of five (5) years from date of Ready for Takeover. The warranty shall include parts, labour, travel costs and living expenses incurred by the manufacturer to provide factory authorized on-site service. The warranty shall be provided by the VFD manufacturer.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ANSI/ASME B31.1, Power Piping.

.3 ANSI/ASME Boiler and Pressure Vessel Code:

- .1 Section 1: Power Boilers.
- .2 Section V: Nondestructive Examination.
- .3 Section IX: Welding and Brazing Qualifications.

.4 CSA W47.2, Certification of Companies for Fusion Welding of Aluminum.

.5 CSA W48, Filler Metals and Allied Metals for Arc Welding.

.6 CSA B51, Boiler, Pressure Vessel and Pressure Piping Code.

.7 CAN/CSA-W117.2, Safety in Welding, Cutting and Allied Processes.

.8 CSA W178.1, Certification of Welding Inspection Organizations.

.9 CSA W178.2, Certification of Welding Inspectors.

.10 AWS B2.1, Specification for Welding Procedure and Performance Qualification.

.11 AWS C1.1, Recommended Practices for Resistance Welding.

.12 AWS W1, Welding Inspection.

.13 ANSI/AWWA C206, Field Welding of Steel Water Pipe.

1.2 WELDERS QUALIFICATIONS

.1 Welding qualifications to be in accordance with CSA B51.

.2 Use qualified and licensed welders possessing certificate for each procedure to be performed from authority having jurisdiction.

.3 Furnish welder's qualifications to Consultant.

.4 Each welder to possess identification stamp issued by authority having jurisdiction.

.5 Certification of companies for fusion welding of aluminum to be in accordance with CSA W47.2.

1.3 INSPECTORS QUALIFICATIONS

.1 Inspectors to be qualified to CSA W178.2.

1.4 WELDING PROCEDURES

.1 Registration of welding procedures in accordance with CSA B51.

.2 Copy of welding procedures to be available for inspection at all times.

.3 Safety in welding, cutting and allied processes to be in accordance with CAN/CSA-W117.2.

Part 2 Products

2.1 ELECTRODES

.1 Electrodes: in accordance with CSA W48 Series.

Part 3 Execution

3.1 WORKMANSHIP

.1 Welding to be in accordance with ANSI/ASME B31.1, ANSI/ASME Boiler and Pressure Vessel Code, Sections I and IX and ANSI/AWWA C206, using procedures conforming to AWS B3.0, AWS C1.1, and applicable requirements of provincial authority having jurisdiction.

.2 Protect all adjacent areas.

3.2 INSTALLATION REQUIREMENTS

.1 Identify each weld with welder's identification stamp.

.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 50 mm (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 all weld quality requirements and defect limits of applicable codes and standards with Consultant before any work is started.

.2 Formulate "Inspection and Test Plan" in co-operation with Consultant.

.3 Do not conceal welds until they have been inspected, tested and approved by inspector.

.4 Provide for inspector to visually inspect all welds during early stages of welding procedures in accordance with AWS W1. Repair or replace all defects as required by codes and as specified herein.

3.4 SPECIALIST EXAMINATIONS AND TESTS

.1 General.

.1 Perform examinations and tests by specialist qualified in accordance with CSA W178.1 and CSA W178.2 and approved by Consultant.

.2 To ANSI/ASME Boiler and Pressure Vessels Code, Section V, CSA B51 and requirements of authority having jurisdiction.

.3 Inspect and test 25% of welds in accordance with "Inspection and Test Plan" by non-destructive visual examination and magnetic particle (hereinafter referred to as "particle") tests and/or full gamma ray radiographic (hereinafter referred to as "radiography") tests as specified.

.2 Hydrostatically test all 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 any weld by visual examination, perform additional testing as directed by Consultant of a total of up to 10% of all welds, selected at random by Consultant by radiographic tests.

3.5 DEFECTS CAUSING REJECTION

.1 As described in ANSI/ASME B31.1 and ANSI/ASME Boiler and Pressure Vessels Code.

.2 In addition, hydronic water systems:

.1 Undercutting greater than 0.8 mm (1/32") adjacent to cover bead on outside of pipe.

.2 . Undercutting greater than 0.8 mm (1/32") adjacent to root bead on inside of pipe.

.3 Undercutting greater than 0.8 mm (1/32") at combination of internal surface and external surface.

.4 Incomplete penetration and incomplete fusion greater than total length of 40 mm (1 1/2") in any 1500 mm (60") length of weld depth of such defects being greater than 0.8 mm (1/32").

.5 Repair all cracks and defects in excess of 0.8 mm (1/32") in depth.

.6 Repair defects whose depth cannot be determined accurately on the basis of visual examination or 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.

3.7 CLAIMS AGAINST OWNER FOR DELAYS

.1 Claims against Owner for delays in completion of project will not be entertained for reasons of failures of welds to pass examinations.

3.8 OCCUPIED AREAS

.1 Do not do any “Hot Work” in occupied areas.

.2 Obtain “Hot Work” permits for working in existing building.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 Canadian General Standards Board (CGSB)

.1 ASTM C553, Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.2 CAN/ULC-S702, Mineral Fiber Thermal Insulation for Buildings.

.3 ASTM C612, Mineral Fiber Block and Board Thermal Insulation.

.4 CGSB 51-GP-52Ma-[89], Vapour Barrier Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.3 Underwriters Laboratories of Canada (ULC).

.1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.

.4 American Society for Testing and Materials (ASTM).

.1 ASTM C 335, Test Method for Steady State Heat Transfer Properties of Pipe Insulation.

.2 ASTM C 449M, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.3 ASTM B 209M, Specification for Aluminum and Aluminum Alloy Sheet and Plate.

.5 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).

.1 ASHRAE Standard 90.1.

.6 Manufacturer's Trade Associations.

.1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with general requirements.

.2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for duct jointing recommendations.

1.3 INSTALLATION INSTRUCTIONS

.1 Submit manufacturer's installation instructions in accordance with general requirements.

.2 Installation instructions to include procedures to be used, installation standards to be achieved.

1.4 QUALIFICATIONS

.1 Installer to be specialist in performing work of this section and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to site in original factory packaging, labeled with manufacturer's name, address.

.2 Protect from weather and construction traffic.

.3 Protect against damage from any source.

.4 Store at temperatures and conditions required by manufacturer.

1.6 DEFINITIONS

.1 For purposes of this section:

.1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.

.2 "EXPOSED" - will mean "not concealed" as defined herein.

.2 Insulation systems - insulation material, fasteners, jackets, and other accessories.

Part 2 Products

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre as specified herein includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C (75°F) mean temperature when tested in accordance with ASTM C 335.

.3 Type C-1: Rigid mineral fibre board to ASTM C612, with factory applied vapour retarder jacket to CGSB 51-GP-52Ma:

.1 Mineral fibre: to ASTM C553.

.2 Jacket: to CGSB 51-GP-52 Ma.

.3 Maximum "k" factor: to ASTM C553.

.4 Type C-2: Mineral fibre blanket to ASTM C553 faced with factory applied vapour retarder jacket to CGSB 51-GP-52Ma:

.1 Mineral fibre: to ASTM C553.

.2 Jacket: to CGSB 51-GP-52 Ma.

.3 Maximum "k" factor: to ASTM C553.

.5 Type C-3: High temperature fire rated duct wrap, ULC classified soluble amorphous wool blanket with factory applied flame resistant aluminum foil fiberglass reinforced facing.

.1 Acceptable Materials:

.1 Morgan Firemaster Fastwrap XL

.2 CL4 Fire

.6 Manufacturers:

.1 All materials must be supplied by the same manufacturer.

.2 Acceptable Materials:

.1 Johns Manville

.2 Fibreglass Canada

.3 Knauf

.4 Manson

.5 Roxul

2.3 JACKETS

.1 Canvas:

.1 220 g/m² (0.0451 lb/ft²) cotton, plain weave, treated with dilute fire-retardant lagging adhesive to ASTM C 921.

.2 Lagging adhesive: Compatible with insulation.

2.4 ACCESSORIES

.1 Vapour retarder lap adhesive:

.1 Water based, fire retardant type, compatible with insulation.

.2 Indoor Vapour Retarder Finish:

.1 Vinyl emulsion type acrylic, compatible with insulation.

.3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C 449.

.4 ULC Listed Canvas Jacket:

.1 220 g/m² (0.0451 lb/ft²) cotton, plain weave, treated with dilute fire-retardant lagging adhesive to ASTM C 921.

.5 Tape: self-adhesive, aluminum, reinforced, 75 mm (3") wide minimum.

.6 Contact adhesive: quick-setting Duro Dyne 1A-22 or equal.

.7 Canvas adhesive: washable.

.8 Tie wire: 1.5 mm (16 gauge) stainless steel.

.9 Facing: 25 mm (1") stainless steel hexagonal wire mesh stitched on one face of insulation

.10 Fasteners: weld pins, length to suit insulation, with 40 mm (1½") diameter clips.

Part 3 Execution

3.1 PRE-INSTALLATION REQUIREMENTS

.1 Pressure testing of ductwork systems to be complete, witnessed and certified.

.2 Surfaces to be clean, dry, free from foreign material.

3.2 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturers instructions and this specification.

.3 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Hangers, supports to be outside vapour retarder jacket.

.4 Supports, Hangers in accordance with general requirements.

.1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.

.5 Fasteners: At 300 mm (12") oc. in horizontal and vertical directions, minimum two rows each side.

.6 Provide rigid insulation for exposed ductwork.

3.3 DUCTWORK INSULATION SCHEDULE

.1 Insulation types and thicknesses conform to following table:

Application	Type	Thickness
Rectangular supply air ducts	C-1	25 mm (1")
Round supply air ducts	C-2	25 mm (1")
Supply, return and exhaust ducts exposed (visible) in space being served	none	
Outdoor air ducts (exterior ductwork)	C-1	80 mm (3")
Outdoor air intake ductwork and plenums	C-1	50 mm (2")
Exhaust plenums dampers and louvres	C-1	25 mm (1")
Interior acoustically lined ducts	none	
Last 1.5m of Exhaust duct	C-1	25 mm (1")
Fire wrapped duct as indicated	C-3	50 mm (2")

.2 Exposed round ducts 600 mm (24") and larger, smaller sizes where subject to abuse:

.1 Use TIAC code C-1 insulation, scored to suit diameter of duct.

.3 Finishes: Conform to following table:

Application	Rectangular	Round
Indoor, concealed	none	none
Indoor, exposed	Canvas	Canvas

3.4 FIRE BARRIER UTILITY SERVICE WRAP INSTALLATION

.1 The Fire Barrier Utility Service Wrap and Fire Barrier Silicone Sealants must be stored in a dry warehouse environment. Pallets should not be stacked.

.2 In order to install the utility service firestop system, the surfaces of all the openings and penetrating items need to be clean, dry, frost free and free of dust.

.3 The Fire Barrier Utility Service Wrap blanket shall be wrapped around the perimeter of the duct and is cut to a length to overlap itself not less than 3 in. (76 mm). The overlap made by adjacent blankets shall form the “longitudinal” overlap. Aluminum foil tape is used to seal all cut edges of the blanket and any tears in the foil scrim.

.4 Filament tape can be used to temporarily hold the blanket in place until the banding is applied. The steel banding is applied around the duct 1-1/2 in. (38 mm) from each edge of the blanket, and maximum 10-1/2 in. (26,7 cm) centers. The banding is placed around the material and tightened so as to sufficiently hold the Fire Barrier Utility Service Wrap in place against the duct, compressing the foil but not cutting the foil.

.5 Additional Pinning to Prevent Sagging of the Wrap: For Ducts 24 in. (60 cm) and larger in width, additional pins are needed to support the blanket on the bottom horizontal surface and on the outside face of a vertical duct run. Space pins a maximum of 10-1/2 in. (26,7 cm) apart in the direction of the blanket width, and a maximum of 12 in. (30 cm) apart in the direction of the blanket length.

.6 Support hanger systems shall be external of the duct wrap.

.7 Provide four galvanized steel threaded rods, ¼ in. diameter (6,35 mm) by 4-1/2 in. to 5 in. long (114 mm to 127 mm) are welded to the duct at the corners of the door opening. Four steel tubes, each 3 in. (76 mm) long, are placed over the rods to act as protection for the Fire Barrier Utility Service Wrap when fastening the door. Four installation pins are welded to the door panel for installation of the blanket. One layer of Fire Barrier Utility Service Wrap shall be cut approximately the same size as the access panel and impaled over the insulation pins on the panel.
It is essential that this layer fit tightly against the wrap surrounding the access door opening with no through openings. A second layer of Fire Barrier Utility Service Wrap shall be cut so as to overlap the first layer by a minimum of 1 in. (25,4 mm). The second layer is impaled over the pins and both layers are locked in place with galvanized speed clips.
Pins that extend beyond the outer layer of Fire Barrier Utility Service Wrap shall be turned down to avoid sharp points on the door.

.8 When the duct penetrates a fire rated wall, ceiling or floor, an approved firestop system must be constructed to manufactures recommendation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 Canadian General Standards Board (CGSB)

.1 ASTM C553, Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.2 CGSB 51-GP-52Ma, Vapour Barrier Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.3 CAN/CGSB-51.53, Poly (Vinyl Chloride) Jacketing Sheet, for Insulating Pipes, Vessels and Round Ducts.

.3 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.4 American Society for Testing and Materials (ASTM)

.1 ASTM C 335, Test Method for Steady State Heat Transfer Properties of Pipe Insulation.

.2 ASTM C 921, Practice for Determining the Properties Jacketing Materials for Thermal Insulation.

.3 ASTM B 209M, Specification for Aluminum and Aluminum Alloy Sheet and Plate.

.5 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).

.1 ASHRAE Standard 90.1.

.6 Manufacturer's Trade Associations

.1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with general requirements.

.2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for pipe, fittings, valves and jointing recommendations.

1.3 INSTALLATION INSTRUCTIONS

.1 Submit manufacturer's installation instructions in accordance with general requirements.

.2 Installation instructions to include procedures to be used, installation standards to be achieved.

1.4 QUALIFICATIONS

.1 Installer to be specialist in performing work of this section and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.2 Protect from weather, construction traffic.

.3 Protect against damage from any source.

.4 Store at temperatures and conditions required by manufacturer.

1.6 DEFINITIONS

.1 For purposes of this section:

.1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.

.2 "EXPOSED" - will mean "not concealed" as defined herein.

Part 2 Products

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre as specified herein includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C (75°F) mean temperature when tested in accordance with ASTM C 335.

.3 Type A-1: Rigid moulded mineral fibre with factory applied vapour retarder jacket.

.1 Mineral fibre: to ASTM C553.

.2 Jacket: to CGSB 51-GP-52 Ma.

.3 Maximum "k" factor: to ASTM C553.

.4 Type A-3: Flexible unicellular tubular elastomer.

.1 Insulation to ASTM C553 with vapour retarder jacket.

.2 Jacket: to CGSB 51-GP-52 Ma.

.3 Maximum “k” factor: to ASTM C553.

.4 To be certified by manufacturer to be free of potential stress corrosion cracking corrodants.

.5 Materials:

.1 All materials must be supplied by the same manufacturer.

.2 Acceptable Materials:

.1 Fibreglass Canada

.2 Knauf

.3 Manson

.4 Pittsburg Corning

2.3 INSULATION SECUREMENT

.1 Tape: Self-adhesive, aluminum, reinforced, 50 mm (2") wide minimum.

.2 Contact adhesive: Quick setting.

.3 Canvas adhesive: Washable.

.4 Tie wire: 1.5mm (16 gauge) diameter stainless steel.

.5 Bands: Stainless steel, 20 mm (3/4") wide, 0.5 mm (26 gauge) thick.

2.4 CEMENT

.1 Thermal insulating and finishing cement:

.1 To ASTM C553.

.2 Hydraulic setting or Air drying on mineral wool, to ASTM C 449M.

2.5 VAPOUR RETARDER LAP ADHESIVE

.1 Water based, fire retardant type, compatible with insulation.

2.6 INDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

2.7 OUTDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

.2 Reinforcing fabric: Fibrous glass, untreated 305 g/m^2 (0.062 lb/ft^2).

2.8 JACKETS

.1 Polyvinyl Chloride (PVC):

.1 One-piece moulded type [and sheet] to CAN/CGSB-51.53 with pre-formed shapes as required.

.2 Colours: white.

.3 Minimum service temperatures: -20°C (-4°F).

.4 Maximum service temperature: 65°C (150°F).

.5 Moisture vapour transmission: 0.02 perm.

.6 Fastenings:

.1 Use solvent weld adhesive compatible with insulation to seal laps and joints.

.2 Tacks.

.3 Pressure sensitive vinyl tape of matching colour.

.2 Aluminum:

.1 To ASTM B 209M.

.2 Thickness: 0.50 mm (26 gauge) sheet.

.3 Finish: Smooth.

.4 Joining: Longitudinal and circumferential slip joints with 50 mm (2") laps.

.5 Fittings: 0.50 mm (26 gauge) thick die-shaped fitting covers with factory-attached protective liner.

.6 Metal jacket banding and mechanical seals: stainless steel, 20 mm (3/4") wide, 0.50 mm (26 gauge) thick at 300 mm (12") spacing.

.3 Canvas:

.1 220 g/m^2 (0.0451 lb/ft^2) cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C 921.

.2 Lagging adhesive: Compatible with insulation.

2.9 CAULKING FOR JACKETS

.1 Caulking: Silicone clear caulking.

Part 3 Execution

3.1 PRE-INSTALLATION REQUIREMENT

.1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.

.2 Surfaces to be clean, dry, free from foreign material.

3.2 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturers' instructions and this specification.

.3 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Hangers, supports to be outside vapour retarder jacket.

.4 Supports, Hangers:

.1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.3 REMOVABLE, PREFABRICATED, INSULATION AND ENCLOSURES

.1 Application: At expansion joints, valves, primary flow measuring elements, flanges, and unions at equipment.

.2 Design: To permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.

.3 Insulation:

.1 Insulation, fastenings and finishes: same as system.

.2 Jacket: As per adjacent insulation.

3.4 PIPING INSULATION SCHEDULES

.1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.

.2 Install insulator and jackets to applicable TIAC codes.

.3 Insulate ends of capped piping with type and thickness indicated for capped service.

.4 Thickness of insulation to be as listed in following table.

.1 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Application	Type	Pipe sizes through (NPS) and insulation thickness mm (")				
		to 25 (1")	32 (1¼") 40 (1½")	50 (2") 80 (3")	105 (4") 150 (6")	200 (8") & over
Condensate	A-1	40 (1½")	40 (1½")	50 (2")	50 (2")	50 (2")
Boiler Feed Water	A-1	25 (1")	25 (1")	25 (1")	25 (1")	25 (1")
Hot Water Heat Pump (Boiler side of Low Loss header)	A-1	40 (1½")	50 (2")	50 (2")	50 (2")	50 (2")
Glycol High Temp Loop	A-1	40 (1½")	50 (2")	50 (2")	50 (2")	50 (2")
Refrigerant piping	A-3	25 (1")	25 (1")	25 (1")	25 (1")	25 (1")

.5 Finishes: Conform to the following table:

Application	Piping	Valves & Fittings
Exposed indoors	PVC	PVC
Exposed in mech. rooms	PVC	PVC
Concealed indoors	N/A	PVC
Exterior refrigerant piping	Aluminum	Aluminum
Within 300 mm (12") of boiler	CANVAS	CANVAS
Exterior piping	Stainless Steel	Stainless Steel

.6 Connection: To appropriate TIAC code.

.7 Finish attachments: SS bands, @ 150 mm (6") oc. seals: closed.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 The approved Building Automations System Contractor per 2.1, referred to herein as the Contractor, shall provide a complete Direct-Digital Control System as indicated on the project documents in accordance with the drawings and as described in these specifications.

.2 Where existing legacy controls exist, the Contractor shall be responsible for the removal and preservation of existing controls and accessories, and to engineer, permit, provide and install a fully functioning Building Automation System which meets the requirements detailed herein.

.3 Where an Owner or Owner's representative provided points / object and equipment list is not provided as part of the bid package, the Contractor shall be responsible to verify existing site conditions and/or review all available drawings so to ensure all existing and/or currently proposed equipment at the facility is identified in accordance with 1.3.2, and is made part of the complete Direct-Digital Control System.

.4 The work administered by this Section of the technical specifications shall include all engineering, programming, labor, materials, special tools, equipment, enclosures, power supplies, software, software licenses, project specific software configurations and database entries, interfaces, wiring, tubing, installation, labeling, calibration, documentation, submittals, testing, verification, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, warranty, specified services and items required for a complete and fully functional Controls Systems.

1.2 RELATED SECTIONS

.1 General and Supplementary Conditions

.2 Division 01 General Requirements

.3 Section 23 08 00 Commissioning of HVAC Systems

.4 Section 23 09 00 Instrumentation and Controls for HVAC

.5 Section 23 09 93 Sequences of Operation for HVAC Control

.6 Section 23 70 00 Central HVAC Equipment

.7 Section 23 80 00 Decentralized HVAC Equipment

.8 Section 25 00 00 Integrated Automation

.9 Section 26 05 00 Common Work Results for Electrical

.10 Section 26 09 00 Instrumentation and Control for Electrical Systems

.11 Section 26 20 00 Low Voltage Electrical Distribution

1.3 DESIGN INSTRUCTIONS

.1 Design shall meet the functional intent of an "open", and interoperable Building Automation System, comprised of a network of stand-alone digital controllers. incorporating the Niagara 4 Framework®.

.2 The Building Automation System is to include, but not limited to, the monitoring and/or control of ALL of following equipment instances at each specified site:

.1 Boilers
.2 Cooling towers
.3 Air handling units
.4 Make up air units
.5 HVAC Equipment
.6 Energy or Heat recovery units
.7 Heat-pumps
.8 Exhaust fans
.9 DX split systems
.10 Variable Frequency Drives
.11 Pumps
.12 Motors
.13 Valves
.14 Unit Heaters
.15 Radiant Heaters
.16 Exterior Lighting
.17 Utility Consumption and Demand Metering

.3 The system shall be modular in nature and designed for future flexibility so to accommodate the addition of functionality, control points or expansion of facility.

.4 The control systems shall be designed such that each mechanical system shall operate under stand-alone mode. The contractor administered by this Section of the technical specifications shall provide controllers for each mechanical system. In the event of a network communication failure, or the loss of any other controller, the control system shall continue to operate independently. Failure of the B-BC shall have no effect on the field controllers, including those involved with global strategies

.5 Coordinate the specifications and equipment schedules in related sections for manufacturer furnished DDC systems to ensure the minimal hardwired points and sequences can be met in accordance with Section 23 09 93. OEM DDC Systems, that meet the minimum hardwired points are preferred and approved for use with the following equipment ONLY; boilers, main air handling equipment and, chillers. The supplier of the equipment is responsible for the configuration, programming, start-up, and testing of that product to meet the sequence of operation and specifications. The supplier shall also provide any licensing, hardware, and software required for interface to the DDC system.

1.4 DEFINITIONS

BAS	Building Automation System
B-BC	BACnet Building Controller
B-AAC	BACnet Advanced Application Controller
B-ASC	BACnet Application Specific Controller
BACnet / BACnet Standard	Building Automation and Controls Network - ANSI/ASHRAE Standard 135-2012
BACnet/IP	BACnet Annex J – describes how BACnet devices can make use of IP directly for communicating across IP-based terminals
BBMD	BACnet Broadcast Management Device, see BACnet Annex J
BIBB	BACnet Interoperability Building Blocks: A BIBB defines a small portion of BACnet functionality that is needed to perform a particular task
BTL	BACnet Testing Laboratory: A recognized, independent third party laboratory certified to test product for compliance to BACnet standards. BTL Certified products are indicated by a registered seal affixed to the product.
B/I	Binary Input
B/O	Binary Output
COV	Change of Value
cUL	Underwriters Laboratory Canada
DDC	Direct Digital Control
D/I	Digital Input
D/O	Digital Output
Embedded Control	Some OEM's (Original Equipment Manufacturer) equipment have a factory installed controller. These controllers must follow these standards. Examples can be found in chillers, boilers, variable frequency drives, etc. Proprietary communication protocols will not be allowed.
Gateway	A device, which contains two or more dissimilar networks/protocols, permitting information exchange between them (ASHRAE/ANSI 135-2004). Gateways are NOT to be included unless approved by the Owner.
GUI	Graphical User Interface
HVAC	Heating, Ventilation and Air-Conditioning
IEEE	Institute of Electrical and Electronics Engineers
I/O	Input / Output
LAN	Local Area Network (an individual school or site)
MS/TP	Master Slave Token Passing: Data link protocol as defined by the BACnet Standard. Operates over a serial field bus network (RS485)
NEMA	National Electrical Manufacturers Association
PICS	Protocol Implementation Conformance Statement: All devices conforming to the BACnet protocol shall have a documented statement that identifies all portions of BACnet that are implemented in the device.

P.I.D.	Proportional Integral Derivative
Shall	indicate a requirement that, in the view of the Board, must be complied with
UPS	Uninterruptible Power Supply Unit
VFD	Variable Frequency Drive
VLAN	Virtual Local Area Network: Dedicated for Facilities Services equipment
WAN	Wide Area Network (board wide)

Definitions of terms used in this section may differ from those given in general and supplementary conditions and take precedence over them.

1.5 REFERENCE STANDARDS

.1 Where edition date is not specified, consider that references to the manufacturer's data, and published codes, standards and specifications are made to the latest edition or revision, approved by the issuing organization.

.2 Reference Standards and specifications are quoted to establish minimum standards. Work in which quality exceeds the specified minimum will be considered to conform.

.3 The requirements of the Contract Documents govern over the requirements of reference standards and specifications.

.4 Standards, specifications, associations, and regulatory agencies are generally referred to throughout the Contract Documents by their abbreviated designations, as listed below:

.1 AMCA American Movement and Air Control Association

.2 ANSI American National Standards Institute

.3 ARI Air Conditioning and Refrigeration Institute

.4 ASME American Society of Mechanical Engineering

.5 ASTM American Society for Testing and Materials

.6 ASHRAE American Society of Heating, Refrigeration and Air Conditioning Engineers

.7 CGA Canadian Gas Association

.8 CGSB Canadian General Standards Board

.9 CSA Canadian Standards Association

.10 NFPA National Fire Protection Association

.11 SMACNA Sheet Metal and Air Conditioning Contractors' National Association

.12 ULC Underwriters' Laboratories of Canada

1.6 SYSTEM ARCHITECTURE AND DESCRIPTION

.1 The Building Automation System as detailed in this Section shall be based on a hierarchical architecture incorporating the Niagara 4 Framework® through Tier 1 and 2 inclusive. Systems not developed on the Niagara 4 Framework® platform are unacceptable.

.2 All Niagara 4 Framework® components shall have an unrestricted interoperability license with a Niagara Compatibility Statement (NiCS) following the Tridium Open NiCS Specification.

.3 All devices supplied under this specification, excluding sensors, shall be connected to the site LAN and shall communicate natively using the following BACnet/IP, BACnet MS/TP, Peer to Peer, or Ethernet (ISO 8802-3), as defined in the ANSI/ASHRAE Standard 135, latest or Peer-to-Peer using Niagara's Fox Protocol or SNMP.

.4 Program databases, data acquisition and all control sequence logic shall reside in the respective B-BC, B-AAC and B-ASC controller. Each device shall, to the greatest extent possible, perform its programmed sequence. Operation of each device shall not be dependent on a connection to a server or master controller.

.5 The B-BC and any B-AAC or B-ASC shall be capable of updating firmware without the replacement of any hardware, microprocessors, or chips.

.6 Each school / site shall be furnished with a single B-BC, which is responsible for and capable of providing fully distributed control including user access control and all necessary site computations at the site, independent of or under the Enterprise Management System and it must be stand-alone, multi-tasking, multi-user with a real-time digital processor. All controlled objects, sequences and associated operational parameters shall be both operator definable and modifiable through the embedded User Interface.

.7 The B-BC shall provide a web-based graphical user interface for programming, monitoring, and control, independent of any Enterprise Management System, be accessible remotely from a central site(s) and locally. The web-enabled user interface shall operate on an industry standard web-browser without the requirement of additional plugins.

.8 Each Mechanical or Electrical System and/or major piece of mechanical or electrical equipment shall have 1 dedicated B-AAC controller with sufficient I/O capacity such that it shall be connected to ALL field devices and points associated with that system, space and/or piece of equipment. B-ASC use shall be limited to VAV box applications provided the full functional intent can be met within the singular device.

.9 Mechanical and Electrical Systems i.e., VFD's, chillers, boilers, unitary equipment, etc. units that are equipped with manufacturers furnished controls shall be BTL certified. Gateways are not to be used unless prior written approval has been acquired. A single B-AAC can be used in combination with the manufacturer supplied controls, only where the manufacturer's controls are unable to meet the functional intent, it shall be implemented in accordance with Section 23 09 93.

.10 The use of multiple application controllers used to control a single piece of equipment is strictly prohibited, except those specifically noted in 1.6.9.

.11 The system shall include real time monitoring of the following utilities; electricity (main feed), natural gas (main), and water (main). Meters supplied under this division shall communicate BACnet Natively. For existing meters, utility owned, coordinate integration requirements with the respective utility provider.

.12 The B-BC shall be connected to the HDSB Facilities VLAN, in accordance with Section 25 00 00, to be supplied by the Owner at the Owners expense.

.13 Site workstations, otherwise referred to as Caretaker PC, will be provided by the Board.

1.7 HARDWARE AND SOFTWARE LICENSING

.1 The Owner shall be named license holder of all controllers and components, software and firmware supplied under this specification. The Owner shall receive ownership of all project specific configuration documentation, data files, and application-level software developed for the site.

.2 The Owner shall have unrestricted access rights for all network management, operating system server, engineering and programming software required for the ongoing maintenance and operation of the building automation system

.3 All software provided shall be full featured and not limited or trial version.

1.8 USER CONTROL OVER CONFIGURATION

.1 The intent of this specification is to provide a system which shall allow the Board to independently do its own modifications to all objects, operational parameters, and sequences.

1.9 INTELLECTUAL PROPERTY AND PROPRIETARY MATERIAL

.1 The Board shall sign a software and hardware licensing agreement, upon review and agreement of terms and conditions, as a condition of contract. Such license will grant use of all programs and application software to the Board and its representatives, as defined by the agreement, and shall protect the manufacturer’s rights to disclosure of intellectual property contained within such software.

1.10 SYSTEM PERFORMANCE

.1 The System shall conform to the following minimum:

.1 The system shall report values with minimum end-to-end accuracy listed in Table 1.

Table 1 - Reporting Accuracy	
Measured Variable	Reported Accuracy
Space Temperature	1% of range
Ducted Air Temperature	1% of range
Outside Air Temperature	±1°C (±2°F)
Water Temperature	1% of range
Water Flow	±2% of full scale
Airflow (terminal)	±10% of full scale (see note 1)
Airflow (measuring stations)	±5% of full scale
Airflow (pressurized spaces)	±3% of full scale
Air Pressure (ducts)	±25 Pa (±0.1 in. w.g.)
Air Pressure (space)	±3 Pa (±0.01 in. w.g.)
Water Pressure	±2% of full scale (see note 2)
Carbon Dioxide (CO^2)	±50 ppm
Electrical (kW, kVA, kWh, A, V, pF)	±1% of reading (see note 3)

Note 1: 10% - 100% of scale

Note 2: For both absolute and differential pressure

Note 3: Not including utility-supplied meters

.2 Control Stability and Accuracy shall maintain measured variable at set-point within tolerances listed in Table 2.

Table 2 – Control Stability and Accuracy		
Controlled Variable	Control Accuracy	Range of Medium Accuracy
Air Pressure	±50 Pa (±0.2 in. w.g.) ±3 Pa (±0.01 in. w.g.)	0-1.5 kPa (0-6 in. w.g.) -25 to 25 Pa (-0.1 to 0.1 in. w.g.)
Airflow	±10% of full scale	
Space Temperature	±1°C (±2°F)	
Duct Temperature	±1.5°C (±3°F)	
Fluid Pressure	±10 kPa (±1.5 psi) ±250 Pa (±1 in. w.g.)	MPa (1-150 psi) 0-12.5 kPa (0-5- in. w.g.) differential

1.11 WORK COVERED BY THE CONTRACT DOCUMENTS

.1 The Scope of Work for the Building Automation Systems Contractor shall include, but is not limited to the following:

.1 Demolition: all existing Building Automation Control(s) and accessories being replaced shall be removed from site and disposed of in accordance with local regulations. Prior to disposal, provide a list of controllers and accessories to Owner, which will be salvaged and remitted to the Owner for the explicit use of maintaining existing legacy systems at other sites.

.2 Furnish and install all necessary controllers, control and/or ancillary devices, sensors, wiring, pneumatic peripherals and tubing, software, licenses, and programming to deliver a complete and functional building automation system, which meets the functional intent of the systems design.

.3 The naming and addressing of all objects and devices to be in accordance with the specifications.

.4 Configure the web-based user interface embedded in the B-BC in accordance with the specifications.

.5 Coordinate equipment specifications for related sections necessary to meet the functional intent including: variable frequency drives, dampers, valves, actuators, and peripheral devices considered to have wet surfaces such as pressure taps, thermal wells, flow switches, flow meters, etc., preference is given to these devices being furnished by the Original Equipment Manufacturer, where applicable.

.6 Review and coordinate with other related sections so to ensure all mechanical and electrical systems and components to be integrated have the necessary hardware and software to meet the points and sequences specified.

.7 Coordinate with the Owner, the setup and communication of the B-BC on the Owners supplied VLAN, in accordance with the specifications.

.8 Coordinate with the Owner and the respective utility provider, the installation and setup of utility metering equipment or the integration of any existing meters, in accordance with the specifications.

.9 Identify and label all controllers and associated devices including but not limited to connected I/O points, address', network id, etc.

.10 Verification of existing equipment operation, and notifying Owner of any deficiencies

.11 Attain, where required, all necessary permits and inspections

.12 Commissioning of new BAS

.13 Submit the required documentation as described herein, including, but not limited to submittals, project record, start-up, commissioning, testing, acceptance documentation and system warranty

.14 Operator Training

1.12 PRODUCTS FURNISHED BUT NOT INSTALLED BY THE BUILDING AUTOMATION CONTRACTOR

.1 Hydronic Piping:

.1 Control Valves

.2 Flow Switches

.3 Temperature Sensor Wells and Sockets

.4 Flow Meters.

.2 Refrigerant Piping:

.1 Pressure Transducers

.3 Ductwork Accessories:

.1 Automatic Dampers

.2 Air Flow Switches

1.13 PRODUCTS NOT FURNISHED OR INSTALLED BUT INTEGRATED BY THE BUILDING AUTOMATION CONTRACTOR

.1 Fire Alarm Systems

.2 Utility Monitoring Systems

.3 Variable Frequency Drives

.4 Boiler Equipment and Controls (BACnet Points necessary to meet specifications for monitoring and history only)

.5 Unitary and Packaged Equipment and Controls (BACnet Points necessary to meet specifications for monitoring and history only)

Responsibility Matrix by Division Contractor

Work / Item / System	**Furnish**	**Install**	**Control Wiring**	**Power**
Control System Communication Wiring	23 09 23	23 09 23	23 09 23	n/a
Controls Equipment, panels, enclosures, and accessories	23 09 23	23 09 23	23 09 23	23 09 23
Interface to OEM furnished controllers supplied under Division 23	23 09 23	23 09 23	23 09 23	23 09 23
MAU, Air Handling, HVAC, VRF or Unitary Manufacturer furnished space mounted controls (i.e., thermostat)	n/a	n/a	n/a	n/a
Cooling Tower Level, Make-up Water and Sump Heater Control Devices (local control only)	23	23	23	23
Starters, operator switches			23 09 23	26

Automatic Damper (not OEM installed)			23 09 23	
Automatic Damper Actuators	23 09 23	23 09 23	23 09 23	
Hydronic Valves			23 09 23	n/a
Hydronic Valve Actuators	23 09 23	23 09 23	23 09 23	
Thermo-wells (including accessories considered “wet”)		23	n/a	n/a
Hydronic Flow Switches and Transducers		23	23 09 23	n/a
Variable Frequency Drives not OEM Furnished		26	23 09 23	26
Fire Alarm control monitoring relay	28	28	23 09 23	26
Power Distribution Monitoring System	Utility	Utility	23 09 23	26
Natural Gas Utility Monitoring System	Utility	26	23 09 23	n/a
Water Meter Monitoring System	Owner	23 09 23	23 09 23	n/a

1.14 QUALITY ASSURANCE

.1 The Controls Contractor shall be responsible for inspection and quality assurance for all materials and workmanship provided

.2 The Controls Contractor shall have an established working relationship with the proposed BAS manufacturer of not less than 3 years.

.3 The Controls Contractor shall have successfully completed all control system training and certification as required by the manufacturer.

1.15 PERMITS, INSPECTION, AND TESTING

.1 Contractor will arrange for submission to the Electrical Safety Authority (ESA) for review of this project and pay all associated fees. Provide Certificate(s) of Acceptance from ESA and other Authorities having jurisdiction upon completion of the Work.

.2 Where modification to mechanical or electrical equipment control wiring is necessary to meet the requirements of the specifications, the contractor is responsible for arranging any testing required by the Authority Having Jurisdiction to maintain the required certification and ensure the safe operation of the equipment modified.

1.16 PERFORMANCE VERIFICATION OF INSTALLED EQUIPMENT

.1 Installed equipment may be subject to performance verification as specified herein if required by Owner or Owner’s Representative(s).

.2 When performance verification is requested, equipment shall be tested to determine compliance with specified performance requirements.

.3 If requested, Contractor shall arrange for services of independent testing agency.

.4 Maintain building comfort condition when equipment removed from service or testing purposes.

.5 Promptly provide Owner, or Owner's Representative(s) with test reports.

.6 Should test results reveal that originally installed equipment meets specified performance requirements, Owner will pay costs resulting from performance verification procedure.

.7 Should test results reveal equipment does not meet specified performance, equipment will be rejected and the following shall apply:

.1 Remove rejected equipment. Replace with equipment that meets requirements of Contract Documents, including specified performance requirements.

.2 Replacement equipment may be subject to performance verification as well; use same testing procedures as performed on originally installed equipment.

.3 Contractor shall pay costs resulting from performance verification procedure.

1.17 SUBMITTALS

.1 All submittals and documentation including complete BAS System Engineering Design Submittal & Drawings, Project Record Documents, Application Engineering Documents and Owner's & Maintenance Manuals shall be submitted electronically in the form of an Adobe Portable Document Format (.pdf). All Control Schematics, Wiring Diagrams, Riser Diagrams, &c. shall be formatted for A3 11" x 17". Floor Plans shall be submitted in CAD format (.dwg). All other documentation may be formatted for 8.5" x 11".

.2 Submit in writing and so delineated at the beginning of each submittal, known substitutions and deviations from requirements of Contract Documents.

.3 Complete BAS Engineering Design Submittal & Drawings shall be prepared in accordance with Section 1.20 using the following guidelines:

.1 Submittal documentation and drawings shall consistently use the same abbreviations, symbols, nomenclature, and identifiers. Each control system element shall be assigned a unique identifier pursuant with the Contract Documents

.2 Submit the following:

.1 A complete bill of materials of all equipment, controllers, devices, sensors, actuators, valves, etc., necessary to meet the requirements detailed herein is to be provided, indicating unique equipment identifier/tag, unique device/controller identifier/tag, manufacturer, and model number.

.2 Riser diagram of Local Area Network (LAN) shall outline execution and details of all network cabling, BAS & Network Hardware including the following:

.1 All BAS/DDC Hardware with controller number, MAC Addresses where required, unique identifier/tag, location, equipment, and service

.2 All Network Hardware with unique identifier, location, and service

.3 Network cabling configuration and execution specification

.4 Location of all cabling termination points and End of Line (EOL) terminators

.5 Location of all network interface jacks

.6 A separate riser diagram shall be provided for each network segment

.3 Provide manufacturers cut sheets for major system components. When manufacturer's cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Include for every BAS component including but not limited to the following:

.1 Gateways or BBMD associated networking peripherals

.2 Control Valves

.3 Dampers

.4 Actuators

.5 Variable Frequency Drives

1.18 SUBSTANTIAL COMPLETION REQUIREMENTS

.1 Contractor shall provide checklist for completion before Substantial Completion Field Review. Provide written declaration that work is complete. The following items shall be complete before Substantial Completion Field Review:

.1 Mechanical and Electrical systems capable of operation with Building Automation System, in operation with alarms functional.

.2 Tests on systems and equipment completed and certificates of approval obtained from regulating Authorities.

.3 Fire stopping completed, if required.

.4 Valve tagging completed and equipment, ductwork and piping identified.

.5 Escutcheons installed.

.6 Extended warranty form mailed to manufacturer and copy provided to Owner.

.7 Ensure access doors suitable located and equipment accessible.

.8 Ensure electrical connections to mechanical equipment are complete and motor rotation correct.

.9 Equipment cleaned inside and out, lubricated and paint touched-up

.10 Commissioning, Testing, Demonstration and Acceptance

.11 Complete program back-up and system files provided and verified for functionality.

1.19 PROJECT RECORD

.1 Upon completion of installation and systems commissioning, submit record documents for review. "As-Built" Project Record Documents should include:

.1 Project Record Application Engineering Drawings shall include all BAS System Engineering Design Submittal with Drawings updated to reflect actual field conditions, architecture, and execution

.2 Electronic Operating & Maintenance (O&M) Manual including:

.1 Operator's Manual with Manufacturers' complete operating instructions.

.2 Documentation of all project specific Application and DDC programs

.3 All necessary system Administrator-Level passwords and/or required access credentials

.4 Information required for programming BAS

.5 Complete Final Point Schedule including all hardware and software data points and documentation of calibration and configuration values for all Inputs, Outputs, Variables and PID Loops at the conclusion of systems commissioning and functional testing.

.6 Routine preventative maintenance procedures, corrective diagnostic troubleshooting procedures and calibration processes

.7 Final Bill of Material with all installed parts, manufacturers, manufacturers' part numbers and ordering information

.3 Sequence of Operation shall be submitted for every piece of equipment being controlled by and/or associated with the BAS. No operational deviation from specified Sequences of Operation as outlined in Contract Documents shall be permitted without prior written approval. Sequences of Operation shall include and conform to the following:

.1 Refer to equipment and control devices by their specific unique identifiers/tags pursuant with the Contract Documents and BAS Submittal package.

.2 Clearly represent actual Application Programming methodology and functional control operation. Do not merely provide a copy of Contract Document specified Sequence of Control.

.3 Include description of functional system operation under normal and failure conditions.

.4 BAS Control Schematics and Wiring Diagrams shall be submitted for every piece of equipment being controlled by and/or associated with the BAS. BAS Control Schematics and Wiring Diagrams shall include and conform to the following:

.1 Floor plan showing exact location, MAC addresses where required, including unique identifiers of all hardware supplied under this section.

.2 Control Schematic flow diagram of each system (air, water, gas, & etc.) being controlled showing actual physical configuration and control device/sensor location of all fans, coils, dampers, valves, pumps, heat exchangers, control devices, &c. including each hardware point type, controller and associated ancillary devices.

.3 Controller termination details showing every controller point termination.

.4 Wiring Diagrams of all packaged equipment, motor starters, relay wiring, equipment interlock, safety circuits, & etc. clearly indicating all interconnecting wiring and termination of all conductors and cables including labels of all cables and points.

.5 Control Enclosure details for every enclosure including panel identifier, location, physical lay-out, dimensions, instrumentation, labels, & etc. Also include detail wiring (I/O, network, and power) and power source for each panel, transformer and controller.

Part 2 Products

2.1 APPROVED MANUFACTURERS

.1 The following controls hardware and software, in no particular order of preference, are approved for use:

Manufacturer	Tier 2 Product Line	Manufacturer Assigned Vendor
Alerton	AIE Niagara 4	HTS Engineering Ltd (115 Norfinch Drive, North York, ON)
Distech Controls	EC-BOS Niagara 4	Energy Controls & Mechanical Services Inc. (Kitchener)

2.2 SOLE VENDOR SITE DESIGNATION

.1 A site or school with an existing B-BC meeting the specifications detailed in 2.3 shall determine the Approved Manufacturer for the respective site.

.2 Any minor site additions or upgrades, requiring manufacturer specific products as detailed herein will be that of the Approved Manufacturer for the site, per 2.3.

.3 The Board reserves the right to change the status of an Approved Manufacturer at any time should they not meet the performance or requirements detailed herein.

2.3 BUILDING CONTROLLER (B-BC)

.1 The B-BC shall be BTL certified, communicate BACnet Natively and incorporate the Niagara 4 Framework®.

.2 The B-BC shall have an unrestricted interoperability license with a Niagara Compatibility Statement (NiCS) following the Tridium Open NiCS Specification and have a value of "*", it shall be understood to mean that parameter is open to all possible values. Note that this will result in the following entries in the license.dat file:

Specific Feature	**license.dat file entry value**
Owner	"HDSB"
Project	"HDSB"
BrandId	"*" preferred, "Distech" or "Alerton" acceptable
accept.station.in	"*"
accept.station.out	"*"
accept.wb.in	"*"
accept.wb.out	"*"
Expiration	
All expiration instances	"never"
Limit	
[1]All .limit instances	"none"
Export	
BACnet	"true"
obix	"true"
Import	
rdbSqlServer	"true"
web	
ui	"true"
ui.wb	"true"
ui.wb.admin	"true

[1] With the exception of limitations defined by hardware configuration

.3 The B-BC shall function in a real-time, multi-tasking networked operating environment. It must complete all necessary site computations based on information from any object in the internetwork and locally execute global strategies and supervisory control for all field devices supplied under this specification, without additional hardware or software and independent of or under a B-AWS. It shall be capable of executing application control programs to provide the following:

.1 Calendar Functions

.2 Scheduling

.3 Trending and Data Management

.4 Alarm Monitoring and Routing

.5 Real-Time Clock and Network Time Synchronization

.6 Network and User Management functions for all devices on the LAN

.4 The B-BC shall be equal to a JACE 8000 and be supplied with the following hardware features as a minimum

.1 Two (2) Ethernet ports

.2 One (2) RS-485 BACnet MS/TP port

.3 One (1) USB port

.4 Wi-Fi connectivity

.5 Expansion capability

.6 A battery backup and/or non-volatile memory. If battery backup or non-volatile memory is not available an Uninterruptable Power Supply must be provided to maintain program file and data base for a minimum 24 hours.

.5 The B-BC shall contain sufficient memory to support its own operating system, User Interface, all specified control strategies and objects, energy management applications, data storage and trending, alarm annunciation, and network management.

.6 The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Google Chrome™. Systems requiring additional software (to enable a standard Web browser) to be resident on the client machine, or manufacturer-specific browsers shall not be acceptable.

.7 The B-BC must enable access to the complete BAS system installed under this section, via web-browser. Access includes but is not limited to comprehensive programming capabilities for all controllers and real-time operational values via an embedded web-browser Graphical User Interface (GUI). The GUI shall support the latest version of standard web-browsers, without the requirement of additional plugins or software, and must be configured in accordance with these specifications.

.8 The B-BC shall provide alarm management to monitor, buffer, and direct alarms and messages to operator devices and memory files, to be assigned in accordance with these specifications. Each B-BC shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic, and prevent alarms from being lost.

.9 The B-BC shall have the ability to collect and archive any data, for any property of any object on the LAN, in accordance with these specifications. The embedded UI shall be capable of configuring the collection of data. The data shall be accessible in either the following formats, XML or CSV from the WAN Server Supervisory Software or through a standard web-browser.

.10 The B-BC shall be capable of maintaining an Audit log that tracks and archives all activities performed.

.11 The B-BC shall provide, a minimum of four (5) levels of local access privileges. The highest level, Administrator Level, shall allow the BAS administrator to perform application, database, and user management functions. Each login credentials shall be assigned to a pre-defined level of access.

.12 The B-BC shall provide WAN access privileges, including a comprehensive list of accessibility/functionality items, to be enabled or disabled for each user according to the level of access granted. Operators shall be able to perform only those commands available for the access level assigned to their login credentials. Login credentials are to be looked up using the Lightweight Directory Access (LDAP) through the BAS server.

2.4 ADVANCED APPLICATION CONTROLLERS (B-AAC)

.1 B-AAC's shall be BTL Certified.

.2 B-AAC objects, sequences and operational parameters must be configurable via the B-BC's embedded graphical user interface.

.3 Each B-AAC shall contain sufficient memory to support its own operating system, data storage and programming requirements.

.4 The B-AAC shall share and use data between all controllers on the network and shall manage the input and output communication signals to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms.

.5 Controllers that perform scheduling shall have a real-time clock.

.6 The B-AAC shall continuously check the status of its processor and memory circuits and in the event an abnormal operation is detected, the controller shall initiate a predetermined failure mode and generate an alarm notification.

.7 Each B-AAC shall be supplied with a minimum 3 spare Universal I/O's.

2.5 APPLICATION SPECIFIC CONTROLLERS (B-ASC)

.1 B-ASC use is limited to VAV box and will not be accepted for use in any other application.

.2 B-ASC's shall be BTL Certified.

.3 B-ASC objects, sequences and operational parameters must be configurable via the B-BC's embedded graphical user interface.

.4 Each B-ASC shall contain sufficient memory to support its own operating system, data storage and programming requirements.

.5 The B-ASC shall share and use data between all controllers on the network and shall manage the input and output communication signals to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms.

.6 Controllers that perform scheduling shall have a real-time clock.

.7 The B-ASC shall continuously check the status of its processor and memory circuits and in the event an abnormal operation is detected, the controller shall initiate a predetermined failure mode and generate an alarm notification.

.8 Each B-ASC shall be supplied with a minimum 3 spare Universal I/O's.

2.6 ROOM AND SPACE CONTROL DEVICES

.1 Room sensors, associated with each "Room Controller" detailed in Section 23 09 93, are to be communicating type complete with integral override button, configurable set-point / offset adjustment and without a display. Only the following room sensors, associated with occupant comfort, are approved for use:

DisTech Controls - Allure EC-Smart-Comfort-SO
Alerton - Microtouch Wall Sensor

Part 3 Execution

3.1 INSTALLATION

.1 The BAS contractor is responsible to verify that equipment can be installed in accordance with the manufacturer's instructions and as detailed within these specifications, as such the contractor shall inspect the site and report any discrepancies, conflicts or omissions to the Owner or it's representative, for resolution prior to the commencement of work.

.2 Unless otherwise specified, meet manufacturer's latest printed instructions for materials, planned maintenance and installation methods.

3.2 OBJECT AND POINT NAMING

.1 Where the first four segments of the object / point name are configured by virtue of the Niagara Network Device Addressing, only the 5th segment shall be defined as the Object / Point Name herein and must be programmed in accordance with Schedule A of Section 23 09 93. It must be demonstrated, by way of the Niagara Enterprise Software instance, that the individual points are searchable by the School's Unique Identifier, or Controller/Equipment Identifier, or Point Name Abbreviation, or any combination of, across the Board's WAN, without interruptions and/or collisions.

.2 All BACnet objects and points programmed under these specifications, shall conform to the following case sensitive convention:

.1 First five characters = School's unique identifier

.2 Sixth character = Network number

.3 Seventh and eighth characters = Device number

.4 Ninth up to required not to exceed nineteen characters = Controller / Equipment Identifier

.5 Last segment = Point name abbreviation

Example: S1156_2_15_HP10_RmTemp (S1156 = Forest Trail, 2 = Network 2, 15 = 15th device on network, HP10 = heat-pump 10, RmTemp = Room Temperature)

.3 Object name segment shall be delimited by (_) character, however, must be consistent by Vendor across all Board sites

.4 Where a BACnet object or point name is not explicitly detailed in Schedule A of these Specifications, the Owner shall supply the required information including, but not limited to, device name, instance number, point name, units, meta tag, etc.,

3.3 CONTROLLER AND DEVICE ADDRESSING

.1 Where the first four segments of the Controller and Device Addressing are configured by virtue of the Niagara Network Device Addressing, only the 4th segment shall be defined as the Object / Point Name herein and must be programmed in accordance with Schedule A of Section 23 09 93. It must be demonstrated, by way of the Niagara Enterprise Software instance, that the individual points are searchable by the School's Unique Identifier, or Controller/Equipment Identifier, or Point Name Abbreviation, or any combination of, across the Board's WAN, without interruptions and/or collisions.

.2 Each device or network installed and programmed under these specifications, shall be addressed and/or named as follows:

.1 Device Instance

.1 First five characters = School's unique identifier

.2 Sixth character = Network number

.3 Seventh and Eighth character = Device number

.4 Ninth up to required not to exceed nineteen characters = Controller / Equipment Identifier

Example: S1156_2_15_HP10 (S1156 = Forest Trail, 2 = Network 2, 15 = 15th device on network, HP10)

.2 BACnet Network Number

.1 First five characters = School's unique identifier

.2 Sixth character = Network number

.3 Seventh = Network and Type

Example: S1156_2_1 (S1156 = Forest Trail, 2 = Network 2, 1 = 1st MS/TP network)

.3 MAC Addresses

.1 0 B-BC

.2 1 Maintenance Connection

.3 2 Reserved

.4 3 – 127 Master Range

.5 128 – 254 Slave Range

.6 255 Broadcast

.3 Object name segment shall be delimited by (_) character, however, must be consistent by Vendor across all Board sites.

3.4 CONTROLLER/DEVICE NAMING

.1 Each device or network installed and programmed under these specifications, shall be addressed and/or named as follows:

.1 Device Instance

.1 First five characters = School's unique identifier

.2 Sixth character = Network number

.3 Seventh and Eighth character = Device number

.4 Ninth up to required not to exceed nineteen characters = Controller / Equipment Identifier

Example: S1156_2_15_HP10 (S1156 = Forest Trail, 2 = Network 2, 15 = 15th device on network, HP10

.2 BACnet Network Number

.1 First five characters = School's unique identifier

.2 Sixth character = Network number

.3 Seventh = Network and Type

Example: S1156_2_1 (S1156 = Forest Trail, 2 = Network 2, 1 = 1st MS/TP network

.3 MAC Address

.1 4 B-BC

.2 5 Maintenance Connection

.3 6 Reserved

.4 7 – 127 Master Range

.5 129 – 254 Slave Range

.6 255 Broadcast

.2 Object name segment shall be delimited by (_) character, however, must be consistent by Vendor across all Board sites

3.5 SCHOOL'S UNIQUE IDENTIFIER

.1 The School's Unique Identifier will be provided by Owner and must be used in the first segment, for all device, network, object, and point names.

3.6 CONTROLLER/EQUIPMENT IDENTIFIER

.1 The Controller / Equipment Identifiers are restricted to dedicated B-AAC and B-ASC controllers. Identifiers are limited those listed below. Where an identifier is not listed below the Owner shall supply the required information.

.1 AC# = Air Conditioning Unit

.2 AHU# = Air Handling Unit

.3 Blr# = Boiler

.4 BPB# = By-Pass Box (constant volume)

.5 Chiller# = Chiller

.6 CU# = Condensing Unit

.7 HVAC# = HVAC Unit

.8 HVAC#VAV# = HVAC Unit (associated with) Variable Air Volume Box

.9 HP# = Heat pump

.10 HWLoop# = Heating Water Loop

.11 HpLoop# = Heat-pump Loop

.12 HX# = Heat Exchanger

.13 MAU# = Make-up Air Unit

.14 Tower# = Cooling Tower

.15 UV# = Unit Ventilator

.16 VRF# = Variable Refrigerant Flow Condensing Unit

.17 VRF#AC# = Variable Refrigerant Flow Unit (associated with) Air Conditioning Unit

.18 VRF#AC# = Variable Refrigerant Flow Unit (associated with) Air Conditioning Unit

.2 Where a dedicated B-AAC or B-ASC is not configured specific to a system or unit, controller identifier is to be approved by Owner.

3.7 POINT NAME ABBREVIATION

.1 The Object / Point Name convention must be followed for the objects / points as listed in Schedule A of this Section, note abbreviations are case sensitive.

.2 Where an identifier is not listed below the Owner shall supply the required information.

3.8 PROGRAMMING

.1 Sequences of Operation are to be programmed in accordance with Section 23 09 93

.2 Programs for like equipment i.e, heat-pump, unit heater, etc. shall be consistent by controls vendor across the facility and all Board sites.

3.9 HISTORY AND TRENDING

.1 A minimum of 7 days history shall be maintained within the B-BC for the points identified in Schedule A of this Section.

.2 Data stored in the B-BC shall be uploaded to the B-AWS in accordance with Section 25 00 00.

.3 Default Graphical trends, Navigation button per 3.9, shall be pre-configured.

3.10 SCHEDULING

.1 Scheduling feature shall include seven-day schedule, plus holiday or event schedule, each with start time and stop time. Schedules shall be individually editable for each day and holiday.

.2 The scheduling feature shall allow for each individual equipment to be assigned to one of the Schedule Groups which includes, but is not limited to:

.1 Administration

.2 Gymnasium

.3 First Floor Classrooms

.4 Second Floor Classrooms

.5 Kindergarten

.6 Library

.7 Daycare

.8 Theatre

.9 Cafeteria

.10 Refuge

.3 The Areas, associated schedule, and equipment grouping will be provided by Owner.

.4 Timed override feature shall allow a temporary change of the scheduled equipment. An override command shall be selectable by an individual unit, all units assigned to a given schedule group, or to all units in a building. Timed override shall terminate at the end of the event. Timed override feature shall be allowed by a password level.

3.11 DEMAND LIMITING

.1 Programming or schedules shall incorporate a delay such that there is a delay between the start-up of each Schedule Group.

.2 Equipment within the Schedule Group shall incorporate a delay such that there is a delay between the start-up of individual equipment within the Schedule Group.

3.12 ALARMS

.1 Logical and consistent alarm strategy must be used as defined within these specifications. The alarm strategy detailed herein applies to those objects identified in Schedule A of this section. It is expected that additional alarms be added when applicable, Owner to determine class.

.2 Alarms, not classified as Emergency or Communication / Network, shall have the following values adjustable: threshold, limit and time delay.

.3 Alarm actions, defined by Alarm Class, shall be annunciated as follows:

.1 Emergency (E): email, header button red, graphic with flashing alarm object, Alarm Portal B-BC record

.2 High Priority (H): graphic with flashing alarm object, header button red, Alarm Portal B-BC record

.3 General (G): Alarm Portal B-BC Record

.4 The complete object / point name shall be included in every alarm message, refer to “Object and Point Naming” within this specification section.

.5 The minimum shall be recorded by the B-BC for each alarm:

.1 Time and Date

.2 Complete object / point name

.3 Acknowledge time, date, and user who issued acknowledgement

3.13 USER ACCESS

.1 Set up the following 5 password levels to include the specified capabilities.

.1 Level 1: (The Board's BAS Administrator)

Level 2 capabilities.

All administrative rights

View, add, change and delete usernames, passwords, password levels.

All unrestricted system capabilities including all network management functions.

.2 Level 2: (TBD)

Level 3 capabilities.

Configure system software.

Modify control unit programs.

Modify graphic software.

Unrestricted except for viewing or modifying usernames, passwords, password levels.

.3 Level 3: (Approved Facilities Staff and Board's HVAC Maintenance Technicians)

Level 4 capabilities.

Temporary override of designated objects and/or points.

Temporary set-point value change.

Change selected equipment schedules.

.4 Level 4: (Approved Facilities Staff)

Level 5 capabilities.

Acknowledge alarms.

Change selected equipment schedules.

.5 Level 5: (Read Only)

Display all graphic data.

Trend point data.

.2 Level 1 and 5 will be accounts which reside locally within the B-BC.

.3 Level 2 through 4 will be will use LDAP for login credential authentication.

3.14 GRAPHICAL USER INTERFACE

.1 Provide a colour graphic home screen, floor plans, system flow diagrams for each system and summary screens, designed and sized for iPAD, with all points indicated on the points list in Schedule A of this Section, and in accordance with these specifications.

.2 All graphics shall be rendered as N4 HTML 5 views. Any graphic page that depends on JAVAbased animated widgets, or in any way depends on any browser-side-applet shall not be acceptable.

.3 The Graphical User Interface shall not use Red as graphical representation for any of the following: stop, alarm, or fault. Red is used explicitly for graphical representation of heat command and/or enable, with the only exception in text format in charts, the word "fault" can be coloured red.

.4 Graphics not explicitly detailed within this section shall be reviewed and approved by Owner.

.5 Common for all Graphics:

.1 Header

The Header is one PX file for the entire project. All links, labels, etc. shall be edited from only one instance of the Header. The following aspects of the Header should appear exactly the same across all Board Facilities: Dimensions, Font Size, Colour(s), Equipment Navigation Buttons' Size, Font, and Colour(s). The following shall be exactly the same 1 - Home Button, 2 - Three Line Menu Navicon. The following aspects are dynamic: 3 - Page title, and 4 - Equipment Navigation Buttons (function and name



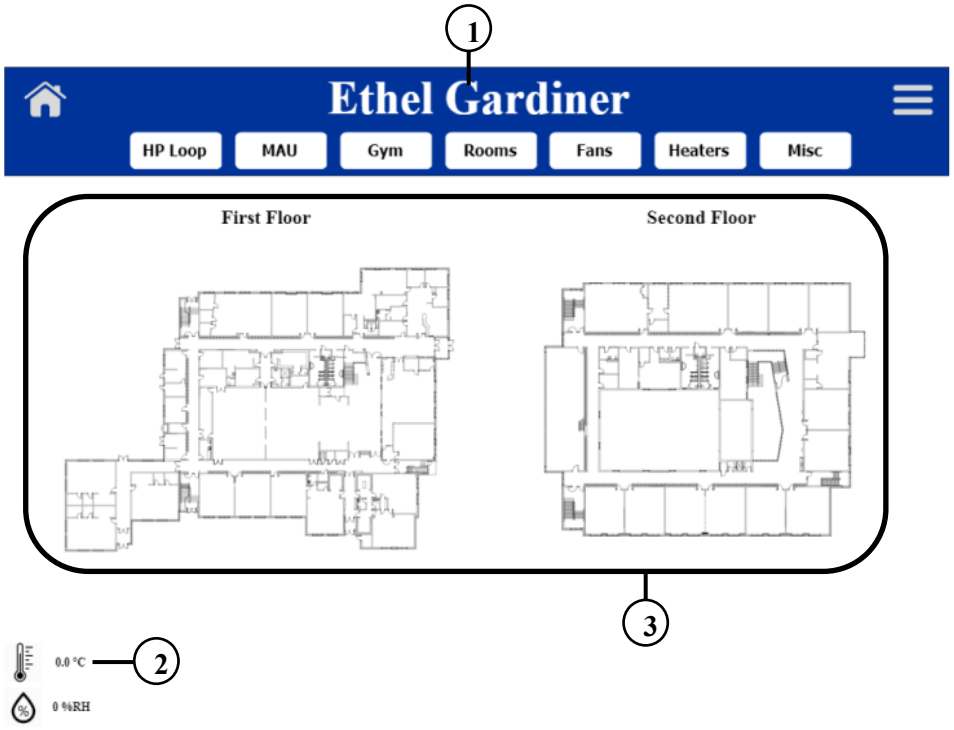
.2 Flashing Alarm Graphic(a standard Niagara graphic white triangle with red boarder and black exclamation mark) shall be consistent for all alarm annunciations, across all Board facilities, regardless of vendor



.3 Page Title shall be representative of the Navigation name used to link to the page and is to include information identifying area or equipment

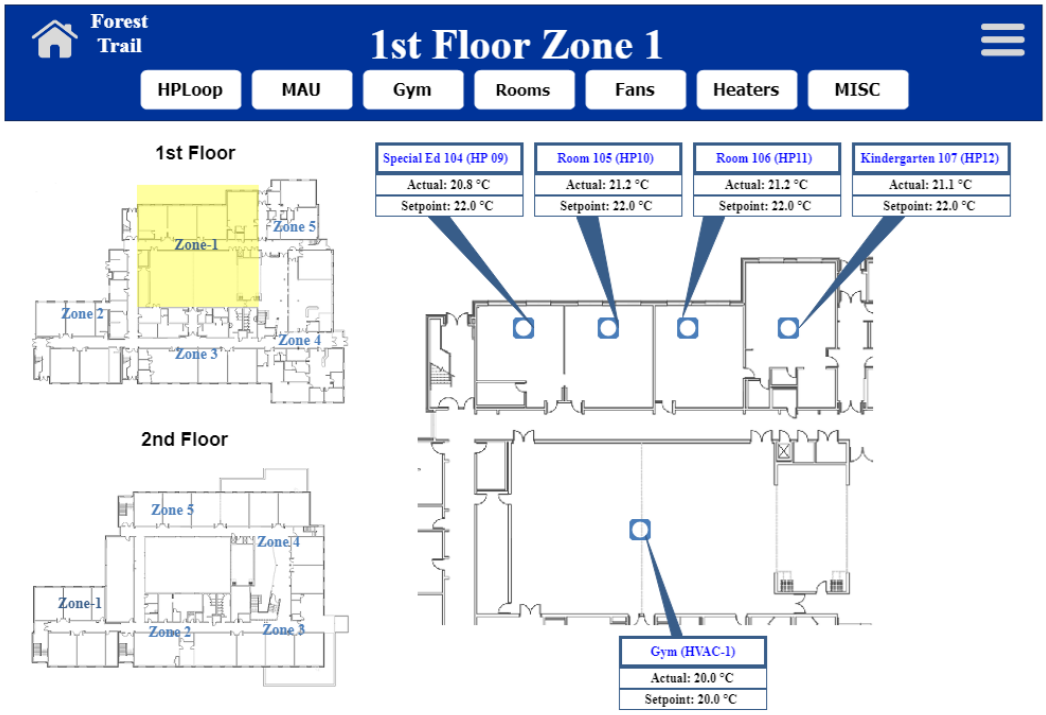
.6 Home Page

The Home Page shall be comprised of the following: 1 – School / Facility name as page title, 2 - Outdoor Air Temperature, 3 - Complete Facility Floor Map (individual floors labelled accordingly).



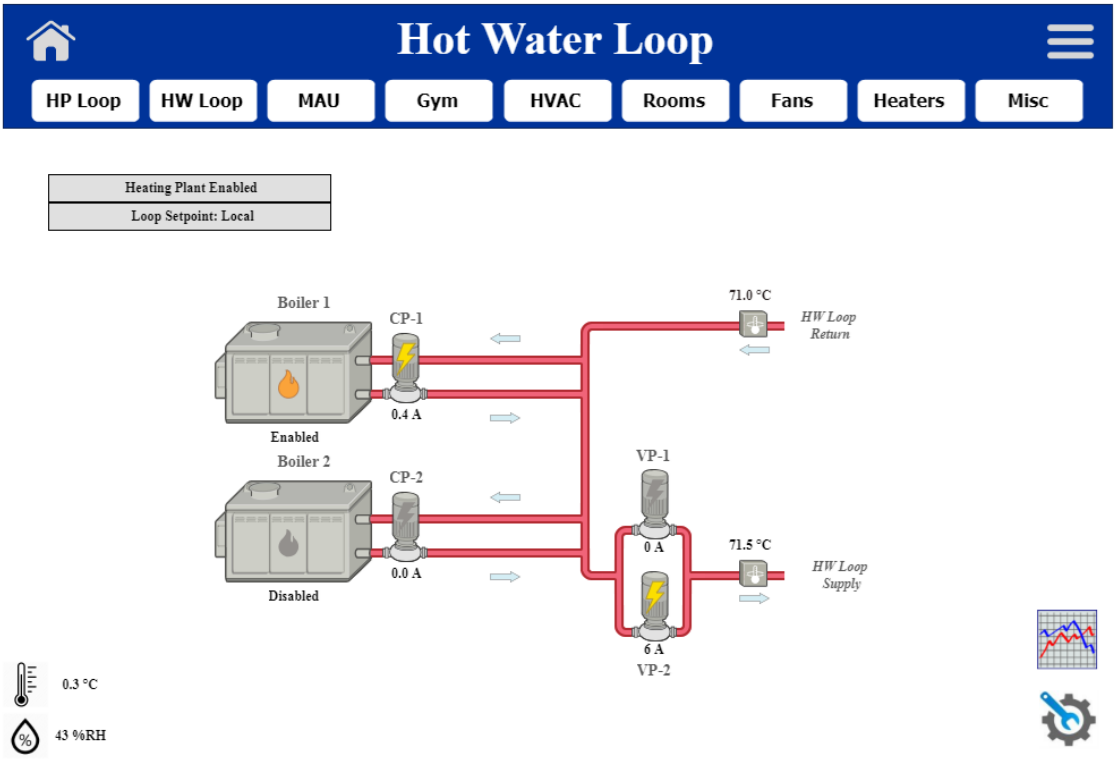
.7 Zone Page(s)

The Zone Page(s) which are scaled portions of the floor plan shall be comprised of 1 – Keyplan indicating respective zone, individual space temperatures and set-points, navigation button to respective equipment



.8 HWLoop Page

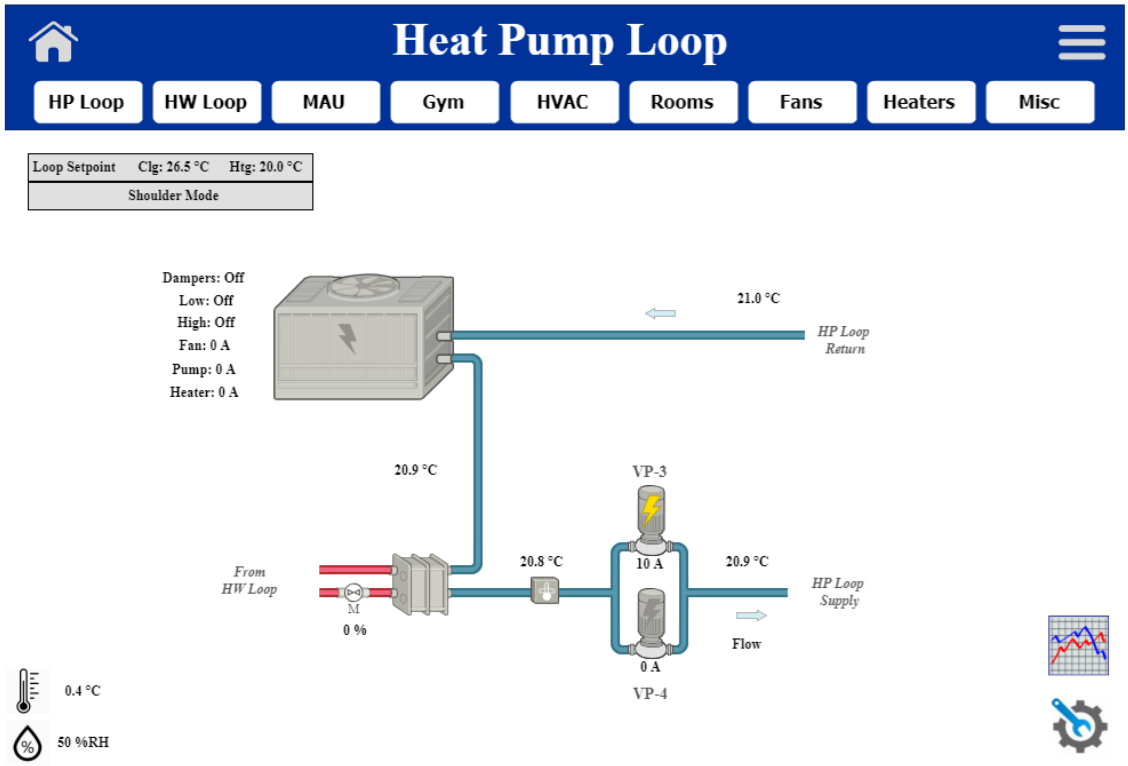
Only include HWLoop Navigation button on Header where Heating Water Loop is present at facility.
The HWLoop (Heating Water Loop) Page shall be comprised of the following: 1 - Trend navigation button (trend defaulted to include 7 days history of loop return water temperature (°C), loop supply water temperature (°C), boiler(s) supply water temperature (°C), and loop set-point (°C), 2 - Settings button to be linked to settings page, 3 - a chart with the loop water temperature set-point, and 4 – graphic depicting all associated the equipment and controlled zones. The following shall be graphically presented on the equipment: pump(s) command (green = on, white or no colour = idle), boiler command (red = on, white or no colour = idle). The following status values shall be presented: pump(s) status (amperage), valve(s) position, boiler command and reset signal value or status, boiler supply water temperature (°C), loop return water temperature (°C), loop supply water temperature (°C), zone supply water temperature (°C), zone return water temperature (°C),



.9 HPLoop Page

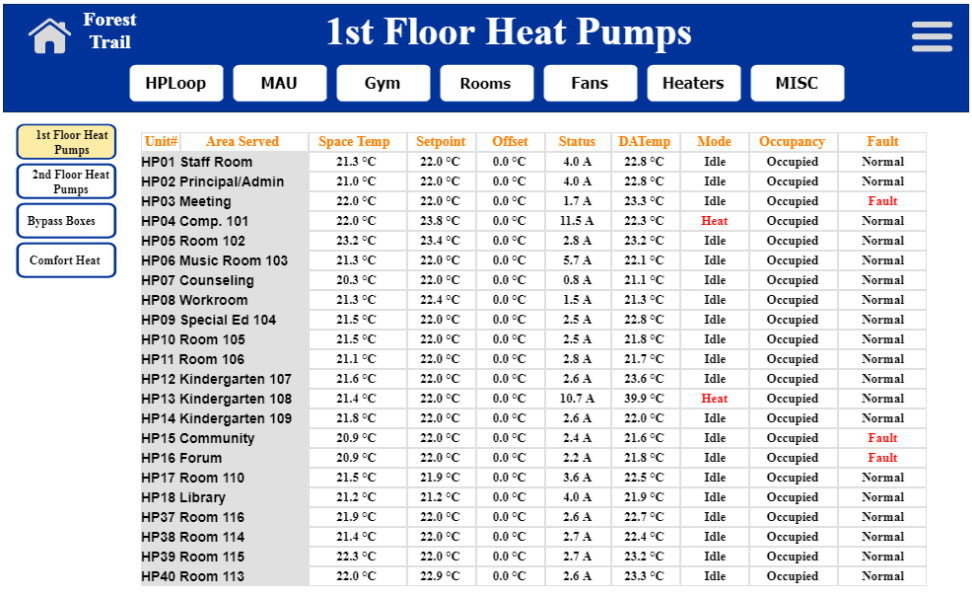
Only include HPLoop Navigation button on Header where Heat-pump Loop is present at facility.

The HpLoop (Heat-pump Loop) Page shall be comprised of the following: 1 - Trend navigation button (trend defaulted to include 7 days history of loop return water temperature (°C), loop supply water temperature (°C), cooling tower leaving water temperature (°C), and set-point (°C), 2 - Settings button to be linked to settings page, 3 - a chart with the mode, and return water temperature set-point (°C), and 4 – graphic depicting all associated the equipment and controlled zones. The following shall be graphically presented on the equipment: pump(s) command (green = on, white or no colour = idle), boiler command for dedicated Heat-pump loop boilers only (red = on, white or no colour = idle), damper(s) position. The following status values shall be presented: fan status (Amperage), cooling tower pan heater status (Amperage), pump(s) status (Amperage), valve(s) position, boiler command and reset signal value or status, boiler supply water temperature (°C), loop return water temperature (°C), loop supply water temperature (°C), cooling tower leaving water temperature (°C), cooling tower damper(s) status (open or closed), cooling tower low speed fan command, cooling tower high speed fan command, cooling tower percentage speed command where VFD installed.



.10 Rooms Page

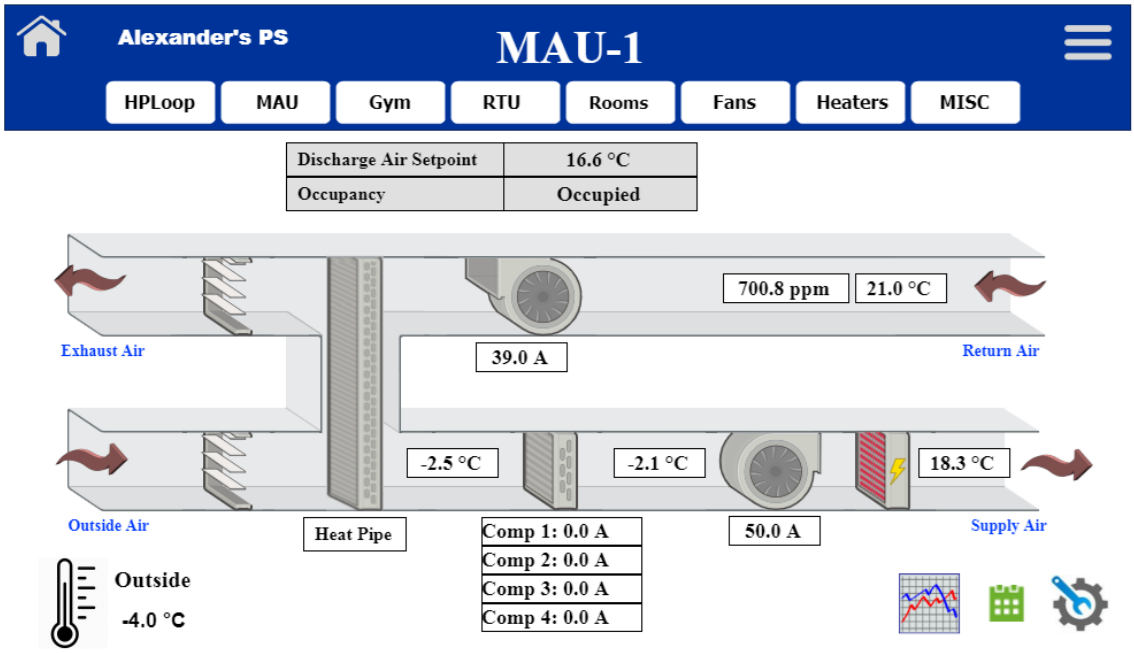
The Rooms page shall be comprised of the following: 1 - Navigation Buttons (left side of Chart) to include but not limited to: equipment by floor (example VAV Boxes 1st Floor), Comfort Heat, By-Pass Boxes, Unit Ventilators, HVAC Units. 2 – Navigation to respective equipment. Chart with live data under the following headers: Unit# (navigation to unit referenced), Area Served, Space Temp, Set point, Offset, Status, DATemp, Mode, Occupancy, Fault



Unit#	Area Served	Space Temp	Setpoint	Offset	Status	DATemp	Mode	Occupancy	Fault
HP01	Staff Room	21.3 °C	22.0 °C	0.0 °C	4.0 A	22.8 °C	Idle	Occupied	Normal
HP02	Principal/Admin	21.0 °C	22.0 °C	0.0 °C	4.0 A	22.8 °C	Idle	Occupied	Normal
HP03	Meeting	22.0 °C	22.0 °C	0.0 °C	1.7 A	23.3 °C	Idle	Occupied	Fault
HP04	Comp. 101	22.0 °C	23.8 °C	0.0 °C	11.5 A	22.3 °C	Heat	Occupied	Normal
HP05	Room 102	23.2 °C	23.4 °C	0.0 °C	2.8 A	23.2 °C	Idle	Occupied	Normal
HP06	Music Room 103	21.3 °C	22.0 °C	0.0 °C	5.7 A	22.1 °C	Idle	Occupied	Normal
HP07	Counseling	20.3 °C	22.0 °C	0.0 °C	0.8 A	21.1 °C	Idle	Occupied	Normal
HP08	Workroom	21.3 °C	22.4 °C	0.0 °C	1.5 A	21.3 °C	Idle	Occupied	Normal
HP09	Special Ed 104	21.5 °C	22.0 °C	0.0 °C	2.5 A	22.8 °C	Idle	Occupied	Normal
HP10	Room 105	21.5 °C	22.0 °C	0.0 °C	2.5 A	21.8 °C	Idle	Occupied	Normal
HP11	Room 106	21.1 °C	22.0 °C	0.0 °C	2.8 A	21.7 °C	Idle	Occupied	Normal
HP12	Kindergarten 107	21.6 °C	22.0 °C	0.0 °C	2.6 A	23.6 °C	Idle	Occupied	Normal
HP13	Kindergarten 108	21.4 °C	22.0 °C	0.0 °C	10.7 A	39.9 °C	Heat	Occupied	Normal
HP14	Kindergarten 109	21.8 °C	22.0 °C	0.0 °C	2.6 A	22.0 °C	Idle	Occupied	Normal
HP15	Community	20.9 °C	22.0 °C	0.0 °C	2.4 A	21.6 °C	Idle	Occupied	Fault
HP16	Forum	20.9 °C	22.0 °C	0.0 °C	2.2 A	21.8 °C	Idle	Occupied	Fault
HP17	Room 110	21.5 °C	21.9 °C	0.0 °C	3.6 A	22.5 °C	Idle	Occupied	Normal
HP18	Library	21.2 °C	21.2 °C	0.0 °C	4.0 A	21.9 °C	Idle	Occupied	Normal
HP37	Room 116	21.9 °C	22.0 °C	0.0 °C	2.6 A	22.7 °C	Idle	Occupied	Normal
HP38	Room 114	21.4 °C	22.0 °C	0.0 °C	2.7 A	22.4 °C	Idle	Occupied	Normal
HP39	Room 115	22.3 °C	22.0 °C	0.0 °C	2.7 A	23.2 °C	Idle	Occupied	Normal
HP40	Room 113	22.0 °C	22.9 °C	0.0 °C	2.6 A	23.3 °C	Idle	Occupied	Normal

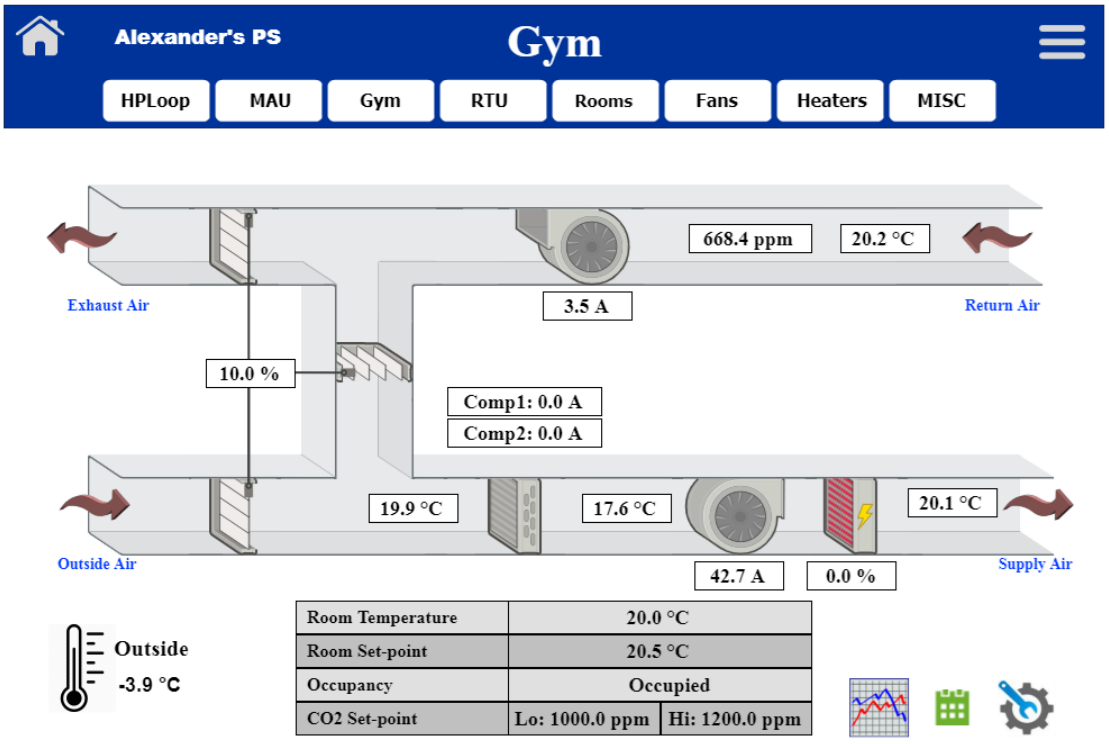
.11 MAU Page

The MA (make-up air unit) page shall be comprised shall be comprised of: 1 - Trend navigation button (trend defaulted to include 7 days history of return air temperature, discharge air temperature, set-point), 2 - Calendar button to be linked to the respective calendar, 3 - Settings button to be linked to settings page, a chart with the discharge air set-point and occupancy, and 4 – template graphic depicting the equipment. The following shall be graphically presented on the equipment: fan(s) command (fan spinning = on, not spinning = idle), heat command (red coil = on, gray coil = idle), cooling command (blue coil = on, gray coil = idle), damper(s) position. The following status values shall be presented: fan(s) status (amperage), exhaust air temperature (°C), discharge air temperature (°C), downstream HRV/ERV air temperature (°C), heating command reset signal value or status, compressor(s) status (amperage), outdoor air damper position (where mechanically linked to return air and/or exhaust air damper(s) value to be outdoor air damper position), HRV/ERV command, HRV/ERV status
Where more than one make-up air unit exists in a facility, navigation buttons located on the left side of the graphic shall be incorporated, labelling to be determined by Owner



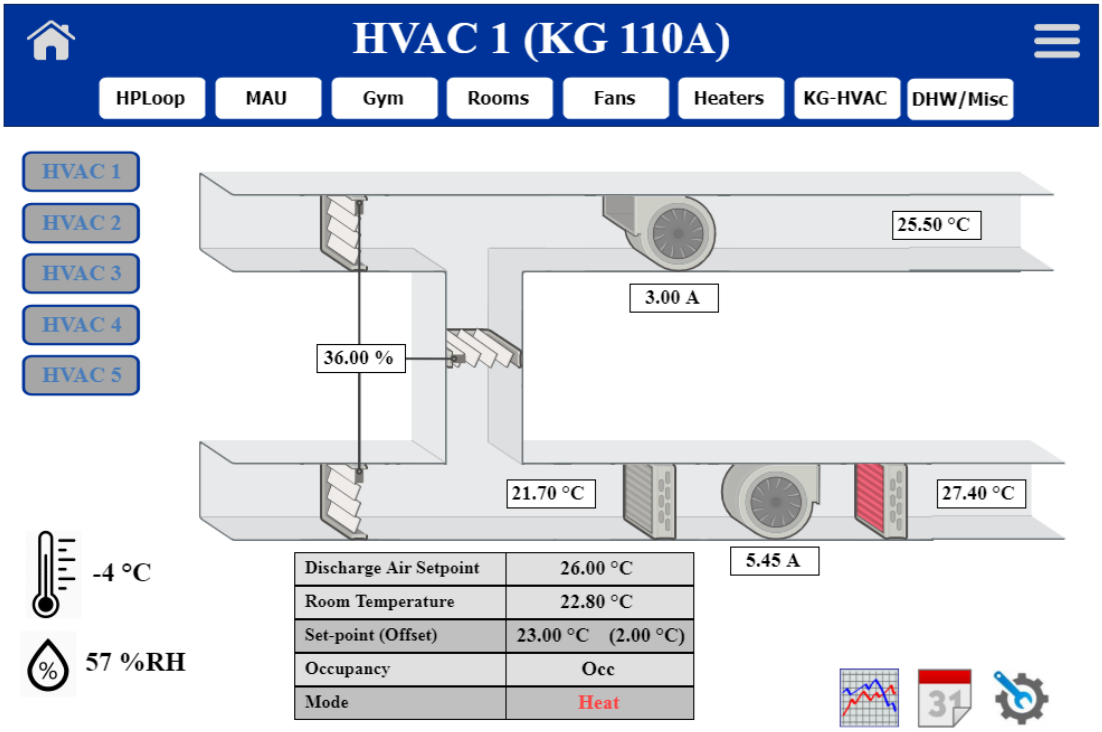
.12 Gym Page

The Gym page shall be comprised of: 1 - Trend navigation button (trend to include 7 days history of return air temperature, discharge air temperature, set-point), 2 - Calendar button to be linked to the respective calendar, 3 - Settings button to be linked to settings page, 4 - a chart with the Room Temperature, Room Set-point and Occupancy, and 5 - template graphic depicting the equipment type servicing the space. The following shall be graphically presented on the equipment graphic: fan(s) command (fan spinning = on, not spinning = idle), heat command (red coil = on, gray coil = idle), cooling command (blue coil = on, gray coil = idle), damper(s) position. The following status values shall be presented: fan(s) status (amperage), return air temperature (°C), discharge air temperature (°C), mixed air temperature (°C), heating command reset signal value or status, compressor(s) status (amperage), outdoor air damper position (where mechanically linked to return air and/or exhaust air damper(s) value to be outdoor air damper position), HRV/ERV command, HRV/ERV status,
Where more than one piece of equipment conditions a single gymnasium, the Room Temperature, Room Set-point and Occupancy shall be a single object and programmed as such.
Where more than one gymnasium exists in a facility, navigation buttons located on the left side of the graphic shall be incorporated, labelling to be determined by Owner.



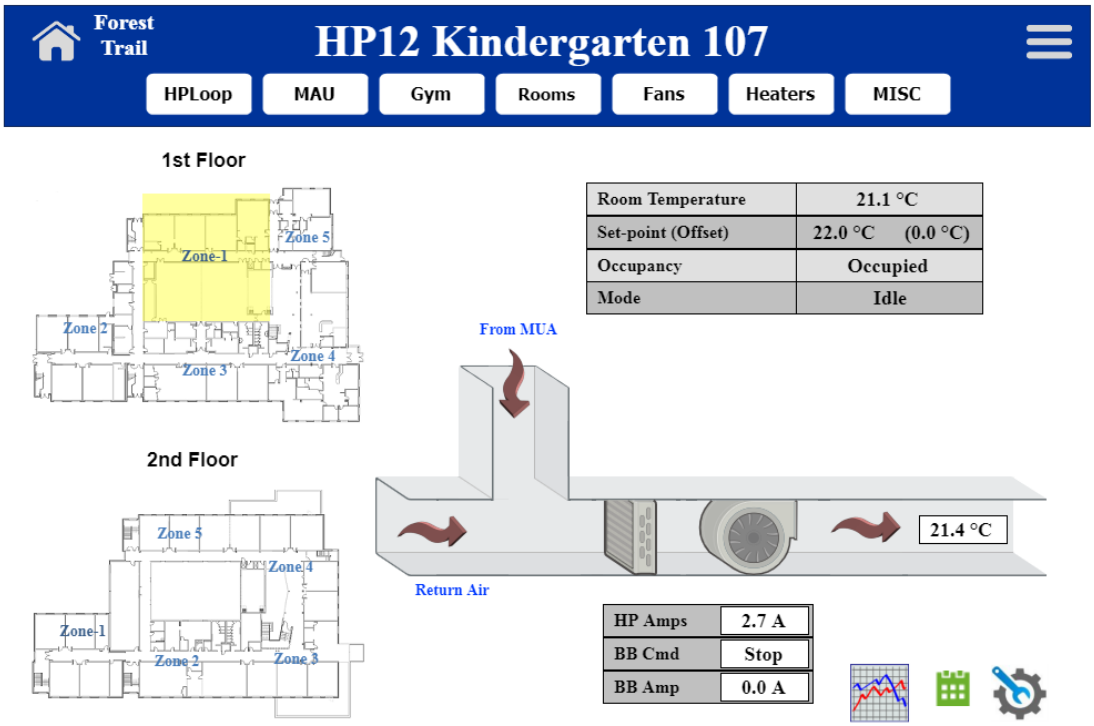
.13 HVAC Page

Where an HVAC Unit serves a classroom or office (which can include 1 by-pass box), an HVAC Header navigation button is not required, and the unit operational information can be presented on the Rooms Page. The individual unit, navigation from chart, is to be configured per below.
Where is more than one HVAC Unit serving multiple common spaces, i.e., Library, Shop, etc., there is to be a HVAC Header navigation button used.
The HVAC page shall be comprised of: 1 - Trend navigation button (trend to include 7 days history of return air temperature, discharge air temperature, set-point, 2 - Calendar button to be linked to the respective calendar, 3 - Settings button to be linked to settings page, 4 - a chart with the Room Temperature, Room Set-point and Occupancy, and 5 - template graphic depicting the equipment type servicing the space. The following shall be graphically presented on the equipment graphic: fan(s) command (fan spinning = on, not spinning = idle), heat command (red coil = on, gray coil = idle), cooling command (blue coil = on, gray coil = idle), damper(s) position. The following status values shall be presented: fan(s) status (amperage), return air temperature (°C), discharge air temperature (°C), mixed air temperature (°C), heating command reset signal value or status, compressor(s) status (amperage), outdoor air damper position (where mechanically linked to return air and/or exhaust air damper(s) value to be outdoor air damper position), HRV/ERV command, HRV/ERV status,
Where more than one HVAC Unit exists in a facility, 6 - navigation buttons located on the left side of the graphic shall be incorporated, labelling to be determined by Owner.



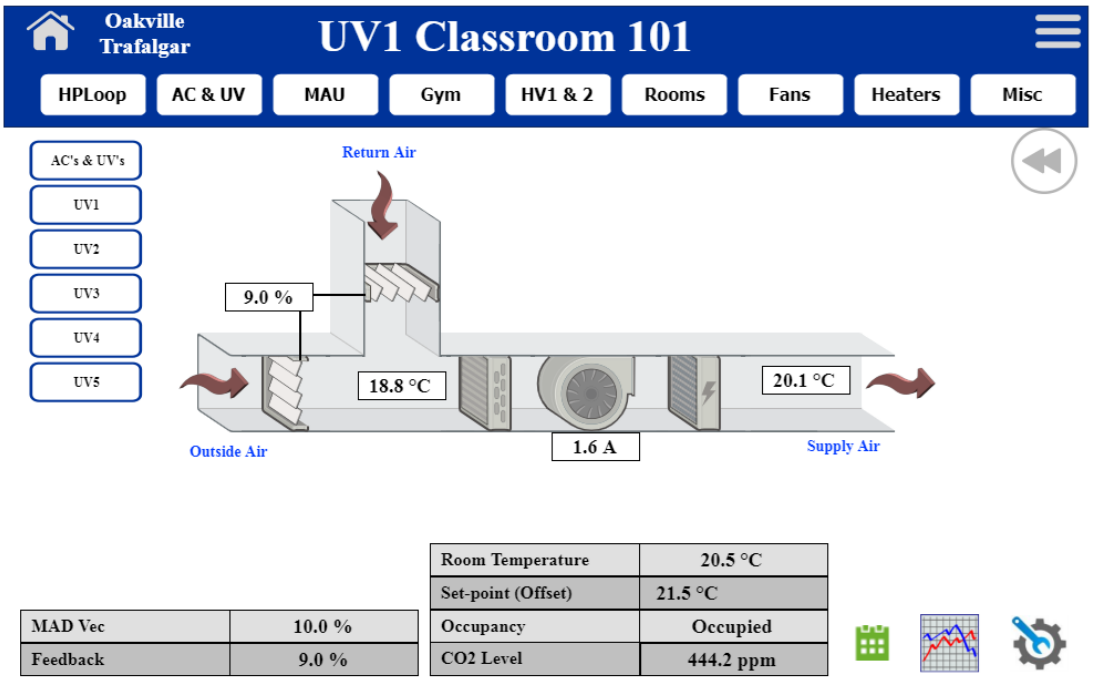
.14 Heat-pump Page (individual equipment)

A Heat-pump page shall be comprised of: 1 - Trend navigation button (trend to include 7 days history of room temperature, set-point offset value, discharge air temperature (°C), and unit status (amperage), 2 - Calendar button to be linked to the respective calendar, 3 - Settings button to be linked to settings page, 4 - a chart with the Room Temperature, Set-point (offset), Occupancy, and Mode, 5 – keyplan indicating zone the respective unit is located, and 6 - template Heat-pump graphic. The following shall be graphically presented on the equipment graphic: fan(s) command (fan spinning = on, not spinning = idle), heat command (red coil = on, gray coil = idle), cooling command (blue coil = on, gray coil = idle). The following status values shall be presented: 7 - unit status including auxiliary heat (amperage), return air temperature (°C), discharge air temperature (°C), auxiliary heat status (amperage)



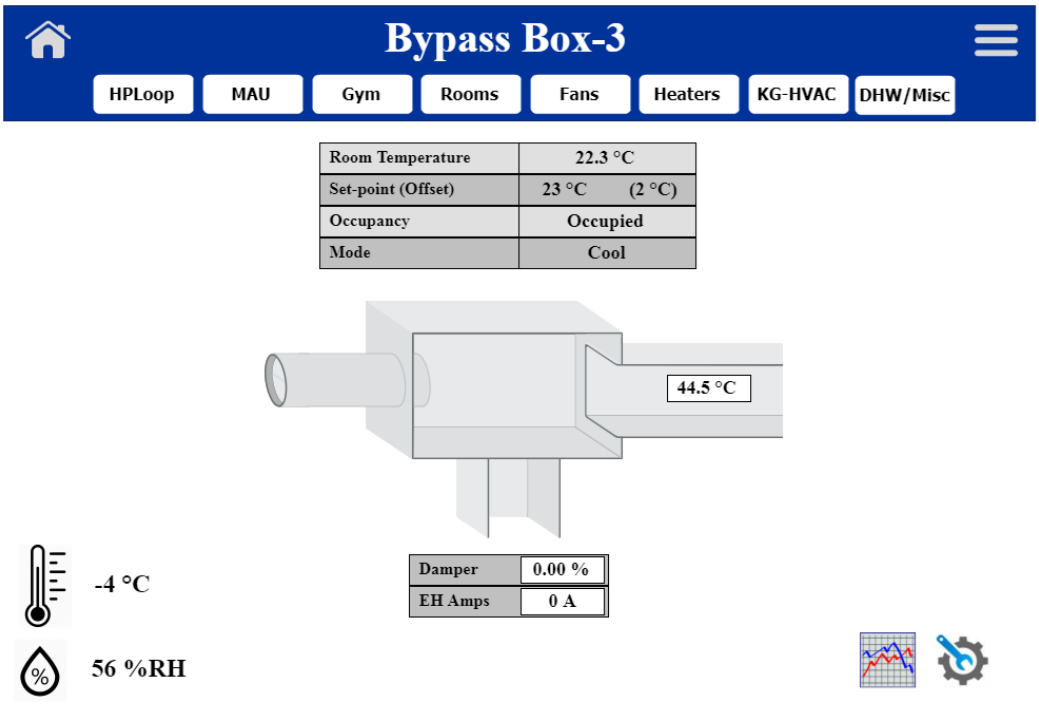
.15 Unit Ventilator Page (individual equipment)

A Unit Ventilator page shall be comprised of: 1 - Trend navigation button (trend to include 7 days history of room temperature, set-point offset value, discharge air temperature (°C), and unit status (amperage), outdoor air damper position, 2 - Calendar button to be linked to the respective calendar, 3 - Settings button to be linked to settings page, 4 - a chart with the Room Temperature, Set-point (offset), Occupancy, and Mode, 5 – navigation buttons located on the left side of the graphic, and 6 - template Unit Ventilator graphic. The following shall be graphically presented on the equipment graphic: fan(s) command (fan spinning = on, not spinning = idle), heat command (red coil = on, gray coil = idle), cooling command (blue coil = on, gray coil = idle). The following status values shall be presented: unit status (amperage), return air temperature (°C), discharge air temperature (°C), heating command reset signal value or status if hydronic, compressor(s) status (amperage) if remote condensing unit, outdoor air damper position (where mechanically linked to return air and/or exhaust air damper(s) value to be outdoor air damper position), HRV/ERV command and HRV/ERV status where applicable, auxiliary heat status (amperage).



.16 By-Pass Box or VAV Page (individual equipment)

A By-Pass or VAV Box page name shall include an equipment identifier from which the air is being supply from.
A By-Pass or VAV Box page shall be comprised of: 1 - Trend navigation button (trend to include 7 days history of room temperature, set-point offset value, and damper positon, discharge air temperature (°C), 2 - Settings button to be linked to settings page, 3 - a chart with the Room Temperature, Set-point (offset), Occupancy, and Mode, and 4 - template By-Pass or VAV box graphic. The following shall be graphically presented on the equipment graphic: re-heat command (red coil = on, gray coil = idle), cooling command (blue coil = on, gray coil = idle). The following status values shall be presented: damper poisiton, return air temperature (°C), 5 - discharge air temperature (°C) and auxiliary heat status (amperage).



.17 Fans and Heaters Page

The Fans and Heaters page(s) shall be comprised of a Chart with live data under the following headers: Unit Number, Area Served, RmTemp, Set-point, Command, Status, and Occupancy

.18 Misc. Page

The Misc page shall comprise operational information for: exterior lighting, domestic hot water status, trap flushing urinal flushing, grouped schedules, network comfort set-point

3.15 LOW-VOLTAGE ELECTRICAL AND CONTROL WIRING

.1 It shall be the System Contractor's responsibility to complete and/or coordinate all wiring, less than 600 V, in accordance with 1.15, required for a complete Control System, including but not limited to:

- .1 All raceways, boxes, cables, circuit breakers, grounding, relays, motors, starters and wirings from existing panel boards or switchgear through splitters, starters and field disconnect switches to complete power supply required for equipment supplied under this Contract not indicated on the electrical plans and specifications.
- .2 Power to all actuators and sensors.
- .3 Provide all wiring and cabling for network communications except for owner provided LAN(s)/WAN(s).
- .4 All sensor and control device input and output wiring.
- .5 All interconnecting cabling between and amongst network devices
- .6 Interlock wiring between devices, and between motor starters.
- .7 All other necessary wiring for fully complete and functional system as specified.
- .8 Install piping, wiring/cabling routed parallel to or at right angles with the structure, properly supported every six (6) feet at a minimum and installed in a workmanlike manner.

.2 Control system wiring and cabling installed for this project shall be performed by professionals in a workmanlike manner and in accordance with National Electric Code (NFPA 70), CSA C22.2 and latest NEMA standards, FCC, and any/all applicable local codes and/or Authorities Having Jurisdiction (AHJ).

.3 All materials must be CSA and NEMA approved. Where this is not possible, arrange and pay for unconditional Electrical Safety Authority approval.

.4 The following cabling shall be installed as continuous links, including shielding. Field splices are strictly prohibited.

- .1 Network / Communication
- .2 Signal (input / output control wiring)

.5 Maximum allowable voltage for control wiring shall be 120-volts.

- .1 All 120 VAC power for any controls equipment shall be from dedicated circuits. Provide a breaker lock for each breaker used to supply the control system. Update the panel circuit directory.
- .2 A 120 VAC duplex receptacle for laptop power shall be provided if the cabinet is located further than 1500 mm (5’) laterally from the nearest outlet.

.6 The Contractor shall terminate all control and/or interlock wiring and shall maintain updated (as-built) wiring diagrams with terminations identified at the job site. This Section includes wiring, circuit breakers and accessories rated 600 V and less.

.7 It is the responsibility of this contractor to provide dedicated 120 V, power from the spare breaker for the automation system from the nearest electrical panel. Provide typewritten information on panel directory.

3.16 POWER WIRING AND CABLING

.1 Power wiring for all enclosures and equipment, including branch circuit wiring from circuit breaker panels shall be the responsibility of the System Contractor unless specifically shown on the Plans or Specifications.

.2 The B-BC panel shall be served from isolated ground receptacle via UPS by dedicated branch circuits.

.3 Power shall NOT be obtained by tapping into miscellaneous circuit that could inadvertently be switched off.

.4 Transformers and power supplies for controllers and field devices shall be supplied in accordance with manufacturers recommendations and shall be located within the designated control enclosure.

.5 Power for controls equipment shall be from a dedicated circuit. Where a controller is dedicated to controlling a single piece of equipment, power may be obtained directly from that equipment.

.6 All other enclosures, sensor and control devices shall be fed from separate circuits in the electrical distribution panels and shall not be served from the typical floor receptacle or lighting circuits.

3.17 NETWORK AND COMMUNICATION CABLING

.1 Network installation shall strictly adhere to the manufacturer's network installation instructions and procedures.

.2 All data cabling shall use stranded conductors. Solid core conductors shall not be accepted.

.3 Data cabling shall be run separately from power and signal wiring

.4 All communications wire shall be externally identified as "Building Automation System Network" in accordance with the HDSB's Building Automation Systems Standards and Design, latest revision.

.5 Network installation shall conform to standards for the LAN types and cabling types selected. Specific network rules inherent to the ANSI/AHRAE Standard 135, latest will be followed. Those include but are not limited to:

.1 Only one path can exist from any BACnet device to another

.2 The maximum length and cabling type of an MS/TP segment shall be in accordance with manufacturers specifications and shall comply with EIA-485.

.3 Each internetwork LAN must have a unique Network Number (1 - 65,545).

.4 The maximum number of nodes per segment shall be 32, as specified in the EIA 485 standard.

.5 Wire type used for MSTP, RS-485 twisted pair communications must be balanced twisted pair with 100 to 120 Ohms Characteristic Impedance. The wire shall be less than 30 pF per foot and preferred 20 AWG or lower. A shield wire shall be included for ground connection.

.6 Primary LAN Network wire and cable shall be run separately from all other wiring.

.7 Other LAN Network wire and cabling shall be installed separate from any wiring over thirty (30) volts.

.8 All communications shielding shall be grounded as per Networked System manufacturer's recommendations.

3.18 BACnet ETHERNET COMMUNICATION CABLING

.1 Data cable shall Category 5 or better Ethernet cable.

.2 Data cable shall be four twisted pair 24 AWG solid copper, Plenum Rated FT-6 / CMP or Riser Rated FT-4 / CMR (as required by local codes) unshielded twisted cable meeting EIA / TIA 568B.1 Category 5e classification.

.3 The maximum cable length for each run shall be limited to 90 meters.

.4 All cables must be Power Sum accepted and recognized by the manufacturer.

.5 Cable Skew must be specified as 20Ns or less per 100 meters.

.6 Cables must display the manufacturer's stamp stating that the cable is included in the latest UL verified publication for respective Category standards.

3.19 SIGNAL (INPUT/OUTPUT CONTROL) WIRING

.1 Minimum #20 AWG stranded copper conductors (larger gauge wire/cable shall be provided where required by BAS equipment and where applications warrant (e.g., rated load, long runs, etc.).

.2 All BMS input/output point wire/cable and communication cable shall be shielded.

.1 Non-shielded cables may be approved for BAS input and output field point wiring following certification from the BAS manufacturer that non-shielded cables will function satisfactorily for the life of the building and that the use of non-shielded cables will not negatively affect other building systems/cabling.

.2 The manufacturers certification shall guarantee to the Board that should it be determined that BAS system performance is negatively affected, or another building system or equipment is negatively affected due to the non-shielded cable, the BAS manufacturer shall replace the cable at no cost to the Board.

.3 All cabling shall be installed in a neat and workman like manner. Follow manufacturer's installation recommendations for all communication cabling.

.4 Free air cabling installed in non-combustible rated buildings shall be fire rated cable with a minimum rating of FT-6.

.5 Wiring located in combustible rated buildings above T-bar ceiling shall be run in free air using fire rated cable with a minimum rating of FT-6.

.6 Note: all free air cabling used in combustible rated buildings to interface to security or fire alarm systems shall be FT-6 rated.

.7 Install plenum wiring in sleeves where it passes through walls and floors. Maintain fire rating at all penetrations.

.8 Cables shall follow building lines and be installed in bundles resting in a cabling support system (J-hooks).

.9 Cable supports shall be attached to the wall or ceiling of the area they are running through. Cable supports shall not be attached to:

.1 Electrical raceways,

.2 Duct work,

.3 Ceiling suspension systems,

.4 Piping,

.5 Wilson joists.

.6 All wire/cable terminations shall be made at screw type terminal strips. Wire nut terminations and butt splices shall not be acceptable. Wiring runs shall be continuous runs without splices.

.10 All BAS equipment and components shall be grounded to building ground facilities.

.11 BAS shall only be capable of controlling electric motors when the associated hand/off/auto (HOA) motor control switches are in the "auto" position. BAS control shall be wired into the auto circuit of the hand/off/auto motor control circuit only. Where hand/off/auto switches do not exist, they shall be provided by the Controls Contractor.

.12 Life safety and equipment protection interlocks shall be wired to override equipment whenever it is in operation.

.13 Existing interlocks and override control should typically not be removed or overridden by the application of new BAS control without the specific instruction and/or approval of the Owner.

3.20 UTILITY MONITORING

.1 The metered systems include the electrical power, natural gas distribution, and water systems. The Controls Contractor is responsible for the integration and/or supply of metering equipment necessary to provide the following:
Electricity – real time and historical kWh and KW
Gas – real time and historical m3
Water – real time and historical L

.2 The Controls Contractor is responsible for coordination with the respective Electricity Provider for integration and/or installation.

.3 The Board will coordinate with Union Gas the installation of the Utility provided signal output. The Controls Contractor is responsible for connection, integration, and programming.

.4 The Controls Contractor is responsible to integrate the water the existing Utility Provider’s (Region of Halton) meter.

3.21 COMMISSIONING, TESTING, DEMONSTRATION, AND ACCEPTANCE

.1 The system shall be commissioned in its entirety. All commissioning and tested shall be documented and submitted prior to Demonstration and Acceptance testing. Commissioning and Testing shall include, but not limited to the following:

.1 Verify all programming, naming, identification, and conforms to the HDSB's Building Automation Systems Standards and Design, latest revision.

.2 A point-to-point check of the location, installation, and labeling

.3 Calibrate all analogue inputs and devices using actual versus the embedded UI

.4 Control loops are to be fully set-up and tuned

.5 Each control program and sequence shall be fully commissioned and confirmed by an end-to-end test, for the complete design intent compliance and functionality.

.6 Verify failsafe conditions

.2 The naming and identification of all points, networking instances, objects, meta tags, etc. is to be extracted from the site controls electronically and sent to the Owner or its Authorized representative in one of the following formats .csv, .xls or xlsx, for review and acceptance. The values are not to be edited or formatted prior to sending.

.3 Pursuant to 3.8.1, assist and cooperate with the Owner approved third party commissioning provider in the following manner: using a skilled technician who is familiar with the building, assist in the functional performance testing of the control system as per test requirements developed in the commissioning check sheets (prepared by the commissioning provider).

.4 When Commissioning, Testing, Demonstration and Acceptance process has been completed and approved and/or verified by the Owner, and within ten (10) days, the contractor will be provided with a signed letter from the owner indicating acceptance.

3.22 TRAINING

.1 Subsequent to the acceptance, per 3.9., and part of this contract, 1 day of training is to be provided to a maximum 6 individuals responsible for the operation of the site at the sole discretion of the Owner. The training shall provide instruction and demonstration on the operation, adjustment, and maintenance of the BAS inclusive of all hardware and software supplied under this and other related specifications necessary to meet the functional intent. The training is to include, but not limited to, the following:

.1 Location of all controllers, devices, sensors, peripherals, etc.

.2 Equipment layout and dependencies

.3 Sequence of operation

.4 Preventative maintenance

3.23 WARRANTY, MAINTENANCE, AND SERVICE

.1 Provide warranty under provisions of these specifications.

.2 At no cost to the Owner, during the warranty period, the Contractor shall provide maintenance services for software and hardware components as specified below:

.1 Normal Service: Any malfunction, failure, or defect in any hardware component or failure of any control programming that would not result in property damage or loss of comfort control shall be corrected and repaired. Response to any request for service shall be provided within eight (8) working hours of the Owner's initial request for service. In the event that the malfunction, failure, or defect cannot be corrected through telephone support to the Owner, or its representatives, the next step is to attempt to correct the issue through remote site access. In the event the problem persists, a service technician, trained in the system to be serviced, shall be dispatched to the Owner's site within forty-eight (48) hours of the Owner's initial request for service, as specified.

.2 Emergency Service: Any malfunction, failure, or defect in any hardware component or failure of any control programming that would result in property damage or loss of comfort control shall be corrected and repaired. Response to any request for service shall be provided within two (2) working hours of the Owner's initial request for service. In the event that the malfunction, failure, or defect cannot be corrected immediately through telephone support or remote site access, a service technician, trained in the system to be serviced, shall be dispatched to the Owner's site within eight (8) hours of the Owner's initial telephone request for service, as specified.

.3 Owners Request for Service: Contractor shall specify three telephone numbers and email addresses, including order of contact and procedure in the event a contact fails to respond, for the Owner to use in the event of a need for service.

.3 Provide all labour, associated travel and expenses, materials, and equipment necessary for the successful operation of this system for a period of 12 months from the date of final acceptance, per 3.9. In addition, provide three (3) visits for testing and evaluating the performance of the hardware and software installed per this specification, to be coordinated with the HDSB's Building Automation Manager. One visit shall be during the cooling season, one visit shall be during the heating season, and one visit shall be during a shoulder season, either spring or fall. Provide a written report after each visit is complete. This service visit shall include, but not be limited to, the following:

.1 Check calibration and re-calibrate if needed instrumentation sensors for air flow, liquid flow, pressure, humidity, temperature, and transducers. Written records shall be kept indicating the performance of such calibrations along with pertinent data.

.2 Check the operation of dampers and damper actuators to assure no lock up has occurred and stroke is proper. Written records shall be kept indicating the performance of such calibrations along with pertinent data.

.3 Check the overall system field operations by performing a review of all points. Verify that all monitoring and command points are valid and active. Written records shall be kept indicating the performance of such exercises.

.4 If a problem develops at any time during the warranty/service period, the affected BAS point/object shall be monitored and logged for the remainder of the warranty/service period. "A problem" in the above statement will refer to an incident in which any of the following occur:

.1 An alarm occurs due to a defective control system component(s), improper installation, or programming.

.2 Overall performance of the system is compromised due to a defective control component(s), improper installation, or programming.

.3 Major recalibration (by greater than 5 times the catalogued accuracy) is required for a sensor during one of the service visits.

.5 Pursuant to 3.3, changes required to meet design, compliance, and functionality, that were not part of the Demonstration and Acceptance process, will be made at no cost to the Owner.

.6 Any changes to programming, inclusive of but not limited to set-points, schedules, sequences, alarms, history, network addressing, object naming, etc. are to be performed in accordance with the Change Management Procedures outlined in the HDSB's Building Automation Systems Standards and Design, latest revision.

3.24 SCHEDULE A

.1 Objects / Points identified in Schedule A as Mandatory ('Y' in Mandatory column) must be included in program of the respective system or equipment. Where an Object or Point is not listed as Mandatory, inclusion within Schedule A does not dictate the requirement for use within a program and are listed for information purposes only where equipment differs from standard and program variations must be made to meet the sequences per 23 09 93.

.2 Objects / Points identified as Mandatory must be adjustable, in accordance with 3.12 of this Section

.3 Where a 'G' and/or 'V' is indicated in the User Interface column, the Object or Point shall be represented on the respective graphic page, in accordance with 3.9 of this Section. Mandatory points without a 'G' and/or 'V' indicated in the User Interface column shall be presented in the settings page.

.4 Where an Object or Point is identified as a software point with a 'B' in the Software Point column of the table, BACnet value will be an accepted means of data source provided change of value requirements are met. BACnet shall not be used as a writeable point or as a data source for Alarms classified as Emergency.

END OF SECTION

23 09 90 Schedule A

Point Description	Object / Point Name Abbreviation	Mandatory	Hardware Point	Software Point	User Interface Graphic or Value	History	Alarm Type	Alarm Parameters
Outdoor Air Temperature	OAT	Y	x		V	x	E	5% from average
Boiler								
Supply or Return Water Temperature Reset Set-point	Blr#ResetTempSpt	Y		x	V	x		
Supply or Return Water Temperature Reset Signal	Blr#ResetSignal	Y	x		V	x		
Boiler Command (Enable / Disable)	Blr#Cmd	Y	x		G	x		
Boiler Lead / Lag Status**	Blr#Lead (Lag)	Y		x				
Supply Water Temperature	Blr#SWT	Y	x	B	V	x		
Return Water Temperature	Blr#RWT		x	B		x		
Boiler Status	Blr#Status		x	B	G	x		
Boiler Alarm	Blr#Alarm	Y	x		G	x	G	Binary
Boiler Output	Blr#Output			B				
Boiler Pump Command (Enable / Disable)**	Blr#PumpCmd	Y	x		G	x		
Boiler Pump Status	Blr#PumpAmp	Y	x	B	V	x		
Boiler Pump Alarm	Blr#PumpAlarm			x	G			
Heating Loop								
Heating Loop Supply Water Temperature Reset Set-point	HWLoop#ResetTempSpt	Y		x	V	x		
Supply Water Temperature	HWLoop#SWT	Y	x		V	x		
Return Water Temperature	HWLoop#RWT	Y	x		V	x		
Water Temperature Alarm	HWLoopTempAlarm	Y		x	G			
Supply Water Pressure	HWLoopSWPress	Y	x		V	x		
Return Water Pressure	HWLoopRWPress	Y	x		V	x		
Pressure Differential Supply vs Return	HWLoop#PD	Y		x	G	x		
Flow Status (when Pressure Differential not available)**	HWLoop#Flow	Y	x		G	x		
Flow Alarm	HWLoop#FlowAlarm	Y		x	G		E	Binary or 30% from set-point
Zone Temperature**	HWLoop#Zone#Temp	Y	x		V	x		
Zone Temperature Alarm**	HWLoop#Zone#TempAlarm	Y		x	G			
Circulating Pump Command (Enable / Disable)	HWLoop#Pump#Cmd	Y	x		G	x		
Circulating Pump Status	HWLoop#Pump#Amp	Y	x		V	x		
Circulating Pump Speed**	HWLoop#Pump#Spd	Y	x		V	x		
Pump Lead / Lag Status**	HWLoop#Pump#Lead(Lag)	Y		x	V			
Chiller								
Occupancy Schedule	OccSched	Y		x	V			
Chilled Water Loop Supply Water Temperature Set-point	LoopSpt	Y		x	V	x		
Chiller Command (Enable / Disable)	Cmd	Y	x		G	x		
Chiller Leaving Water Temperature	LWT	Y	x	B	V	x		
Chiller Entering Water Temperature	EWT	Y	x	B	V	x		
Condenser Leaving Water Temperature	CndLWT	Y	x	B	V	x		
Condenser Entering Water Temperature	CndEWT	Y	x	B	V	x		
Alarm	Alarm	Y	x		G		G	On failure
Condenser Flow	CondFlow			B	V			
Condenser Pump Command (Enable / Disable)	CndPumpCmd			B	V			
Condenser Pump Status	CndPumpAmp			B	V	x		
Refrigerant Saturated Condensing Temperature	SCT			B	V	x		
Refrigerant Discharge Pressure	Discharge			B	V	x		
Refrigerant Discharge Line Temperature	DischargeLineTemp			B	V	x		
Refrigerant Saturated Suction Temperature	SST			B	V	x		
Refrigerant Suction Pressure	Suction			B	V	x		
Refrigerant Suction Line Temperature	SuctionLineTemp			B	V	x		
Refrigerant Liquid Pressure	Liquid			B	V	x		
Refrigerant Liquid Line Tempertaure	LiquidLineTemp			B	V	x		
Refrigerant Superheat	SH			B	V	x		
Refrigerant Sub-cooling	SC			B	V	x		
Compressor Command (Enable / Disable)	CompCmd			B	V	x		
Compressor Speed	CompSpd			B	V	x		
Compressor Status L1	CompAmpL1	Y		B	V	x		
Compressor Status L2	CompAmpL2	Y		B	V	x		
Compressor Status L3	CompAmpL3	Y		B	V	x		
Compressor Voltage L1	CompVoltL1	Y		B	V	x		
Compressor Voltage L2	CompVoltL2	Y		B	V	x		
Compressor Voltage L3	CompVoltL3	Y		B	V	x		
Compressor Run-time	CompRunTime	Y		B	V	x		
Evpaorator Flow	EvapFlow			B	V			
Refrigerant Monitor	RefMonitor	Y	x		G		E	On failure

Point Description	Object / Point Name Abbreviation	Mandatory	Hardware Point	Software Point	User Interface Graphic or Value	History	Alarm Type	Alarm Parameters
Cooling Tower								
Cooling Tower Command (Enable / Disable)**	TowerCmd		x		V	x		
Cooling Tower Leaving Water Temperature	TowerLWT	Y	x		V	x		
Cooling Tower Return Water Temperature**	TowerRWT	Y	x		V	x		
Sump Temperature	TowerSumpTemp	Y	x		V	x	H	≤ 4°C
Sump Heater Status	TowerSumpHeaterAmp	Y	x		V	x		
Sump Heater Command (Enable / Disable)**	TowerSumpHeaterCmd		x		V	x		
Dampers Open	TowerDOpen	Y	x		V	x		
Spray Pump Command (Enable / Disable)	TowerSprayCmd	Y	x		G	x		
Spray Pump Status	TowerSprayAmp	Y	x		V	x		
Cooling Tower Fan Command (Enable / Disable)	TowerFanCmd	Y	x		G	x		
Cooling Tower Low Speed Fan Command (Enable / Disable)**	TowerLowSpdFanCmd	Y	x		V	x		
Cooling Tower High Speed Fan Command (Enable / Disable)**	TowerHighSpdFanCmd	Y	x		V	x		
Cooling Tower Fan Speed**	TowerFanSpd	Y	x		V	x		
Cooling Tower Fan Status	TowerFanAmp	Y	x		V	x		
Heat-pump Loop								
Heat-pump Loop Mode	HpLoopMode	Y		x	V	x	H	In Emergency Mode
Heat-pump Loop Cooling Supply Water Temperature Set-point	HpLoopClgSWTSpt	Y		x	V	x		
Heat-pump Loop Heating Supply Water Temperature Set-point	HpLoopHtgSWTSpt	Y		x	V	x		
Supply Water Temperature	HpLoopSWT	Y	x		V	x		
Return Water Temperature	HpLoopRWT	Y	x		V	x		
Heat-pumps Cooling	HpLoopHPClg	Y		x		x		
Heat-pumps Heating	HpLoopHPHtg	Y						
Supply Water Pressure	HpLoopSWPress	Y	x		V	x		
Return Water Pressure	HpLoopRWPress	Y	x		V	x		
Pressure Differential Supply vs Return	HpLoopPD	Y	x		G	x		
Flow Status (when Pressure Differential not available)**	HPLoopFlow	Y	x		G	x	E	Binary or 30% from set-point
Main Circulating Pump #1 Command (Enable / Disable)	HpLoopP1Cmd	Y	x		G			
Main Circulating Pump #1 Status	HpLoopP1Amp	Y	x	B	V	x		
Main Circulating Pump #1 Speed**	HpLoopP1Spd	Y	x		V	x		
Main Circulating Pump #2 Command (Enable / Disable)**	HpLoopP2Cmd	Y	x		G			
Main Circulating Pump #2 Status**	HpLoopP2Amp	Y	x	B	V	x		
Main Circulating Pump #2 Speed**	HpLoopP2Spd	Y	x		V	x		
Pump Lead / Lag Status**	HpLoopLead (Lag)	Y		x	V			
Heat-Exchanger								
Primary Entering Water Temperature**	HtExchanger#EWT	Y	x		V	x		
Primary Leaving Water Temperature	HtExchanger#LWT	Y	x		V	x		
Supply Water Temperature	HtExchanger#SWT	Y	x		V	x		
Return Water Temperature**	HtExchanger#RWT	Y	x		V	x		
Valve Signal	HtExchanger#Valve%	Y	x		V	x		
Supply or Return Water Reset Set-point	HtExchanger#Spt	Y		x	V	x		
Domestic Hot Water								
Occupancy Schedule	DHWOccSched	Y		x	V			
Supply Water Temperature	DHW#SWT	Y	x		V	x		
Supply Water Temperature Set-point**	DHW#Spt		x		V	x		
DHW Circulating Pump Command (Enable / Disable)	DHW#PumpCmd	Y	x		V			
DHW Circulating Pump Status	DHW#PumpAmp	Y	x		V	x		

Point Description	Object / Point Name Abbreviation	Mandatory	Hardware Point	Software Point	User Interface Graphic or Value	History	Alarm Type	Alarm Parameters
Make-up Air Unit								
Occupancy Schedule	OccSched	Y		x	V			
MAU Unit Command (Enable / Disable)	Cmd	Y	x		V	x		
MAU Unit Alarm	Alarm	Y	x		G		H	On failure
Fire Interlock Command (Enable / Disable)	FireCmd		x		V			
Supply Air Fan Command (Enable / Disable)	SAFanCmd	Y	x		G	x		
Supply Air Fan Speed Schedule**	SAFanSpdSched			x	V			
Supply Air Fan Speed Set-point**	SAFanSpd	Y	x		V	x		
Supply Air Fan Status	SAFanAmp	Y	x		V	x		
Outdoor Air Damper Schedule	OADOccSched			x	V			
Outdoor Air Damper Status	OADPosition		x	B	G/V			
Outdoor Air Damper Signal	OAD%	Y	x		G/V	x		
Exhaust Air Fan Command (Enable / Disable)	EAFanCmd		x	B	G			
Exhaust Air Fan Speed Schedule	EAFanSpdSched			x	V			
Exhaust Air Fan Speed Set-point	EAFanSpd		x	B	V			
Exhaust Air Fan Status	EAFanAmp	Y	x	B	V	x		
Exhaust Air Damper Status	EADPosition		x	B	G/V			
Exhaust Air Damper Signal**	EAD%	Y	x		G/V			
Cooling Command (Enable / Disable)	ClgCmd	Y	x		G	x		
Cooling Stage**	ClgStg#Cmd	Y	x	B	V			
Cooling Output Signal**	Clg%	Y	x	B	G/V			
Compressor Status **	Comp#Amp	Y	x	B	V	x		
Heat Command (Enable / Disable)	HtgCmd	Y	x		G	x		
Heat Output Signal**	Htg%	Y	x	B	G/V			
Heat Status	HtgStatus		x	B	V			
Discharge Air Temperature	DATemp	Y	x		V	x		
Discharge Air Temperature Reset Set-point	DATSpt	Y		x	V	x		
Discharge Air Temperature Reset Signal	DATSptSignal	Y	x		V	x		
Discharge Air Temperature Alarm	DATempAlarm	Y	x		V	x	H	>20°C more than 20 min
Return Air Temperature	RATemp	Y	x	B	V	x		
Downstream H/ERV Temperature	ERVOutTemp	Y	x	B	V	x		
H/ERV Command (Enable / Disable)	ERVCmd		x		G			
Mixed Air Temperature	MATemp	Y	x	B	V	x		
Exhaust Fan Interlock**	EF#Interlock		x		V			
Freeze Stat (when unit contains hydronic heating coil)	FreezeStat	Y	x		G	x	H	On failure
Fresh Air Filter / Supply Fan Belt Status	SAService			x	G			
Exhaust Air Filter / Belt Status	EAService			x	G			

Point Description	Object / Point Name Abbreviation	Mandatory	Hardware Point	Software Point	User Interface Graphic or Value	History	Alarm Type	Alarm Parameters
HVAC Unit								
Occupancy Schedule	OccSched	Y		x	V			
Room Temperature**	RmTemp	Y	x		V	x		
Occupied Cooling Set-point	OccClgSpt	Y		x				
Occupied Heating Set-point	OccHtgSpt	Y		x				
Network Set-point**	NtwkSpt	Y		x	V	x		
Room Temperature Sensor Offset**	RmTempOffset	Y		x	V	x		
Actual Room Temperature Set-point**	ActRmSpt	Y		x	V	x		
Unoccupied Cooling Set-point	UnOccClgSpt	Y		x				
Unoccupied Heating Set-point	UnOccHtgSpt	Y		x				
Room Temperature Alarm**	RmTempAlarm	Y		x	G		L	≤ 17°C during Occupied
HVAC Unit Command (Enable / Disable)	Cmd	Y	x			x		
HVAC Unit Alarm	Alarm	Y	x		G		H	On failure
Fire Interlock Command (Enable / Disable)	FireCmd		x		V			
Supply Air Fan Command (Enable / Disable)	SAFanCmd	Y	x		G	x		
Supply Air Fan Speed Set-point**	SAFanSpd	Y	x		V	x		
Supply Air Fan Status	SAFanAmp	Y	x		V	x		
Return Air Fan Command (Enable / Disable)	RAFanCmd	Y	x		G	x		
Return Air Fan Speed Set-point**	RAFanSpd	Y	x		V	x		
Return Air Fan Status	RAFanAmp	Y	x		V	x		
Exhaust Air Fan Command (Enable / Disable)**	EAFanCmd	Y	x		G	x		
Ehaust Air Fan Speed Set-point**	EAFanSpd	Y	x		V	x		
Exhaust Air Fan Status**	EAFanAmp	Y	x		V	x		
Outdoor Air Damper Schedule	OADOccSched	Y	x		G/V			
Outdoor Air Damper Status	OADPosition	Y		x	G/V	x		
Outdoor Air Damper Signal	OAD%	Y	x		V	x		
Return Air Damper Status**	RADPosition	Y		x	V	x		
Return Air Damper Signal**	RAD%	Y	x		G/V	x		
Exhaust Air Damper Status**	EADPosition	Y		x	G/V	x		
Exhaust Air Damper Signal**	EAD%	Y	x		G/V	x		
Cooling Command (Enable / Disable)	ClgCmd	Y	x		G	x		
Cooling Stage	ClgStg#Cmd		x	B	G/V			
Cooling Output	Clg%		x	B	G/V			
Compressor Status **	Comp#Amp	Y	x		V	x		
Heat Command (Enable / Disable)	HtgCmd	Y	x		G	x		
Heat Output	Htg%		x	B	G/V			
Heat Status	HtgStatus		x	B	G/V			
Discharge Air Temperature	DATemp	Y	x		V	x		
Discharge Air Temperature Reset Set-point**	DATSpt	Y		x	V	x		
Discharge Air Temperature Reset Signal**	DATSptSignal	Y	x		V	x		
Discharge Air Temperature Alarm**	DATempAlarm	Y	x		V	x		
Return Air Temperature	RATemp	Y	x		V	x		
Downstream H/ERV Temperature	ERVOutTemp	Y	x	B	V	x		
H/ERV Command (Enable / Disable)	ERVCmd		x		G			
Mixed Air Temperature	MATemp	Y	x		V	x		
Return Air CO2	RACO2	Y	x		V	x		
Return Air CO2 Set-point	RACO2Spt			x	V			
Freeze Stat (when unit contains hydronic heating coil)	FreezeStat	Y	x		G/V	x	H	On failure
Occupancy Override Push-button**	OccPB	Y	x			x		
Occupancy Override Time**	OccTimer	Y		x				
Supply Air Service	SAService			x	G			
Return Air Service	RAService			x	G			

Point Description	Object / Point Name Abbreviation	Mandatory	Hardware Point	Software Point	User Interface Graphic or Value	History	Alarm Type	Alarm Parameters
Room Controller Heat-pump								
Occupancy Schedule	OccSched	Y		x	V			
Room Temperature	RmTemp	Y	x		V	x		
Occupied Cooling Set-point	OccClgSpt	Y		x				
Occupied Heating Set-point	OccHtgSpt	Y		x				
Network Set-point	NtwkSpt	Y		x	V	x		
Room Temperature Sensor Offset	RmTempOffset	Y		x	V	x		
Actual Room Temperature Set-point	ActRmSpt	Y		x	V	x		
Unoccupied Cooling Set-point	UnOccClgSpt	Y		x				
Unoccupied Heating Set-point	UnOccHtgSpt	Y		x				
Room Temperature Alarm	RmTempAlarm	Y		x	G		L	≤ 17°C
Loop Valve Open / Close**	LVlv	Y	x		V			
Fan Command (Enable / Disable)	Fan	Y	x		G	x		
Fan and Compressor Status (total unit CT)	Amp	Y	x		V	x		
Low Amperage	LowAmp	Y		x	G			
Heating Command (Enable / Disable)	HtgCmd	Y	x		G	x		
Cooling Command (Enable / Disable)	ClgCmd	Y	x		G	x		
Heating Minimum Run-time	HtgMinRun	Y		x				
Cooling Minimum Run-time	ClgMinRun	Y		x				
Heating Call Delay	HtgDmdDelay			x				
Cooling Call Delay	ClgDmdDelay			x				
Heating Cooling Switch-over Delay	HtgClgDelay	Y		x				
Discharge Air Temperature	DATemp	Y	x		V	x		
Discharge Air Temperature Alarm	DATempAlarm			x				
Heat-pump Alarm	Alarm	Y	x		G	x	L	On failure
Occupancy Override Push-button	OccPB	Y	x			x		
Occupancy Override Time	OccTimer	Y		x				
Auxiliary Electric Heat Command (Enable / Disable)**	EH#AuxHtgCmd	Y	x		G	x		
Auxiliary Electric Heat Control Signal**	EH#AuxHtg%	Y	x		V	x		
Auxiliary Hydronic Heat Command (Enable / Disable)**	HH#AuxHtgCmd	Y	x		G	x		
Auxiliary Hydronic Heat Control Signal**	HH#AuxHtg%	Y	x		V	x		
Auxiliary Heat Status (Hydronic)**	HH#Temp	Y	x		V	x	H	≤ 5°C
Auxiliary Heat Status (Electric)**	EH#Amp	Y	x		V	x		
Window Interlock Status [1]	Window		x		V	x		
Room Controller By-Pass Box (Dump)								
Occupancy Schedule	OccSched	Y		x	V			
Room Temperature	RmTemp	Y	x		V	x		
Occupied Cooling Set-point	OccClgSpt	Y		x				
Occupied Heating Set-point	OccHtgSpt	Y		x				
Network Set-point	NtwkSpt	Y		x	V	x		
Room Temperature Sensor Offset	RmTempOffset	Y	x		V	x		
Actual Room Temperature Set-point	ActRmSpt	Y		x	V	x		
Unoccupied Cooling Set-point	UnOccClgSpt	Y		x				
Unoccupied Heating Set-point	UnOccHtgSpt	Y		x				
Room Temperature Alarm	RmTempAlarm	Y		x	G			
Damper Position	Damper%	Y		x	V	x		
Discharge Air Temperature	DATemp	Y	x		V	x		
Discharge Air Temperature Alarm**	DATempAlarm			x				
Re-Heat Command (Enable / Disable)**	ReHtCmd	Y	x		G	x		
Re-Heat Control Signal (where modulating)**	ReHt%	Y	x		V	x		
Auxiliary Electric Heat Command (Enable / Disable)**	EH#AuxHtgCmd	Y	x		G	x		
Auxiliary Electric Heat Control Signal**	EH#AuxHtg%	Y	x		V	x		
Auxiliary Hydronic Heat Command (Enable / Disable)**	HH#AuxHtgCmd	Y	x		G	x		
Auxiliary Hydronic Heat Control Signal**	HH#AuxHtg%	Y	x		V	x		
Auxiliary Heat Status (Hydronic)**	HH#Temp	Y	x		V	x	H	≤ 5°C
Auxiliary Heat Status (Electric)**	EH#Amp	Y	x		V	x		

Point Description	Object / Point Name Abbreviation	Mandatory	Hardware Point	Software Point	User Interface Graphic or Value	History	Alarm Type	Alarm Parameters
Room Controller V.V.T.								
Occupancy Schedule	OccSched	Y		x	V			
Room Temperature	RmTemp	Y	x		V	x		
Occupied Cooling Set-point	OccClgSpt	Y		x				
Occupied Heating Set-point	OccHtgSpt	Y		x				
Network Set-point	NtwkSpt	Y		x	V	x		
Room Temperature Sensor Offset	RmTempOffset	Y	x		V	x		
Actual Room Temperature Set-point	ActRmSpt	Y		x	V	x		
Unoccupied Cooling Set-point	UnOccClgSpt	Y		x				
Unoccupied Heating Set-point	UnOccHtgSpt	Y		x				
Room Temperature Alarm	RmTempAlarm	Y		x	G		L	≤ 17°C
Damper Position	Damper%	Y		x	V	x		
Discharge Air Temperature	DATemp	Y	x		V	x		
Discharge Air Temperature Alarm	DATempAlarm			x				
Re-Heat Command (Enable / Disable)**	ReHtCmd	Y	x		G	x		
Re-Heat Control Signal (where modulating)**	ReHt%	Y	x		V	x		
Auxiliary Electric Heat Command (Enable / Disable)**	EH#AuxHtgCmd	Y	x		G	x		
Auxiliary Electric Heat Control Signal**	EH#AuxHtg%	Y	x		V	x		
Auxiliary Hydronic Heat Command (Enable / Disable)**	HH#AuxHtgCmd	Y	x		G	x		
Auxiliary Hydronic Heat Control Signal**	HH#AuxHtg%	Y	x		V	x		
Auxiliary Heat Status (Hydronic)**	HH#Temp	Y	x		V	x	H	≤ 5°C
Auxiliary Heat Status (Electric)**	EH#Amp	Y	x		V	x		
Room Controller Electric or Hydronic Heat								
Occupancy Schedule	OccSched	Y		x	V			
Room Temperature	RmTemp	Y	x		V	x		
Occupied Heating Set-point	OccHtgSpt	Y		x				
Network Set-point	NtwkSpt	Y		x	V	x		
Room Temperature Sensor Offset	RmTempOffset	Y	x			x		
Actual Room Temperature Set-point	ActRmSpt	Y		x		x		
Unoccupied Heating Set-point	UnOccHtgSpt	Y		x				
Room Temperature Alarm	RmTempAlarm	Y		x	G		L	≤ 17°C
Comfort Heat Enable / Disable	Cmd	Y	x		G	x		
Comfort Heat Status**	Temp	Y	x		V	x	H	≤ 5°C
Comfort Heat Status**	Amp	Y	x		V	x		
Heat Output (where modulating)**	Htg%	Y	x		V	x		
Occupancy Override Push-button	OccPB	Y	x			x		
Occupancy Override Time	OccTimer	Y		x				
Discharge Air Temperature (where applicable)**	DATemp	Y	x		V	x		
Discharge Air Temperature Alarm (where applicable)**	DATempAlarm	Y	x		G	x		

Point Description	Object / Point Name Abbreviation	Mandatory	Hardware Point	Software Point	User Interface Graphic or Value	History	Alarm Type	Alarm Parameters
Room Controller Unit Ventilator								
Occupancy Schedule	OccSched	Y		x	V			
Room Temperature	RmTemp	Y	x		V	x		
Occupied Cooling Set-point	OccClgSpt	Y		x				
Occupied Heating Set-point	OccHtgSpt	Y		x				
Network Set-point	NtwkSpt	Y		x	V	x		
Room Temperature Sensor Offset	RmTempOffset	Y	x		V	x		
Actual Room Temperature Set-point	ActRmSpt	Y		x	V			
Unoccupied Cooling Set-point	UnOccClgSpt	Y		x				
Unoccupied Heating Set-point	UnOccHtgSpt	Y		x				
Room Temperature Alarm	RmTempAlarm	Y	x		G		L	≤ 17°C
Loop Valve Open / Close**	LVlv	Y	x		G	x		
Fan Command (Enable / Disable)	Fan	Y	x		G	x		
Fan and Compressor Status (total unit CT)	Amp	Y	x		V	x		
Low Amperage	LowAmp	Y		x	G			
Outdoor Air Damper	OADCmd	Y	x		G	x		
Outdoor Air Damper Position	OADPosition	Y	x		V	x		
Outdoor Air Damper Signal	OAD%	Y	x		V	x		
Heating Command (Enable / Disable)	HtgCmd	Y	x		G	x		
Free Cooling Command (Enable / Disable)	FreeClgCmd		x			x		
Cooling Command (Enable / Disable)	ClgCmd	Y	x		G	x		
Heating Minimum Run-time	HtgMinRun			x				
Cooling Minimum Run-time	ClgMinRun	Y		x				
Heating Call Delay	HtgDmdDelay			x				
Cooling Call Delay	ClgDmdDelay			x				
Heating Cooling Switch-over Delay	HtgClgDelay	Y		x				
Discharge Air Temperature	DATemp	Y	x		V	x		
Discharge Air Temperature Alarm	DATempAlarm			x				
Unit Ventilator Alarm	Alarm	Y	x		G	x	L	On failure
Occupancy Override Push-button	OccPB	Y	x			x		
Occupancy Override Time	OccTimer	Y		x				
Auxiliary Electric Heat Command (Enable / Disable)**	EH#AuxHtgCmd	Y	x		G	x		
Auxiliary Electric Heat Control Signal**	EH#AuxHtg%	Y	x		V	x		
Auxiliary Hydronic Heat Command (Enable / Disable)**	HH#AuxHtgCmd	Y	x		G	x		
Auxiliary Hydronic Heat Control Signal**	HH#AuxHtg%	Y	x		V	x		
Auxiliary Heat Status (Hydronic)**	HH#Temp	Y	x		V	x	H	≤ 5°C
Auxiliary Heat Status (Electric)**	EH#Amp	Y	x		V	x		
Window Interlock Status [1]	Window		x		V	x		
Room Controller Air Conditioning, Heat-pump, Ductless Split, or V.R.F. - Indoor Air Handling (Cassette / Fan Coil) Unit Only								
Occupancy Schedule	OccSched	Y		x	V			
Room Temperature	RmTemp	Y	x		V	x		
Occupied Cooling Set-point	OccClgSpt	Y		x				
Occupied Heating Set-point	OccHtgSpt	Y		x				
Network Set-point	NtwkSpt	Y		x	V	x		
Room Temperature Sensor Offset	RmTempOffset	Y	x		V	x		
Actual Room Temperature Set-point	ActRmSpt	Y		x	V			
Unoccupied Cooling Set-point	UnOccClgSpt	Y		x				
Unoccupied Heating Set-point	UnOccHtgSpt	Y		x				
Room Temperature Alarm	RmTempAlarm	Y		x	G		L	≤ 17°C
Fan Command (Enable / Disable)	Fan	Y	x		G	x		
Fan Status	FanAmp			x	V	x		
Low Amperage	LowAmp			x	G			
Heating Command (Enable / Disable)	HtgCmd	Y	x		G	x		
Heat Control (where modulating)	Htg%		x		V	x		
Heat Status (Hydronic)	HH#Temp		x		V	x		
Heat Status (Electric)	EH#Amp		x		V	x		
Cooling Command (Enable / Disable)	ClgCmd	Y	x		G	x		
Heating Call Delay	HtgDmdDelay			x				
Cooling Call Delay	ClgDmdDelay			x				
Heating Cooling Switch-over Delay	HtgClgDelay	Y		x				
Discharge Air Temperature	DATemp		x		V	x		
Discharge Air Temperature Alarm	DATempAlarm			x				
Unit Alarm	Alarm	Y	x		G		L	On failure
Occupancy Override Push-button	OccPB	Y	x			x		
Occupancy Override Time	OccTimer	Y		x				
Window Interlock Status [1]	Window		x		V	x		
Remote Condensing Unit - excluding V.R.F.								
Condensing Unit Command (Enable / Disbable)	CU#Cmd	Y	x		V			
Fan and Compressor Status (total unit CT)	CU#Amp	Y	x		V	x		

Point Description	Object / Point Name Abbreviation	Mandatory	Hardware Point	Software Point	User Interface Graphic or Value	History	Alarm Type	Alarm Parameters
Supply Air Fan								
Supply Fan Schedule	SAFan#OccSched	Y		x	V			
Supply Fan Command (Enable / Disable)	SAFan#Cmd	Y	x		G	x		
Supply Fan Status	SAFan#Amp	Y	x		V	x		
Return Air Fan								
Return Fan Schedule	RAFan#OccSched	Y		x	V			
Return Fan Command (Enable / Disable)	RAFan#Cmd	Y	x		G	x		
Return Fan Status	RAFan#Amp	Y	x		V	x		
Exhaust Fan								
Exhaust Fan Schedule	EFOccSched	Y		x	V			
Exhaust Fan Command (Enable / Disable)	EF#Cmd	Y	x		V			
Exhaust Fan Status	EF#Amp	Y	x		V	x		
MAU Interlock (where applicable)	EF#MAU#Interlock	Y		x	V			
Ancillary Heat - electric or hydronic								
Ancillary Heat OAT Disbable	AncillaryHeatOATCmd	Y		x	V			
Ancillary Heat Schedule	AncillaryHeatOccSched	Y		x	V			
Ancillary Heat Command (Enable / Disable)	AncillaryHeatCmd							
Ancillary Heat Status	HH#Temp	Y	x		V	x	E	≤ 5°C
Ancillary Heat Status	EH#Amp	Y	x		V	x		
Space Temperature**	EH#RmTemp	Y	x		V	x	H	≤ 5°C
Space Temperature**	HH#RmTemp	Y	x		V	x	H	≤ 5°C
Space Temperature Set-point**	EH#Spt	Y		x	V			
Space Temperature Set-point**	HH#Spt	Y		x	V			
Lighting								
Exterior Light Astronomical Clock	ExtLtgClock	Y		x	V			
Etxterior Wall Packs Schedule	ExtLtgWP#Schedule	Y		x	V			
Etxterior Wall Packs Command (Enable / Disable)	ExtLtgWP#Cmd	Y	x		V			
Exterior Wall Pack Status	ExtLtgWP#ON (OFF)	Y	x		V			
Parking Lot Schedule	ExtLtgPL#Schedule	Y		x	V			
Parking Lot Command (Enable / Disable)	ExtLtgPL#Cmd	Y	x		V			
Parking Lot Lighting Status	ExtLtgPL#ON (OFF)	Y	x		V			
Misc								
Trap Seal Primer Command (Enable / Disable) **	Trap#Cmd	Y	x		V			
Trap Seal Primer Schedule**	Trap#Schedule	Y		x	V			
Urinal Flush Valve Command (Enable / Dsisable) **	Urinal#Cmd	Y	x		V			
Urinal Flush Valve Schedule**	Urinal#Schedule	Y		x	V			
Metering								
Eletricity kWh	kWh	Y	x		V	x		
Eletricity kW	kW	Y	x		V	x		
Natural Gas	m3	Y	x		V	x		
Water	L	Y	x		V	x	H	TBD

** Indicates Object or Point may not be applicable i.e., Room Controller with no Auxillary Heat, or single Boiler subsequently no Lead / Lag requirement

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Control Sequences for HVAC Systems, sub-systems, and accessories

.2 Related Sections:

.1 Section 23 09 00 – Instrumentation and Control for HVAC

.2 Section 23 70 00 – Central HVAC Equipment

.3 Section 23 80 00 – Decentralized HVAC Equipment

.4 Section 25 00 00 – Integrated Automation

1.2 GENERAL

.1 Sequences specified herein indicate the functional intent of the systems operation and do not fully detail the programming required to obtain the indicated operation.

.2 Throttling ranges, proportional bands, and cycle differentials shall be centered on the associated set-point. All modulating feedback control loops shall include the capability of having proportional, integral, and derivative action. Contractor shall apply appropriate elements of integral and derivative gain to each control loop which shall result in stable operation, minimum settling time, and shall maintain the primary variable within the specified maximum allowable variance.

.3 Equipment start-up concluding a power failure shall be provisioned such that there is protection against building reduced voltage resulting from starting multiple inductive loads. Mechanical equipment shall be grouped such that the combined starting current of the defined group will not exceed the electrical distribution system rated capacity less base load. An interval of not less than 3 seconds shall be maintained between starting of the defined groups.

.4 Preference will be given to using OEM furnished controls. OEM furnished controls must have minimum hard-wired points as indicated herein.

Part 2 Products

SECTION NOT USED

Part 3 Execution

3.1 HYDRONIC HEATING LOOP

HIGH TEMPERATURE HEATING LOOP

.1 Hydronic heating loop applications, requiring a high temperature loop, include but is not limited to radiant heating, hydronic heating coils (air handling units, unit heaters, etc.), heat exchangers.

.2 The Heating plant command is to be interlocked with the hydronic loop circulating pump(s).

.3 The BAS shall enable and/or command on primary and secondary heating circulating pump(s) between December 15th and March 31st.

.4 Between March 31st and December 14th, primary and secondary heating circulating pump(s) shall be enabled and/or commanded on if the outdoor air temperature is less than 5°C for 12 hours or there is a call for heat for the Heat-pump Loop or any HVAC System furnished with Hydronic Coil which serves an occupied area. The hydronic heating loop shall remain enabled until the outdoor air temperature is greater than 18°C.

.5 Where multiple circulation pumps exist for redundancy, the BAS shall rotate the lead pump every Tuesday at 6 am. In the event a pump fails the alternate pump shall start.

.6 All heating system pumps are to run for 15 minutes minimum per week.

3.2 CENTRAL HEATING PLANT (BOILERS)

.1 The BAS shall continuously enable and/or command on the boiler plant with any call for heating from the Heat-pump Loop, HVAC System furnished with a hydronic coil, or High Temperature Heating Loop.

.2 The boiler supply water temperature shall be rest using an outdoor air reset for non-condensing boilers and a return water temperature reset for condensing boiler systems. Set-points are to adjust to higher set-points to meet the functional intent of all attached appliances.

.3 Where redundant boilers are installed, the lead boiler shall be rotated every Tuesday at 6 am.

.4 The control of boiler pumps shall be facilitated by the boiler plant OEM furnished controllers. Pump status shall be monitored using an analog signal from a Current Transformer.

3.3 HEAT PUMP LOOP

.1 The Heat-pump Loop main circulation pump shall be enabled and/or commanded on. For pumps equipped with a VFD, pump speed is to vary based on the design pressure differential between the Heat-pump Loop Supply Pressure and Heat-pump Loop Return Water Pressure.

.2 Where redundant circulation pumps exist, lead pump designation shall rotate every Tuesday at 6 am. In the event a lead pump failure occurs the lag pump shall be energized.

.3 The heat-pump loop temperature shall be configured to maximize efficiency of the heat-pumps using 5 distinct modes, “High Temperature”, “Low Temperature”, “Heating”, “Shoulder” and “Cooling”. No two modes can operate simultaneously.

.4 “High Temperature” and “Low Temperature” modes have priority over other modes. An Emergency Class Alarm is to be generated during these events.

.5 NOTE: The program shall be written such that no event enables both the cooling tower and boiler simultaneously.

.6 **High Temperature Mode (Safety):** Enabled when the Heat-pump Loop Return Water Temperature is greater than 31°C. This shall enable and/or command on the first two Stages of the cooling tower. Stages three and four shall be enabled and/or commanded on when the Return Water Temperature is greater than 32°C. This mode is released when the Return Water Temperature is less than 26°C.

.7 **Low Temperature Mode (Safety):** Enabled when the Heat-pump Loop Return Water Temperature is less than 14°C. This enables and/or commands on the boiler(s) or opens the heat-exchanger valve. This mode is released when the Return Water Temperature is 22°C.

.8 **Shoulder Mode:** Active when no other mode is active.

.9 **Heating Mode:** Enabled when the Outdoor Air Temperature is less than 10°C for a period of 45 hours. This mode is released when half (adjustable) of the Heat-pumps enable cooling during the last 24 hour period (counter to be reset at 2 pm) or the Outdoor Air Temperature is above 20°C or in the event of network failure.

.10 **Cooling Mode:** Enabled when the Outdoor Air Temperature is greater than 25°C and should half (adjustable) of the Heat-pumps enable cooling during the last 24 hour period (counter to be reset at 2 pm). This mode is disabled when Outdoor Air Temperature is below 15°C or in the event of network failure.

3.4 HEATING PLANT FOR HEAT PUMP LOOP

.1 Pump status shall be monitored using an analog current transformer.

.2 Redundant boilers are rotated every Tuesday at 6 am.

.3 In “Heating” mode, the boiler(s)/heat injection will modulate the heat pump supply water temperature to a maximum of 32°C to maintain the return water temperature at 29°C.

.4 In “Shoulder” mode, the boiler(s)/heat will modulate the heat pump supply water temperature to a maximum of 32°C to maintain the return water temperature at 20°C.

3.5 COOLING TOWER FOR HEAT PUMP LOOP

.1 When in the "Cooling" mode, the Cooling Tower shall be staged using the following values:

Return Water Temperature	Stage	Enable
Base set-point + 2°C	4	Ramp Fan Speed to Maintain
Base set-point + 1.5°C	3	Spray Pump
Base set-point + 1°C	2	Fan Minimum Speed
Base set-point + 0.5°C	1	Open Dampers
Base set-point		Off

The base set-point is equal to the Outdoor Air Temperature minus 5°C but is limited between 17°C and 28°C.

.2 When in the "Shoulder" mode, the Cooling Tower shall be staged using the following values:

Return Water Temperature	Stage	Stage
28°C	4	Ramp Fan Speed to Maintain
27.5°C	3	Spray Pump
27°C	2	Fan Minimum Speed
26.5°C	1	Open Dampers
26°C		Off

.3 The BAS shall disable the Spray Pump when Outdoor Air Temperature is less than 4°C.

3.6 HEAT PUMP LOOP CONTROL – BOILERS, AIR TO WATER HEAT PUMP AND COOLING TOWER

.1 GENERAL

.1 The Central plant provides the hydronic water to the buildings heat pumps.

.2 The building consists of water to air heat pumps in each classroom. These units utilize a heat pump cycle to cool or heat the individual rooms as required.

.3 The system is switched between heating and cooling manually on site. Provide ability to switch BAS mode from heating to cooling at operator workstation on the graphics.

.4 Heat is provided by the boilers or air to water heat pumps installed on the roof. The ASHP units are integrated into the main building system via a plate and frame heat exchanger. The boilers are integrated via a low loss header.

.5 Heat rejection is provided by the cooling tower.

.2 SAFETIES AND LIMITS

.1 Minimum start and stop time delays are provided on all outputs to prevent short cycling of equipment.

.2 Boilers have a minimum on time of 5 minutes and off time of 2.5 minutes.

.3 If the outdoor air sensor fails, the boiler system will be enabled. The setpoints will set to -15° C outside air temperature if the calendar mode is winter.

.4 The system pumps will run for 10 minutes after the boilers shut down to dissipate heat.

.5 The boiler circulation pumps shall run for 10 minutes after the boilers shut down to dissipate heat.

.6 Control each boilers discharge temperature to ensure it does not cross the high limit of 93.3 degrees C (i.e., limit boiler modulation as discharge temperature approaches high limit).

.7 Condensing boiler to be on for at least 2 minutes before it will modulate above minimum firing rate.

.8 The system shall default to the non-condensing curve at OA below -10°C.

.9 Minimum on/off times are to be user adjustable in text.

.10 Cooling tower safeties missing.

.3 SYSTEM START/STOP

.1 The system will be able to run year round unless disabled by the operator on the graphics.

.2 The system will operate in heating or cooling mode based on selection made by the operator on the graphics.

.4 CONTROL STRATEGY

.1 Heating will be enabled once system main circulator pump status is confirmed.

.2 Hot Water Supply Temperature Control

.3 The BAS shall operate the boilers or ASHP units to maintain the heat pump loop setpoint.

.5 HEATING SOURCE CONTROL

.1 The Heating Plant shall utilize the boilers to provide heat as follows:

.1 When the OAT is below -5°C (adj)

.2 When the Air Source Heat Pump has been unable to maintain Hot Water Supply Setpoint for a period of 15 minutes (adj) (boiler plant takes lead for next 4 hours).

.3 When Glycol Water Return temp is below ASHP start up temperature. (refer to ASHP warm up sequence)

.4 When the ASHP are unavailable/in error.

.2 The Heating Plant shall utilize the ASHP as the primary heat source at all other times.

.6 AIR SOURCE HEAT PUMP CONTROL

.1 Start up Sequence

.1 The BAS shall open the glycol bypass valve and enable the lead glycol pump for 2 minutes (adj). If the glycol loop is below the manufacturer's start up temperature a glycol warmup sequence shall occur. Refer to warmup sequence.

.2 The hot water pump on the building side of the glycol heat exchanger shall be enabled whenever the glycol pumps are running / prior to enabling the ASHP to ensure that heat transfer occurs across the heat exchanger.

.2 Warm-up Cycle

.1 If the glycol is below ASHP start up temperature the heat exchanger pump shall run, the glycol pump shall run and the glycol bypass valve shall open.

.2 The boilers shall be enabled to keep the Heat pump loop warm and heat will transfer through the heat exchanger to the glycol loop until the glycol has met the ASHPs required start up temperature.

.3 Once the ASHP start up temperature is achieved the boilers will be staged down the ASHP staged on to maintain loop setpoint.

.3 Normal Operation

.1 The BAS shall stage and sequence the ASHPs to maintain the heat pump loop setpoint. The lead ASHP shall alternate weekly to equalize run time.

.2 The glycol bypass valve shall be modulated as required to maintain static pressure set point of the glycol loop.

.3 The glycol pump speed shall be modulated as required to maintain flow through one or both ASHP units as they are staged on/off.

.4 The pump on the water side of the heat exchanger runs continuously at constant speed to transfer heat from the glycol loop to the building loop.

.5 The BAS shall respect minimum run times of the ASHP as supplied by the equipment manufacturer.

.6 The lead ASHP shall be rotated weekly.

.7 The motorized isolation valve and flow switch for each ASHP are integral to the ASHP and controlled by the ASHP.

.8 BAS shall control/monitor the following:

.1 Temperatures into/out of the glycol to water heat exchanger.

.2 Temperatures into/out of each ASHP unit.

.3 Control and staging of the modular ASHP unit.

.4 Operating temperatures, status etc. through the ASHP BACNet integration cards.

.9 Boiler Control

.1 The boilers are piped into the main circulation system through a low loss header. Each boiler has its own circulator pump.

.2 Boiler shall not be fired until local circulator pump status is confirmed.

.3 The boilers shall be operated in sequence to maintain SWT. Note that condensing boiler efficiency is maximized when boilers are operating at low fire. As such, the second boiler should be staged on when the first reaches 40% firing, then two boilers operate at 20% simultaneously.

.4 Boilers are equipped with factory supplied and installed controllers and safeties.

.5 Provide boiler alarm wiring.

.6 The boilers shall be integrated via terminal strip.

.7 Provide boiler discharge temperature sensors on each boiler.

.8 Alternate boilers weekly to equalize equipment run time.

.10 Cooling Tower Control

.1 When in the "Cooling" mode, the Cooling Tower shall be staged using the following values:

Return Water Temperature	Stage	Enable
Base set-point + 2°C	4	Ramp Fan Speed to Maintain
Base set-point + 1.5°C	3	Spray Pump
Base set-point + 1°C	2	Fan Minimum Speed
Base set-point + 0.5°C	1	Open Dampers
Base set-point		Off

The base set-point is equal to the Outdoor Air Temperature minus 5°C but is limited between 17°C and 28°C.

.11 When in the "Shoulder" mode, the Cooling Tower shall be staged using the following values:

Return Water Temperature	Stage	Stage
28°C	4	Ramp Fan Speed to Maintain
27.5°C	3	Spray Pump
27°C	2	Fan Minimum Speed
26.5°C	1	Open Dampers
26°C		Off

.12 The BAS shall disable the Spray Pump when Outdoor Air Temperature is less than 4°C.

.13 An alarm for the following shall be generated on the BAS:

.14 Boiler status is received, and its pump status is off or the boiler is commanded off.

.15 ASHP system is in alarm.

.16 Boiler or ASHP status is not received, and the boiler command is on (5 minute delay).

.17 Boiler alarm contact indicates boiler is in alarm.

.18 Pump status is received, and the command is off (10 minute delay).

.19 Pump status is not received, and the command is on, or status and command mismatch (5 minute delay).

.20 The heating system is on and the primary supply water temperature is more than 10 degrees from setpoint.

.21 An alarm will be generated if any space temperature is below 10° C.

.22 An alarm will be generated if the boiler loop pressure sensor drops below an adjustable threshold.

.23 System differential pressure deviates from set point. (Set with TAB agent to avoid nuisance trips)

.24 If primary pump is commanded on and the flow switch is not closed after 5 minutes.

3.7 GYMNASIUM UNIT(S)

.1 **Unit OEM Controller Minimum Hard-wired points**
Outdoor Air Damper Position Signal: Analogue input (0 to 10 Vdc, or 4 to 20 mA)
Fan(s) Command and/or Enable: Binary input
Heating Command and/or Enable: Binary input
Mechanical Cooling Command and/or Enable: Binary input

.2 In the event of power loss, the outdoor and exhaust air dampers are to close by way of mechanical spring, return air dampers shall open by way of mechanical spring and fans, heating, cooling, and mechanical energy recovery system are to be disabled and/or commanded off.

.3 Scheduled Occupancy

.1 ***Pre-Occupancy:*** The BAS shall command on and/or enable the supply and return air fans, 30 minutes prior to the start of the *Occupied* period. Outdoor air dampers are to remain closed. The unit is controlled to maintain the space temperature to the occupied set-point.

.2 ***Occupied:*** The BAS shall command on and/or enable the unit (and all associated HVAC equipment, i.e., change room exhaust fans) as per Occupancy Appendix. The outdoor air dampers are to be kept to a minimum position or to vary to maintain a return air CO^2 level equal to or less than 800 ppm. The unit is controlled to maintain the space temperature at 19°C.

.3 ***Un-Occupied:*** The BAS shall command off and/or disable the unit as per Occupancy Appendix. All fans are to be commanded off and/or disabled and the outdoor and exhaust air dampers are to be closed by way of mechanical spring return. The return air dampers are to be released and open by way of mechanical spring return. Outdoor air dampers are to remain closed during un-occupied times. The space temperature shall be controlled to maintain between 16°C and 25°C

3.8 MAKE-UP AIR UNIT

.1 **Unit OEM Controller Minimum Hard-Wired Points**
Discharge Air Temperature Reset Signal: Analogue input (0 Vdc – 10 Vdc or 4mA to 20 mA)
Outdoor Air Damper Position Signal: Analogue input (0 to 10 Vdc, or 4 to 20 mA)
Fan(s) Command and/or Enable: Binary input
Heating Command and/or Enable: Binary input
Mechanical Cooling Command and/or Enable: Binary input

.2 In the event of power loss, the outdoor and exhaust air dampers are to close by mechanical spring, fans, heating, cooling, and mechanical energy or heat recovery system are to shut down.

.3 When the supply and exhaust air fans are controlled by VFD, fan speed is programmed to maintain constant static pressure, per engineer or OEM specifications. A service notification is to be generated when either fan increases above design speed.

.4 Scheduled Occupancy

.1 ***Occupied:*** The BAS shall command on and/or enable the unit 15 minutes prior to scheduled occupancy, per Occupancy Appendix.

The Discharge Air Temperature shall reset between 18°C to 15°C based on outdoor air temperature of 0°C to 20°C respectively.

.2 ***Un-Occupied:*** The BAS shall disable the unit according as per Occupancy Appendix. All fans are to be shut down, the outdoor and exhaust air dampers are to be close by way of mechanical spring return.

3.9 ROOM CONTROL HEAT PUMP

.1 **Heat-Pump Controls Minimum Hard-Wired Points**
Fan Command and/or Enable: Binary input
Heating Command and/or Enable: Binary input
Cooling Command and/or Enable: Binary input

.2 Network Occupied Set-point is calculated each scheduled occupancy day at 7 am, from 21°C to 24°C based on Outdoor air temperature -10°C to 27°C, respectively. A +/-2°C set-point offset shall be provisioned through the room sensor.

.3 Heating or Cooling is to be enabled when the room temperature is 1°C away from set-point and will be disabled using a 1°C dead-band.

.4 A 1 hour Heating-Cooling Switch Over Delay is to be programed.

.5 The compressor will have minimum run time of 5 minutes.

.6 Scheduled Occupancy

.1 ***Occupied:*** Fan will run continually. Occupancy is to be scheduled as per Occupancy Appendix.

.2 ***Un-Occupied:*** Cooling and heating set-points shall be 18°C and 27°C and will be disabled by a 2°C dead-band, fan shall operate on a call for heating or cooling. The room sensor shall be provisioned with an occupancy override button that allows temporary occupancy for 120 minutes.

.3 ***Perimeter Heat (Auxiliary Heat)***

When a room, conditioned by a heat-pump, is provisioned with auxiliary heating, the auxiliary heat shall be enabled when the heat pump has been heating for 30 minutes. For hydronic heating only, the heat is to be enabled when the radiant device is equal to or less than 6°C (must enable respective circulation pump).

3.10 ROOM CONTROL TERMINAL OR BY-PASS BOX (EXCLUDES V.A.V. OR V.V.T.)

.1 Room temperature set points are set to a Network Occupied Set-point, reset at 7 am each occupied period, from 21°C to 24°C based on Outdoor air temperature -10°C to 27°C, respectively. A +/-2°C set-point offset shall be provisioned through the room sensor.

.2 Heating or Cooling is to be enabled when the room temperature is 1°C away from set-point. Damper to open when there is a minimum 5°C differential between room temperature and the air supplied by the respective unit (Heating call supply air to be 5°C above room temperature, Cooling call supply air to be 5°C below room temperature), otherwise remain at minimum position. Heating or cooling will be disabled using a 1°C dead-band. There shall be a 30 minutes delay between heating and cooling.

.3 Scheduled Occupancy

.1 ***Occupied:*** Occupancy is to be scheduled as per Occupancy Appendix.

.2 ***Perimeter Heat (Auxiliary Heat)***

When a room conditioned by a terminal or by-pass box is provisioned with auxiliary heating, the auxiliary heat shall be enabled when there has been a call for heat exceeding 30 minutes. For hydronic heating only, the heat is to be enabled when the radiant device is equal to or less than 6°C (must enable respective circulation pump).

3.11 ROOM CONTROL HVAC UNIT (SINGLE ZONE)

.1 **HVAC Unit Controls Minimum Hard-Wired Points**
Outdoor Air Damper Signal (0 Vdc – 10 Vdc or 4mA to 20 mA)
Fan(s) Enable / Disable (10 Vdc to 24Vdc)
Heating Enable (10 Vdc to 24Vdc)
Mechanical Cooling Enable (10 Vdc to 24Vdc)

.2 Room temperature set-points are set to a Network Occupied Set-point, reset at 7 am each occupied period, from 21°C to 24°C based on Outdoor air temperature -10°C to 27°C, respectively. A +/-2°C set-point offset shall be provisioned through the room sensor.

.3 Heating or Cooling is to be enabled when the room temperature is 1°C away from set-point and will be disabled using a 1°C dead-band. There shall be a 30 minutes delay between heating and cooling.

.4 The compressor will have minimum run time of 5 minutes.

.5 In the event of power loss, the outdoor and exhaust air dampers are to close by way of mechanical spring, return air dampers shall open by way of mechanical spring and fans, heating, cooling and mechanical energy recovery system are to shut down.

.6 Where the unit is equipped with a hydronic heating coil, the heating valve will keep the unit internal temperature (mixed air temperature) to a minimum of 15°C. When the outdoor air is below 10°C or there is a heating load, any heating coil pump will run.

.7 Where the unit is equipped with a hydronic heating coil, in the event the freeze stat senses a low temperature event, the unit fans are to be disabled, outdoor air dampers close by way of mechanical spring, and the heating valve is to be opened 100% (heating circulation pump, where equipped is to be enabled).

.8 Scheduled Occupancy

.1 ***Pre-Occupancy:*** The BAS shall enable the supply and return air fans 30 minutes prior to the start of the *Occupied* period. Outdoor air dampers are to remain closed. The unit is controlled to maintain the space temperature to the occupied set-point.

.2 ***Occupied:*** The BAS shall enable the unit as per Occupancy Appendix. The dampers are to be kept to a minimum position or to maintain the return air CO^2 to a level of 800 ppm. The unit is controlled to maintain the space temperature. The exhaust fan and dampers are enabled with the supply and return air fans.

.3 ***Un-Occupied:*** The BAS shall disable the unit as per Occupancy Appendix. All fans are to be disabled and the outdoor and exhaust air dampers are to be closed by way of mechanical spring return. The return air dampers are to be released and open by way of mechanical spring return. The space temperature shall be controlled to maintain between 16°C and 25°C.

.4 ***Perimeter Heat (Auxiliary Heat)***

When a room conditioned by a HVAC unit is provisioned with auxiliary heating, the auxiliary heat shall be enabled when the heat pump has been heating for 30 minutes. For hydronic heating only, the heat is to be enabled when the radiant device is equal to or less than 6°C (must enable respective circulation pump).

.9 Scheduled Occupancy

.1 ***Occupied:*** Occupancy is to be scheduled as per Occupancy Appendix.

.2 ***Un-Occupied:*** Cooling and heating set-points shall be 18°C and 27°C and will be disabled by a 2°C dead-band.

3.12 ROOM CONTROL OCCUPANT COMFORT HEAT - INCLUDES DUCT HEATERS

.1 Occupant comfort heat includes but is not limited to the following instances:

.1 Perimeter heaters, unit heaters, duct heaters, radiant panels, etc., in all classrooms, administrative areas, work rooms and resource areas.

.2 Room temperature set-points are set to a Network Occupied Set-point, reset at 7 am each occupied period, from 21°C to 24°C based on Outdoor air temperature - 10°C to 27°C, respectively. A +/-2°C set-point offset shall be provisioned through the room sensor.

.3 Heating is to be enabled when the room temperature is 1°C away from set-point and will be disabled using a 1°C dead-band.

.4 The BAS shall control room temperature and indicate status with an analog current Transformer or temperature sensor in accordance with Object Table.

3.13 DOMESTIC HOT WATER

.1 The BAS shall monitor the Domestic Supply Water Temperature and domestic hot water circulating pump(s) using an analog current transformer

3.14 BYPASS BOX CONTROL

.1 DDC Control shall modulate damper to maintain space temperature set point as follows:

.2 Occupied Mode: Damper shall modulate to maintain a space temperature. Damper shall modulate in conjunction with local radiant heat where applicable.

.3 Unoccupied Mode: Bypass box shall provide airflow to the space and send a heat/cool call to the packaged HVAC unit as required. Unit shall enter occupied mode until the room setpoint is satisfied.

.4 Upon signal from the associated HVAC unit's leak detection system:

.1 Disable any electric reheat or other sources of ignition in the ductwork system.

.2 Fully open zone dampers within the ductwork system/close bypasses.

.3 Energize all fans within the duct system/general exhaust fans in area affected.

3.15 ANCILLARY HEAT

.1 Ancillary Heat shall use a stainless-steel plate sensor include the following areas:

.1 Vestibules

.2 Above ceiling freeze protection

.3 Outdoor storage areas

.4 Receiving areas

.5 Electrical rooms

.6 Supply storage rooms

.7 Stairwells

.2 "Spare" I/O points from a typical room controller are not to be used for Ancillary Heat (i.e. points from Room Controller located within proximity to the Ancillary Heater). I/O point terminations and control points are to be detailed on the drawings.

.3 Stairwells: Ancillary heaters servicing a stairwell and vestibule are to be grouped and controlled using a sensor located within the stairwell (not the vestibule area). Status is required for individual heaters.

.4 Grouping multiple Ancillary Heaters to a single I/O control point is preferred. Status is required for individual heaters.

.5 The BAS shall indicate status using a temperature sensor located on the unit return water piping (Hydronic heater) or using an analog current transformer (Electric heater).

.6 The room temperature set-point shall use unoccupied set-point as for comfort heaters.

.7 For Hydronic heaters the heat is to be enabled and/or commanded on to maintain heater temperature at a minimum of 6°C. Will enable circulation pump where applicable.

3.16 EXHAUST FANS

.1 The BAS shall control exhaust fans and monitor status with an analog current transformer.

.2 Fans are to be enabled in accordance with local, provincial, and federal code requirements.

.3 **Group A** fans include but is not limited to the following instances:

.1 Gym washrooms / change rooms

.2 Laundry room

Fans are to be enabled with the gymnasium HVAC unit occupancy schedule.

.4 **Group B** fans include but is not limited to the following instances:

.1 Exterior storage areas

.2 Machine room (elevator)

.3 Electrical & Sprinkler rooms

.4 Hub room

.5 Mechanical room

Fans are to be enabled to maintain room temperature below 27°C.

.5 **Group C** fans include but is not limited to the following instances:

.1 Staff and Classroom washrooms

.2 Interior storage areas

Fans are to be enabled during hours of school occupancy and when the school is occupied by custodial or cleaning staff.

.6 **Group D** fans include but is not limited to the following instances:

.1 Food preparation (excluding staffroom kitchenettes)

.2 Kiln rooms

.3 Dust collectors

Fans are to be removed from the BAS and controlled via a switch near their relative equipment.

3.17 EXTERIOR LIGHTING

.1 The BAS shall enable or disable exterior lighting using a combination calendar and astronomical clock. Command status shall be verified using an analog Current Transformer.

.2 The lighting is to be grouped as Wall-packs and Pole Lighting.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 Canadian General Standards Board (CGSB)

.1 ASTM C553, Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.2 ASTM C612, Mineral Fiber Block and Board Thermal Insulation.

.3 CGSB 51-GP-52Ma, Vapour Barrier Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.3 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.

.4 American Society for Testing and Materials (ASTM)

.1 ASTM C1729 Standard Specification for Aluminium Jacketing for Insulation.

.2 ASTM C1393 Standard Specification for Perpendicularly Oriented Mineral Fibre Roll and Sheet Thermal Insulation for Pipes and Tanks.

.3 ASTM C534 Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

.4 ASTM C533 Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.

.5 ASTM C177 Standard Test Method for Safety-State Heat Flux Measurements and Thermal Transmission Proprieties by Means of the Guarded-Hot-Plate Apparatus.

.6 ASTM C518 Standard Test Method for Steady-State Thermal Transmission Proprieties by Means of the Heat Flow Meter Apparatus.

.7 ASTM C411, Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.8 ASTM C449, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.9 ASTM C795, Specification for Thermal Insulation for Use with Austenitic Stainless Steel.

.10 ASTM C921, Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.5 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.1 ASHRAE Standard 90.1.

.6 Manufacturer's Trade Associations

.1 Thermal Insulation Association of Canada (TIAC)

.2 North American Commercial and Industrial Insulation Standards.

1.2 PRODUCT DATA

.1 Submit Product Data in accordance general requirements.

1.3 SAMPLES SUBMITTALS

.1 Submit samples in accordance with general requirements.

.2 Submit for approval: completed detail plate assemblies of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 15 mm (1/2") plywood board. Affix typewritten label beneath sample indicating service.

1.4 INSTALLATION INSTRUCTIONS

.1 Submit properly completed detail plates from the North American Commercial and Industrial Insulation Standards manual, applicable to installation types required by this specification section.

.2 Submit manufacturer's installation instructions in accordance with general requirements.

.3 Installation instructions to include procedures to be used, installation standards to be achieved.

1.5 QUALIFICATIONS

.1 Installer to have successfully completed apprenticeship program.

.2 Installer to be specialist in performing work of this section and have at least three (3) years successful experience in this size and type of project, qualified to standards of TIAC.

1.6 DELIVERY, STORAGE ANDHANDLING

.1 Deliver materials to site in original factory packaging, labeled with manufacturer's name, address.

.2 Protect from weather and construction traffic.

.3 Protect against damage from any source.

.4 Store at temperatures and conditions required by manufacturer.

1.7 DEFINITIONS

.1 For purposes of this section:

.1 “CONCEALED” – insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.

.2 “EXPOSED” – will mean “not concealed” as defined herein.

.3 “Insulation Systems” – insulation material, fasteners, jackets, and other accessories.

.4 “ASJ+” All Service Jacket – vapor retarded laminate of aluminium foil inner layer reinforced with fibreglass scrim, bonded to a bleached kraft paper with outer poly film layer leaving no paper exposed.

.5 "ASJ" All Service Jacket – (no outer film) vapor retarder laminate of aluminum foil inner layer reinforced with fibreglass scrim, bonded to a bleached kraft paper outer layer.

.6 "FSK" Foil Scrim Kraft – vapor retarder laminate of aluminium foil outer layer, reinforced with fibreglass scrim, bonded to a natural kraft paper inner layer.

.7 "PSK" Poly Scrim Kraft – vapor retarder laminate of polypropylene outer layer, reinforced with fibreglass scrim, bonded to a natural kraft paper inner layer.

.8 "PVC" Poly Vinyl Chloride – polymer to manufacture non-metallic final protective finish jacket over insulation systems.

Part 2 Products

2.1 LIMITATION ON MATERIALS

.1 Product shall not contain formaldehyde, asbestos, lead, mercury, or mercury compounds, or PBDE fire retardants.

2.2 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.3 INSULATION

.1 Mineral fibre as specified herein includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C (75°F) mean temperature when tested in accordance with ASTM C177 or ASTM C518.

.3 Type C-1: Rigid mineral fibre board, unfaced.

.1 Mineral fibre: to ASTM C612

.2 Maximum "k" value: 0.033W/M•°C (23 BTU•IN/HR•FT^2•°F)

.4 Type A-1: Fibre glass pipe and tank insulation

.1 Segmented, flexible fiberglass board bonded to laminated vapor retarder, ASJ or FSK.

.2 Complying with ASTM C1393, Type II or Type III Category 2.

.3 Maximum "k" value: 0.037W/M (or less) x C^o@100°F (38°C) is 0.26BTU x IN/H FT^2 x °F

.4 Jacket: specified in 'Factory-Applied Jackets' Article

.5 TypeA-6: Flexible unicellular tubular elastomer.

.1 Insulation: to ASTM C553 with vapour retarder jacket.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: to ASTM C553.

.4 To be certified by manufacturer to be free of potential stress corrosion cracking corrodents.

2.4 CEMENT

.1 Hydraulic setting cement

.1 To ASTM C449

.2 Air setting cement

.1 To ASTM C195

.3 Hydraulic setting cement shall be used for all finishing work and areas where equipment is not concealed.

2.5 JACKETS

.1 Canvas:

.1 220 g/m² (6 oz/sq yd) cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.

.2 Lagging adhesive: Compatible with insulation.

2.6 INSULATION SECUREMENTS

.1 Tape: Self-adhesive, aluminum, [reinforced], 50 mm (2") wide minimum.

.2 Contact adhesive: Quick setting.

.3 Canvas adhesive: Washable.

.4 Tie wire: 1.5 mm (16 gauge) diameter stainless steel.

.5 Bands: Stainless steel, 20 mm (3/4") wide, 0.5 mm (26 gauge) thick.

.6 Facing: 25 mm (1") galvanized steel hexagonal wire mesh on one face of insulation.

.7 Fasteners: 4 mm (5/32") diameter pins with 40 mm (1½") clips. Length of pin to suit thickness of insulation. Pins to be CD weld, self-adhesive or glue applied – to be selected and confirmed with consultant in accordance with required service conditions.

2.7 VAPOUR RETARDER LAP ADHESIVE

.1 Water based, fire retardant type, compatible with insulation.

2.8 INDOOR VAPOUR RETARDER FINISH

.1 Compatible with insulation.

2.9 OUTDOOR VAPOUR RETARDER MASTIC

.1 Compatible with insulation.

.2 Reinforcing fabric: Open weave fibreglass fabric with a maximum weave of 10 x 10 squares per inch.

Part 3 Execution

3.1 PRE-INSTALLATION REQUIREMENTS

.1 Pressure testing of equipment and adjacent piping systems to be complete, witnessed, and certified.

.2 Surfaces to be clean, dry, free from foreign material.

3.2 INSTALLATION

.1 Install in accordance with TIAC and North American Commercial and Industrial Insulation Standards.

.1 Hot equipment: To TIAC code 1503-H.

.2 Cold equipment: to TIAC code 1503-C.

.2 Provide a completely insulated system allowing for insulation over all valves, fittings, air separators, pumps, buffer tanks, and other connected equipment to the system.

.3 Elastomeric Insulation: to remain dry at all times. Overlaps to be to manufacturer instructions. Joints to be tight and sealed properly.

.4 Provide vapour retarder as recommended by manufacturer.

.5 Apply materials in accordance with insulation and equipment manufacturers instructions and this specification.

.6 Below ambient/chilled water installation:

.1 All pipes, fittings, valves, strainers, flanges, unions, and other pipe system components and specialties must be properly insulated with correctly completed vapor retarded applied.

.2 All insulation material must have properly installed and sealed vapor retarding jacket, including circumferential and longitudinal seams.

.3 All penetrations, tears, and punctures must be repaired and sealed with a vapor retarding material with a .02 or lower perm rating.

.4 Vapor stops must be installed at 18' intervals, at all pipe insulation termination points, including fittings, flanges, and other changes in direction or other types of piping specialities.

.5 All fitting insulation must be of the same type, thickness, and density of the pipe insulation, be premoulded insulation covers or fabricated from the same material as the pipe insulation. Full thickness must be factory-applied, vapor-retarder facing is unacceptable.

.6 A complete vapor retarder must be installed on insulation over fittings before applying final finish. Vapor retarder must extend onto and be sealed to the vapor retarder or pipe insulation.

.7 Additional fitting covers, PVC or metal, must have a vapor retarder seal applied to all longitudinal and circumferential seams in addition to the vapor retarder applied to the fitting insulation.

.8 Additional field applied jackets must not use staples, screws, tacks or rivets for attachment, to avoid puncturing vapor retarder underneath.

.9 Insulating support inserts are to be high compressive strength insulation with a rigid shield. No calcium silicate is to be used for insulation on below-ambient operation piping.

.7 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm (3").

.8 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Hangers, supports to be outside vapour retarder jacket.

.9 Supports, Hangers:

.1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.3 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

.1 Flexible removable blanket insulation covers are not acceptable for below ambient (cold) operating piping systems. Rigid removable insulation jackets of the vapor retarder exterior material that can be vapor sealed at the seams, are acceptable on below ambient (cold) operation piping systems.

.2 Application: At expansion joints, valves, primary flow measuring elements flanges and unions at equipment.

.3 Installation to permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation. Fabricate flexible, removable insulation in accordance with ASTM C 1695, Standard Specification for fabrication of flexible removable and reusable blanket insulation for hot service.

3.4 EQUIPMENT INSULATION SCHEDULES

.1 Includes valves, valve bonnets, strainers, flanges, air separators, and fittings unless otherwise specified.

.2 Hot Equipment:

.1 Type and Thickness:

ITEM	THICKNESS	TYPE
Heat exchangers	50 mm (2")	A1
Low Loss Headers	50 mm (2”)	A1
Buffer Tank	50 mm (2”)	A1
Hot Water Pumps (C-4/C-5)	**25 mm (1”)**	**A1**
Hot Water Pumps (BP-1/BP-2)	**25 mm (1”)**	**A1**
Air Separator (C-4/5 loop only)	25mm (1”)	A1

.3 Finishes:

.1 Equipment in mechanical rooms: TIAC code CEF/1 with canvas jacket.

.2 Equipment elsewhere: TIAC code CEF/2 with canvas jackets.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ANSI/ASME B16.5, Pipe Flanges and Flanged Fittings: NPS ½ through NPS 24 Metric/Inch.

.3 ANSI B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.

.4 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

.5 ANSI B18.2.1, Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series).

.6 ASTM A47/A47M, Specification for Ferritic Malleable Iron Castings.

.7 ASTM A53/A53M, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.

.8 ASTM B32, Specification for Solder Metal.

.9 ASTM B75M, Specification for Seamless Copper Tube [Metric].

.10 CSA B149.1, Natural Gas and Propane Installation Code.

.11 CSA W47.1, Certification of Companies for Fusion Welding of Steel.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings product data in accordance with general requirements.

.2 Indicate on manufacturers catalogue literature.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in general requirements.

Part 2 Products

2.1 GAS SERVICE

.1 Arrange with the local utility to have the gas service provided from the street to the gas meter where indicated.

.2 Fees and charges requested by the local utility to provide the gas service and meter.

.3 Submit all plans as requested by the local utility.

.4 Utility supplied gas meter shall be complete with pulse signal for connection to BAS system (co-ordinate pulse representation in m^3 of gas used on meter specifications.

.5 Provide approved pulse gas meter in all locations where indicated on the drawings.

2.2 PIPE

.1 Steel pipe: to ASTM A53/A53M, Schedule 40, seamless as follows:

.1 NPS 15 mm to 50 mm (1/2" to 2"), screwed.

.2 NPS 65 mm (2 1/2") and over, plain end.

.2 Buried pipe: CGA approved polypropylene complete with tracer wire and marker.

.3 Copper tube: to ASTM B75M.

2.3 JOINTING MATERIAL

.1 Screwed fittings: pulverized lead paste.

.2 Welded fittings: to CSA W47.1.

.3 Flange gaskets: non-metallic flat.

.4 Soldered: to ASTM B32, tin antimony 95/5.

.5 Screwed brass fittings: Teflon Tape.

2.4 FITTINGS

.1 Steel pipe fittings, screwed, flanged or welded:

.1 Malleable iron: screwed, banded, Class 150.

.2 Steel pipe flanges and flanged fittings: to ANSI/ASME B16.5.

.3 Welding: butt-welding fittings.

.4 Unions: malleable iron, brass to iron, ground seat, to ASTM A47/A47M.

.5 Bolts and nuts: to ANSI B18.2.1.

.6 Nipples: schedule 40, to ASTM A53/A53M.

.2 Copper pipe fittings, screwed, flanged or soldered:

.1 Cast copper fittings: to ANSI B16.18.

.3 Brass fittings: To ASTM B16.

2.5 BALL VALVES

.1 NPS 50 mm (2") and under:

.1 Body and cap: cast high tensile bronze to ASTM B62.

.2 Pressure rating: Class 125, 860 kPa (125 psi) steam, WP = 1.4 MPa (203 psi) WOG.

.3 Connections: Screwed ends to ANSI B1.20.1 and with hex. shoulders.

.4 Stem: 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.

2.6 LUBRICATED PLUG VALVES

.1 All sizes

.1 Provincial Code approved, lubricated plug type.

.2 Body: cast iron to ASTM A 126 Class B semi-steel.

.1 Rating: Class 125 psig.

.3 Plug: tapered, with regular pattern port – 90 from full open to fully closed.

.4 Ends: 50 mm (2") and smaller with hexagon shoulders, ends screwed to ANSI B1.20.1. Flanged to ANSI B16.1.

.5 Lubrication system, nickel-plated.

.6 Lubricant: to suit type, temperature and pressure of contained fluid.

.7 Feeding system: lubricant forced into lubrication grooves between seating surfaces of plug and body to form positive seal, leakproof operation, and corrosion preventing film.

.8 Lubricant screw for lubrication.

.9 O-rings between body and plug.

.10 Operator: removable manual lever handle.

.11 Acceptable materials:

.1 Newman Hattersley

.2 Crane

.3 Jenkins

.4 Milwaukee

.5 Toya

2.7 CONTRACTOR PROVIDED GAS METERS

.1 This contractor shall provide a gas meter complete with digital pulse for connection to the BAS system for where indicated on the drawings.

.2 The gas meter shall be compatible with the requirement of the local utility and BAS contractor.

.3 Acceptable materials: Badger Meter Inc. (Line Process Controls 1-416-291-8525).

2.8 GAS REGULATOR

.1 Reduce pressure from 34.5 kPa (5 psi) to 1.74 kPa (7" WC) capacity as indicated.

.2 Acceptable products:

.1 Singer

.2 Schlumberger

.3 Vent interior relief valve to outdoors with gooseneck and stainless-steel insect screen. Vent piping shall be sized as per manufacturers' requirements and recommendations.

.4 Isolate with lubricated plug valve and union connection.

2.9 MANUFACTURED ROOF SUPPORTS

.1 Single piece injection moulded polypropylene support.

.2 Type 3-20 psi extruded polystyrene UV protected base glued to the support.

.3 Minimum base dimension of 300 x 225 (12" x 9") and be 140 mm (5.5") high.

.4 Pull test of 1.4 KN (315 lbs) using two #14-10 screws on pipe strap.

.5 Acceptable materials:

.1 Quick Block

.2 Erico

2.10 PIPING THROUGH ROOF

.1 Provide Thaler MEF-9 or equal gas piping flashing where pipe and/or relief vent penetrates roof.

Part 3 Execution

3.1 PIPING

.1 Install in accordance with applicable Provincial/Territorial Codes.

.2 Install in accordance with CAN/CSA B149.

.3 Assemble piping using fittings manufactured to ANSI standards.

.4 Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.

.5 Slope piping down in direction of flow to low points.

.6 Install drip points:

.1 At low points in piping system.

.2 At each connection to equipment.

.7 Use eccentric reducers at pipe size change installed to provide positive drainage.

.8 Provide clearance for access and for maintenance.

.9 Ream pipes, clean scale and dirt, inside and out.

.10 Install piping to minimize pipe dismantling for equipment removal.

.11 Install regulator vents to code. Terminate in open air with Gooseneck fitting complete with stainless steel screen.

.12 Paint gas piping with two (2) coats yellow paint. Banding of gas will not be accepted.

3.2 PIPING ON ROOF

.1 Support piping as follows or as per seismic requirements (1.8 M (6' - 0") O.C.) whichever is more stringent:
≤ 40 mm (1½") 2.4 M (8' – 0") O.C.
≥ 50 mm (2") 3.0 M (10' - 0") O.C.

.2 Provide support at each elbow and fitting.

.3 Provide support at each regular and/or isolating valve.

.4 Provide support within 600 mm (24") of each piece of equipment.

3.3 VALVES

.1 Install valves with stems upright or horizontal unless otherwise approved by Consultant.

.2 Install valves at branch take-offs to isolate each piece of equipment, and as indicated.

.3 Provide lubricated plug type when gas line is exterior of building or 65 mm (2½") and larger.

.4 Provide ball valve when gas line is interior of building and 50 mm (2") or smaller.

3.4 SUPERVISORY SWITCH

.1 Install on valves as indicated to monitor open/closed position of valve and send signal to fire alarm system. Install to manufacturer's recommendations.

3.5 FIELD QUALITY CONTROL

.1 Test system in accordance with CAN/CSA B149. Requirements of authorities having jurisdiction.

.2 Provide copy of TSSA tag to the consultant.

3.6 PURGING

.1 Purge after pressure test in accordance with CAN/CSA B149.

3.7 GAS SERVICE

.1 Arrange with local gas distributor to install gas service and gas meter. Pay all fees and charges to provide the gas service and gas meter.

.2 Install all the gas meters where indicated.

3.8 GAS FIRED EQUIPMENT START-UP

.1 Start-up of all new and existing gas fired equipment shall be by this contractor to the requirements of the equipment manufacturer.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 Canadian Standards Association (CSA).

.1 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code.

.3 American Society for Testing and Materials (ASTM).

.1 ASTM A47/A47M, Specification for Ferritic Malleable Iron Castings.

.2 ASTM A278/A278M, Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures up to 650°F (350°C).

.3 ASTM A516/A516M, Specification for Pressure Vessel Plates, Carbon Steel, for Moderate - and Lower - Temperature Service.

.4 ASTM A536, Specification for Ductile Iron Castings.

.5 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.

.4 American Society of Mechanical Engineers (ASME).

.1 ANSI/ASME, Boiler and Pressure Vessels Code (BPVC).

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with general requirements.

.2 Indicate on product data expansion tanks, air vents, separators, valves, strainers.

1.3 CLOSEOUT SUBMITTALS

.1 Submit maintenance data in accordance with general requirements.

Part 2 Products

2.1 BLADDER TYPE EXPANSION TANK

.1 Vertical galvanized steel pressurized bladder type expansion tank.

.2 Model: 600 L

.3 Size: 1626 (64") x 750 (30") diameter.

.4 Working pressure: 860 kPa (125 psi) with ASME stamp and certification.

.5 Air precharged to 84 kPa (12 psi) (initial fill pressure of system).

.6 Base mount for vertical installation.

.7 Suitable for glycol services when specified.

.8 Acceptable materials:

.1 Amtrol

.2 Armstrong

.3 Bell & Gossett

2.2 AIR SEPARATOR EXPANSION TANK FITTING

.1 Complete with adjustable vent tube and built-in manual vent valve.

.2 Working pressure: 860 kPa (125 psi).

2.3 AIR SEPARATOR IN-LINE

.1 Size: line size as indicated.

2.4 COMBINATION LOW PRESSURE RELIEF AND REDUCING VALVE

.1 Adjustable pressure setting: 206 kPa (30 psi) relief, 55 to 172 kPa (8.0 to 25 psi) reducing.

.2 Low inlet pressure check valve.

.3 Removable strainer.

2.5 PIPELINE STRAINER

.1 NPS 15 mm to 50 mm (1/2" to 2"): bronze body to ASTM B62, screwed connections.

.2 NPS 65 mm to 300 mm (2 1/2" to 12"): cast steel body to ASTM A278M, Class 30, flanged connections.

.3 NPS 50 mm to 300 mm (2" to 12"): T type with malleable iron body to ASTM A47M, grooved ends.

.4 Blowdown connection: NPS 25 mm (1").

.5 Screen: stainless steel with 1.19 mm (50 mil) perforations.

.6 Working pressure: 860 kPa (125 psi).

2.6 SUCTION DIFFUSER

.1 Body: cast iron with flanged connections.

.2 Strainer: with built-in, disposable 1.19 mm (50 mil) mesh, low pressure drop screen and NPS 25 mm (1") blowdown connection.

.3 Permanent magnet particle trap.

.4 Full length straightening vanes.

.5 Pressure gauge tappings.

.6 Adjustable support leg.

.7 Acceptable manufacturer: To be same as manufacturer of base mounted pumps.

Part 3 Execution

3.1 GENERAL

.1 Install as indicated and to manufacturer's recommendations.

.2 Run drain lines (and blow off connections) to terminate above nearest drain.

.3 Maintain proper clearance to permit service and maintenance.

.4 Should deviations beyond allowable clearances arise, request and follow Consultant's directive.

.5 Check shop drawings for conformance of all tappings for ancillaries and for equipment operating weights.

3.2 STRAINERS

.1 Install in horizontal or down flow lines.

.2 Ensure clearance for removal of basket.

.3 Install ahead of each pump.

.4 Install ahead of each automatic control valve and as indicated.

.5 Strainer size to match pipe size.

3.3 EXPANSION TANKS

.1 Adjust expansion tank pressure to suit design criteria.

.2 Install isolation ball valve and union at inlet to tank.

3.4 PRESSURE SAFETY RELIEF VALVES

.1 Run discharge pipe to terminate above nearest drain.

3.5 SUCTION DIFFUSERS

.1 Install on inlet to pumps.

3.6 AIR SEPARATOR

.1 Provide independent support from structure.

.2 Provide high capacity air vent as indicated.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 HVAC Water Treatment Section.

1.2 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 Canadian Standards Association (CSA).

.1 CSA W47.1, Certification of Companies for Fusion Welding of Steel.

.3 American National Standards Institute (ANSI).

.1 ANSI/ASME B16.1, Gray Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800.

.2 ANSI/ASME B16.3, Malleable-Iron Threaded Fittings, Classes 150 and 300.

.4 American Society for Testing and Materials (ASTM).

.1 ASTM A47/A47M, Specification for Ferritic Malleable Iron Castings.

.2 ASTM A53/A53M, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.

.3 ASTM A536, Specification for Ductile Iron Castings.

.4 ASTM B61, Specification for Steam or Valve Bronze Castings.

.5 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.

.6 ASTM E202, Test Method for Analysis of Ethylene Glycols and Propylene Glycols.

.5 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).

.1 MSS-SP-67, Butterfly Valves.

.2 MSS-SP-70, Cast Iron Gate Valves, Flanged and Threaded Ends.

.3 MSS-SP-71, Cast Iron Swing Check Valves, Flanged and Threaded Ends.

.4 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.

.5 MSS-SP-85, Cast Iron Globe, and Angle Valves, Flanged and Threaded Ends.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with general requirements.

.2 Indicate on manufacturers catalogue literature the following:

.1 Piping

.2 Valves

.3 Accessories

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in general requirements.

Part 2 Products

2.1 PIPE

.1 Steel pipe: to ASTM A53/A53M, Grade B, as follows:

.1 NPS 150 mm (6") and smaller: Schedule 40.

.2 Final connection to copper heating elements.

.1 Type “L” copper with 95/5 solder joints and dielectric couplings. Maximum length 600 mm (24").

2.2 PIPE JOINTS

.1 NPS 50 mm (2") and under: screwed fittings with pulverized lead paste.

.2 NPS 65 mm (2½") and over: welding fittings and flanges to CSA W47.1.

.3 Flanges: plain or raised face, slip-on.

.4 Flange gaskets: suitable for hydronic heating up to 110°C (220°F).

.5 Pipe thread: taper.

.6 Bolts and nuts: to ANSI B18.2.1 and ANSI/ASME B18.2.2.

2.3 FITTINGS

.1 Screwed fittings: malleable iron, to ANSI/ASME B16.3, Class 150.

.2 Pipe flanges and flanged fittings:

.1 Cast iron: to ANSI/ASME B16.1, Class 125.

.2 Steel: to ANSI/ASME B16.5.

.3 Butt-welding fittings: steel, to ANSI/ASME B16.9.

.4 Unions: malleable iron, to ASTM A47/A47M and ANSI/ASME B16.3.

2.4 VALVES MANUFACTURERS

.1 All valves shall be of commercial grade and of same manufacturer.

.2 Acceptable Manufacturers:

.1 Newman Hattersley Canada Ltd.

.2 Jenkins/Crane

.3 Milwaukee

.4 Toyo

.5 Kitz

2.5 VALVES

.1 Connections:

.1 NPS 50 mm (2") and smaller: screwed ends.

.2 NPS 65 mm (2 ½") and larger: flanged ends.

.2 Gate valves: Application: Isolating equipment, control valves, pipelines:

.1 NPS 50 mm (2") and under:

.1 Mechanical Rooms: Class 125, rising stem, solid wedge disc. Jenkins 810J.

.2 Elsewhere: Class 125, non-rising stem, solid wedge disc. Jenkins 310J.

.2 NPS 65 mm (2 1/2") and over:

.1 Mechanical Rooms:

.1 Rising stem, solid wedge disc, bronze trim. Jenkins 454J.

.1 Operators: handwheel.

.2 Non-rising stem, solid wedge disc, bronze trim. Jenkins 452J.

.1 Operators: handwheel.

.3 Butterfly valves: Application: Isolating each cell or section of multiple component equipment and where indicated.

.1 NPS 65 mm (2 1/2") and over: Flanged ends. Jenkins FIG 2232 ELJ.

.4 Globe valves: Application: Throttling, flow control, emergency bypass:

.1 NPS 50 mm (2") and under:

.1 With PFTE disc, as specified. Jenkins 106BJ. Bronze.

.2 NPS 65 mm (2 1/2") and over:

.1 With solid bronze disc, bronze trim, cast iron body. Jenkins 2342.

.5 Drain valves: Gate, Class 125, non-rising stem, solid wedge disc, with chain and cap.

.6 Swing check valves:

.1 NPS 50 mm (2") and under:

.1 Class 150, swing, with PFTE disc, as specified. Bronze. Jenkins 4475TJ.

.2 NPS 65 mm (2 1/2") and over:

.1 Flanged or Grooved ends, Bronze trim, Cast Iron: Gate, Globe, Check. Jenkins 587J.

.7 Ball valves:

.1 NPS 80 mm (3") and under:

.1 Body and cap: cast high tensile bronze to ASTM B62.

.2 Pressure rating: Class 125, 860 kPa (125 psi) steam, WP = 1.4 MPa (203 psi) WOG.

.3 Connections:

.1 NPS 50 mm (2") and under screwed ends to ANSI B1.20.1 and with hex. shoulders.

.2 NPS 65 mm (2½") and over flanged ends.

.4 Stem: stainless steel tamperproof ball drive.

.5 Ball and seat: replaceable stainless steel solid ball and teflon seats.

.6 Operator: removable lever handle.

.7 Extended handles on chilled water valves.

.8 Full port.

.9 Jenkins 201SJ.

2.6 BALANCING VALVES

.1 Size 15 mm (1/2") to 50mm (2"): Bronze body, brass ball, NPT connections and variable orifice.

.2 Size 65 mm (2 1/2") to larger: Cast iron body, raised flange connections, glove style with brass plug.

.3 Differential pressure readout ports with internal EPT inserts and check values, 6 mm (¼")NPT tapped drain/purge ports, memory stop and calibrated nameplate.

.4 Acceptable materials:

.1 Bell & Gossett Circuit Setters

.2 Armstrong

.3 Taco

.4 Tour & Anderson

.5 Oventrop

2.7 AUTOMATIC AIR VENT

.1 Industrial float vent: cast iron body and NPS 15 mm (1/2") connection and rated at 860 kpa (125 psi) working pressure.

.2 Float: solid material suitable for 115°C (240°F) working temperature.

.3 Plastic vents are not acceptable.

.4 Acceptable materials:

.1 Maid-O-Mist No. 67

.2 Spirax Sarco

2.8 PRE-ASSEMBLED COIL KITS

.1 Ball valve/strainer/drain assembly: cast brass blowout proof stem, Teflon packing, plated ball, strainer-blowdown. Strainer has 20 mesh stainless steel screen, removable. Assembly has temp/pressure port and extra port/plugged) on top. Rated up to 400 psi (2760 kPa) and 110°C (230°F).

.2 Coil hoses: Stainless steel braided exterior, synthetic polymer core hose and stainless ferrules. Rated to 110°C (230°F).

.3 Union/Port fitting: Cast brass with EPDM O-ring, complete with side temp/pressure port, manual air vent on top and union fitting. Rated for 400 psi (2760 kPa) and 110°C (230°F).

.4 ATC: temperature control valve supplied by BAS contractor and turned over to manufacturer for assembly into coil kit. 2-way or 3-way as indicated.

.5 Balancing valve: A metal copper alloy body bonnet, stem and restriction cone. EPDM O-ring union seal and seat seal, with plastic handwheel.

Two pressure measuring ports for accurate setting. Handwheel range from 4 turns to 22 turns with locking tamperproof setting. Rated from -20°C to 180°C (-4 to 250°F).

.6 Bypass (for TCV & coil bypass): Provide additional, 3rd hose and ball valve/union assembly.

.7 Components to be factory assembled and tested.

.8 Strainer/ball valve/drain on coil inlet.

Union/Port fitting, ATC, balancing valve on coil outlet.

.9 Acceptable manufacturer:

.1 Victaulic Koil Kit

.2 Nexus

Part 3 Execution

3.1 PIPING INSTALLATION

.1 Installation shall be by a licensed pipe fitter.

.2 Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.

.3 Install concealed pipes close to building structure to keep furring space to minimum. Install to conserve headroom and space. Run exposed piping parallel to walls. Group piping wherever practical.

.4 Slope piping in direction of drainage and for positive venting.

.5 Use eccentric reducers at pipe size change installed to provide positive drainage or positive venting.

.6 Provide clearance for installation of insulation and access for maintenance of equipment, valves and fittings.

.7 Ream pipes, clean scale and dirt, inside and outside, before and after assembly.

.8 Assemble piping using fittings manufactured to ANSI standards.

.9 Saddle type branch fittings may be used on mains if branch line is no larger than half the size of main. Hole saw or drill and ream main to maintain full inside diameter of branch line prior to welding saddle.

3.2 VALVE INSTALLATION

.1 Install rising stem valves in upright position with stem above horizontal.

.2 Install butterfly valves on chilled water and condenser water lines only.

.3 Install gate or ball valves at branch take-offs and to isolate each piece of equipment, and as indicated.

.4 Install globe valves for balancing and in by-pass around control valves as indicated.

.5 Provide silent check valves on discharge of pumps and in vertical pipes with downward flow and as indicated.

.6 Provide swing check valves in horizontal lines as indicated.

.7 Install chain operators on valves NPS 65 mm (2 1/2") and over where installed more than 2400 mm (96") above floor in Boiler Rooms and Mechanical Equipment Rooms.

.8 Provide ball valves for glycol service.

3.3 AIR VENTS

.1 Install at high points of systems.

.2 Install ball valve on automatic air vent inlet.

.3 Extend vent lines in Mechanical Room with screwdriver stop at 1.8 m AFF.

3.4 CIRCUIT BALANCING VALVES

.1 Install flow measuring stations and flow balancing valves as indicated and as follows:

.1 On return side of all heating devices (convectors, panels, force flows, radiation, coils, etc.).

.2 On return side of all water or glycol cooling coils.

.3 On return side of all reverse return piping loops and/or branch circuits.

.2 Install to manufacturers requirements.

.3 Valve size shall be one trade size smaller than piping.

.4 Refer to Testing Adjusting and Balancing Section for applicable procedures.

3.5 FILLING OF SYSTEM

.1 Refill system with clean water adding water treatment as specified.

.2 Co-ordinate filling of system with HVAC water treatment contractor.

.3 Drain and vent all new and existing piping, radiation, etc. for a complete operable system.

.4 Refill glycol heating system with 40% propylene glycol solution as specified.

3.6 TESTING

.1 Test system in accordance with Mechanical General Requirements Section.

.2 For glycol systems, retest with propylene glycol to ASTM E202, inhibited, for use in building system after cleaning. Repair any leaking joints, fittings or valves.

3.7 GLYCOL CHARGING

.1 Provide mixing tank and positive displacement pump for glycol charging.

.2 Retest for concentration to ASTM E202 after cleaning.

.3 Provide report to Consultant.

.4 Maintain glycol level in storage tank until system is fully charged and has equalized throughout the entire system. Monitor system on bi-weekly basis until system is completely filled. Provide glycol solution as required.

3.8 FLUSHING AND CLEANING

.1 Procedure:

.1 Flushing and cleaning should only take place after successful piping pressure testing.

.2 Terminal device (reheat coils, heat pumps, perimeter radiation, etc.), air handling unit coils and their associated control and balancing valves should be bypassed during the preliminary flushing and cleaning process.

.3 Instruments such as flow meters, flow metering valves and orifice plates should only be installed after flushing and cleaning.

.2 Timing:

.1 The overall construction schedule identifies piping flushing and cleaning with realistic time allotments.

.2 The mechanical contractor is required to provide a detailed report outlining the processes and procedures for flushing and cleaning per piping system at least 4 to 6 weeks in advance of work.

.3 As a minimum, at least one piping flushing and cleaning procedure shall be witnessed, by the consultant and/or commissioning agent.

.3 The mechanical contractor shall to utilize a qualified water treatment specialist to supervise the flushing and cleaning process and provide the certified water analysis report certifying that the piping systems are clean.

.4 Coordinate flushing and cleaning of mechanical systems with HVAC water treatment contractor and HVAC systems commissioning contractor.

.5 Flush and clean new piping system in presence of Consultant.

.6 Flush after pressure test for a minimum of 4 hrs.

.7 Fill system with solution of water and non-foaming, phosphate-free detergent 3% solution by weight. Circulate for minimum of 8 hrs.

.8 Thoroughly flush all new mechanical systems and equipment with approved cleaning chemicals designed to remove deposition from construction such as pipe dope, oils, loose mill scale and other extraneous materials. Chemicals to inhibit corrosion of various system materials and be safe to handle and use.

.9 During circulation of cleaning solution, periodically examine and clean filters and screens and monitor changes in pressure drop across equipment.

.10 Refill system with clean water. Circulate for at least 2 hours. Clean out strainer screens/baskets regularly. Then drain.

.11 Drainage to include drain valves, dirt pockets, strainers, every low point in system.

.12 Drain and flush systems until alkalinity of rinse water is equal to make-up water. Refill with clean water treated to prevent scale and corrosion during system operation.

.13 Re-install strainer screens/baskets only after obtaining Consultant's approval and approval from HVAC water treatment contractor.

.14 Repeat system drain and flush as often as necessary to have a clean system.

.15 Disposal of cleaning solutions to be approved by authority having jurisdiction.

.16 Isolate new piping system from existing system as required for system cleaning.

.17 After hydronic system is cleaned, refill with clean water and chemical as per chemical supplier treatment.

.18 After glycol piping system is cleaned, refill with 40% glycol solution.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with General Requirements.

.2 Submit manufacturer's 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.

.3 Submit product data of pump curves for review showing point of operation.

.4 Indicate piping, valves and fittings shipped loose by packaged equipment supplier, showing their final location in field assembly.

1.2 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

Part 2 Products

2.1 IN-LINE CIRCULATORS

.1 Volute: bronze radially split, with screwed or flanged design suction and discharge connections.

.2 Impeller: bronze.

.3 Shaft: alloy steel with copper sleeve bearing, integral thrust collar.

.4 Seal assembly: mechanical for service to 135°C (275°F).

.5 Coupling: flexible self-aligning.

.6 Motor: resilient mounted, drip proof, sleeve bearing, as indicated.

.7 Capacity: as indicated.

.8 Design pressure: 1207 kPa (175 psi).

.9 Acceptable material:

.1 Bell & Gossett Model e90

.2 Armstrong

2.2 VERTICAL IN-LINE CIRCULATORS (CLOSE-COUPLED) (5HP AND UNDER)

.1 Close-coupled, inline for vertical or horizontal installation, in cast iron stainless steel fitted construction specifically designed for quiet operation.

.2 The pump internals shall be capable of being serviced without disturbing piping connections.

.3 Shaft: solid alloy steel that is integral to the motor. A non-ferrous shaft sleeve shall be employed to completely cover the wetted area under the seal.

.4 The motor bearings shall support the shaft via heavy-duty grease lubricated ball bearings.

.5 Pump shall be equipped with an internally flushed mechanical seal assembly installed in an enlarged tapered seal chamber. Seal assembly shall have a stainless steel housing, Buna bellows and seat gasket, stainless steel spring, and be of a carbon ceramic design with the carbon face rotating against a stationary ceramic face.

.6 Pump shaft shall connect to a stainless steel impeller. Impeller shall be hydraulically and dynamically balanced to Hydraulic Institute Standards ANSI/HI 9.6.4.-2016. The allowable residual imbalance conforms to ANSI grade G6.3, keyed to the shaft and secured by a stainless steel locking capscrew or nut.

.7 Pump should be designed to allow for true back pull-out access to the pump's working components for ease of maintenance.

.8 Pump volute shall be of a Class 30 cast iron design for heating systems. Volute shall include gauge ports at nozzles, and vent and drain ports. The volute shall be designed with a base ring matching an ANSI 125# flange that can be used for pump support.

.9 Motors shall meet scheduled horsepower, speed, and voltage. Motors shall have permanently lubricated ball bearings sized to offset the additional bearing loads associated with the closed-coupled pump design. Motors shall be non-overloading at any point on the pump curve and shall meet NEMA specifications.

.1 Motors shall be TEFC, totally enclosed fan cooled.

.10 Pump shall be of a maintainable design and for ease of maintenance should use machine fit parts. Press fit components shall not be permitted.

.11 Design Pressure & Temperature: Suitable standard operations at 225°F and 175 PSIG working pressure when building is under six stories, and 250°F and 250 PSIG when building is over six stories.

Working pressures shall not be de-rated at temperatures up to 250°F.

.12 Capacity: as indicated on schedules.

.13 Accessories:

.1 Suction strainer.

.2 Triple duty valve.

.3 One mechanical seal for each model type of primary pump.

.4 Factory mounted VFD **(WRITER TO SELECT: institutional clients typically want field installed VFDs)**

.5 Sediment separator shall be furnished for installation on the flushing line between the pump discharge flange and the seal area.

.14 Acceptable Manufacturers:

.1 Bell & Gossett Series e80

.2 Armstrong

.3 Grundfos

2.3 VERTICAL IN-LINE CIRCULATORS (SPLIT-COUPLED) (7.5HP AND OVER)

.1 Split-coupled, inline for vertical installation, in cast iron stainless steel fitted construction specifically designed for quiet operation.

.2 Pump internals shall be capable of being serviced without disturbing piping connections.

.3 Shaft: 416 stainless steel shaft that is guided by a carbon graphite lower throttle bushing.

.4 Pump shall be equipped with a unitized inside mechanical seal assembly with flush line. The seal assembly shall have an EPR elastomer bellows and a positive metal-to-metal drive system to reduce torsional stress on the bellows. The bellows will be pressure supported without creases or folds for long life. The mechanical seal shall have a rotating carbon face against a stationary ceramic face. (As an option, an outside mechanical seal may be used in lieu of the inside mechanical seal design. The outside seal materials shall be EPR elastomer with carbon-ceramic faces.)

.5 Pump shaft shall connect to a stainless steel impeller. Impeller shall be hydraulically and dynamically balanced to Hydraulic Institute Standards ANSI/HI 9.6.4.-2016. The allowable residual imbalance conforms to ANSI grade G6.3, keyed to the shaft and secured by a stainless steel locking capscrew or nut.

.6 The pump shall include a spacer coupling of high tensile aluminum, split to allow servicing of the mechanical seal without disturbing the pump or motor. Coupling shall incorporate tapered washer shaft jacking design.

.7 The combination motor bracket and volute coverplate shall be a one-piece unit to ensure concentric alignment of the motor to the pump casing. A carbon steel coupler guard shall be mounted on the motor bracket for safety.

.8 Pump volute shall be of a Class 30 cast iron design for heating systems. Volute shall include gauge ports at nozzles, and vent and drain ports. The volute shall be designed with a base ring matching an ANSI 125# flange that can be used for pump support.

.9 Motors shall meet scheduled horsepower, speed, and voltage. Motors shall have permanently lubricated ball bearings sized to offset the additional bearing loads associated with the closed-coupled pump design. Motors shall be non-overloading at any point on the pump curve and shall meet NEMA specifications.

.1 Motors shall be TEFC, totally enclosed fan cooled.

.10 Pump shall be of a maintainable design and for ease of maintenance should use machine fit parts. Press fit components shall not be permitted.

.11 Design Pressure & Temperature: Suitable standard operations at 225°F and 175 PSIG working pressure for buildings up to six stories, and 250°F and 250 PSIG working pressures for building over six stories high.

Working pressures shall not be de-rated at temperatures up to 250°F.

.12 Capacity: as indicated on schedules.

.13 Accessories:

.1 Suction strainer.

.2 Triple duty valve.

.3 One mechanical seal for each model type of primary pump.

.4 Factory mounted VFD **(WRITER TO SELECT: institutional clients typically want field installed VFDs)**

.5 Sediment separator shall be furnished for installation on the flushing line between the pump discharge flange and the seal area.

.14 Acceptable Manufacturers:

.1 Bell & Gossett Series e80SC

.2 Armstrong

.3 Grundfos

.15 The seismic capability of the pump shall allow it to withstand a horizontal load of 0.5g, excluding piping and/or fasteners used to anchor the pump to mounting pads or to the floor, without adversely affecting pump operation.

2.4 SINGLE SUCTION CENTRIFUGAL PUMP

.1 General: bronze fitted all iron pump complete with motor.

.2 Base: common fabricated steel with drip rim and tapping for drain connection.

.3 Volute: cast iron radially split, end suction, flanged suction and discharge, with drain plug and vent cock, suction and discharge pressure gauge tappings.

.4 Impeller: bronze type, keyed drive with locking nut or screw.

.5 Shaft: stainless steel with two point support,

.6 Seal assembly: mechanical seal, oil lubricated.

.7 Coupling: flexible self-aligning complete with guard.

.8 Motor: EEMAC Class B, squirrel cage induction, continuous duty, drip proof, ball bearing, TEFC, maximum temperature rise 50°C (90°F) as indicated.

.9 Inlet suction guide with strainers and triple duty valve.

.10 Capacity: as indicated.

.11 Design pressure: 1200 kPa (175 psi).

.12 Acceptable material:

.1 Bell & Gossett Series 1510

.2 Armstrong

2.5 SUCTION DIFFUSER

.1 Body: cast iron with flanged connections.

.2 Strainer: with built-in, disposable 1.19 mm (3/64") mesh, low pressure drop screen and NPS 25 mm (1") blowdown connection.

.3 Permanent magnet particle trap.

.4 Full length straightening vanes.

.5 Pressure gauge tappings.

.6 Adjustable support leg.

.7 Acceptable Material:

.1 To match pump supplier.

Part 3 Execution

3.1 INSTALLATION

.1 In line circulators: install as indicated by flow arrows. Support at inlet and outlet flanges or unions. Install with bearing lubrication points accessible suction discharge in vertical alignment.

.2 Base mounted type: supply templates for anchor bolt placement. Furnish anchor bolts with sleeves. Place level, shim unit and grout. Align coupling in accordance with manufacturer's recommended tolerance. Check oil level and lubricate. After run-in, tighten glands.

.3 Ensure that pump body does not support piping or equipment. Provide stanchions or hangers for this purpose. Refer to manufacturer's installation instructions for details.

.4 Pipe drain tapping to floor drain complete with isolating valve.

.5 Install volute venting pet cock in accessible location.

.6 Check rotation prior to start-up.

.7 Install pressure gauge with plug cocks on inlet and outlet on pump.

3.2 SUCTION DIFFUSER

.1 Install on inlet to pumps.

.2 Provide 4x pipe diameter spool piece between suction diffuser and pump inlet.

.3 Remove construction screen from inlet suction guide after system cleaned and before balancing.

3.3 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.2 Warranty Duration:

.1 One (1) year warranty period applies.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ANSI/ASME B16.22, Wrought Copper Alloy and Copper Alloy Solder - Joint Pressure Fittings: Classes 150, 300, 600, 900, 1500, and 2500.

.3 ANSI/ASME B16.24, Cast Copper Pipe Flanges and Flanged Fittings.

.4 ANSI/ASME B16.26, Cast Copper Alloy Fittings for Flared Copper Tubes.

.5 ANSI/ASME B31.5, Refrigeration Piping and Heating Transfer Components.

.6 ASTM A307, Specification for Carbon Steel Bolts and Studs, 413.5 mPa (60,000 psi) Tensile Strength.

.7 ASTM B280, Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

.8 CSA B52, Mechanical Refrigeration Code.

.9 EPS 1/RA/2, Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.

Part 2 Products

2.1 TUBING

.1 Processed for refrigeration installations, deoxidized, dehydrated and sealed.

.1 Hard copper: to ASTM B280, type ACR-B.

2.2 FITTINGS

.1 Service: design pressure 2070 kPa (300 psi) and temperature 121°C (250°F).

.2 Brazed:

.1 Fittings: wrought copper to ANSI/ASME B16.22.

.2 Joints: silver solder, 45% Ag-15% Cu or copper-phosphorous, 95% Cu-5%P and non-corrosive flux.

.3 Flanged:

.1 Bronze or brass, to ANSI/ASME B16.24, Class 150 and Class 300.

.2 Gaskets: suitable for service.

.3 Bolts, nuts and washers: to ASTM A307, heavy series.

.4 Flared:

.1 Bronze or brass, for refrigeration, to ANSI/ASME 16.26.

2.3 PIPE SLEEVES

.1 Hard copper or steel, sized to provide 6 mm (1/4") clearance all around between sleeve and uninsulated pipe or between sleeve and insulation.

2.4 VALVES

.1 22 mm (7/8") and under: Class 500, 3.5 MPa (500 psi), globe or angle non-directional type, diaphragm, packless type, with forged brass body and bonnet, moisture proof seal for below freezing applications, brazed connections.

.2 Over 22 mm (7/8"): Class 375, 2.5 MPa (375 psi), globe or angle type, diaphragm, packless type, back-seating, cap seal, with cast bronze body and bonnet, moisture proof seal for below freezing applications, brazed connections.

2.5 FILTER-DRIER

.1 On lines 20 mm (3/4") outside diameter and larger, filter-drier shall be replaceable core type with Schraeder type valve.

.2 On lines smaller than 20 mm (3/4") outside diameter, filter-drier shall be sealed type using flared copper fittings.

.3 Size shall be full line size.

.4 Approved manufacturers:

.1 Mueller

.2 Parker

.3 Sporlan

.4 Virginia

2.6 SIGHT GLASS

.1 Combination moisture and liquid indicator with protection cap.

.2 Sight glass shall be full line size.

.3 Sight glass connections shall be solid copper or brass, no copper-coated steel sight glasses allowed.

.4 Approved manufacturers:

.1 Mueller

.2 Henry

.3 Parker

.4 Superior

2.7 SUCTION LINE TRAP

.1 Manufactured standard one-piece traps.

2.8 EXPANSION VALVES

.1 For pressure type distributors, externally equalized with stainless steel diaphragm, and same refrigerant in thermostatic elements as in system.

.2 Size valves to provide full rated capacity of cooling coil served. Co-ordinate selection with evaporator coil and condensing unit.

.3 Approved manufacturers:

.1 Henry

.2 Mueller

.3 Parker

.4 Sporlan

2.9 FLEXIBLE CONNECTORS

.1 Designed for refrigerant service with bronze seamless corrugated hose and bronze braiding.

.2 Approved manufacturers:

Anaconda “Vibration Eliminators” by Anamet

Vibration Absorber Model VAF by Packless Industries

Vibration Absorbers by Superior Valve Co

Style “BF” Spring-flex freon connectors by Vibration Mountings.

2.10 ROOF FLASHING

.1 Thaler or equal spun aluminum complete with insulation, cap, and rubber gasket.

2.11 PIPING SUPPORT ASSEMBLY

.1 All channel members shall be fabricated from structural grade steel conforming to one of the following ASTM specifications: A1011/A1011M, A653/A653M.

.2 All fittings shall be fabricated from steel conforming to one of the following ASTM specifications: A575, A36/A36M or A635/A635M.

.3 Electro galvanized cush clamps with shoulder bolt and molded thermoplastic cushion, size to suit pipe.

.4 Acceptable materials:

.1 Unistrut

.2 Or equal

Part 3 Execution

3.1 GENERAL

.1 Hard copper to be used. Throughout the project, the use of annealed copper shall not be used without approval of the consultant.

.2 Install in accordance with CSA B52, EPS 1/RA/2 and ANSI/ASME B31.5.

.3 Connect to equipment with isolating valves and unions.

.4 Provide space for servicing, disassembly and removal of equipment and components all as recommended by manufacturer.

.5 Protect all openings in piping against entry of foreign material.

.6 Provide all necessary equipment including thermal expansion valve, sight glass, solenoid valve, filter dryer, etc., for a complete installed system. Pipe system as per manufacturer's recommendation and requirements.

.7 Provide number of refrigerant circuits and appropriate corresponding piping as per manufacturer's recommendations and requirements.

3.2 BRAZING PROCEDURES

.1 Bleed inert gas into pipe during brazing.

.2 Remove valve internal parts, solenoid valve coils, sight glass.

.3 Do not apply heat near expansion valve and bulb.

3.3 PIPING INSTALLATION

.1 General:

- .1 Hard drawn copper tubing: do not bend. Minimize use of fittings.
- .2 Pitch at least 1:240 down in direction of flow to prevent oil return to compressor during operation.
- .3 Provide trap at base of risers greater than 2.4m (8') high and at each 7.6m (25'-0") thereafter.
- .4 Provide inverted deep trap at top of each riser.
- .5 Provide double risers for compressors having capacity modulation.
  - .1 Large riser: install traps as specified above.
  - .2 Small riser: size for 5.1 m/s (1000 ft/min) at minimum load. Connect upstream of traps on large riser.

3.4 PRESSURE AND LEAK TESTING

.1 Close valves on factory charged equipment and other equipment not designed for test pressures.

.2 Leak test to CSA B52 before evacuation to 2 MPa (290 psi) and 1 MPa (145 psi) on high and low sides respectively.

.3 Test Procedure: Build pressure up to 35 kPa (5 psi) with refrigerant gas on high and low sides. Supplement with nitrogen to required test pressure. Test for leaks with electronic or halide detector. Repair leaks and repeat tests.

3.5 DEHYDRATION AND CHARGING

.1 Close service valves on factory charged equipment.

.2 Ambient temperatures to be at least 13°C (55°F) for at least 12 h before and during dehydration.

.3 Use copper lines of largest practical size to reduce evacuation time.

.4 Use 2-stage vacuum pump with gas ballast on 2nd stage capable of pulling 5 Pa (0.02" WC) absolute and filled with dehydrated oil.

.5 Measure system pressure with vacuum gauge. Take readings with valve between vacuum pump and system closed.

.6 Triple evacuate all system components containing gases other than correct refrigerant or having lost holding charge as follows:

.1 Twice to 14 Pa (0.056" WC) absolute and hold for 4 h.

.2 Break vacuum with refrigerant to 14 kPa (0.056" WC).

.3 Final to 5 Pa (0.02" WC) absolute and hold for at least 12 h.

.4 Isolate pump from system, record vacuum and time readings until stabilization of vacuum.

.5 Submit all test results to Consultant.

.7 Charging:

.1 Charge system through filter-drier and charging valve on high side. Low side charging not permitted.

.2 With compressors off, charge only amount necessary for proper operation of system. If system pressures equalize before system is fully charged, close charging valve and start up. With unit operating, add remainder of charge to system.

.3 Re-purge charging line if refrigerant container is changed during charging process.

.8 Checks:

.1 Make all checks and measurements as per manufacturer's operation and maintenance instructions.

.2 Record and report all measurements to Consultant.

3.6 INSTRUCTIONS

.1 Post instructions in frame with glass cover in accordance with Operation and Maintenance Manual Section and CSA B52.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Plumbing Specialties and Accessories.

.2 Hydronic Systems – Steel.

1.2 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 American Society of Mechanical Engineers (ASME).

.3 ANSI/ASME Boiler and Pressure Vessel Code, Section VI.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with general requirements.

1.4 CLOSEOUT SUBMITTALS

.1 Submit operation and maintenance data for incorporation into manual specified in general requirements

.2 Include following:

.1 Log sheets as recommended by manufacturer.

.2 Test reports.

Part 2 Products

2.1 MANUFACTURER

.1 Equipment, chemicals, service by one supplier.

.2 Acceptable manufacturer:

.1 Chem Aqua (226-808-3617) (**Cooling Towers & Chillers only**).

.1 Rob Jarvis (rjarvis@chemaqua.com)

.2 Rochester Midland Corporation (905-619-6738) (**Hot Water Heating & Glycol Heating Loops only).**

.1 Rance Willis (rwillis@rochestermidland.com)

2.2 POT FEEDER

.1 Welded steel, pressure rating 1200 kPa (175 psi). Temperature rating: 90°C (194°F).

2.3 CHEMICAL FEED PIPING

.1 Resistant to chemicals employed. Pressure rating: 1200 kPa (175 psi).

2.4 CHEMICAL FEED PUMPS

.1 Top-mounted electronic metering diaphragm type: flow range 0-100%, adjustable, plus or minus 1.0% accuracy (repetitive), on-off operation, with pressure relief valve, check valve, foot valve, injection fitting.

.2 Piston type: flow range 0-100%, adjustable, plus or minus 1.0% accuracy (repetitive), on-off operation, with stainless steel piston, pressure relief valve, double ball and check valves.

2.5 SHIPPING/ FEEDING CHEMICAL CONTAINERS

.1 High density moulded polyethylene, with liquid level graduations, cover.

.2 Agitators: as required by manufacturer.

2.6 CONDUCTIVITY CONTROLLER

.1 Fully transistorized, suitable for wall or flush panel mounting, linear over full measuring range of 0-5000 micro omhs.

.2 Insensitive to phase angle shifts, capable of operating on 95-130 Volts without affecting accuracy, power, bleedoff status lights.

2.7 CONDUCTIVITY PROBES

.1 Dual carbon elements in PVC holder, quick disconnect, self-locking connection.

2.8 WATER TREATMENT FOR CONDENSER WATER SYSTEMS, SPRAY WATER SIDE OF CLOSED-CIRCUIT COOLERS

.1 Chemical feed pump:

.1 To provide proportional chemical feed.

.2 Chemical container:

.1 See specification elsewhere this section.

.3 Bleed-off solenoid and throttling valves.

.4 Panel: EEMAC type 5 12 4 enclosure with enamel finish, pre-wired, following features:

.1 Internal wiring harness, colour-coded, identified, brought to central terminal board.

.2 Grounded AC receptacles for feed pumps and utility.

.3 Main power switch, indicating light, legend nameplate.

.4 Manual-auto selector switches, indicating lights for bleed-off control, chemical feed, with legend plates.

.5 Timers pulsed from water meter with contacting register to operate feed pumps [and bleed-off solenoid valve].

.5 Flow assembly: Consisting of conductivity probe mounted in flow-tee complete with isolating valves.

.6 Automatic flow switch: To shut down and re-start water treatment system on interruption of water flow.

.7 Make-up water meter:

.1 Bronze, capacity to meet requirements, non-reset electric cumulative totalizer, electric contacting register.

.8 Pot feeder:

.1 For addition of biocides.

2.9 GLYCOL HEATING FEED SYSTEM

.1 Glycol feed system:

.1 200 litre polyethylene 40% polypropylene glycol solution holding tank complete with suction strainer and shut-off valve on a painted blue, angle iron steel stand.

.2 Rotary bronze gear pump 1/3 HP, 2.0 USGPM @75 psi maximum 120 V/1/60 differential pressure (.25 kW, 7.5 l/min @ 517 kPa) with built-in relief valve.

.3 Low-level float switch, audible alarm and light.

.4 Adjustable pressure switch 10-150 psi (100-1000 kPa) range.

.5 Prewired, tank mounted control panel including the following:

.1 Power On switch and status lights

.2 Hand-Off-Auto selection switch

.3 Pump S.P. S. T. relay

.4 Terminal Strip

.5 NEMA 1 enclosure

.2 Hydronic System: Pot Feeder 25L

.3 Micron filter for pot feeder:

.1 Capacity 2% of pump recirculating rate at operating pressure.

.2 Six (6) sets of filter cartridges for each type, size of micron filter.

.4 Balancing valve set for 2% pump capacity.

.5 Glycol solution shall be Dowfrost HD inhibited propylene glycol-based fluid as manufactured by Dow Chemical. Temperature range (-50°F - 325°F).

2.10 CHEMICALS

.1 Provide 1 year’s supply.

2.11 TEST EQUIPMENT

.1 Provide one set of test equipment for each system to verify performance.

.2 Complete with carrying case, reagents for chemicals, all specialized or supplementary equipment.

2.12 CLEANING CHEMICALS

.1 Provide as required to make system clean.

.2 Cleaner chemical: compatible and of the same manufacturer of the water treatment supplier.

2.13 RECORD MANAGEMENT

.1 Provide cards and card holder mounted on wall adjacent to each pot feeder.

Part 3 Execution

3.1 INSTALLATION

.1 Install HVAC water treatment systems in accordance with ASME Boiler Code Section VII, and requirements and standards of authorities having jurisdiction, except where specified otherwise.

.2 Ensure adequate clearances to permit performance of servicing and maintenance of equipment.

3.2 CHEMICAL FEED PIPING

.1 Install crosses at all changes in direction. Install plugs in all unused connections.

3.3 WATER TREATMENT SERVICES

.1 After entire new and existing system is cleaned as specified elsewhere, provide monthly water treatment monitoring and consulting services for period of one year after system start-up. Provide written report to consultant after each visit. Service to include:

.1 Initial water analysis and treatment recommendations.

.2 System start-up assistance.

.3 On site system testing and recording of treated hydronic system.

.4 Operating staff training.

.5 Visit plant every 7 days during first month of operation and as required until system stabilizes and advise consultant in writing on treatment system performance.

.6 Provide monthly visits with reports after system has stabilized to the satisfaction of the owner.

.7 Provide necessary monthly recording charts and log sheets for one year operation.

.8 Provide necessary laboratory and technical assistance.

.9 Instructions and advice to operating staff to be clear, concise and in writing.

3.4 START-UP

.1 Start up water treatment systems in accordance with manufacturer's instructions.

3.5 SYSTEM COMMISSIONING AND TRAINING

.1 Commissioning and training shall be provided by installing water treatment sub-contractor and water treatment supplier.

.2 Timing:

.1 After start-up deficiencies rectified.

.2 After start-up and before TAB of connected systems.

.3 Pre-commissioning Inspections:

.1 Verify:

.1 Presence of test equipment, reagents, chemicals, details of specific tests to be performed, operating instructions.

.2 Suitability of logbook.

.3 Currency and accuracy of initial water analysis.

.4 Required quality of treated water.

.4 Commissioning procedures - applicable to all Water Treatment Systems:

.1 Establish, adjust as necessary and record all automatic controls and chemical feed rates.

.2 Monitor performance continuously during commissioning of all connected systems and until acceptance of project.

.3 Establish test intervals, regeneration intervals.

.4 Record on approved report forms all commissioning procedures, test procedures, dates, times, quantities of chemicals added, raw water analysis, treated water analysis, test results, instrument readings, adjustments made, results obtained.

.5 Establish, monitor and adjust automatic controls and chemical feed rates as necessary.

.6 Visit project at monthly intervals after commissioning is satisfactorily completed to verify that performance remains as set during commissioning (more often as required until system stabilizes at required level of performance).

.7 Advise Engineer in writing on all matters regarding installed water treatment systems.

.5 Commissioning procedures - Water side of closed-circuit coolers, Cooling Tower Systems:

.1 Verify operation of bleed-off system.

.2 Establish bleed-off flow rate.

.3 Establish rate of chemical feed - continual and periodic.

.4 Test system water for chlorides, TDS, suspended solids, algae, slime, inhibitor level, pH, alkalinity, hardness, other impurities and microbiological organisms.

.5 Compare with readings of total dissolved and suspended solids meter.

.6 Read make-up water meter, compare with chiller load summation (ton-hours).

.7 Test make-up water for chlorides, hardness.

.8 Compare test results with readings from TDS meter.

.9 Record quantity of make-up water, compare with summation of chiller load (in ton-hours).

.10 Record types, quantities of chemicals applied.

.6 Commissioning procedures - Closed Circuit Hydronic Systems:

.1 Analyse water in system.

.2 Based upon an assumed rate of loss approved by Engineer, establish rate of chemical feed.

.3 Record types, quantities of chemicals applied.

.4 Provide written verification of glycol solution concentration.

.7 Training:

.1 Commission systems, perform tests in presence of, and using assistance of, assigned O&M personnel.

.2 Train O&M personnel in softener regeneration procedures.

.8 Certificates:

.1 Upon completion, furnish certificates confirming satisfactory installation and performance.

.9 Commissioning Reports:

.1 To include system schematics, test results, test certificates, raw and treated water analyses, design criteria, all other data required by Consultant.

.10 Commissioning activities during Warranty Period:

.1 Check out water treatment systems on regular basis and submit written report to Consultant.

3.6 CLEANING OF MECHANICAL SYSTEM

.1 Coordinate cleaning of mechanical systems with mechanical contractor.

.2 Provide copy of recommended cleaning procedures and chemicals for approval by Consultant.

3.7 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.2 Warranty Duration:

.1 One (1) year warranty period applies.

.3 Warranty Coverage:

.1 Applies to parts and labour.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 SMACNA HVAC Duct Construction Standards, Metal and Flexible.

.3 SMACNA HVAC Duct Leakage Test Manual.

.4 ASTM A480/A480M, Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.

.5 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process. (Metric).

.6 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.

.7 ANSI/NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.

.8 ANSI/NFPA 96, Ventilation Control and Fire Protection of Commercial Cooking Operations.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section general requirements.

.2 Indicate following:

- .1 Sealants
- .2 Tape
- .3 Proprietary Joints
- .4 Fittings

1.3 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

Part 2 Products

2.1 DUCTWORK

.1 Galvanized Steel:

- .1 Galvanized steel with Z90 designation zinc coating lock forming quality: to ASTM A653/A653M.

.2 Thickness:

Size Type	**Class A Gauge**	**Class B Gauge**	**Class C Gauge**
Square and Rectangular			
Up to 600 mm (24”)	22	24	24
625 mm to 1000 mm (25” to 40”)	20	22	24
1025 mm to 1800 mm (41” to 72”)	18	20	22
1825 mm to 2400 mm (73” to 96")	16	18	20
2450 mm and over (97")	16	16	16
Round and Oval			
Up to 300 mm (12”)	24	24	24
325 mm to 600 mm (13” to 24”)	22	24	24
625 mm to 900 mm (25" to 36")	20	22	24
925 mm to 1200 mm (37” to 48”)	18	20	22
1225 mm (49”) and over	18	18	20

.3 All ductwork between HVAC unit connections and 3.0 m (10'-0") downstream or to silencers shall be 1.4 mm (18 gauge).

.2 Black Steel

.1 To ASTM A6653/A653M.

.2 Thickness: 1.2 mm (18 gauge)

.3 Fabrication: ducts and fittings to ASHRAE and SMACNA.

.4 Reinforcement: as indicated.

.5 Joints: continuous weld.

.3 Aluminum

.1 To ASHRAE and SMACNA. Aluminum type: 3003-H-14.

.2 Thickness, fabrication, and reinforcement: to ASHRAE and SMACNA or as indicated.

.3 Joints: to ASHRAE and SMACNA.

.1 Acceptable material:

.1 Ductmate Canada Ltd.

.4 Foil tape all transverse and longitudinal joints.

2.2 DUCT CONSTRUCTION

.1 Round and oval:

.1 Ducts: factory fabricated, spiral wound, with matching fittings and specials to SMACNA.

.2 Transverse joints up to 900 mm (36"): slip type with tape and sealants.

.3 Transverse joints over 900 mm (36"): Ductmate or Exanno Nexas Duct System.

.2 Square and rectangular:

.1 Ducts: to SMACNA.

.2 Transverse joints, longest side:

up to and including 750 mm (30"): SMACNA proprietary duct joints.

.3 Ducts with sides over 750 mm (30") to 1200 mm (48"), transverse duct joint system by Ductmate/25, Nexus, or WDCI (Lite) (SMACNA ”E” or “G” Type connection). Weld all corners.

.1 Acceptable materials:

.1 Ductmate Canada Ltd.

.2 Nexus, Exanno Corp.

.3 WDCI

.4 Ducts 1200 mm (48") and larger, Ductmate/35, Nexus, or WDCI (heavy) (SMACNA “J” Type connection). Weld all corners.

.1 Acceptable materials:

.1 Ductmate Canada Ltd.

.2 Nexus, Exanno Corp.

.3 WDCII.

2.3 FITTINGS

.1 Fabrication: to SMACNA.

.2 Radiused elbows:

.1 Rectangular: standard radius and or short radius with single thickness turning vanes Centreline radius: 1.5 times width of duct.

.2 Round:

.1 In exposed areas one-piece smooth radius, 1.5 times diameter.

.2 In concealed areas 3-piece adjustable, 1.5 times diameter.

.3 Mitred elbows, rectangular:

.1 To 400 mm (16"): with double thickness turning vanes.

.2 Over 400 mm (16"): with double thickness turning vanes.

.4 Branches:

.1 Rectangular main and branch: with 45º entry on branch.

.2 Round main and branch: enter main duct at 45º with conical connection.

.3 Provide volume control damper in branch duct near connection to main duct.

.4 Main duct branches: with splitter damper.

.5 Diffuser connection to main:

.1 90º round spin in collars with balancing damper and locking quadrant.

.6 Transitions:

.1 Diverging: 20º maximum included angle.

.2 Converging: 30º maximum included angle.

.7 Offsets:

.1 Full short radiused elbows.

.8 Obstruction deflectors: maintain full cross-sectional area.

2.4 SEAL CLASSIFICATION

.1 Classification as follows:

Maximum Pressure Pa (" w.c.)	SMACNA Seal Class
2500 (10")	A
1500 (6")	A
1000 (4")	A
750 (3")	A
500 (2")	B
250 (1")	B
125 (0.5")	C

.2 Seal classification:

.1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.

.2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant.

.3 Class C: transverse joints and connections made airtight with gaskets, or sealant or combination thereof. Longitudinal seams sealed with foil tape or sealant.

2.5 SEALANT

.1 Sealant: oil resistant, polymer type flame resistant duct sealant. Temperature range of -30°C (-22°F) to plus 93°C (199°F).

.1 Acceptable materials:

.1 Duro Dyne S-2

.2 Foster

2.6 TAPE

.1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm (2") wide.

.1 Acceptable material:

.1 Duro Dyne FT-2

2.7 DUCT LEAKAGE

.1 In accordance with SMACNA HVAC Duct Leakage Test Manual.

2.8 FIRESTOPPING

.1 40 mm x 40 mm x 3 mm (1½" x 1½" x 16ga) retaining angles all around duct, on both sides of fire separation.

.2 Firestopping material and installation must not distort duct.

.3 All ductwork passing through partition walls shall be firestopped.

2.9 KITCHEN EXHAUST SYSTEMS

.1 Construct in accordance with ANSI/NFPA 96.

.2 Material: Type 316 stainless steel sheet or carbon steel.

.3 Clearance: 450 mm (18") to combustible materials or protected to NFPA 96 requirements.

.4 Fabrication: as indicated.

2.10 HANGERS AND SUPPORTS

.1 Band hangers: use on round and oval ducts only up to 500 mm (20") diameter, of same material as duct but next sheet metal thickness heavier than duct.

.2 Trapeze hangers: ducts over 500 mm (20") diameter or longest side, to ASHRAE and SMACNA.

.3 Hangers: galvanized steel angle with black steel rods to ASHRAE and SMACNA following table:

Duct Size mm (")	Angle Size mm (")	Rod Size mm (")
up to 750 (30)	25 x 25 x 3 (1 x 1 x 1/8)	6 (1/4)
>750 to 1050 (>30 to 42)	40 x 40 x 3 (1½ x 1½ x 1/8)	6 (1/4)
>1050 to 1500 (>42 to 60)	40 x 40 x 3 (1½ x 1½ x 1/8)	10 (3/8)
>1500 to 2100 (>60 x 84)	50 x 50 x 3 (2 x 2 x 1/8)	10 (3/8
>2100 to 2400 (>84 x 96)	50 x 50 x 5 (2 x 2 x 1/8)	10 (3/8)
>2400 (96) and over	50 x 50 x 6 (2 x 2 x ¼)	10 (3/8)

.4 Upper hanger attachments:

.1 For concrete: manufactured concrete inserts.

.1 Acceptable material:

.1 Myatt fig. 485

.2 For steel joist: manufactured joist clamp or steel plate washer.

.1 Acceptable material:

.1 Grinnell fig. 61 or 60

.3 For steel beams: manufactured beam clamps:

.1 Acceptable material:

.1 Grinnell Fig. 60

2.11 WATERTIGHT DUCT

.1 Provide watertight duct for:

.1 Dishwasher exhaust.

.2 Fresh air intake.

.3 Minimum 3000 mm (120") from duct mounted humidifier in all directions.

.4 As indicated.

.2 Form bottom of horizontal duct without longitudinal seams. Solder or weld joints of bottom and side sheets. Seal all other joints with duct sealer.

Part 3 Execution

3.1 GENERAL

.1 The following systems shall conform to these requirements:

System	Class	Material
Science Room Exhaust	A	Galvanized steel
HVAC Supply and Return General Exhaust Ventilation Plenum Exhaust Plenum Shower Exhaust	B B B B B	Galvanized steel Galvanized steel Galvanized steel Galvanized steel Aluminum
Individual Exhaust	C	Galvanized steel
Kitchen Exhaust	Welded	Black Steel

.2 Do work in accordance with ASHRAE and SMACNA.

.3 Do not break continuity of insulation vapour barrier with hangers or rods.

.4 Support risers in accordance with ASHRAE and SMACNA.

.5 Install breakaway joints in ductwork on each side of fire separation.

.6 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

.7 Manufacture duct in lengths to accommodate installation of acoustic duct lining.

3.2 HANGERS

.1 Strap hangers: install in accordance with SMACNA.

.2 Angle hangers: complete with locking nuts and washers.

.3 Hanger spacing in accordance with ASHRAE, SMACNA and as follows:

Duct Size mm (")	Spacing mm (")
to 1500 (60")	3000 (120")
over 1500 (60")	2500 (100")

.4 Do not support ductwork over 250 mm x 250 mm (10" x 10") from roof deck.

3.3 KITCHEN EXHAUST SYSTEMS

.1 Install to ANSI/NFPA 96 and as indicated.

.2 Provide smoke test on exhaust ductwork and report to the engineer.

.3 Provide smoke test on system to the local authorities' requirements.

3.4 SEALING

.1 Apply sealant to outside of joint to manufacturer's recommendations.

.2 Bed tape in sealant and recoat with minimum of 1 coat of sealant to manufacturers recommendations.

3.5 WATERTIGHT DUCT

.1 Slope horizontal branch ductwork down towards hoods served. Slope header ducts down toward risers.

.2 Fit base of riser with 150 mm (6") deep drain sump and 25 mm (1") drain connected, with deep seal trap and valve and discharging to open funnel drain.

3.6 LEAKAGE TESTS

.1 Co-ordinate leakage testing with TAB contractor **and commissioning agent**. TAB contractor will be responsible for all duct testing.

.2 Duct to be tested in accordance with SMACNA HVAC Duct Leakage Test Manual.

.3 Leakage tests to be done in sections.

.4 Trial leakage tests to be performed as instructed to demonstrate workmanship.

.5 Install no additional ductwork until trial test has been passed.

.6 Test section to be minimum of 15 m (50'-0") long with not less than 3 branch takeoffs and two 90º elbows. Maximum test length and area to be determined by BAS testing equipment. Allow for twelve (12) tests.

.7 Complete test before insulation or concealment.

.8 Provide all necessary end caps and fittings as required for the TAB contractor. Remove same after successful completion of duct test.

.9 Pressure test ductwork to 1½ times operating pressure (minimum pressure 500 Pa (2" wc) all systems).

3.7 CLEANING

.1 Keep ducts clear from dust and debris

.2 Keep duct liner clean from dust, debris, and moisture.

.3 At completion of project vacuum ducts if dirt or dust is present.

.4 Where new systems connect into existing systems the existing systems shall be cleaned and vacuumed prior to reconnection.

.5 Ensure all systems are clean prior to start up.

3.8 INSTALLATION REQUIREMENTS

.1 All ductwork is to be protected from the weather and precipitation. The top and sides of all ductwork are to be completely covered with 6mil poly to the satisfaction of the consultant. Maintain protection of the ductwork until the building is made watertight and hollow cores drained. Tape all joints.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

.3 ASTM C423, Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

.4 ASTM E90, Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.5 ASTM E477, Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with general requirements.

.2 Provide separate shop drawings for each piece of attenuation equipment complete with product data.

1.3 PERFORMANCE RATING DATA

.1 Provide performance rating data, certified by an accredited test laboratory, and supported by calculations and verified by test results in accordance with referenced standards as follows:

.1 Silencer: insertion loss, pressure drop at design conditions, generated noise level.

.2 Acoustic plenums: transmission loss and acoustical absorption.

Part 2 Products

2.1 ABSORPTION AND INSULATING MEDIA

.1 Acoustical performance measurements to be made in accordance with ASTM E477, ASTM E90 and ASTM C423, except where specified otherwise.

.2 Acoustic quality, glass fibre, free of shot and odor; bacteria and fungus resistant; free of corrosion causing or accelerating agents; packed to density to meet performance requirements; and meet NBC fire requirements or requirements of authority having jurisdiction for duct lining.

2.2 PREFABRICATED PLENUMS

.1 Panels: tongue and groove connection type, designed for individual panel removal for equipment access without major dismantling of plenum.

.1 Outer sheet: 1.3 mm (18 gauge) thick galvanized steel to ASTM A653/A653M, with coating designation Z90.

.2 Inner sheet: 0.085 mm (22 gauge) thick galvanized steel to ASTM A653/A653M, with coating designation Z90 with 2 mm (79 mil) diameter clean cut perforations on 5 mm (3/16") staggered centres.

.3 Fully framed with 1.3 mm (18 gauge) thick galvanized steel channels.

.4 Horizontal stiffeners: 0.85 mm (22 gauge) minimum galvanized steel on 800 mm (32") centres to control media settlement.

.5 Access panels: sized for equipment removal; two handles per panel; screw at 100 mm (4") maximum centres; perimeter neoprene sponge gasket; materials same as standard panel.

.6 Deflection: not to exceed 1/240 of unsupported panel span at design pressure differential of 2500 Pa (10" w.c.).

.7 Connections: as indicated.

.2 Doors: access doors with minimum 510 mm x 1375 mm (20" x 54") opening.

.1 Construction same as standard panel except interiors to be solid.

.2 Two butt-type nylon bushed hinges, two cam-type latches with inside and outside handles.

.3 Neoprene gasket seal.

.4 Zinc plated hardware.

.5 Open against air pressure.

.3 Windows: inspection windows, 300 mm x 300 mm (12" x 12"), double glazed with 6 mm (1/4") wire reinforced glass mounted in neoprene "U" channels]

.4 Assembly: base sections and flashings 1.3 mm (18 gauge) minimum galvanized steel.

.1 Panel and flashing joints externally sealed with 6 mm (1/4") diameter bead of non sag, non hardening sealant. Floor channel to floor connection sealed with 3 mm x 15 mm (1/8" x 1/2") monolastomeric tape.

.2 Factory cut and frame openings where greatest dimension exceeds 300 mm (12"). Smaller panel openings, to be site located and cut 50 mm (2") larger in diameter, sleeved with 0.7 mm (22 gauge) minimum galvanized steel.

.3 Fill space between pipe or conduit and sleeve with acoustic media, covered and mastic sealed in accordance with manufacturer's instructions.

.4 No sensory leakage at design pressure differential of 1000 KPa (145 psi).

.5 Assembly RSI not less than 1.2 m2°C/W (6.81 ft2°F/Btuh) at 10°C (50°F).

.6 Certified acoustical performance:

.1 Transmission loss to ASTM E90.

.2 Acoustical absorption to ASTM C423.

Octave bands, (Hz)	125	250	500	1000	2000	4000
Transmission loss, dB	[21]	[28]	[39]	[50]	[53]	[56]
Absorption coefficient	[0.7]	[0.9]	[.99]	[.99]	[0.9]	[0.9]

.5 Acceptable materials:

.1 Vibron

.2 BVA Systems

.3 VAW Systems

.4 IAC Acoustics

.5 EH Price

2.3 ACOUSTIC SOUND PLENUMS

.1 Panels: 50 mm thick tongue and groove connection type, designed for individual panel removal for equipment access without major dismantling of plenum.

.1 Outer sheet: 1.3 mm (18 gauge) thick galvanized steel to ASTM A526/A526M, with coating designation Z90.

.2 Inner sheet: 0.085 mm (4 mil) thick galvanized steel to ASTM A526/A526M, with coating designation Z90 with 2 mm (79 mil) diameter clean cut perforations on 5 mm (3/16") staggered centres.

.3 Fully framed with 1.3 mm (18 gauge) thick galvanized steel channels.

.4 Horizontal stiffeners: 0.85 mm (22 gauge) minimum galvanized steel on 800 mm (32") centres to control media settlement.

.5 Deflection: not to exceed 1/240 of unsupported panel span at design pressure differential of 2500 Pa (10" w.c.).

.6 Connections: as per manufacturers requirements.

.2 Assembly:

.1 Panel and flashing joints externally sealed with 6 mm (1/4") diameter bead of non sag, non hardening sealant. Floor channel to floor connection sealed with 3 mm x 15 mm (1/8" x 1/2") monolastomeric tape.

.2 Factory cut and frame openings where greatest dimension exceeds 300 mm (12"). Smaller panel openings, to be site located and cut 50 mm (2") larger in diameter, sleeved with 0.7 mm (22 gauge) minimum galvanized steel.

.3 Fill space between pipe or conduit and sleeve with acoustic media, covered and mastic sealed in accordance with manufacturer's instructions.

.4 No sensory leakage at design pressure differential of 1000 KPa (145 psi).

.5 Assembly RSI not less than 1.2 m2°C/W (6.81 ft2°F/Btuh) at 10°C (50°F).

.3 Acceptable materials:

.1 BVA Systems

.2 Vibron

.3 VAW Systems

.4 IAC Acoustics

.5 EH Price

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Noise flanking: where indicated, install in wall sleeve with uniform clearance all around to ensure no contact of silencer with wall sleeve. Pack with flexible, non hardening caulking on both sides of sleeves.

.3 Instrument test ports: install at inlet and outlet to permit measurement of insertion loss and pressure loss.

.4 Suspension: to manufacturer's instructions.

3.2 SITE VISIT

.1 Supplier of equipment to visit site to ensure installation is in accordance with manufacturer's instructions and submit report to Consultant

.2 Make adjustments and corrections in accordance with written report.

.3 Provide Consultant with notice 48h in advance of visit.

3.3 TESTING

.1 Experienced and competent sound and vibration testing professional engineer to take sound measurement after start up and testing, adjusting and balancing of systems to Testing Adjusting and Balancing (TAB) of Mechanical Systems section.

.2 Sound measurements to extend over specified frequency range of 250 to 2000 and to be taken:

.1 Upstream and downstream of each silencer and plenum.

.2 In areas adjacent to mechanical equipment rooms, duct, and pipe shafts.

.3 At 1800 mm (72") above floor adjacent to first air terminal.

.3 Provide Consultant with notice 48 h in advance of commencement of tests.

.4 Establish adequacy of equipment isolation, acceptability of noise levels in occupied areas, other conditions affecting acoustics and, where appropriate, recommendation for remedial measures and costs.

.5 Submit complete report of test results including sound curves.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 SMACNA HVAC Duct Construction Standards, Metal and Flexible.

.3 ANSI/NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.

.4 ANSI/NFPA 96, Ventilation Control and Fire Protection of Commercial Cooking Operations.

.5 CSA B228.1, Pipes, Ducts and Fittings for Residential Type Air Conditioning.

1.2 PRODUCT DATA

.1 Submit product data in accordance with general requirements.

.2 Indicate the following:

.1 Flexible connections.

.2 Duct access doors.

.3 Turning vanes.

.4 Instrument test ports.

1.3 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

Part 2 Products

2.1 GENERAL

.1 Manufacture in accordance with CSA B228.1.

2.2 FLEXIBLE CONNECTIONS

.1 Frame: galvanized sheet metal frame with fabric clenched by means of double locked seams.

.2 Material:

.1 Fire resistant, self-extinguishing, neoprene coated glass fabric, temperature rated at -40°C (-40°F) to plus 90°C (194°F), density of 1.3 kg/m.

2.3 ACCESS DOORS IN DUCTS

.1 Non-insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm (25 gauge) thick complete with sheet metal angle frame.

.2 Insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm (24 gauge) thick complete with sheet metal angle frame and 25 mm (1") thick rigid glass fiber insulation.

.3 Gaskets: neoprene

.4 Hardware:

.1 Up to 300 mm (12"): 2 sash locks

.2 301 mm to 450 mm (13" to 18"): 4 sash locks Complete with safety chain.

.3 451 mm to 1000 mm (19" to 40"): piano hinge and minimum 2 sash locks.

.4 Doors over 1000 mm (40"): piano hinge and 2 handles operable from both sides.

.5 Hold open devices.

.5 Acceptable materials:

.1 Nailor

.2 E. H. Price

.3 Titus

.6 Provide access doors in kitchen exhaust duct with bolted cover to the requirements of NFPA and authority having jurisdiction.

2.4 TURNING VANES

.1 Factory or shop fabricated double thickness, to recommendations of SMACNA and as indicated.

.2 Acceptable materials:

.1 Duro Dyne

.2 Ductmate

2.5 INSTRUMENT TEST PORTS

.1 1.6 mm (16 gauge) thick steel zinc plated after manufacture.

.2 Cam lock handles with neoprene expansion plug and handle chain.

.3 28 mm (1 1/8") minimum inside diameter. Length to suit insulation thickness.

.4 Neoprene mounting gasket.

.5 Acceptable material:

.1 Duro Dyne IP1 or IP2

.2 Duct mate

2.6 PREFABRICATED ROOF CURB

.1 Construction: welded with exposed joints ground flush and smooth.

.2 Material: 1.3 mm (18 gauge) galvanized steel with raised cant and wood nailer.

.3 25 mm (1") insulation 3 lb density.

.4 Acceptable materials:

.1 Greenheck GPR – 600 mm (24") high

.2 Penn

2.7 SPIN-IN COLLAR

.1 Construction: galvanized conical spin-in collar complete with spin-in bead and crimped collar connection.

.2 Provide balancing damper where indicated.

.3 Acceptable materials:

.1 Ecco Manufacturing

.2 Flex Master

Part 3 Execution

3.1 INSTALLATION

.1 Flexible connections:

.1 Install in following locations:

.1 Inlets and outlets to supply air units and fans. (Unless internally isolated)

.2 Inlets and outlets of exhaust and return air fans.

.3 As indicated.

.2 Length of connection: 100 mm (4").

.3 Minimum distance between metal parts when system in operation: 75 mm (3").

.4 Install in accordance with recommendations of SMACNA.

.5 When fan is running:

.1 Ducting on each side of flexible connection to be in alignment.

.2 Ensure slack material in flexible connection.

.2 Access doors and viewing panels:

.1 Size:

.1 600 mm x 600 mm (24" x 24") for person size entry.

.2 600 mm x 1000 mm (24" x 40") for servicing entry.

.3 300 mm x 300 mm (12" x 12") for viewing.

.4 As indicated.

.2 Location:

.1 At fire and smoke dampers.

.2 At control dampers.

.3 At devices requiring maintenance.

.4 At locations required by code.

.5 At inlet and outlet of reheat coils.

.6 Elsewhere as indicated.

.7 Inlet and outlet of duct mounted coils.

.3 Instrument test ports.

.1 General:

.1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.2 Locate to permit easy manipulation of instruments

.3 Install insulation port extensions as required.

.4 Locations.

.1 For traverse readings:

.1 At ducted inlets to roof and wall exhausters.

.2 At inlets and outlets of other fan systems.

.3 At main and sub-main ducts.

.4 And as indicated.

.2 For temperature readings:

.1 At outside air intakes.

.2 In mixed air applications in locations as approved by Consultant.

.3 At inlet and outlet of coils.

.4 Downstream of junctions of two converging air streams of different temperatures.

.5 And as indicated.

.4 Turning vanes:

.1 Install in accordance with recommendations of SMACNA and as indicated.

.2 Install on supply ducts only.

3.2 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.2 Warranty Duration:

.1 One (1) year warranty period applies.

.3 Warranty Coverage:

.1 Applies to parts and labour.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 SMACNA HVAC Duct Construction Standards, Metal and Flexible.

1.2 PRODUCT DATA

.1 Submit product data in accordance with general requirements

.2 Indicate the following: performance data.

Part 2 Products

2.1 GENERAL

.1 Manufacture to SMACNA standards.

2.2 SINGLE BLADE DAMPERS

.1 Of same material as duct, but one sheet metal thickness heavier. V-groove stiffened, minimum 1.6 mm (16 gauge).

.2 Size and configuration to recommendations of SMACNA, except maximum height 100 mm (4").

.3 Shaft extension to accommodate insulation thickness and locking quadrant.

.4 Inside and outside nylon end bearings.

.5 Channel frame of same material as adjacent duct, complete with angle stop.

2.3 MULTI-BLADED DAMPERS

.1 Factory manufactured of material compatible with duct.

.2 Opposed blade: configuration, metal thickness and construction to recommendations of SMACNA.

.3 Maximum blade height:

.1 50 mm (2") up to 375 mm (15") high duct.

.2 100 mm (4") max 400 mm (16") high duct and over.

.4 Bearings: self-lubricating nylon.

.5 Linkage: shaft extension with locking quadrant.

.6 Channel frame of same material as adjacent duct, complete with angle stop.

.7 Shaft extension to accommodate insulation thickness and locking quadrants.

.8 Acceptable materials:

.1 Duro Dyne

.2 National Controlled Air (NCA)

.3 Nailor

.4 T.A. Morrison

.5 Tamco

.6 Ruskin

.7 Ventex/Alumavent

.8 United Enertech

2.4 LOCKING QUADRANTS

.1 6 mm (1/4") dial regulator with square bearing shaft.

.1 18 gauge oval frame, cadmium plated, clearly shows damper position.

.2 18 gauge formed handle for easy adjustment.

.3 Bolt and wing nut lock damper securely.

.4 Offset mounting holes avoid interference with damper movement and mechanical fastening to duct.

.2 9 mm (3/8") and larger: clamp quadrant with square bearing shaft.

.1 Accommodates and securely locks square rod, bearing fitting and adaptor pins.

.2 Heavily ribbed 16 gauge steel frame, 3 mm (1/8") thick formed steel handle, cadmium-plated.

.3 By tightening nut, bearing is securely locked in handle, preventing slippage and rattle.

.4 Neoprene and steel washer assembly seals bearing opening to eliminate air-leakage.

.5 Screw holes for mechanically fastening to ductwork.

.3 High pressure system locking quadrant:

.1 Airtight, rattle-proof regulator, designed for ZERO leakage at high pressure. Use for applications up to 500°F constant temperature.

.2 Handle design for easy recognition of damper position.

.3 Heavy-gauge, zinc-plated steel, 2 high temperature rubber seals and washers, end bearing support, and 2 end bearings. Pressure loss and damper rattle in ductwork has been a constant annoyance for as long as HVAC ductwork has been installed. Now, a truly air-tight, rattle-proof regulator is available. The SPEC-SEAL regulator utilizes a special high-temperature rubber seal to eliminate leakage and rattle even at many times the pressure found in high pressure.

.4 Soft, comfortable grip handle with a highly-visible, plastic cover which indicates the damper position.

.5 Handle to accommodate 9 mm (3/8") or 12 mm (1/2") to match damper shaft size, square and round bearing shafts.

.4 Acceptable manufacturers:

.1 Duro Dyne

.2 Ductmate

2.5 VOLUME EXTRACTORS

.1 Fully adjustable gang operated blade volume extractor.

.2 Cold rolled steel construction, 25 mm (1") blade spacing with matte black finish.

.3 Provide Type 1 manual adjusting operating lever.

.4 Acceptable Material

.1 EH Price AE-1

.2 Krueger EX8/EX88

.3 Or equal approved by consultant

Part 3 Execution

3.1 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.3 For supply, return and exhaust systems, locate balancing dampers in each branch duct.

.1 Single blade dampers up to 200 mm (8").

.2 Multi-blade dampers over 200 mm (8").

.4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.

.5 All dampers to be vibration free.

.6 Leave all dampers in open position for T.A.B.

.7 Fasten locking quadrants to ductwork and shaft.

.8 Place locking quadrants on standoffs where ductwork insulated.

.9 Lock down quadrant arm in the open position.

3.2 VOLUME EXTRACTOR

.1 Install at branch take off connections where indicated.

.2 Secure lever adjustment rod to inside duct collar after final adjustments.

3.3 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.2 Warranty Duration:

.1 One (1) year warranty period applies.

.3 Warranty Coverage:

.1 Applies to parts and labour.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.

.3 CAN/ULC-S112, Standard Method of Fire Test of Fire Damper Assemblies.

.4 CAN/ULC-S112.1, Standard Method of Fire Test of Ceiling Firestop Flap Assemblies.

.5 ULC-S505, Fusible Links for Fire Protection Service.

1.2 PRODUCT DATA

.1 Submit product data in accordance with general requirements.

.2 Indicate the following:

.1 Fire dampers.

.2 Operators.

.3 Firestop flaps.

.4 Fusible links.

1.3 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

1.4 MAINTENANCE MATERIALS

.1 Provide following:

.1 6 fusible links of each type.

1.5 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

Part 2 Products

2.1 FIRE DAMPERS (STATIC)

.1 Fire dampers: arrangement as indicated, listed and bear label of ULC, meet requirements of provincial fire authority and authorities having jurisdiction. Fire damper assemblies to be fire tested in accordance with CAN/ULC-S112.

.2 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.

.3 Top hinged: offset single damper, round or square; multi-blade hinged or interlocking type; guillotine type; sized to maintain full duct cross section.

.4 Fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type or roll door type in horizontal position with vertical air flow.

.5 40 mm x 40 mm x 3 mm (1½" x 1½" x 16ga) retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.

.6 Acceptable materials:

.1 Ruskin

.2 Nailor

.3 National Controlled Air (NCA)

.4 T.A. Morrison

.5 Tamco

.6 Ventex/Alumavent

.7 United Enertech

.8 Safeair-Dowco (stainless steel)

.9 Greenheck

2.2 FIRE DAMPERS (DYNAMIC)

.1 Multi blade or roll type, fire damper suitable for HVAC system velocities up to 2000 fpm (610 m/mm), dual direction air flow, max 4" wg pressure.

.2 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.

.3 Top hinged: offset single damper, round or square; multi-blade hinged or interlocking type; guillotine type; sized to maintain full duct cross section.

.4 Stainless closure spring to positively close damper upon fusible link release, for horizontal or vertical orientations.

.5 Linkage concealed in frame.

.6 40 mm x 40 mm x 3 mm (1½" x 1½" x 16ga) retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.

.7 Fire damper assemblies and type to meet requirements of provincial fire authority and authority having jurisdiction.

.8 Acceptable materials:

.1 Ruskin

.2 Nailor

.3 National Controlled Air (NCA)

.4 T.A. Morrison

.5 Tamco

.6 Greenheck

.7 Ventex/Alumavent

2.3 MULTIBLADE DAMPERS (DYNAMIC OR STATIC)

.1 Provide and install multiblade dampers where roll type fire dampers do not have a ULC listing for the size of the penetration through the assembly.

.2 Multi blade type fire dampers shall be suitable for HVAC system velocities up to 2000 fpm (610 m/mm), dual direction air flow, max 4" wg pressure.

.3 Damper shall be labelled for dynamic or static systems as appropriate for the installed location.

.4 Frame shall be constructed on 16 ga (1.6) steel hat channel with mitered corners reinforced with die-formed corner gussets for strength.

.5 Damper blades shall be 14 ga (2.0) equivalent steel formed double skin, airfoil design.

.6 Damper shall be of opposed blade configuration with an interlocking blade design. Blade seals are not acceptable.

.7 Blade axels shall be double bolted at each end of the blade to provide positive locking connection.

.8 Bearings shall be sintered stainless steel type.

.9 Blade linkage shall be zero-maintenance, concealed in frame and out of the air stream.

.10 Each damper shall be complete with a UL listed fusible link that will cause the damper to close and lock in closed position by means of an over centre/knee lock linkage for assured closure.

.11 Each damper shall be provided with an internal manual locking quadrant(s) for setting and locking of blades in desired position.

.12 Provide a steel sleeve of appropriate gauge and length for the assembly being penetrated.

.13 Provide a 40 mm x 40 mm x 3 mm (1½" x 1½" x 16ga) retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.

.14 Fire damper assemblies and type to meet requirements of provincial fire authority and authority having jurisdiction.

.15 Acceptable materials:

.1 Ruskin

.2 Nailor

.3 E.H. Price

.4 T.A. Morrison

.5 Tamco

.6 Greenheck

.7 Ventex/Alumavent

Part 3 Execution

3.1 INSTALLATION

.1 Provide where indicated and at all fire rated partitions indicated, on architectural drawing.

.2 Install in accordance with ANSI/NFPA 90A and in accordance with conditions of ULC listing.

.3 Maintain integrity of fire separation.

.4 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.

.5 Install access door adjacent to each damper.

.6 Coordinate with installer of firestopping.

.7 Static fire dampers: Only on transfer air ducts where ductwork is not connected to a fan/blower.

.8 Dynamic fire dampers: In all duct work where air is moved by a fan/blower.

3.2 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.2 Warranty Duration:

.1 One (1) year warranty period applies.

.3 Warranty Coverage:

.1 Applies to parts and labour.

END OF SECTION

Part 1 General

1.1 CODES AND STANDARDS

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.

.3 CAN/ULC-S112, Standard Method of Fire Test of Fire Damper Assemblies.

.4 CAN/ULC-S112.1, Standard Method of Fire Test of Ceiling Firestop Flap Assemblies.

.5 ULC-S505, Fusible Links for Fire Protection Service.

.6 CAN/ULC-S524, Installation of Fire Alarm Systems

.7 CAN/ULC-S1001.11, Integrated Systems Testing of Fire Protection and Life Safety Systems.

1.2 PRODUCT DATA

.1 Submit product data in accordance with general requirements indicating the following:

.1 Damper type

.2 Operators

.3 Fusible links

.4 Smoke detectors

.5 Power requirements

.6 Size, orientation, construction

1.3 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

1.4 MAINTENANCE MATERIALS

.1 Provide the following:

.1 Six (6) fusible links of each type.

1.5 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

Part 2 Products

2.1 SMOKE DAMPERS

.1 Provide a complete system, consisting of the damper, damper actuator, smoke detector with duct sample tube, sleeve and all other components necessary for a complete and operable system. **The assembly shall be factory assembled as a single unit**. Field assembly shall be permitted at contractor discretion provided all listings are maintained and the installation follows all manufacturer installation guidelines.

.2 Damper

- .1 Damper shall be ULC listed and labelled
- .2 Both damper and damper actuator to be ULC listed and labelled.
- .3 Normally closed smoke/seal: folding blade type. Blade edge seals of flexible stainless steel shall provide required constant sealing pressure. Stainless steel negator springs with locking devices shall ensure positive closure for units.
- .4 Damper shall have Class I leakage rating.
- .5 Suitable for horizontal or vertical installations.
- .6 Damper Material: Damper material shall match ductwork it is installed in (i.e., stainless steel in laboratory). Refer to specification section 23 31 13 Metal Ducts.

.3 Actuator

- .1 Actuator shall be ULC listed and labelled
- .2 Motorized actuator: 2-position, spring return, normally open with power on. When power is interrupted damper shall close automatically. Upon return of power, damper shall automatically reset open. Actuators are to be located outside of airstream, unless otherwise specified or shown on drawings.
- .3 Exterior visualization of damper position.
- .4 Damper actuator end switches for monitoring damper position by the BAS.
- .5 Where the FSD is mounted immediately behind a sidewall grille the actuator shall be mounted inside the ductwork to avoid an additional access door beside the grille.

.4 Factory sleeve.

- .1 Type and style: matching application.

.5 Operating Temperature: 0° Celsius to 99° Celsius ambient temperature rating for 300 fpm to 4000 fpm air velocity.

.6 Smoke Detector:

- .1 ULC approved photoelectric duct smoke detector.
- .2 Operates from 300 to 3000 ft/min air velocity (fan system), -4 to 158°F temperature, and 0 to 95% non-condensing humidity.
- .3 Operates from 100 to 4000 ft/min air velocity, -4 to 158°F temperature and 0 – 95% non-condensing humidity (transfer ducts).
- .4 Test/reset button with LED display.

.5 The detector housing shall be ULC listed specifically for use in air handling systems; capable of local testing via magnetic switch and test button; duct mounted smoke detector with sampling tube, housing.

.6 The detector shall incorporate separate 2.0A 30VDC Alarm and Supervisory contacts. Alarm contacts shall be normally open (N.O.) in which closed contacts will indicate an alarm condition to the fire alarm panel. Supervisory contacts shall be normally closed (N.C.) in which open contacts will indicate a trouble condition to the fire alarm panel.

.7 Where the SD is mounted immediately behind a sidewall grille the smoke detector shall be mounted inside the ductwork to avoid an additional access door beside the grille.

.7 Damper assembly to operate at 120V with single point power connection.

.8 Large damper sizes can be provided in multiple sections. Field assembly is acceptable following manufacturer's installation guidelines.

.9 Size: as indicated on drawings.

.10 Detectors and electrical components within the airstream shall be classified for use in a Class I, Zone 2 system (as defined by the Electrical Safety Code).

.11 Acceptable Manufacturers:

.1 E H Price

.2 NCA Ltd.

.3 Nailor Industries Inc.

.4 Ruskin

.5 Alumavent

.6 United Enertech

.7 Safeair-Dowco (stainless steel)

.8 Pottorff

2.2 COMBINATION FIRE AND SMOKE DAMPERS

.1 Provide a complete system, consisting of the damper, damper actuator, smoke detector with duct sampling tube, sleeve and all other components necessary for a complete and operable system. **The assembly shall be factory assembled as a single unit.** Field assembly shall be permitted at contractor discretion provided all listings are maintained and the installation follows all manufacturer installation guidelines.

.2 Damper

.1 Damper shall be ULC listed and labelled

.2 Both damper and damper actuator to be ULC listed and labelled.

.3 Normally closed smoke/seal: folding blade type. Blade edge seals of flexible stainless steel shall provide required constant sealing pressure. Stainless steel negator springs with locking devices shall ensure positive closure for units.

.4 Damper shall have Class I leakage rating.

.5 Suitable for horizontal or vertical installations.

.6 Damper Material: Damper material shall match ductwork it is installed in (i.e., stainless steel in laboratory). Refer to specification section 23 31 13 Metal Ducts.

.3 Actuator/Link

.1 Actuator shall be ULC listed and labelled

.2 Motorized actuator: 2-position, spring return, normally open with power on. When power is interrupted damper shall close automatically. Upon return of power, damper shall automatically reset open. Actuators are to be located outside of airstream, unless otherwise specified or shown on drawings.

.3 Exterior visualization of damper position.

.4 Damper actuator end switches for monitoring damper position by the BAS.

.5 Combined actuator: electrical control system actuated from smoke sensor or smoke detection system and from fusible link.

.6 Fusible link, or electric re-settable link (ERL).

.7 Electric fire sensor capable of remote openable control is to be provided in place of fusible link where specifically indicated in project documents.

.8 Where ERL or electric fire sensor is used in place of fusible link, this device shall fail closed upon power failure.

.9 Where the FSD is mounted immediately behind a sidewall grille the actuator shall be mounted inside the ductwork to avoid an additional access door beside the grille.

.4 Factory sleeve.

.1 Type and style: matching application.

.5 Operating Temperature: 0° Celsius to 99° Celsius ambient temperature rating for 300 fpm to 4000 fpm air velocity.

.6 Smoke Detector:

.1 ULC approved photoelectric duct smoke detector;

.2 Operates from 300 to 3000 ft/min air velocity (fan systems), -4 to 158°F temperature, and 0 to 95% non-condensing humidity;

.3 Operates from 100 to 4000 ft/min air velocity, -4 to 158°F temperature and 0 – 95% non-condensing humidity (transfer ducts)

.4 Test/reset button with LED display;

.5 The detector housing shall be ULC listed specifically for use in air handling systems; capable of local testing via magnetic switch and test button; duct mounted smoke detector with sampling tube, housing

.6 The detector shall incorporate separate 2.0A 30VDC Alarm and Supervisory contacts. Alarm contacts shall be normally open (N.O.) in which closed contacts will indicate an alarm condition to the fire alarm panel. Supervisory contacts shall be normally closed (N.C.) in which open contacts will indicate a trouble condition to the fire alarm panel.

.7 Where the FSD is mounted immediately behind a sidewall grille the smoke detector shall be mounted inside the ductwork to avoid an additional access door beside the grille.

.7 Damper assembly to operate at 120V with single point power connection.

.8 Large damper sizes can be provided in multiple sections. Field assembly is acceptable following manufacturer's installation guidelines.

.9 Fire rating to match wall assembly i.e. 1 hour/1 ½ hour/2 hour/ 3 hour.

.10 Size: as indicated on drawings.

.11 Detectors and electrical components within the airstream shall be classified for use in a Class I, Zone 2 system (as defined by the Electrical Safety Code).

.12 Acceptable Manufacturers:

.1 E H Price

.2 NCA Ltd.

.3 Nailor Industries Inc.

.4 Ruskin

.5 Alumavent

.6 United Enertech

.7 Pottorff

.8 Safeair-Dowco (stainless steel)

.9 Pottorff

2.3 LOCATION OF SMOKE DETECTORS

.1 Ontario Building Code Section 3.1.8.11 requires the smoke detector to be installed downstream of the damper.

.2 Ship units to site to suit supply or return/exhaust configuration.

.3 The contractor shall be responsible to cover all costs of a qualified Electrician/Fire Alarm Technician should field relocation of the damper components be required.

2.4 TRANSFER DUCTS

.1 In accordance with OBC 3.1.8.11, provide secondary smoke detector at all transfer ductwork. Smoke detector shall be installed on both sides of rated separation.

.2 This contractor shall be responsible to cover all costs of a qualified Electrician/Fire alarm Technician to field supply, install, and wire the secondary detectors.

.3 This contractor shall extend transfer ductwork and acoustic lining to facilitate proper installation and clearance requirements.

2.5 NUMBER OF AIR TYPE SMOKE DETECTORS

.1 Where air velocities are greater than 1.5 m/s (300 feet per second), one air duct type detector shall be installed for every 1.5 meters square (16 square feet) of cross-sectional duct area.

.2 Where air velocities are less than 1.5 m/s (300 feet per second), one duct type smoke detector shall be installed for every 0.5 meters square (5.3 square feet) or cross-sectional duct area.

2.6 PRESSURE RELIEF DOORS

.1 Frames shall be Z-shape, 12 gage (2.8) galvanized steel.

.2 Door shall be 12 gage (2.8) galvanized steel, hinged on one side.

.3 Seal shall be around the door perimeter allowing no more than 7 cfm/ft2 at 1.0 inch w.g..

.4 Door shall include stainless steel springs to close door upon pressure relief and system shutdown.

.5 All release mechanisms, springs and parts shall be completely out of airstream.

.6 Pressure relief settings available from 2" (0.5 kPa) to 10" (2.49 kPA) increments of 1" w.g. (0.25 kPa). Supplier shall examine plans to provide appropriate pressure relief based on associated air handling system.

.7 Pressure relief mechanism shall be factory calibrated in an AMCA Registered Laboratory.

.8 Pressure Relief Doors shall be provided as indicated in the execution section.

Part 3 Execution

3.1 INSTALLATION

.1 Provide smoke dampers where indicated and at all duct penetrations through smoke barrier partitions indicated on architectural drawings.

.2 Provide combination fire and smoke dampers where indicated and at all duct penetrations through fire rated smoke barrier partitions indicated on architectural drawings. To provide separated fire dampers and smoke dampers, obtain approval from the consultant for the alternate arrangement.

.3 Provide pressure relief doors (both positive and negative as applicable) as follows:

.1 For all systems with a combination fire smoke or smoke damper in the duct main of the system when:

.1 The system operates at static pressure of 1.0 inches w.g. or higher; and

.2 More than 50% of the system airflow passes through the combination fire/smoke or smoke damper.

.2 Where/as indicated on the plans.

.4 Install in accordance with ANSI/NFPA 90A, in accordance with conditions of ULC listing and manufacturer's recommendation.

.5 Maintain integrity of smoke separation and fire rating.

.6 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.

.7 Install access door adjacent to each damper and smoke detector.

.8 Front grille access for through wall dampers that terminate in a grille is acceptable.

.9 Provide proper firestopping and duct seal to fire barrier wall.

.10 Confirm proper operation and test sheets.

.11 Should contractor provide separated devices mount smoke detector downstream of damper and within 1.5 m (5 ft) of damper.

.12 Ensure access doors/panels, fusible links, damper actuators and sensors are easily observed and accessible.

3.2 LOCATION OF SMOKE DETECTORS

.1 Ontario Building Code Section 3.1.8.11 requires the smoke detector to be installed downstream of the damper.

.2 Ship units to site to suit supply or return/exhaust configuration.

.3 The contractor shall be responsible to cover all costs of a qualified Electrician/Fire Alarm Technician should field relocation of the damper components be required.

3.3 TRANSFER DUCTS

.1 In accordance with OBC 3.1.8.11, provide secondary smoke detector at all transfer ductwork. Smoke detector shall be installed on both sides of rated separation.

.2 This contractor shall be responsible to cover all costs of a qualified Electrician/Fire alarm Technician to field supply, install, and wire the secondary detectors.

.3 This contractor shall extend transfer ductwork and acoustic lining to facilitate proper installation and clearance requirements.

3.4 PROTECTION

.1 Contractor is to ensure all fire smoke dampers detectors are protected from dust, dirt, humidity, and water at all times during construction. This applies to detectors installed, stored on site or stored in storage containers. Contractor shall seal all open-ended ductwork on site at all times. Failure to properly protect dampers, ductwork and detectors will result in the Contractor cleaning all dampers and ductwork. Any detectors that are damaged or dirty shall be replaced at the contractor’s expense.

3.5 WIRING

.1 All fire alarm wiring shall be 1 hour rated and in conduit or as per electrical fire alarm wiring requirement.

3.6 CLEANING

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools, and equipment.

3.7 INTEGRATED LIFE SAFETY SYSTEMS TESTING

.1 Prior to the building Integrated Life Safety Systems Testing the mechanical contractor shall commission/verify the operation of all installed smoke dampers.

.2 Participate in the Integrated Life Safety Systems Testing to confirm proper operation of all operating smoke dampers and associated Life Safety Systems (i.e. fire alarm).

.3 This contractor shall work with the Integrated Life Safety Contractor and reset all systems back into proper operation.

.4 Include all costs associated with participation Integrated Life Safety System Testing in the tender value.

3.8 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.2 Warranty Duration:

.1 One (1) year warranty period applies.

.3 Warranty Coverage:

.1 Applies to parts and labour.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 This section applies to operating dampers not specified in Controls Section.

1.2 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

1.3 PRODUCT DATA

.1 Submit product data in accordance with general requirements.

.2 Indicate the following:

.1 Performance data.

1.4 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

1.5 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency.

Part 2 Products

2.1 MOTORIZED DAMPERS

.1 Opposed blade type.

.2 Extruded aluminum, interlocking blades, complete with extruded vinyl seals, spring stainless steel side seals, extruded aluminum frame.

.3 Pressure fit self-lubricated bronze bearings.

.4 Linkage: plated steel tie rods, brass pivots and plated steel brackets, complete with plated steel control rod.

.5 Operator: Refer to BAS Section.

.6 Performance:

.1 Leakage: in closed position to be less than 2% of rated air flow at 250 kPa (36 psi) differential across damper.

.2 Pressure drop at full open position to be less than 100 kPa (15 psi) differential across damper.

.7 Insulated aluminum dampers:

.1 Frames: insulated with extruded polystyrene foam with R factor of 5.0.

.2 Blades: constructed from aluminum extrusions with internal hollows insulated with polyurethane or polystyrene foam, R factor of 5.0.

.3 Use on services to the exterior.

.8 Acceptable materials:

.1 Honeywell

.2 Johnson

.3 T. A. Morrison

.4 National Controlled Air (NCA)

.5 Tamco

.6 Ruskin

.7 Nailor

.8 Henderson Industrial

.9 Ventex/Alumavent

2.2 DISC TYPE DAMPERS

.1 Frame: brake formed, welded, 1.6 mm (16 gauge) thick, Type Z90 galvanized steel to ASTM A653/A653M.

.2 Disc: spin formed, 1.6 mm (16 gauge) thick, Type Z90 galvanized steel to ASTM A653/A653M.

.3 Gasket: extruded neoprene, field replaceable, with 10 year warranty.

.4 Bearings: roller self lubricated and sealed.

.5 Operator: compatible with damper, linear stroke operator, spring loaded actuator, zinc-aluminum foundry alloy casting cam follower.

.6 Performance:

.1 Leakage: in closed position to be less than 0.001% of rated air flow at 100 kPa (15 psi) pressure differential across damper.

.2 Pressure drop: at full open position to be less than 100 kPa (15 psi) differential across damper.

.7 Acceptable material:
Duro Dyne
Henderson Industrial

2.3 BACK DRAFT DAMPERS

.1 Automatic gravity operated, multi leaf, aluminum construction with nylon bearings, centre pivoted or counterweighted, as indicated.

.2 Acceptable materials:

.1 T.A. Morrison
.2 Tamco Series 7000
.3 Ruskin
.4 Nailor
.5 National Controlled Air (NCA)
.6 Henderson Industrial
.7 Ventex/Alumavent

Part 3 Execution

3.1 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.

.3 Seal multiple damper modules with silicon sealant.

.4 Install access door adjacent to each damper. See Duct Accessories Section.

.5 Insulated dampers on all outside air intake and exhaust damper.

.6 Non-insulated dampers on all interior motorized dampers not exposed to outside air.

3.2 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.2 Warranty Duration:

.1 One (1) year warranty period applies.

.2 Disk type dampers gasket: Ten (10) years warranty.

.3 Warranty Coverage:

.1 Applies to parts and labour.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 CAN/ULC-S110, Standard Methods of Test for Air Ducts.

.3 UL 181, Factory Made Air Ducts and Air Connectors.

.4 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.

.5 ANSI/NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.

.6 SMACNA HVAC Duct Construction Standards - Metal and Flexible.

1.2 PRODUCT DATA

.1 Submit product data in accordance with general requirements.

.2 Indicate the following:

.1 Thermal properties.

.2 Friction loss.

.3 Acoustical loss.

.4 Leakage.

.5 Fire rating.

1.3 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

Part 2 Products

2.1 GENERAL

.1 Factory fabricated to CAN/ULC S110.

.2 Pressure drop coefficients listed below are based on relative sheet metal duct pressure drop coefficient of 1.00.

.3 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.

2.2 METALLIC INSULATED

.1 Spiral wound flexible aluminum with factory applied, 25 mm (1") thick flexible glass fibre thermal insulation with vapour barrier and vinyl jacket, Class 1 duct material.

.2 Performance:

.1 Factory tested to 2.5 kPa (10" w.c.) without leakage.

.2 Maximum relative pressure drop coefficient: 3.

.3 Operating pressure: 300 mm (12”).

.3 Acceptable materials:

.1 Flexmaster T/L – VT

.2 Ductmate

Part 3 Execution

3.1 DUCT INSTALLATION

.1 Install in accordance with: SMACNA.

.2 Maximum length of flexible duct: 1.8 m (6' 0").

.3 Minimum length of acoustical ductwork; 1.5 m (5' 0") with minimum of 1 bend.

.4 Provide support at centre of flexible duct with 25 mm (1") wide galvanized hanger.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 SMACNA HVAC Duct Construction Standards, Metal and Flexible.

.3 ASTM C553, Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.4 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.

.5 ANSI/NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.

1.2 PRODUCT DATA

.1 Submit product data in accordance with general requirements.

Part 2 Products

2.1 DUCT LINER

.1 General:

- .1 Rigid fibrous glass duct liner: air stream side faced with mat facing.
- .2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50 when tested in accordance with CAN/ULC-S102.
- .3 Acceptable material:
  - .1 Johns Manville, Permacote Linacoustic R-300
  - .2 Owen Corning

.2 Rigid:

- .1 Use on flat surfaces.
- .2 25 mm (1") thick, to CGSB 51-GP-10M, fibrous glass rigid board duct liner.
- .3 Density: 36 kg/m² (7.4 lb/ft²).
- .4 Thermal resistance to be minimum 750 mm (30") C/W for 25 mm (1") thickness 1150 mm (45") C/W for 40 mm (1½") thickness when tested in accordance with ASTM C177, at 24°C (75°F) mean temperature.

2.2 ADHESIVE

.1 Meet requirements of ANSI/NFPA 90A and ANSI/NFPA 90B.

.2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range -29°C (-20°F) to 93°C (200°F).

.3 Acceptable material:

- .1 Duro Dyne 1A-22
- .2 Ductmate

2.3 FASTENERS

.1 Weld pins 2.0 mm (14 gauge) diameter, length to suit thickness of insulation. Metal retaining clips, 32 mm (1¼") square.

.2 Acceptable material:

.1 Duro Dyne

.2 Ductmate

2.4 JOINT TAPE

.1 Poly-Vinyl treated open weave fiberglass membrane 50 mm (2") wide.

.2 Acceptable materials:

.1 Duro Dyne FT2

.2 Ductmate

2.5 SEALER

.1 Meet requirements of ANSI/NFPA 90A and ANSI/NFPA 90B.

.2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range -68°C (-90F) to 93°C (200°F).

.3 Acceptable materials:

.1 Duro Dyne 1A-94

.2 Ductmate

Part 3 Execution

3.1 GENERAL

.1 Do work in accordance with recommendations of SMACNA duct liner standards as indicated in SMACNA HVAC Duct Construction Standards, Metal and Flexible, except as specified otherwise.

.2 Line inside of ducts where indicated.

.3 Duct dimensions, as indicated, are clear inside duct lining.

.4 Provide an interior of ductwork from fans from minimum distance of 3 m (10'-0").

3.2 DUCT LINER

.1 Install in accordance with manufacturer's recommendations, and as follows:

.1 Fasten to interior sheet metal surface with 100% coverage of adhesive.

.2 In addition to adhesive, install weld pins not less than 2 rows per surface and not more than 300 mm (12") on centres.

.2 Weld pins are to have cupped or beveled heads to prevent damage to lining surface.

.3 Store foam liners away from sunlight.

3.3 JOINTS

.1 Seal all butt joints, exposed edges, weld pin and clip penetrations and all damaged areas of liner with joint tape and sealer. Install joint tape in accordance with manufacturer's recommendations, and as follows:

.1 Bed tape in sealer.

.2 Apply 2 coats of sealer over tape.

.2 Replace damaged areas of liner at discretion of Consultant.

.3 Protect leading and trailing edges of each duct section with sheet metal nosing having 15 mm (1/2") overlap and fastened to duct.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 AMCA 99, Standards Handbook.

.3 ANSI/AMCA 210, Laboratory Methods of Testing Fans for Certified Aerodynamics Performance Rating.

.4 AMCA 300, Revised 1987, Reverberant Room Method for Sound Testing of Fans.

.5 AMCA 301, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

.6 ANSI/ASHRAE 51, Laboratory Methods of Testing Fans for Certified Aerodynamics Performance Rating.

.7 ANSI/NFPA 96 – Ventilation Control and Fire Protection of Commercial Cooking Operations.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with general requirements.

.2 Product data to include fan curves and sound rating data.

1.3 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for incorporation into manual specified in general requirements.

1.4 CERTIFICATION OF RATINGS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered from independent testing agency signifying adherence to codes and standards in force.

.2 Provide confirmation of testing.

Part 2 Products

2.1 FANS GENERAL

.1 Capacity: flow rate, total static pressure Pa, r/min, W (" w.c., r/min, bhp) model and size and sound ratings as indicated on schedule.

.2 Statically and dynamically balanced. Constructed in conformity with AMCA 99.

.3 Sound ratings: comply with AMCA 301, tested to AMCA 300.

.4 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210, and ANSI/ASHRAE 51.

.5 Bearings: sealed lifetime of self aligning type with oil retaining dust excluding seals and a certified minimum rated life of 80,000 100,000 h in accordance with AFBMA L10 life standard. Bearings to be rated and selected in accordance with AFBMA 9 and AFBMA 11.

.6 Acceptable materials:

.1 Penn-Barry
.2 Greenheck
.3 Cook
.4 Jenco (S & P)/Jenn
.5 Carnes
.6 Acme
.7 Zonex
.8 Nutone (Range hood only)
.9 Broan (Range hood only)
.10 Twin-City
.11 Ortech (Dryer booster only)
.12 Reversomatic (Dryer booster only)
.13 Fantech
.14 Aerovent

.7 Provide factory mounted speed control for all direct drive motors.

2.2 WALL EXHAUSTERS

.1 Centrifugal backward inclined or Axial fan units, V belt or direct driven as indicated.

.1 Spun aluminum [FRP] [PVC] housings, complete with resilient mounted motor and fan.
.2 15 mm (1/2") mesh 2.0 mm (79 mil) diameter aluminum birdscreen.
.3 Automatic gasketted aluminum backdraft dampers.
.4 Disconnect switch within fan housing.
.5 Cadmium plated securing bolts and screws.

.2 Eisenheiss coated wheel for fume service with motor out of air stream.

.3 Housings:

.1 Provide with rubber or neoprene grommets for wiring passages, integral attachment collar, or angle ring mounted to mating flanged wall sleeve with full gasketting.
.2 Discharge pattern: away from building.

.4 Size, type, and capacity: as indicated.

2.3 ROOF EXHAUSTERS

.1 Centrifugal V belt or direct driven as indicated.

.1 Housing: spun aluminum complete with resilient mounted motor and fan.

.2 Impeller: aluminum non-overloading.

.3 Adjustable motor sheave

.4 15 mm (1/2") mesh 2.0 mm (79 mil) diameter aluminum bird screen.

.5 Automatic gasketed aluminum backdraft dampers.

.6 Provide insulated motorized dampers on fan greater than 140 l/s (300 cfm). Damper motors suitable for 120/1/60 with end switch to star/stop fans. Wired into fan motor.

.7 Disconnect switch within fan housing.

.8 Continuous curb gaskets, cadmium plated securing bolts and screw, and sound insulating.

.2 Roof curbs; of same manufacturer as fan and built to suit model specified.

.3 Size, type, and capacity: as indicated

.4 To NFPA 96 requirements where indicated.

2.4 CABINET FANS – IN-LINE

.1 Fan characteristics and construction: As centrifugal fans.

.2 Casing floor mounted or cabinet hung single inlet aluminum wheel in factory fabricated casing complete with vibration isolators and seismic control measures, motor, V-belt drive and guard inside or outside casing as indicated.

.3 Fabricate casing of zinc coated or phosphate treated steel reinforced and braced for rigidity. Provide removable panels for access to interior. Uncoated, steel parts shall be painted over with corrosion resistant paint to CAN/CGSB 1.181. Internally line cabinet with 25 mm (1") thick rigid acoustic insulation, pinned and cemented bell mouth inlet cone.

.4 Size, type, and capacity: As indicated.

2.5 CEILING DISCHARGE FANS

.1 Centrifugal direct drive, with plug in type electric motor suitable for ceiling installation, zinc coated rectangular metal housing.

.2 Sizes and capacity: as indicated.

.3 Toggle switch operated complete with integral electrical outlet box with plug-in type receptacle.

.4 Side duct outlet with integral backdraft damper, size as indicated.

.5 Wall cap complete with spring loaded backdraft damper with neoprene gasket.

.6 Silver anodized aluminum grille paint finish.

2.6 RANGE HOOD EXHAUST FANS

.1 Centrifugal direct drive 750 mm (30") wide, suitable for under cabinet installation, enamel steel metal housing complete with halogen lights, colour selected by Consultant.

.2 Sizes and capacity: As indicated.

.3 Internal Toggle switch operated fan and light.

.4 Top or rear side 80 mm x 250 mm (3" x 10") rectangular duct outlet with integral backdraft damper.

.5 Wall cap complete with spring loaded backdraft damper with neoprene gasket.

.6 Aluminum mesh cleanable grease filter.

2.7 PROPELLER FANS

.1 Fabricate multibladed propellers of aluminum of airfoil shape within bell mouth entrance on integral mounts, with grease lubricated ball bearings, with extended lubrication fittings, suited for operating in any position, direct or (belt) driven, complete with motor as indicated.

.2 Provide blade guards, bird screen and automatic back draft dampers on discharge or intake, with gasketed edges.

.3 Provide insulated motorized dampers on fan great than 140 l/s (300 cfm). Damper motors suitable for 120/1/60 with end switch to star/stop fans. Wired into fan motor.

.4 Acceptable materials:

.1 Penn Barry

.2 Buffalo

2.8 DRYER BOOSTER FAN

.1 Provide a fully automatic dryer booster fan where indicated.

.2 Provide a Fantech DBLT or equal 100 mm (4") paintable galvanized lint trap complete with removable filter and 15 mm flange for flush mounting.

.3 Fan shall be inline complete with low profile, self cleaning backward inclined impeller and high efficiency meter suitable for 120/1/60.

.4 Provide a current sensing relay and turn over to Electrical Division for installation.

.5 All wiring shall be by Electrical Division.

.6 Acceptable material:

.1 Ortech SDF200 with Ortech AS0 sensor.

.2 Reversomatic ‘TLD’ Series with DAS 200 sensor.

2.9 CABINET FANS – IN-LINE

.1 Fan characteristics and construction: as centrifugal fans.

.2 Casing floor mounted or cabinet hung single inlet aluminum wheel in factory fabricated casing complete with vibration isolators and seismic control measures, motor, V-belt drive and guard inside or outside casing as indicated.

.3 Fabricate casing of zinc coated or phosphate treated steel reinforced and braced for rigidity. Provide removable panels for access to interior. Uncoated, steel parts shall be painted over with corrosion resistant paint to CAN/CGSB 1.181. Internally line cabinet with 25 mm (1") thick rigid acoustic insulation, pinned and cemented bell mouth inlet cone.

.4 Size, type, and capacity: as indicated.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Provide flexible duct connection at roofline.

.3 Provide backdraft damper at building exterior penetration.

3.2 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.2 Warranty Duration:

.1 One (1) year warranty period applies.

.3 Warranty Coverage:

.1 Applies to parts and labour.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Conference of Governmental Industrial Hygienists, Industrial Ventilation Manual of Recommended Practices, latest edition.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with general requirements.

.2 Indicate:

.1 Fan performance curves.

.2 Dust extractor.

.3 Inlet hood details.

1.3 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

1.4 MAINTENANCE MATERIALS

.1 Provide maintenance materials in accordance with general requirements.

.2 Furnish list of manufacturer's recommended spare parts for equipment such as bearings and seals, and addresses of suppliers, together with list of specialized tools necessary for adjusting, repairing or replacing, for placement into operating manual.

1.5 CERTIFICATION OF RATINGS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

Part 2 Products

2.1 EQUIPMENT CONNECTIONS

.1 Type of connections: provide as detailed complete with blast gates where noted.

.2 Prior to manufacturing confirm type and configuration with equipment supplier.

2.2 DUCTWORK

.1 Refer to Ductwork Section.

.2 Duct system shall include all equipment hoods, ductwork and equipment between the dust extractor and the owners supplied equipment including all blast gates, cleanouts, etc. as indicated.

2.3 DUST EXTRACTOR

.1 General

.1 Draw through filter dust extractor suitable for indoor installation complete with 1.5 KW (2 hp), 208/3/60 motor and 300 mm (12" diameter) dust canister. Capacity 448 l/s (950 cfm).

.2 Equipment:

.1 Acceptable materials:

.1 King Canada

.2 Oneida Air Systems

.3 Grizzly Industrial

.4 Busy Bee Tools

.2 Complete with wall mounting bracket, dust canister, magnetic starter and switch.

.3 Manufacturer shall ensure power requirements do not exceed specified capacity. Contract for equipment, which exceeds the specified capacity shall be the responsibility of the manufacturer.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Follow ACGIH industrial ventilation details.

.3 Make joints watertight and airtight.

.4 Install duct supports to manufacturer's recommendations.

.5 Install duct system after final installation of equipment. Adjust ductwork to suit.

.6 Connect to owner's supplied equipment using non-crush high pressure neoprene hoses with adapter.

3.2 TESTING

.1 Test assembled and sealed ductwork from fan inlet to suction inlets under 2.5 kPa pressure for 30 min. Leakage not to exceed 1% of design total air flow.

.2 Test apparatus to include calibrated orifice and manometer.

3.3 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.2 Warranty Duration:

.1 One (1) year warranty period applies.

.3 Warranty Coverage:

.1 Applies to parts and labour.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

1.2 PRODUCT DATA

.1 Submit product data in accordance with general requirements.

.2 Indicate the following:

.1 Performance data.

.2 Noise data.

.3 Physical dimensions.

1.3 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

1.4 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by an independent testing agency.

Part 2 Products

2.1 CONSTANT VOLUME BYPASS BOXES

.1 Maintains space condition by bypassing supply air to return air.

.2 Sizes, capacities, pressure loss as indicated.

.3 Complete with:

.1 Bypass collar for connection to return air duct.

.2 Minimum air volume stop.

.3 Controller and operator.

.4 Manual balancing damper.

.5 Multi-port outlets as indicated.

.6 Discharge silencer as indicated.

.4 Casing: constructed of 0.7 mm (22 gauge) thick galvanized steel, internally lined with 25 mm (1"), 0.7 kg/m2 (0.14 lb/ft2) density fibrous glass, to UL 181 and ANSI/NFPA 90A. Mount control components inside protective metal shroud.

.5 Damper: galvanized steel with peripheral gasket and self-lubricating bearings. Air leakage past closed damper not to exceed 2% of nominal rating at 750 Pa (3" w.c.) inlet static pressure, in accordance with Air Diffusion Council test procedure.

.6 Acceptable materials:

.1 Krueger
.2 EH Price
.3 Titus
.4 Barber Colman
.5 Carnes
.6 Nailor

Part 3 Execution

3.1 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.

.3 Install quick opening access door (with sash locks) adjacent to each damper.

.4 Install quick opening access door (with sash locks) downstream of heating coil.

.5 Install controls as per manufacturer’s requirements.

.6 Install with at least 100 mm (4") of flexible inlet ducting.

3.2 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.2 Warranty Duration:

.1 One (1) year warranty period applies.

.1 Warranty Coverage:

.1 Applies to parts and labour.

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

.1 Submit product data in accordance with general requirements.

.2 Indicate the following:

- .1 Capacity.
- .2 Throw and terminal velocity.
- .3 Noise criteria.
- .4 Pressure drop.
- .5 Neck velocity.

1.2 MAINTENANCE MATERIALS

.1 Include:

- .1 Keys for volume control adjustment.
- .2 Keys for air flow pattern adjustment.

1.3 MANUFACTURED ITEMS

.1 Grilles, registers and diffusers of same generic type to be product of one manufacturer.

1.4 CERTIFICATION OF RATINGS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

Part 2 Products

2.1 GENERAL

.1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.

.2 Frames:

- .1 Full perimeter gaskets.
- .2 Plaster frames where set into plaster or gypsum board and as specified.
- .3 Concealed fasteners.

.3 Concealed operators.

.4 Colour and Finish: standard as directed by Consultant.

.5 Acceptable materials:

.1 Krueger
.2 E.H. Price
.3 Nailor
.4 Titus
.5 Carnes
.6 Seiho
.7 Metalaire

2.2 RETURN AND EXHAUST GRILLES

.1 General: with opposed blade dampers as indicated, concealed manual operator and gaskets.

.2 Type, size, and capacity: refer to drawing schedule.

2.3 DIFFUSERS

.1 General: volume control dampers with flow straightening devices and blank-off quadrants, as indicated and gaskets.

.2 Type, size, and capacity: refer to drawing schedule.

2.4 SUPPLY GRILLES AND REGISTERS

.1 General: with opposed blade dampers as indicated, concealed manual operator and gaskets.

.2 Type, size, and capacity: refer to drawing schedule.

2.5 OPEN MESH SCREEN

.1 15 mm x 15 mm (½"x ½") open mesh screen fastened on 25 mm (1") border, screw fasten.

.2 On all open ends of ductwork and where indicated.

.3 Size: To match ductwork size.

2.6 DOOR GRILLES

.1 Heavy duty steel construction, sight proof, complete with flat border both sides, screwed fastening. Finish by Consultant (allow for premium/custom colours).

.2 Install door grille in door.

.3 Type, size, and capacity: refer to drawing schedule.

2.7 LINEAR BAR, WALL GRILLES

.1 Fixed 15° pattern, 15 mm (½") spacing, side wall mounted, narrow border, alignment pins concealed fastening.

.2 Plaster frame, sealing strip and accessories.

.3 Grilles to be continuous around entire bulkhead as indicated.

.4 Model: Kreuger 1850

.5 Provide grilles for blank space for continuous wall installation.

.6 Finish to approval of consultant.

.7 Type, size, and capacity: refer to drawing schedule.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Install with flat head screws in countersunk holes where fastenings are visible.

.3 Bolt grilles, registers and diffusers, in place

.4 Provide concealed safety chain on each grille, register and diffuser in gymnasium, similar game rooms, and on exposed diffusers, and elsewhere as indicated.

.5 Clean grilles upon completion.

.6 Paint ductwork beyond grilles, matte black where visible.

.7 Ensure all grilles, diffusers, etc. match opening sizes as indicated on the drawings and as fabricated on site by the contractor.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASTM E90, Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions, and Elements.

1.2 PRODUCT DATA

.1 Submit product data in accordance with general requirements.

.2 Indicate the following:

.1 Pressure drop.

.2 Face area.

.3 Free area.

.4 Colour and finish.

1.3 CERTIFICATION OF RATINGS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

1.4 TEST REPORTS

.1 Submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E90.

Part 2 Products

2.1 GOOSENECK HOODS

.1 Thickness: to ASHRAE and SMACNA.

.2 Fabrication: to ASHRAE and SMACNA.

.3 Joints: to ASHRAE and SMACNA and or proprietary manufactured duct joint.

.1 Acceptable material:
Ductmate Canada
Exanno Nexus

.4 Supports: as indicated.

.5 Complete with integral birdscreen of 2.7 mm (12 gauge) diameter aluminum wire. Use 15 mm (1/2") mesh on exhaust 20 mm (3/4") mesh on intake.

.6 Vertical or Horizontal backdraft dampers as required.

.7 Prefabricated roof curb through roof complete with insulation and counter flashing.

2.2 FIXED LOUVRES – ALUMINUM

.1 Construction: welded with exposed joints ground flush and smooth.

.2 Material: extruded aluminum alloy 6063-T5.

.3 Blade: **drainable blade pattern** with centre watershed in blade, reinforcing bosses and maximum blade length of 1500 mm (60").

.4 Frame, head, sill and jamb: 100 mm (4") deep one piece extruded aluminum, minimum 3 mm (1/8") thick with approved caulking slot, integral to unit.

.5 Mullions: at 1500 mm (60") maximum centres.

.6 Fastenings: stainless steel (Society of Automotive Engineers) SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.

.7 Screen: 15 mm (1/2") exhaust 20 mm (3/4") intake mesh, 2 mm (5/64") diameter wire aluminum birdscreen on inside face of louvres in formed U-frame.

.8 Finish: Kynar 500
Colour: to Consultant's approval. Allow for 2 premium colours.

.9 Acceptable materials:
Ventex 2435
Greenheck
Construction Specialties
E.H. Price
Krueger
Ruskin
Ventmaster
Ventex
Nailor

2.3 BRICK VENTS (FLANGE FRAME)

.1 Construction: welded with exposed joints ground flush and smooth.

.2 Material: extruded aluminum alloy 6063-T5.

.3 Blade: stormproof pattern.

.4 Perimeter flange frame, head, sill and jamb: 40 mm (1½") deep one-piece extruded aluminum, minimum 3 mm (1/8") thick with approved caulking slot, integral to unit.

.5 Fastenings: stainless steel (Society of Automotive Engineers) SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.

.6 Screen: 15 mm (1/2") exhaust 20 mm (3/4") exhaust mesh, 2 mm (5/64") diameter wire aluminum birdscreen on inside face of louvres in formed U-frame.

.7 Finish: Kynar 500

Colour: to Consultant's approval. Allow for 2 premium colours.

.8 Options:

.1 Straight duct extension.

.2 Perimeter flange frame.

.9 Acceptable materials:

Ventex 2115
Greenheck Model BVF
Construction Specialties
E.H. Price
Krueger
Ruskin
Ventmaster
Nailor

2.4 THIN LINE FIXED LOUVRES – ALUMINUM

.1 Construction: welded with exposed joints ground flush and smooth.

.2 Material: extruded aluminum alloy 6063-T5.

.3 Blade: stormproof pattern with centre watershed in blade, reinforcing bosses and maximum blade length of 1500 mm (60").

.4 Perimeter flange frame, head, sill and jamb: 50 mm (2") deep one piece extruded aluminum, minimum 3 mm (1/8") thick with approved caulking slot, integral to unit

.5 Fastenings: stainless steel (Society of Automotive Engineers) SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.

.6 Screen: 20 mm (3/4"), 2 mm (5/64") diameter wire aluminum birdscreen on inside face of louvres in formed U-frame.

.7 Finish: Kynar 500
Colour: to Consultants approval. Allow for 2 premium colours

Acceptable materials:
Ventex 2115
Greenheck
Construction Specialties
E.H. Price
Krueger
Ruskin
Ventmaster
Nailor

2.5 ALUMINUM WALL CAPS (CLOTHES DRYER)

.1 Application: Clothes dryer or as noted on drawings.

.2 0.3 mm (16 gauge) aluminum wall sleeve sized as noted on plans.

.3 0.3 mm (16 gauge) sloping exterior wall cap with integral sides, base plate, and 25 mm (1") perimeter flange with 4-hole screw fasten. Fasteners at each corner.

.4 Bottom outlet with removable 15 mm x 15 mm (1/2") x (1/2") aluminum screen.

.5 Neoprene backdraft damper with aluminum crimp on bottom edge.

.6 Acceptable materials:

.1 Reversomatic

.2 Broan

.3 Ventex

.4 Shop fabricated (submit sample for approval).

2.6 GRAVITY ROOF OUTSIDE AIR INTAKES AND RELIEF VENTS

.1 Factory manufactured louvred penthouse.

.1 3 mm (1/8") thick stormproof extruded aluminum louvers with mitred corners. Brace and support louvres at 1500 mm (5') intervals.

.2 2 mm (0.081") thick insulated aluminum sheet roof.

.3 Constructed of 50 mm x 50 mm x 6 mm (2" x 2" x ¼") aluminum angles for roof support and corner angle.

.4 15 mm x 15 mm x 0.063 diameter (½" x ½" x 1.6" diameter) intercrimp aluminum screen on back of all sides.

.2 Provide roof curb sized to suit penthouse or flat or sloped roof as required or indicated. Curb to place bottom louvre minimum 600 mm (24") above roof.

.3 Maximum throat velocity 3.3 m/s (11 ft/s) intake.

.4 Maximum loss through unit: 15 Pa (0.06" in w.c.) static pressure.

.5 Finish as specified by consultant.

.6 Shape and size as indicated.

.7 Acceptable manufacturers:
Greenheck WRH
Nailor 1720
Carnes GLAB
Penn Barry
Ventex

Part 3 Execution

3.1 INSTALLATION

.1 In accordance with manufacturers and SMACNA recommendations.

.2 Reinforce and brace air vents, intakes and goosenecks as indicated.

.3 Anchor securely into opening.

.4 Seal with caulking all around to ensure weather tightness.

END OF SECTION

Part 1 wGeneral

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ANSI/NFPA 96, Ventilation Control and Fire Protection of Commercial Cooking Operations.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with general requirements.

1.3 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements

1.4 CERTIFICATION OF RATINGS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

Part 2 Products

2.1 BOX CANOPY FILTER HOOD

.1 General Description:

.1 The filter hood shall be suitable for all cooking equipment.

.2 The hood shall be ceiling hung with a recommended mounting height of 1981 mm (6' - 6") from the finished floor. The hood shall be finished in a No. 4 stainless steel finish on all exposed sides.

.2 Efficiency:

.1 The hood shall be equipped with high efficiency UL/ULC listed baffle grease filters. The exhaust air shall accelerate through multiple turns within the baffle filter.

.2 The liquefied grease shall drain down the baffles, along the grease trough, and into a grease cup.

.3 Spring Air Systems FD-B Hood

.1 The filter hood shall be box canopy, high efficiency, filter hood, UL/ULC listed, and built-in accordance with the NFPA-96. The unit casing shall be a minimum 18 ga. stainless steel on all exposed surfaces.

.2 The filter hood shall include UL/ULC listed baffle grease filters mounted in an integral stainless steel rack inclined at 45 degrees.

.3 The filter rack shall include a full length stainless steel grease gutter and grease cup.

.4 The fire damper shall be an arrangement “D”, butterfly type, constructed of stainless steel with metal blade and edge seals. The fire damper shall be activated by a fusible link and dead weight arrangement.

.5 The hood shall have LED lights evenly spaced along the length of the hood.

.6 Accessories:

.1 Stainless steel No. 4 finish fascia panel.

.2 Spacer from wall.

.7 Acceptable Materials

.1 Spring Air

.2 Garland

.3 CaptiveAire

.4 Halton

2.2 GREASE FILTER TYPE

.1 To NFPA 96.

.2 ULC labelled.

.3 Configuration: as indicated.

.4 Materials:

.1 Welded type 304 stainless steel

.2 Lights: Incandescent vapour proof.

.3 Washable filters.

.4 Drain connector.

.5 Performance: as indicated.

.6 Acceptable materials:

.1 Spring Air

.2 Garland

.3 Halton

.4 CaptiveAire

2.3 FIRE SUPPRESSION SYSTEM

.1 Fire detection and suppression system: ULC listed and labeled, wet chemical pre-engineered fixed nozzle type for appliances, filters and ductwork.

.2 Automatic gas shut off valve.

.3 Manual and automatic dump system. Automatic actuation shall be provided by an appropriate number of fuse link detectors mounted in series on a stainless steel wire input line to the control head. Manual actuation shall be provided by turning a handle on the primary head and/or by an optional remote pull station with a dedicated stainless steel input line to the control head.

.4 Cable and conduit system.

.5 Bottle capacity to meet demand. Submit sizing with shop drawings.

.6 The cartridge shall be an integral part of the control head assembly. The wet chemical storage cylinder shall be D.O.T.-rated for stored pressure of 225 psig, and a pressure gauge shall be provided on the cylinder valve for visual inspection.

.7 Nozzles in exhaust duct, hood plenum, and appliance protection.

.8 Engineered drawings (stamped) and field review by a Professional Engineer submitted to the consultants and authority having jurisdiction. Same Professional Engineer to provide sigh-off for the operation.

.9 Engineered drawings (stamped) and field review by a Professional Engineer submitted to the consultants and authority having jurisdiction. Same Professional Engineer to provide sigh-off for the operation.

.10 Gas solenoid valve and trim.

.11 Acceptable materials:

.1 Spring Air

.2 Garland

.3 Pyro-Chem

.4 CaptiveAire

2.4 FIRE BARRIER DUCT WRAP

.1 Fire Barrier Duct Wrap 15A blanket, thickness as approved by manufacturer.

.2 Aluminum foil tape.

.3 Minimum ¾ in. (19 mm) wide filament tape.

.4 Carbon steel or stainless steel banding material, minimum 1/2 in. (12,7 mm) wide, minimum 0.015 in. (0,38 mm) thick, with steel banding clips.

.5 Hand banding tensioner, crimping tool, and banding cutter. Minimum 12 gauge copper-coated steel insulation pins; galvanized steel speed clips, minimum 1-1/2 in. (38 mm) square or 1-1/2 in. (38 mm) dia. round, or equivalent sizes insulated cup head pins; capacitor discharge stud gun.

.6 Access door hardware: four galvanized steel thread rods, ¼ in. (6 mm) diameter by 4-1/2 in. to 5 in. long (114 mm to 127 mm) with ¼ in. (6 mm) wing nuts and ¼ in. (6 mm) washers: 4 in. (102 mm) long steel hollow tubing to fit threaded rods.

.7 Acceptable materials:

.1 3M Fire Barrier 1000 N/S, 1003 S/L or 2000+ Silicone Sealant.

.2 CL4FIRE

2.5 FIRE BLANKET

.1 100% non-combustible fire-retardant glass fibre, non-toxic, non-conductor, cleanable complete with straps.

.2 Size: 1 m x 1 m (40" x 40").

.3 Cabinet to be surface mounted, 400 mm x 300 mm (16" x 12").

.4 Mount on wall in kitchen area where indicated or directed on site by consultant.

.5 Manufacturer:
National FB 4040 blanket
FB 6078 MC cabinet.

Part 3 Execution

3.1 INSTALLATION

.1 Install hoods in accordance with manufacturers instructions.

.2 Install hoods in accordance with NFPA 96 standards.

3.2 EXHAUST SYSTEM TESTING

.1 Test exhaust and ductwork system in accordance with local authority requirements. Provide written documentation and verification of acceptance.

.2 Testing existing systems where modified or altered.

.3 Provide all equipment to provide testing of system.

3.3 FIRE SUPPRESSION SYSTEM

.1 Adequate capacity for number of nozzles.

.2 Nozzles over each appliance.

.3 Nozzles to protect filter plenum and exhaust duct.

.4 To automatically shut off gas and/or electricity to appliances upon activation.

.5 Fusible links where required.

3.4 FIRE SUPPRESSION SYSTEM TESTING

.1 Dump test system to requirements of local authorities.

.2 After completion of test recharge system and make operable for owners' use.

3.5 FIRE BARRIER DUCT WRAP INSTALLATION

.1 The Fire Barrier Duct Wrap 15A and 3M Fire Barrier 1000 N/S, 1003 S/L and 2000+ Silicone Sealants must be stored in a dry warehouse environment. Pallets should not be stacked.

.2 In order to install the duct firestop system, the surfaces of all the openings and penetrating items need to be clean, dry, frost free and free of dust.

.3 The 3M Fire Barrier Duct Wrap 15A blanket shall be wrapped around the perimeter of the duct and is cut to a length to overlap itself not less than 3 in. (76 mm). The overlap made by adjacent blankets shall form the "longitudinal" overlap. Aluminum foil tape is used to seal all cut edges of the blanket and any tears in the foil scrim.

.4 Filament tape can be used to temporarily hold the blanket in place until the banding is applied. The steel banding is applied around the duct 1-1/2 in. (38 mm) from each edge of the blanket, and maximum 10-1/2 in. (26,7 cm) centers. The banding is placed around

the material and tightened so as to sufficiently hold the 3M Fire Barrier Duct Wrap 15A in place against the duct, compressing the foil but not cutting the foil.

.5 Additional Pinning to Prevent Sagging of the Wrap: For Ducts 24 in. (60 cm) and larger in width, additional pins are needed to support the blanket on the bottom horizontal surface and on the outside face of a vertical duct run. Space pins a maximum of 10-1/2 in. (26,7 cm) apart in the direction of the blanket width, and a maximum of 12 in. (30 cm) apart in the direction of the blanket length.

.6 Support hanger systems shall be external of the duct wrap.

.7 Provide four galvanized steel threaded rods, ¼ in. diameter (6,35 mm) by 4-1/2 in. to 5 in. long (114 mm to 127 mm) are welded to the duct at the corners of the door opening. Four steel tubes, each 3 in. (76 mm) long, are placed over the rods to act as protection for the 3M Fire Barrier Duct Wrap 15A when fastening the door. Four installation pins are welded to the door panel for installation of the blanket. One layer of 3M Fire Barrier Duct Wrap 15A shall be cut approximately the same size as the access panel and impaled over the insulation pins on the panel.
It is essential that this layer fit tightly against the wrap surrounding the access door opening with no through openings. A second layer of 3M Fire Barrier Duct Wrap 15A shall be cut so as to overlap the first layer by a minimum of 1 in. (25,4 mm). The second layer is impaled over the pins and both layers are locked in place with galvanized speed clips.

Pins that extend beyond the outer layer of 3M Fire Barrier Duct Wrap 15A shall be turned down to avoid sharp points on the door.

.8 When the duct penetrates a fire rated wall, ceiling or floor, an approved firestop system must be constructed to manufactures recommendation.

3.6 FIRE BLANKET

.1 Hang blanket on wall in cabinet as indicated, to manufacturers' recommendations.

.2 Fire blanket next to each NFPA 96 hood mounted on wall.

3.7 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.2 Warranty Duration:

.1 One (1) year warranty period applies.

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

.1 Submit product data in accordance with general requirements.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with general requirements.

.2 Clearly indicate following:

- .1 Methods of sealing sections.
- .2 Methods of expansion.
- .3 Details of thimbles.
- .4 Bases/Foundations.
- .5 Supports.
- .6 Guy details.
- .7 Rain caps.

.3 Venting manufacturer shall provide shop drawings for review based on boiler model and capacity, height, offset and termination location. Submit venting calculations certified by the boiler manufacturer.

1.3 CLOSEOUT SUBMITTALS

.1 Submit operation and maintenance data for incorporation into manual specified in general requirements.

1.4 CERTIFICATIONS

.1 Catalogued or published ratings shall be those obtained from tests carried out by independent testing agency or manufacturer signifying adherence to codes and standards.

Part 2 Products

2.1 POSITIVE PRESSURE VENTING (CATEGORY III AND IV)

.1 The vent shall be of the double wall, factory-built type, designed for use in conjunction with Category III, or IV condensing or non-condensing positive pressure appliances or as specified by the heating equipment manufacturer.

.2 Maximum continuous flue gas temperature shall not exceed 550 degrees F (288 degrees C).

.3 Vent shall be listed for a maximum positive pressure rating of 6.0" w.c. and shall have passed testing at 15.0" w.c.

.4 The vent system shall be continuous from the appliance's flue outlet to the vent termination outside the building. All systems components shall be ULC listed and supplied by the same manufacturer.

.5 The vent shall be constructed with an inner and outer tube, with an annular space between the tubes of 25 mm (1").

.6 The inner tube (flue gas conduit) shall be constructed from AL29 4C® or UNS S44735 stainless steel, with a min. wall thickness of 0.4 mil (26 ga) for 3" through 7" diameter vents, 0.5 mil (24 ga) for 8" through 12" diameter vents and 0.6 mil (22 ga) for 14" and 16" diameter vents.

.7 The outer tube (jacket) shall be constructed from 304 or 430 stainless steel, with a minimum wall thickness of 0.4 mil (26 ga) for 3" through 6" diameter vents and 0.6 mil (22 ga) for 7" through 16" diameter vents.

.8 All systems components such as vent supports, roof or wall penetrations, terminations, appliance connectors and drain fittings required to install the vent system shall be UL listed and provided by the vent manufacturer.

.9 All system components shall include a factory-installed gasket in their female-end to render the vent air and watertight when the male/female ends are pushed together as per manufacturer's instructions. Vent systems requiring field installed sealants or compounds shall not be acceptable.

.10 All systems components shall include a factory installed, internal mechanical locking band for fastening and securing all vent components against each other.

.11 Vent layout shall be designed and installed in compliance with manufacturer's installation instructions boiler manufacturer, and all applicable local codes.

.12 Acceptable Manufacturers:

.1 Pro Tech Systems, Inc. – FasNSeal W2 (Insulated)

.2 Van Packer

.3 Z-Flex Model SVE-IV (Insulated)

.4 Cheminée Lining

.5 Selkirk/Ampco

.6 Security Chimneys International

.7 ICC Chimney VIP

2.2 ACCESSORIES

.1 Cleanouts: bolted, gasketted type, full size of breeching, as indicated.

.2 Barometric dampers: double acting, 70% of full size of breeching area.

.3 Hangers and supports: in accordance with recommendations of Sheet Metal and Air Conditioning Contractors National Association Inc. (SMACNA)

.4 Velocity Cone.

.5 Expansion sleeves with heat resistant caulking, held in place as indicated.

.6 Roof flashing cones.

.7 Guy wire supports and anchors.

Part 3 Execution

3.1 INSTALLATION – GENERAL

.1 Follow manufacturer's and SMACNA installation recommendations for shop fabricated components.

.2 Suspend breeching at 1.5 m (5') centres and at each joint.

.3 Support chimneys at bottom, roof and intermediate levels as indicated.

.4 Install thimbles where penetrating roof, floor, ceiling and where breeching enters masonry chimney. Pack annular space with heat resistant caulking.

.5 Install flashings on chimneys penetrating roofs and building structures.

.6 Install rain caps and cleanouts, as indicated.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 Canadian Standards Association (CSA).

.1 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code.

.3 Canadian Gas Association (CGA).

.1 CAN1-3.1, Industrial and Commercial Gas-Fired Package Boilers.

.2 CSA-B149.1, Natural Gas and Propane Installation Code.

.4 American National Standards Institute (ANSI).

.1 ANSI Z21.13, Gas-Fired Low-Pressure Steam and Hot Water Boilers.

.5 American National Standards Institute (ANSI)/ American Society of Mechanical Engineers (ASME).

.1 ANSI/ASME Boiler and Pressure Vessel Code, Section IV.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with general requirements.

.2 Indicate the following:

.1 General arrangement showing terminal points, instrumentation test connections.

.2 Clearances for operation, maintenance, servicing, cleaning.

.3 Piping hook-ups.

.4 Equipment electrical drawings.

.5 Burners and controls.

.6 All miscellaneous equipment.

.7 Flame safety control system.

.8 Breeching and stack configuration.

.9 Stack emission continuous monitoring system to measure C0, 0, N0x, S0, and stack temperature.

.3 Engineering data to include:

.1 Boiler efficiency at 100% of design capacity.

.2 Radiant heat loss at 100% design capacity.

1.3 CLOSEOUT SUBMITTALS

.1 Submit operation and maintenance data for incorporation into manual specified in general requirements.

1.4 CERTIFICATION

.1 Manufacturer's Certification: The boiler manufacturer shall certify the following:

.1 The products and systems furnished are in strict compliance with the specifications.

.2 the boiler, burner and other associated mechanical and electrical equipment have all been properly coordinated and integrated to provide a complete and operable boiler.

.3 ASME certification.

.4 CSA (AGA/CGA) certification.

.5 The specified factory tests have been satisfactorily performed.

.6 The equipment furnished contains inter-changeable parts with the specified equipment so that all major equipment parts can be obtained from the specified manufacturer.

1.5 BOILER SYSTEM LAYOUT ON FLOOR

.1 Pre-planning of the boiler room system must be done prior to any new construction in the boiler room beginning. The contractor shall provide a full scale markup of the boiler system on the floor of the boiler room. The markup shall be in various coloured chalk and shall include all the components/equipment of the boiler system.

.1 Housekeeping pad sizes/locations.

.2 Floor/hub drain locations.

.3 Vent/chimney stack locations and locations thru roof.

.4 Boiler positions (including burner & front door swing – depending on type of boiler).

.5 Rough locations and routing for heating supply/return headers and branch piping.

.6 Location of gas train (compared to boiler access/door swing) so gas can be disconnected from one or two unions.

.7 Locations for pumps, air separator, sink, eyewash, expansion tanks, etc.

.8 Locations for chemical treatment pot feeder assembly and makeup water assembly.

.9 Coordinate with the electrician and include markup locations for starters, panels, VFDs, etc.

.10 Location of unistrut supports where needed to route wiring or mount piping or equipment.

.11 Location of BAS controls & panels.

.2 Markup shall be reviewed with the consultant and owner prior to new installations starting. Changes or adjustments of the layout will be made with chalk during the review.

.3 Contractor to provide multiple photos of the final chalk layout.

Part 2 Products

2.1 GENERAL

.1 Furnish two (2) factory "packaged" low pressure hot water boilers. Each factory "packaged" boiler shall be complete with all components, accessories, and appurtenances necessary for a complete and operable boiler as hereinafter specified. Each unit shall be furnished factory assembled with required wiring and piping as a self-contained unit. Each unit shall be readily transported and ready for installation.

.2 Each factory "packaged" boiler, including pressure vessel, trim, valve trains, burner, control system, low-loss header (Viessmann Model 400/200), and all related components, accessories and appurtenances as herein specified shall all be assembled and furnished by the boiler manufacturer. The boiler manufacturer shall provide unit responsibility for the engineering, coordination, workmanship, performance, warranties, and all field services for each factory "packaged" boiler as specified herein. The boiler manufacturer shall be fully responsible for all components assembled and furnished by him whether or not they are of his own manufacture.

2.2 PERFORMANCE CRITERIA

.1 The minimum capacity of each boiler shall be to produce continuously an output of 1,940,000 Btu's per hour at the water outlet when fired with an input of 2,000,000 Btu's per hour at sea-level conditions. Each boiler shall be capable of operating continuously at rated capacity while maintaining a CSA certified efficiency of not less than 97%. Each boiler shall be capable of operating with a minimum outlet water temperature of 68ºF.

.2 Boiler shall comply with ASME Section IV for 50 psig (max 200ºF).

.3 Boiler relief valve setting shall be 50 psig max.

.4 Boiler outlet water temperature shall be 150°F (200ºF max).

.5 Boiler inlet water temperature shall be 130^{o}F.

.6 Boiler design water flow rate shall be 194 g.p.m.

.7 Fuel shall be natural gas with an assumed higher heating value of 1,030 Btu/Cu Ft and an assumed specific gravity of 0.60 (relative to air). Natural gas shall be supplied at a pressure of no less than 3.5” w.c. to the inlet gas valve. Maximum inlet gas pressure shall not exceed 14” w.c.

.8 Ambient air temperature shall be assumed to range from 50^{o}F to 90^{o}F with an average of 70^{o}F.

.9 Power voltage shall be 120 vac, 1-phase, 60 hertz. Control voltage shall be 24 vac (transformer to be supplied by boiler manufacturer).

2.3 BOILER DESIGN

.1 Each hot water boiler shall consist of a vertical, stainless steel heat exchanger complete with trim, valve trains, burner, and boiler control system. The boiler manufacturer shall fully coordinate the boiler as to the interaction of its elements with the burner and the boiler control system in order to provide the required capacities, efficiencies, and performance as specified.

.2 Each boiler heat exchanger shall be stainless steel, single pass, down fire, counter-flow design for maximum heat transfer with the multiple sections arranged in a reverse return configuration to assure balanced flow through each section

.3 All boiler pressure parts shall be constructed in accordance with the latest revision of the ASME Boiler and Pressure Vessel Code, Section IV, and shall be so stamped.

.4 Boiler heat exchanger headers shall be fabricated steel and be completely removable for inspection. Seals shall be EPDM, rated for 400°F service. Push nipples or gaskets between the sections are not permitted.

.5 Boiler shall be enclosed with a single wall outer casing. It shall be fabricated from a minimum 16 gauge carbon steel. The front and top wall shall be secured in place with ¼ -20 NC bolts (sheet metal screws are not acceptable). The complete outer casing shall be finished, inside and out, with a powder coat finish.

The composite structure of the boiler combustion chamber, insulating air gap and outer casing shall be of such thickness and materials to assure an outer casing temperature of not more than 50°F above ambient temperature when the boiler is operated at full rated load.

.6 An observation port shall be located on the boiler to allow for observation of the burner flame.

.7 A flue gas outlet shall be located on the rear of the boiler. Boiler to be certified for installation with Category IV venting (stack) as defined in NFPA 54 (ANSI Z221), latest edition. Contractor must provide venting (stack) certified for installation on a Category IV appliance.

2.4 BOILER CONNECTIONS

.1 Each boiler shall be provided with all necessary inlet and outlet connections. Boiler connections shall be as follows:

.1 One (1) water supply outlet, (fitting to be supplied with boiler, adapter by contractor).

.2 One (1) water return inlet, (fitting to be supplied with boiler, adapter by contractor).

.3 One (1) relief valve outlet.

.4 One (1) flue gas vent outlet.

.5 One (1) fuel gas inlet, FPT.

2.5 BOILER TRIM

.1 Boiler shall be provided with all necessary trim. Boiler trim shall be as follows:

.1 Safety relief valve shall be provided in compliance with the ASME code. Contractor to pipe to acceptable drain.

.2 Water pressure-temperature gauge.

.3 Primary low water flow fuel cutoff (probe type with manual reset).

.4 High limit water temperature controller to stop burner operation at excess water temperature (shall be manual reset).

.5 Operating temperature control to control the sequential operation of the burner.

.6 Separate inlet and outlet water temperature sensors capable of monitoring flow.

.7 Exhaust temperature sensor.

2.6 BOILER FUEL BURNING SYSTEM

.1 The boiler manufacturer shall furnish each boiler with an integral, power type, straight gas, fully automatic fuel burner. The fuel burner shall be an assembly of gas burner, combustion air blower, valve train, and ignition system.

The burner manufacturer shall fully coordinate the burner as to the interaction of its elements with the boiler heat exchanger and the boiler control system in order to provide the required capacities, efficiencies, and performance as specified.

.2 Burner shall be provided with an integral gas firing combustion head.

.3 Burner shall provide adequate turbulence and mixing to achieve proper combustion without producing smoke or producing combustibles in the flue gases.

.4 Boiler shall be provided with an integral variable speed power blower to premix combustion air and fuel within the blower. The combustion air blower shall have sufficient capacity at the rated firing rate to provide air for stoichiometric combustion plus the necessary excess air. Static and total pressure capability shall comply with the requirements of the boiler. The blower shall be a maximum of 300 watts and operate at 6000 RPM maximum without undue vibration and noise and shall be designed and constructed for exposure to temperatures normal to its location on the boiler. The operating fan speed will be tachometer sensed and be capable of being displayed at the LED display.

.5 Each burner shall of the down-fired type and constructed of steel with a stainless steel inner and stainless steel mesh outer screen.

.6 Each boiler shall be provided with a “Full Modulating” firing control system whereby the firing rate is infinitely proportional at any firing rate between 20% and 100% as determined by the pulse width modulation input control signal. Both fuel input and air input must be sequenced in unison to the appropriate firing rate without the use of mechanical linkage.

.7 The Micro Processor shall use a Proportional Integral Algorithm to determine the firing rate.

The control must have the following capabilities:

.1 Maintain single set point

.2 Reset the set point based on outdoor air temperature.

.3 Boiler shutdown based on outdoor air temperature

.4 Internal dual set point program with an external switchover. (e.g. - night setback w/external clock, supplied by others)

.5 Alarm relay for any for any manual reset alarm function.

.6 Programmable Low Fire Delay to prevent short cycling based on a time and temperature factor for release to modulation.

.7 LED Display showing current supply and return temperatures, current set points as well as differential set points. It must also display any fault codes whether automatically reset or manually reset.

.8 Local Manual Operation.

.9 Remote Control System (Building Management / Sequencer Control) - The boiler control shall be capable of accepting a 0 -10vdc remote external analog signal to control the firing rate

.10 Computer (PC) interface for programming and monitoring all functions

2.7 MAIN GAS VALVE TRAIN

.1 Each boiler shall be provided with an integral main gas valve train. The main gas valve trains shall be factory assembled, piped, and wired. Each gas valve train shall include at least the following:

.1 One (1) manual shutoff valve (gas train inlet connection).

.2 Two (2) safety shutoff valves. Valves equipped with dual solenoids that can independently energized for leak testing.

.3 Air – Gas ratio control (maximum inlet pressure 14” w.c.).

.4 One (1) low gas pressure switch (manual reset).

.5 One (1) high gas pressure switch (manual reset).

.6 Two (2) pressure test ports.

2.8 IGNITION SYSTEM

.1 Each boiler shall be equipped for direct spark ignition.

2.9 COMBUSTION AIR CONTROL SYSTEM

.1 Each boiler shall be provided with an integral combustion air control system. The combustion air system shall be factory assembled. Each combustion air control system shall include at least the following:

.1 The primary control shall vary the speed of the blower based on load demand. The blower shall apply a varying negative pressure on the gas valve, which will open or close to maintain zero pressure at the valve orifice, thereby increasing or decreasing the firing rate. Both the air and gas shall be premixed in the blower.

.2 One (1) low airflow differential pressure switch to ensure that combustion air is supplied.

.3 High exhaust back pressure switch.

2.10 BURNER CONTROL SYSTEM

.1 The control system shall be supplied with a 24 vac transformer (120 vac, single phase, 60 hertz primary). The 120/1/60 power supply to each boiler shall be protected by a 15 Amp circuit breaker located in electrical panel (supplied by contractor).

.2 The boiler must include an electric spark ignition system. Main flame shall be monitored and controlled by flame rod (rectification) system.

.3 Each boiler shall be provided with all necessary controls, all necessary programming sequences, and all safety interlocks. Each boiler control system shall be properly interlocked with all safeties.

.4 Each boiler control system shall provide timed sequence pre-ignition air purge of boiler combustion chamber. The combustion airflow sensor shall monitor and prove the airflow purge.

2.11 BOILER CONTROL PANEL

.1 The boiler manufacturer shall provide each boiler with an integral factory prewired control panel. The control panel shall contain at least the following components, all prewired to a numbered terminal strip:

.1 One (1) burner "on-off" switch.

.2 One (1) electronic combination temperature control, flame safeguard and system control.

.3 Control circuit breaker, 5 amp.

.4 All necessary control switches, pushbuttons, relays, timers, terminal strips, etc.

.5 LED Display Panel to adjust set points and control operating parameters. LED display to indicate burner sequence, all service codes (0-65), fan speed, boiler set point, sensor values such as inlet, outlet, flue gas and outdoor air.

2.12 ACCEPTABLE MATERIALS

.1 Viessmann CI2

.2 Cleaverbrooks Clearfire

.3 PK Solis

2.13 LOW LOSS HEADER

.1 Provide all welded steel insulated low-loss header suitable for system flow complete with sensor well tapping, ½", ½" air bleeding tapping, ½", drain/flush tapping, 2", ANSI flanges welded on.

Part 3 Execution

3.1 FACTORY TESTING - HYDROSTATIC

.1 Each factory “packaged” boiler shall be hydrostatically tested and bear the ASME “H” stamp.

3.2 FACTORY TESTING – FIRE TESTING

.1 Each factory "packaged" boiler shall be fire tested. The boiler manufacturer shall perform this fire test under simulated operating conditions, with the boiler attached to a working chimney system and with water circulating through the boiler. The manufacturer shall provide a fire test report, including fuel and air settings and combustion test results permanently affixed to the boiler.

3.3 FIELD TESTING

.1 The boiler manufacturer shall field test the following:

.1 Boiler and burner interlocks.

.2 Actuators.

.3 Valves.

.4 Controllers.

.5 Gauges.

.6 Thermometers.

.7 Pilot lights.

.8 Switches.

.9 Any malfunctioning component shall be replaced.

3.4 COMMISSIONING

.1 Manufacturer to:

.1 Certify installation.

.2 Start up and commission installation.

.3 Carry out on-site performance verification tests.

.4 Demonstrate operation and maintenance.

.2 Provide Consultant at least 48h notice prior to inspections, tests, and demonstrations. Submit written report of inspections and test results.

3.5 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.2 Warranty Duration:

.1 One (1) year warranty period applies.

.2 Manufacturer's standard form in which manufacturer agrees to repair or replace components of boilers that fail in materials or workmanship within the specified period:

.1 Pressure Vessel and Heat Exchanger: The boiler manufacturer shall warranty against failure due to thermal shock, flue gas condensate corrosion, and/or defective material or workmanship for a period of 10 years, non-prorated, from the date of Ready for Takeover provided the boiler is installed, controlled, operated, and maintained in accordance with the Installation, Operation and Maintenance Manual.

.2 Burner: The boiler manufacturer shall warranty the burner against defective material or workmanship for a period of five (5) years, non-prorated, from the date of Ready for Takeover.

.3 All other Components: The boiler manufacturer will repair or replace any part of the boiler that is found to be defective in workmanship or material within twelve (12) months from the date of Ready for Takeover.

END OF SECTION

Part 1 General

1.1 REFERENCE

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 CAN/CSA B149.1 Natural Gas Installation Code.

.3 ANSI Z83.8/CSA 2.6, Standard for Gas Unit Heaters, Gas Package Heaters, Gas Utility Heaters, and Gas-Fired Duct Furnaces.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with general requirements.

.2 Indicate:

.1 Equipment, capacity, and piping connections.

.2 Dimensions, internal and external construction details, recommended method of installation with proposed support, sizes and location of mounting bolt holes.

1.3 MAINTENANCE

.1 Provide maintenance data for incorporation into manual specified in general requirements.

Part 2 Products

2.1 HORIZONTAL GAS FIRED UNIT HEATERS (UH-1 & UH-2)

.1 Casing: 1.6 mm (16 gauge) thick cold rolled steel, gloss enamel finish, with threaded connections for hanger rods.

.2 Heat Exchanger: Aluminized steel tubing, silver brazed to steel headers, evenly spaced.

.3 Fan: direct drive propeller type, factory balanced, with anti-corrosive finish and fan guard.

.4 Motor: speed as indicated continuous duty, built-in overload protection, and resilient motor supports.

.5 Air outlet: two-way adjustable louvers, matching cabinet finish.

.6 Aluminized steel burner complete with gas valve and limit controls.

.7 Induced draft blower suitable for 120/1/60.

.8 Factory installed vibration isolated power vent fan and motor, to draw combustion air through unit.

.9 Capacity: as indicated, minimum 82% efficiency. Gravity vent models will not be accepted.

.10 Control room thermostat: by building automation system.

.11 Acceptable materials:

.1 Reznor UDAS Series

.2 Lennox

.3 Trane

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Horizontal or vertical vent termination, as indicated.

.3 Provide flexible connection to gas valve.

.4 Provide supplementary suspension steel as required.

.5 Before acceptance, set discharge patterns and fan speeds to suit requirements.

3.2 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.2 Warranty Duration:

.1 One (1) year warranty period applies.

.3 Warranty Coverage:

.1 Applies to parts and labour.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASTM A153, Specification for zinc coating (Hot- Dip) on iron and steel hardware.

.3 CTI ATC-105, acceptance test code.

.4 CTI STD-201-, Standard for the Certification of Water Cooling Towers Thermal Performance.

.5 CSA B52, Mechanical refrigeration code.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with General Requirements Section.

.2 Indicate:

.1 Connections, piping, fittings valves, strainers, control assemblies and ancillaries, identifying factory and field assembled.

.3 Wiring as assembled and schematically.

.4 Dimensions, construction details, recommended installation and support, mounting bolt hole sizes and locations and point loads.

.5 Vibration control measures.

.6 Manufacturers recommended clearances.

1.3 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for incorporation into manual specified in General Requirements Section.

.2 Include:

.1 Description of equipment giving manufacturers name, type, model year, capacity.

.2 Start-up and commissioning procedures.

.3 Details of operation, servicing and maintenance.

.4 Recommended spare parts list.

1.4 SPARE PARTS

.1 Furnish following spare parts:

.1 Belts

.2 Spray nozzles.

Part 2 Products

2.1 COOLING TOWER

.1 Factory-assembled, counterflow, blow-through design with single side air entry. Unit shall be of a one-piece design with all moving parts factory mounted and aligned, with no joints which require field sealing. All structural elements and steel panels shall be constructed of Z-700 hot-dip galvanized steel.

2.2 PERFORMANCE

.1 Cool 455 USGPM of water from 100°F to 90°F with 76°F entering air wet bulb temperature. Cooling Tower model line shall be certified by the Cooling Tower Institute in accordance with CTI Certification Standard STD-201 or, lacking such certification, a field acceptance test shall be conducted within the warranty period in accordance with CTI Acceptance Test Code ATC-105 by the Cooling Tower Institute or other qualified independent agency such as certified agency of the Associated Air Balance Council (AABC). When a field acceptance test is required, the Cooling Tower submittal shall include performance curves in accordance with Section II of ATC-105. A Manufacturer's guarantee performance bond or test by the Manufacturer will not be accepted as an alternative to CTI Certification or an independent field test.

2.3 PAN/FAN SECTION

.1 Heavy gauge Z-700 galvanized steel panels utilizing double brake flanges for maximum strength, rigidity and reliable sealing at watertight joints. Standard pan accessories shall include large circular access doors, large area lift-out strainer of anti-vortexing design and solid brass make-up valve with large diameter, unsinkable, polystyrene-filled plastic float arranged for easy adjustment.

.2 The fan shall be located in the dry entering air stream to provide greater reliability and ease of maintenance. Fan wheels are to be forwardly curved centrifugal squirrel-cage type and shall be statically and dynamically balanced and shall be mounted on a steel fan shaft supported by heavy-duty, self-aligning, relubricatable bearings with cast iron housings. Intermediate sleeve bearings **will not be acceptable**. Fan housings shall have curved inlet rings for efficient air entry. Fan wheels and housings shall be constructed of heavy gauge galvanized steel. The fan housings shall be of split design to facilitate fan wheel and shaft removal. Towers not having split housing design must co-ordinate layout with the architect to allow space for fan shaft removal.

.3 Provide Baltibond Corrosion Protection System coating for the entire cooling tower unit (excluding coil pack).

2.4 FAN MOTOR AND DRIVE

.1 One (1) 40 HP., 1800/900 RPM, single winding, T.E.F.C., ball bearing type with 1.15 service factor and shall be located at the base of the unit. The motor shall be mounted on a heavy-duty motor base, adjustable by means of a single threaded bolt-and-nut arrangement. The motor shall be suitable for outdoor service on 575 volt, 60 hertz, 3 phase electrical service.

.2 V-belt fan drive shall be sized for not less than 150% of motor nameplate horsepower. Drive and all moving parts shall be protected by removable hot-dip galvanized screens or panels.

2.5 SURFACE SECTION

.1 The heat transfer section shall include serpentine, PVC wet deck surface below a spray-type water distribution system, all encased by Z-700 hot-dip galvanized steel panels. The Polyvinyl Chloride (PVC) sheets shall be impervious to rot, decay, fungus or biological attack and have a flame spread rating of 5 per ASTM Standard E84-77a. The surface shall be manufactured and performance tested by the Cooling Tower Manufacturer to ensure single source responsibility and control of the final product.

2.6 WATER DISTRIBUTION

.1 Distributed evenly over the heat transfer section. The system shall consist of Schedule 40 PVC header and spray branches with large diameter, non-clog, plastic spray nozzles. The branches and spray nozzles shall be held in place by snap-in rubber grommets, providing quick removal of individual spray nozzles or complete branches for cleaning or flushing. Screw-in nozzles **will not be acceptable**.

2.7 ELIMINATORS

.1 Constructed of specially formulated PVC and be removable in easily handled sections. They shall have a minimum of three changes in air direction with an air deceleration zone to direct discharge air away from the fans and limit drift loss to less than 0.002% of the total water circulated.

2.8 ELECTRIC IMMERSION PAN HEATER

.1 Electric immersion pan heater to prevent the condenser water from freezing when the unit is inoperative. The heater shall be sized to maintain the pan water temperature at plus 40º F (4.5º C), when the ambient air temperature is minus 20º F (minus 29º C).

.2 One (1), three phase 575 volt heater shall be provided having a total capacity of 7.0 kW. The heater shall be tubular element construction and the contact terminals enclosed in a moisture-proof terminal box. A 110 volt, moisture-resistant temperature controller shall be included. A low water level cutout shall be provided to de-energize the heater in the event element is not fully submerged.

2.9 REMOTE CONTROL PANEL

.1 Provide remote control panel complete with remote VFD for cooling tower fan motor, panel heater, spray pump, and damper control. Mount VFD in existing Mechanical Room as indicated complete with motor and pan heater disconnects. Control panel, VFD, and disconnects to be supplied by cooling tower manufacturer.

2.10 UNIT SIZE

.1 Overall unit dimensions shall not exceed approximately 13' feet x 7' feet with an overall height not exceeding approximately 13' feet (including discharge hood). The operating weight shall not exceed 20,585 lbs.

2.11 EXTENDED WARRANTY

.1 In addition to the one (1) year warranty on the entire Unit the Cooling Tower Manufacturer shall provide a five (5) year Warranty on materials and workmanship on the drive components, including fans, fan shaft, shaft bearings, sheaves and fan motors.

2.12 ACCESSORIES

.1 Minimum 2" static deflection isolation rails.

.2 Tapered discharge hood complete with weatherproof access doors suitable for outdoors, discharge motorized damper, and complete with 600mm high roof curb.

.3 Fan and motor enclosure with screened inlet and hinged access door.

.4 Tapered discharge hood complete with the access door.

2.13 Fan and motor enclosure complete with solid bottom panels and inlet screening omitted for ducted application. Mechanical contractor to provide access doors in inlet ducting for motor/cooling tower access.

2.14 Acceptable Manufacturers:

.1 Baltimore Air Coil

.2 Evapco

Part 3 Execution

3.1 GENERAL

.1 Mount on structural supports [and vibration isolators] [as indicated] and to manufacturer’s recommendations.

.2 Ensure clearance for servicing and maintenance as recommended by manufacturer.

.3 Manufacturers field service representative to approve installation, to [supervise] start up and to instruct operators.

3.2 TEST

.1 Test under actual operating conditions in accordance with CTI ATC-105 to verify specified performance.

3.3 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.2 Warranty Duration:

.1 One (1) year warranty period applies.

.2 In addition to the one (1) year warranty on the entire unit, the Cooling Tower Manufacturer shall provide a five (5) year Warranty on materials and workmanship on the drive components, including fans, fan shaft, shaft bearings, sheaves and fan motors.

.3 Warranty Coverage:

.1 Applies to parts and labour.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ANSI/ARI 210/240, Unitary Air-Conditioning, and Air-Source Heat Pump Equipment.

.3 ARI 270, Standard for Sound Rating of Outdoor Unitary Equipment.

.4 CSA C22.1, Canadian Electrical Code, Part 1.

.5 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.

.6 ANSI/UL 1995, Central Cooling Air Conditioning.

.7 AFBMA 9 – Load Ratings and Fatigue Life for Ball Bearings.

.8 AMCA 99 – Standards Handbook

.9 AMCA 500 – Test Methods for Louver, Dampers, and Shutters.

.10 AHRI 340/360 – Unitary Large Equipment.

.11 NEMA MG1 – Motors and Generators.

.12 National Electrical Code.

.13 NFPA 70 – National Fire Protection Agency.

.14 SMACNA – HVAC Duct Construction Standards – Metal and Flexible.

.15 UL 900 – Test Performance of Air Filter Units.

.16 C.1 CSA B52-2023, Mechanical Refrigeration Code

.17 C.2 CAN/CSA-C22.2 No 60335 Safety of Household and similar electrical appliances – Heat Pumps, Air-conditioners and dehumidifiers

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with general requirements.

.2 Indicate:

.1 Equipment, and connections, together with control assemblies, 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.

.2 Piping, valves, fitting shipped loose showing final location in assembly.

.3 Control equipment shipped loose, showing final location in assembly.

.4 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.

.5 Detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices or ancillaries, accessories, controllers.

.6 Details of vibration isolation.

.7 Estimate of sound levels to be expected across each individual octave band in dB referred to A rating.

.8 Type of refrigerant used (A1 or A2L type only).

1.3 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

.2 Indicate:

.1 Brief description of unit, indexed, with details of function, operation, control, and service for each component.

.3 Manufacturer's installation instructions shall govern and unless otherwise noted, operation, maintenance, and service of items. Include names and addresses of spare part suppliers.

.4 Include following:

.1 Provide for each unit, manufacturer's name, type, year, number of units, and capacity.

Part 2 Products

2.1 ACCEPTABLE MANUFACTURERS

.1 Carrier

.2 Lennox

.3 Trane

2.2 GENERAL DESCRIPTION

.1 Furnish as shown on plans, Single zone Heating and Cooling Unit(s). Unit performance and electrical characteristics shall be per the job schedule

.2 Configuration: Fabricate as detailed on prints and drawings:

.1 Return plenum/economizer section complete with power exhaust

.2 Filter section

.3 Cooling coil section

.4 Supply fan section

.5 Condensing unit section

.3 The complete unit shall be cETLus listed.

.4 The unit shall be ASHRAE 90.1-2016 compliant and labeled.

.5 Each unit shall be specifically designed for outdoor rooftop application and include a weatherproof cabinet. Each unit shall be completely factory assembled and shipped in one piece. Packaged units shall be shipped fully charged with refrigerant and oil.

.6 The unit shall undergo a complete factory run test prior to shipment. The factory test shall include a refrigeration circuit run test, a unit control system operations checkout, a unit refrigerant leak test and a final unit inspection.

.7 All units shall have decals and tags to indicate caution areas and aid unit service. Unit nameplates shall be fixed to the main control panel door. Electrical wiring diagrams shall be attached to the control panels. Installation, operating and maintenance bulletins and start-up report forms shall be supplied with each unit.

.8 Efficiency:

.1 Units under 5 tons of cooling meet a SEER rating of 14.0.

.2 Units 6 tons of cooling and larger meeting an EER rating of 12.0 (9.6 for 12 ½ ton unit).

.3 Electronic controls with data link and diagnostic operation.

.4 Energy Star rated.

2.3 CABINET, CASING, AND FRAME

.1 Panel construction shall be double-wall construction for all panels. All floor panels shall have a solid galvanized steel inner liner on the air stream side of the unit to protect insulation during service and maintenance. Insulation shall be a minimum of 2" thick with an R-value of 13.0 and shall be 2-part injected foam. Panel design shall include no exposed insulation edges. Unit cabinet shall be designed to operate at total static pressures up to5.0 inches w.g.

.2 Exterior surfaces shall be constructed of painted galvanized steel, for aesthetics and long-term durability. Paint finish will include a base primer with a high-quality polyester resin topcoat

.3 Service doors shall be provided on the fan section, filter section, control panel section, and heating vestibule in order to provide user access to unit components. All service access doors shall be mounted on multiple, stainless-steel hinges and shall be secured by a ¼ turn handle and latch system. Removable service panels secured by multiple mechanical fasteners are not acceptable.

.4 The unit base shall overhang the roof curb for positive water runoff and shall seat on the roof curb gasket to provide a positive, weathertight seal. Lifting brackets shall be provided on the unit base to accept cable or chain hooks for rigging the equipment.

2.4 OUTDOOR/RETURN AIR SECTION

.1 Unit shall be provided with an outdoor air economizer section. The economizer section shall be fully integral to the mechanical cooling and allow up to 100% of mechanical cooling if needed to maintain the cooling discharge air temperature. The outdoor air hood shall be factory installed and constructed from galvanized steel finished with the same durable paint finish as the main unit. The hood shall include moisture eliminator filters to drain water away from the entering air stream. The outside and return air dampers shall be sized to handle 100% of the supply air volume. The dampers shall be parallel blade design. Damper blades shall be gasketed with side seals to provide an air leakage rate of 1.5 cfm / square foot of damper area at 1" differential pressure in according with testing defined in AMCA 500. A barometric exhaust damper shall be provided to exhaust air out of the back of the unit. A bird screen shall be provided to prevent infiltration of rain and foreign materials. Exhaust damper blades shall be lined with vinyl gasketing on contact edges.

.2 Control of the dampers shall be by a factory installed direct coupled actuator. Damper actuator shall be of the modulating, spring return type. A comparative enthalpy control shall be provided to sense and compare enthalpy in both the outdoor and return air streams to determine if outdoor air is suitable for “free” cooling. If outdoor air is suitable for "free" cooling, the outdoor air dampers shall modulate in response to the unit’s temperature control system.

.3 Unit shall be provided with a 100% outdoor air hood. The 100% outdoor air hood shall allow outdoor air to enter from the back of the unit, at the draw-through filter section. The outdoor air hood shall be factory installed and constructed from galvanized steel finished with the same durable paint finish as the main unit. The hood shall include a bird screen to prevent infiltration of foreign materials and a rain lip to drain water away from the entering air stream.

2.5 FILTERS

.1 Unit shall be provided with a draw-through filter section. The filter rack shall be designed to accept a 2" prefilter and a 4" post filter. The unit design shall have a hinged access door for the filter section. The manufacturer shall ship the rooftop unit with 2" MERV 8 construction filters. The contractor shall furnish and install, at building occupancy, the final set of filters per the contract documents.

.2 Provide two (2) sets of final filters.

2.6 COOLING COIL

.1 The indoor coil section shall be installed in a draw through configuration, upstream of the supply air fan. The coil section shall be complete with a factory piped cooling coil and an ASHRAE 62.1 compliant double sloped drain pan.

.2 The direct expansion (DX) cooling coils shall be fabricated of seamless high efficiency copper tubing that is mechanically expanded into high efficiency aluminum plate fins. Coils shall be a multi-row, staggered tube design with a minimum of 3 rows. All cooling coils shall have an interlaced coil circuiting that keeps the full coil face active at all load conditions. All coils shall be factory leak tested with high pressure air under water.

.3 The cooling coil shall have an electronic controlled expansion valve. The unit controller shall control the expansion valve to maintain liquid subcooling and the superheat of the refrigerant system.

.4 The refrigerant suction lines shall be fully insulated from the expansion valve to the compressors.

.5 The drain pan shall be stainless steel and positively sloped. The slope of the drain pan shall be in two directions and comply with ASHRAE Standard 62.1. The drain pan shall have a minimum slope of 1/8" per foot to provide positive draining. The drain pan shall extend beyond the leaving side of the coil. The drain pan shall have a threaded drain connection extending through the unit base.

2.7 SUPPLY FAN

.1 Supply fan shall be a single width, single inlet (SWSI) airfoil centrifugal fan. The fan wheel shall be Class II construction with fan blades that are continuously welded to the hub plate and end rim. The supply fan shall be a direct drive fan mounted to the motor shaft. Belts and sheaves are not acceptable due to the additional maintenance.

.2 All fan assemblies shall be statically and dynamically balanced at the factory, including a final trim balance, prior to shipment.

.3 Supply fan and motor assembly combinations larger than 8 hp or 22" diameter shall be internally isolated on 1" deflection, spring isolators and include removable shipping tie downs.

.4 **Units over 15 tons:** the motor shall be T frame and open drip proof. Overload protection and speed control is provided by the factory installed VFD and rooftop unit controller. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase. Motors shall be premium efficiency.

.5 **Units 15 tons and under:** the fan motor shall be a totally enclosed EC motor that is speed controlled by the rooftop unit controller. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase. Motors shall be premium efficiency.

.6 The supply fan shall be capable of airflow modulation from 30% to 100% of the scheduled designed airflow. The fan shall not operate in a state of surge at any point within the modulation range.

2.8 VARIABLE AIR VOLUME CONTROL

.1 **Units over 15 tons:** an electronic variable frequency drive shall be provided for the supply air fan. Each drive shall be factory installed out of the air stream in a conditioned cabinet. Drives shall meet UL Standard 95-5V. The completed unit assembly shall be listed by a recognized safety agency, such as ETL. Drives are to be accessible through a hinged door assembly. Mounting arrangements that expose drives to high temperature unfiltered ambient air are not acceptable.

.2 The unit manufacturer shall install all power and control wiring.

.3 **Units over 15 tons:** supply air fan drive output shall be controlled by the factory installed main unit control system and drive status and operating speed shall be monitored and displayed at the main unit control panel.

.4 **Units 15 tons and under:** the unit controller shall proportionally control the ECM motors on the supply fan based on space temperature. The unit controller shall increase/decrease the speed of the supply fan in order to maintain the space temperature within its setpoint and deadband. The unit controller shall provide discharge air temperature control with the compressor modulation.

2.9 HEATING SECTION

.1 Electric Heat (Optional)

.1 The rooftop unit shall include an electrical resistance heating coil section. Electric heating coil modules shall be factory installed downstream of the supply air fan in the heating section of the rooftop unit. Heating coils shall be constructed of a low watt density, nickel -chromium alloy resistance wire with intermediate supports that include ceramic bushings. The electrical contactors shall be of the full line- breaking type with all the electrical power legs being disconnected when the contactors are not energized. All electrical circuit wiring shall be designed with copper conductors, aluminum wires are not acceptable. Heating element branch circuits shall be individually fused to a maximum of 48 Amps per NEC requirements. The power supply for the electric heater shall be factory wired into the unit's main power block or disconnect switch.

.2 The heating modules shall have an automatic reset, high temperature limit safety protection. A secondary high limit protection shall also be provided that requires a manual reset. An airflow switch shall be provided with the heating module to prevent the electric heater from operating in the event of no airflow.

.3 The electric heater elements shall be controlled by the factory installed DDC unit control system. The heater shall have SCR control.

.4 Field installed heating modules shall require a field ETL certification. Duct heaters mounted within the rooftop unit in the field shall not be acceptable. The manufacturer's rooftop unit ETL certification shall cover the complete unit including the electric heating modules.

.2 Gas Heat (Optional)

.1 The rooftop unit shall include a natural gas heating section. The gas furnace design shall be one natural gas fired heating module factory installed downstream of the supply air fan in the heat section. The heating module shall be a tubular design with in-shot gas burners.

.2 Each module shall have minimum four (4) stages of heating control for units under 15 tons and be modulating for larger units.

.3 The heat exchanger tubes shall be constructed of stainless steel.

.4 The module shall have an induced draft fan that will maintain a negative pressure in the heat exchanger tubes for the removal of the flue gases.

.5 Each burner module shall have two flame roll-out safety protection switches and a high temperature limit switch that will shut the gas valve off upon detection of improper burner manifold operation. The induced draft fan shall have an airflow safety switch that will prevent the heating module from turning on in the event of no airflow in the flue chamber.

.6 The factory installed DDC unit control system shall control the gas heat module. Field installed heating modules shall require a field ETL certification. The manufacturer's rooftop unit ETL certification shall cover the complete unit including the gas heating modules.

2.10 HEAT PUMP HEATING

.1 The evaporator coil, condenser coil, compressors and refrigerant circuit shall be designed for heat pump operation. The refrigerant circuit shall contain a 4-way reversing valve for the heat pump operation. The outdoor coil shall have an electronic expansion valve to control the refrigerant flow. The unit controller shall modulate the expansion valve to maintain compressor operation within the compressor operational envelope.

.2 The refrigerant system shall have a pump-down cycle.

.3 The unit shall have a natural gas furnace for hybrid heating. When the heat pump operation cannot maintain the discharge air temperature setpoint the natural gas furnace shall temper the airstream to the discharge air temperature setpoint.

2.11 CONDENSING SECTION

.1 Outdoor coils shall be cast aluminum, micro-channel coils. Plate fins shall be protected and brazed between adjoining flat tubes such that they shall not extend outside the tubes. A sub-cooling coil shall be an integral part of the main outdoor air coil. Each outdoor air coil shall be factory leak tested with high-pressure air under water.

.2 Fan motors shall be an ECM type motor for proportional control. The unit controller shall proportionally control the speed of the condenser fan motors to maintain the head pressure of the refrigerant circuit from ambient condition of (0,25)-120°F. Mechanical cooling shall be provided to (0, 25) ° F. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase.

.3 The condenser fan shall be low noise blade design. Fan blade design shall be a dynamic profile for low tip speed. Fan blade shall be of a composite material

.4 The unit shall have scroll compressors. One of the compressors shall be an inverter compressor providing proportional control. The unit controller shall control the speed of the compressor to maintain the discharge air temperature. The inverter compressor shall have a separate oil pump and low oil safety protection.

.5 Pressure transducers shall be provided for the suction pressure and head pressure. Temperature sensor shall be provided for the suction temperature and the refrigerant discharge temperature of the compressors. All of the above devices shall be an input to the unit controller and the values be displayed at the unit controller.

.6 Each circuit shall be dehydrated, and factory charged with refrigerant and oil.

.7 Refrigerant to be A1 or A2L classification.

2.12 REFRIGERATION DETECTION SYSTEM:

.1 The Refrigerant detection system shall meet the requirements of CSA B52 and have the following functionality:

.1 Utilize a set point, nonadjustable in the field, to generate a digital output signal to initiative mitigation actions to both internal safeties and external components in the ductwork (dampers, electric coils etc.). Signal shall be generated in not more than 30 seconds from sensor exposure to refrigerant concentration of 25% LFL (+0$, -1%)

.2 Sensor within the equipment, near potential source of leaks.

.3 Field calibration of the system is not allowed.

.4 Be capable of detecting the refrigerant used in the system.

.5 Have self diagnostics

.6 Energize fans upon failure of a self-diagnostic check

.7 Activate refrigerant safety shut off valves in the event of a leak being detected.

2.13 ELECTRICAL

.1 Unit wiring shall comply with NEC requirements and with all applicable UL standards. All electrical components shall be UL recognized where applicable. All wiring and electrical components provided with the unit shall be number and color- coded and labeled according to the electrical diagram provided for easy identification. The unit shall be provided with a factory wired weatherproof control panel. Unit shall have a single point power terminal block for main power connection. A terminal board shall be provided for low voltage control wiring. Branch short circuit protection, 120- volt control circuit transformer and fuse, system switches, and a high temperature sensor shall also be provided with the unit. Each compressor and condenser fan motor shall be furnished with contactors and inherent thermal overload protection. Supply fan motors shall have contactors and external overload protection. Knockouts shall be provided in the bottom of the main control panels for field wiring entrance.

.2 Kilo Ampere Interrupting Capacity (kAIC) Rating

.1 Equipment shall be rated a interrupting capacity rating of 25 kAIC.

.2 All products supplied to the site shall meet or exceed this kAIC rating.

.3 The kAIC rating may be lowered to match or exceed the available fault current indicated on the Short Circuit Co-ordination Study completed by the electrical trade.

2.14 CONTROLS

.1 Provide a complete integrated microprocessor based Direct Digital Control (DDC) system to control all unit functions including temperature control, scheduling, monitoring, unit safety protection, including compressor minimum run and minimum off times, and diagnostics. This system shall consist of all required temperature sensors, pressure sensors, controller and keypad/display operator interface. All MCBs and sensors shall be factory mounted, wired and tested.

.2 The stand-alone DDC controllers shall not be dependent on communications with any on-site or remote PC or master control panel for proper unit operation. The microprocessor shall maintain existing set points and operate stand alone if the unit loses either direct connect or network communications. The microprocessor memory shall be protected from voltage fluctuations as well as any extended power failures. All factory and user set schedules and control points shall be maintained in non-volatile memory. No settings shall be lost, even during extended power shutdowns.

.3 The DDC control system shall permit starting and stopping of the unit locally or remotely. The control system shall be capable of providing a remote alarm indication. The unit control system shall provide for outside air damper actuation, emergency shutdown, remote heat enable/disable, remote cool enable/ disable, heat indication, cool indication, and fan operation.

.4 All digital inputs and outputs shall be protected against damage from transients or incorrect voltages. All field wiring shall be terminated at a separate, clearly marked terminal strip.

.5 The DDC controller shall have a built-in time schedule. The schedule shall be programmable from the unit keypad interface. The schedule shall be maintained in non-volatile memory to ensure that it is not lost during a power failure. There shall be one start/stop per day and a separate holiday schedule. The controller shall accept up to sixteen holidays each with up to a 5-day duration. Each unit shall also have the ability to accept a time schedule via BAS network communications.

.6 The keypad interface shall allow convenient navigation and access to all control functions. The unit keypad/display character format shall be 4 lines x 20 characters. All control settings shall be password protected against unauthorized changes. For ease of service, the display format shall be English language readout. Coded formats with look-up tables will not be accepted. The user interaction with the display shall provide the following information as a minimum:

.1 Return air temperature.

.2 Discharge air temperature.

.3 Outdoor air temperature.

.4 Space air temperature.

.5 Outdoor enthalpy, high/low.

.6 Compressor suction temperature and pressure.

.7 Compressor head pressure and temperature.

.8 Expansion valve position.

.9 Condenser fan speed.

.10 Inverter compressor speed.
.11 Dirty filter indication.
.12 Airflow verification.
.13 Cooling status.
.14 Control temperature (changeover).
.15 VAV box output status.
.16 Cooling status/capacity.
.17 Unit status.
.18 All time schedules.
.19 Active alarms with time and date.
.20 Previous alarms with time and date.
.21 Optimal start.
.22 Supply fan and exhaust fan speed.
.23 System operating hours.
.1 Fan
.2 Exhaust fan
.3 Cooling
.4 Individual compressor
.5 Heating
.6 Economizer
.7 Tenant override

.7 The user interaction with the keypad shall provide the following:
.1 Controls mode
.1 Off manual
.2 Auto
.3 Heat/Cool
.4 Cool only
.5 Heat only
.6 Fan only
.2 Occupancy mode
.1 Auto
.2 Occupied
.3 Unoccupied
.4 Tenant override
.3 Unit operation changeover control
.1 Return air temperature
.2 Space temperature
.3 Network signal

.4 Cooling and heating change-over temperature with deadband

.5 Cooling discharge air temperature (DAT)

.6 Supply reset options

.1 Return air temperature

.2 Outdoor air temperature

.3 Space temperature

.4 Airflow (VAV)

.5 Network signal

.6 External (0-10 vdc)

.7 External (0-20 mA)

.7 Temperature alarm limits

.1 High supply air temperature

.2 Low supply air temperature

.3 High return air temperature

.8 Lockout control for compressors.

.9 Compressor interstage timers

.10 Night setback and setup space temperature.

.11 Building static pressure.

.12 Economizer changeover

.1 Enthalpy

.2 Drybulb temperature

.13 Currently time and date

.14 Tenant override time

.15 Occupied/unoccupied time schedule

.16 One event schedule

.17 Holiday dates and duration

.18 Adjustable set points

.19 Service mode

.1 Timers normal (all time delays normal)

.2 Timers fast (all time delays 20 sec)

.8 If the unit is to be programmed with a night setback or setup function, an optional space sensor shall be provided. Space sensors shall be available to support field selectable features. Sensor options shall include:

.1 Zone sensor with tenant override switch

.2 Zone sensor with tenant override switch plus heating and cooling set point adjustment. (Space Comfort Control systems only)

.9 To increase the efficiency of the cooling system the DDC controller shall include a discharge air temperature reset program for part load operating conditions. The discharge air temperature shall be controlled between a minimum and a maximum discharge air temperature (DAT) based on one of the following inputs:

.1 Airflow

.2 Outside air temperature

.3 Space temperature

.4 Return air temperature

.5 External signal of 1-5 vdc

.6 External signal of 0-20 mA

.7 Network signal

2.15 SYSTEM CONTROL

.1 Equipment control will be by the unit manufacturer and integral economizer controls.

.2 System controls will be by Building Automation System Contractor.

.3 **BAS contractor to provide outside air damper motor for control of outside air.**

.4 Provide unit manufacturer programmable room thermostat with fan switching and locking cover. All control wiring shall be by this contractor.

2.16 CAPACITY

.1 As indicated.

2.17 ACCESSORIES

.1 600 mm (24") high roof curb.

.2 Vibration rail.

.3 Opposed blade economizer dampers.

.4 Condenser coil hail guard.

.5 Power exhaust on units nominal 7.5 tons and larger (with field installed wiring).

.6 Stainless steel vertical extension on flue gas discharge.

.7 Stainless steel heat exchanger.

.8 Commission low speed fan setting to 57 Hz on two speed VFD systems.

Part 3 Execution

3.1 INSTALLATION

.1 Install as per manufacturers' instructions on roof curbs provided by manufacturer as indicated. Provide all necessary continuous wolmanized wood blocking to install roof curb level complete with 20 gauge liner to ensure combustible wood blocking is not exposed in the building.

.2 Manufacturer to certify installation, supervise start-up and commission unit.

.3 Run drain line from cooling coil condensate drain pan to discharge over roof drain.

3.2 START-UP/COMMISSIONING

.1 Unit manufacturer shall perform start-up and commissioning.

3.3 ELECTRICAL REQUIREMENTS

.1 Field installed devices.

.1 Provide all field installed wiring required for all units that are equipped with power exhaust. Provide transformers as required.

.2 Mount all accessories shipped loose onto the units.

3.4 REFRIGERANT LEAK DETECTION SYSTEM

.1 This contractor shall provide all wiring between leak detection systems installed within the provided equipment and system components in the spaces served and ductwork system.

.2 Specifically, the following shall occur for each independent system on registration of a refrigerant leak:

.1 Open all zone dampers in the affected system.

.2 Disable all electric reheat coils within the affected system.

.3 Activate field installed safety shut off valves within the affected refrigeration system.

.4 Energize all fans within the affected ductwork system.

.5 Activate and refrigerant leak system specific ventilation systems.

.6 De-energize any other potential sources of ignition within the affected system.

.3 All interlocks between field installed detection systems and associated safety system components shall be tested and verified to operate as per the requirements of CSA B52.

3.5 TRAINING

.1 Provide 2 hours training to owner’s staff on the care, maintenance and operation of the equipment. Dedicated visit to site is required as it will not be paired with equipment startup.

3.6 SPARE PARTS

.1 Two (2) complete sets of filters.

.2 One (1) set of spare belts.

3.7 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.2 Warranty Duration:

.1 One (1) year on parts and labour on all components.

.2 Five (5) years on compressor.

.3 Ten (10) years on stainless steel heat exchanger.

.4 Manufacturer hereby warrants refrigeration compressors in accordance with GC 24, but for five (5) years.

.5 Manufacturer hereby warrants the gas heat sections for a minimum of ten (10) years.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ANSI/NFPA-90A, Installation of Air Conditioning and Ventilating Systems.

.3 AMCA 99 – Standard Handbook.

.4 AMCA 210 – Laboratory Methods of Testing Fans for Rating Purposes.

.5 ARI 270, Standard for Sound Rating of Outdoor Unitary Equipment.

.6 ANSI/AHRI 340/360 – Performance Rating of Commercial and Industrial Unitary Air Conditioning and Heat Pump Equipment.

.7 AMCA 500 – Test Methods for Louvers, Dampers, and Shutters.

.8 AHRI 260 – Sound Rating of Ducted Air Moving and Conditioning Equipment.

.9 NFPA 90A – Installation of Air Conditioning and Ventilation Systems.

.10 UL-1995 – Standard for Safety for Heating and Cooling Equipment.

1.2 QUALITY ASSURANCE

.1 Manufacturer shall have a minimum 15 years of experience in designing, manufacturing and servicing large air handling units.

.2 Units shall be factory tested prior to shipment.

1.3 ALTERNATES

.1 The design indicated on the schedules and shown on the drawings is based upon the products of the named manufacturer. Alternate equipment manufacturers named in this specification are acceptable if equipment meets scheduled performance requirements.

.2 If equipment is supplied by a manufacturer other than the one named as the basis of design, coordinate with the General Contractor and affected subcontractors to ensure the specified performance is met. This coordination shall include (but is not limited to) the following:

.1 Structural supports for units.

.2 Location of roof curbs, unit supports and roof penetrations.

.3 Ductwork sizes and connection locations.

.4 Piping size and connection/header locations.

.5 Interference with existing or planned ductwork, piping and wiring.

.6 Electrical power requirements and wire/conduit and over current protection sizes.

.3 The Mechanical Contractor shall be responsible for costs incurred by the General Contractor, Subcontractors, and Consulting Engineers to accommodate units furnished by a manufacturer other than manufacturer named as basis of design.

.4 Substitution of products from manufacturers not listed in the list of acceptable manufacturers shall not be accepted.

1.4 RATINGS AND CERTIFICATIONS

.1 Unit shall conform to AMCA 210 for fan performance ratings.

.2 Unit sound ratings shall be reported in accordance with AHRI 260 for inlet and discharge sound power levels.

.3 Unit casing radiated sound ratings shall be reported in accordance with ISO 9614 parts 1&2 and ANSI S12.12.

.4 Unit shall conform to AHRI 410 for capacities, pressure drops, and selection procedures of air coils.

.5 Unit shall conform to ANSI/AHRI 430 for all fabrication procedures of air handling units.

.6 Control Wiring comply with NEC codes and all other requirements of the Authority Having Jurisdiction.

.7 Units shall comply with energy use AHSRAE 90.1 and meet all Government of Canada and Ontario Building Code energy requirements, including SB-10 energy efficiency requirements.

1.5 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section general requirements. Ensure the following information is included:

.2 Furnish fan performance ratings and fan curves with specified operating point clearly plotted.

.3 Furnish drawings indicating unit dimensions, required clearances, field connection locations, wiring diagrams, shipping drawings, and curb drawings.

.4 Furnish performance report showing unit level performance data including: fan(s), motor(s), coil(s) and other functional components. Performance report shall also include unit casing performance.

.5 Furnish operation and maintenance data, including instructions for lubrication, filter replacement, motor and drive replacement, and condensate pan cleaning; spare parts lists, and wiring diagrams.

.6 Adjust and report performance ratings for the proper altitude of operation.

.7 Report air-handling unit performance ratings in accordance with ANSI/AHRI-430 (static pressure, airflow, fan speed, and fan brake horsepower).

.8 Report coil ratings in accordance with AHRI-410 (capacities and pressure drops).

.9 Report unweighted octave band AHU sound power for inlets and outlets rated in accordance with AHRI Standard 260. Provide eight data points, the first for the octave centered at 63 Hz, and the eighth centered at 8,000 Hz. Manufacturer shall not use sound estimates based on bare fan data (AMCA ratings), nor use calculations like the substitution method based on AHRI 260 tests of other AHU products. Provide data for inlets and outlets as scheduled. Report unweighted casing radiated sound power over the same 8 octave bands in accordance with ISO 9614 Parts 1&2 and ANSI S12.12.

.10 Report weight loads and distributions by component section.

.11 Report product data for filter media, filter performance data, filter assembly, and filter frames.

.12 Report electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.

.13 Report motor electrical characteristics.

1.6 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

1.7 MAINTENANCE MATERIALS

.1 Provide maintenance materials in accordance with general requirements.

1.8 UNIT ASSEMBLY

.1 Unless stated otherwise, air handling units are to be shipped to the job in one piece, factory assembled. All equipment shall be factory tested prior to shipment.

.2 Units that are shipped in segments must be re-assembled by manufacturer's factory trained service personnel.

1.9 PERFORMANCE RATINGS

.1 Unit certification: Units shall conform to CSA-C746-2006 and ARI 340/360-2007, be listed by NRCan as approved for sale in Canada and be compliant with the SB-10 Supplement of the Ontario Building Code. Manufacturers shall have performance certified by a third party testing organization which has been accredited by the Standards Council of Canada. A certificate issued by this third party testing organization shall be available for the equipment being submitted upon request by the Consultant.

Part 2 Products

2.1 GENERAL

.1 Field Factory assembled components to form units supplying air at design conditions as indicated and specified.

Acceptable materials:

.1 Daikin Applied

.2 Engineered Air

.3 Haakon

2.2 GENERAL DESCRIPTION

.1 The air handling unit (AHU) shall consist of the following components:

.1 Structural frame, including base.

.2 Wall panels complete with access doors.

.3 Filters, motors, motor controls, dampers and other components as specified.

.4 A supply air fan with vertical inlet.

.5 An exhaust fan with vertical inlet.

.6 Horizontal outdoor air/relief sections

.7 High efficiency modulating gas heat exchanger.

.8 Packaged DX cooling.

.9 A mixed air section complete with economizer operation.

.10 Integral aluminum energy recovery wheel complete with bypass damper and purge.

.11 Provide 50mm pre-filters and 50mm final filters.

.12 Single point power connection.

.13 Provide terminal strip for BAS integration.

2.3 UNIT CONSTRUCTION

.1 Base Rail:

.1 Units shall be provided with a structural steel base rail under the full perimeter of the unit, formed from mill galvanized steel, or welded structural steel if determined to be necessary based on unit size by the manufacturer.

.2 Base rail shall allow for clearances for proper trapping of drain pans and condensate.

.3 Base rail shall have a lifting lug system that does not require additional support for rigging on site. Alternatively, lifting lugs or forklift openings on cabinet are acceptable if designed for on site rigging.

.2 Casing:

.1 Air handling units shall be weatherproofed and equipped for installation outdoors. This shall include for the prevention of infiltration of rain and snow into the unit, and louvres or hoods on air intakes and exhaust openings with 25 mm (1") galvanized inlet screens. Provide rain gutters over all access doors and caulk all joints with a water resistant sealant.

.2 Casing panels shall be 2" double-wall construction with thermal break. Thermal break shall be between interior and exterior liner of the panel assembly, and between the panel and casing framework.

.3 Unit casing shall be of minimum 1.3 mm (18 gauge) satin coat galvanized sheet metal. Surfaces shall be cleaned with a degreasing solvent to remove oil and metal oxides and primed with a two-part acid based etching primer. Finish coat shall be an electrostatically applied enamel, to all exposed surfaces. All unprotected metal and welds shall be factory coated.

.4 All walls, roofs and floors shall be of formed construction, with at least two breaks at each joint. Joints shall be secured by sheet metal screws or pop rivets. Wall and floor joints shall be broken in and roof joints broken out (exposed) for rigidity. All joints shall be caulked with a water resistant sealant.

.5 Provide casing with minimum thermal resistance (R-value) of 13 hr-ft2-°F/BTU. Exposed insulation is not acceptable.

.6 Casing panel insulation shall be injected polyurethane foam. Rigid foam board panels are acceptable provided the above noted R value is met.

.7 Insulation system provided shall be resistant to mold growth in accordance with a standardized test method such as UL 181 or ASTM C 1338.

.8 Encapsulate insulation with sheet metal so that air does not contact insulation. Solid lined double-walled panels insulated with injected foam shall be hermetically sealed at each corner and around their entire perimeter to eliminate airflow through the panel and to eliminate microbial growth potential within the casing wall.

.9 Casing panels with perforated interior liners (perforated panels) shall be provided where indicated on the drawings and/or schedule. Perforated panels shall be a hybrid combination of 1" fiberboard and 1" injected polyurethane foam. Rigid foam board panels shall not be used. Minimum perforated panel thermal resistance (R-Value) shall be R11 hr-ft2-°F/BTU.

.10 Unit shall be designed to reduce air leakage and infiltration through the cabinet. Cabinet leakage shall not exceed 1% of total airflow when tested at 3 times the minimum external static pressure provided in AHRI Standard 340/360 or AHRI Standard 1350, whichever is more strict.

.11 Provide wall/roof/floor panels and access doors that deflect no more than L/240 when subjected to 1.5 times design static pressure up to a maximum of +5 inches w.g. in positive pressure sections and -5 inches w.g. in negative pressure sections. 'L' is the panel-span length and 'L/240' is the deflection at panel midpoint.

.12 Provide outdoor AHUs with a roof system that deflects no more than L/240 when subjected to a static snow load of 30 lb./ft2. 'L' is defined as the panel-span length and 'L/240' is the deflection at the panel midpoint.

.3 Access Doors

.1 Units shall be provided with double wall gasketed access doors that meet the requirements of the AHU casing.

.2 Access doors shall be provided to the following components: fans and motors; filters; dampers and operators; and access plenums. Access doors shall be large enough for easy access. Removal of screwed wall panels will not be acceptable.

.3 Provide hinged access doors, fully lined, with hinges, with a minimum of two camlock fasteners for all units over 1200 mm (48") high.

.4 Whenever possible, hinged access doors to areas of negative pressure shall open out, and to areas of positive pressure shall open in. Where space constrictions require the use of outward opening doors to an area of positive pressure, a clear warning label must be affixed.

.5 Hinged access doors shall be provided with tie back clips.

.6 Doors shall have a drip guard above the door frame, extending 50 mm (2") beyond door surface.

.7 Access doors to be complete with ¼ turn lockable handles.

.4 Ensure suitable access is provided for condenser coil cleaning and fan replacement. Provide suitable platform if required. Provide suitable platform if required.

2.4 DX COOLING COILS

.1 General

.1 Coils shall meet or exceed performance scheduled on drawings.

.2 Coils shall be provided with performance certified in accordance with AHRI Standard 410 for coil capacity and pressure drop, wherever applicable. Coils circuits shall be designed such that the fluid velocity is within the range of certified rating conditions at design flow.

.3 Cooling coils shall be provided with a maximum face velocity of 500 feet per minute. Face velocity calculations shall be based on the finned area of the coil.

.4 Cooling coil shall be provided with drain pan that is sufficient to contain coil condensate. Drain pan shall extend a minimum of 10" downstream of the face of the coil.

.5 Coil segment casing shall accommodate full-face or reduced-face coils as scheduled. Face and bypass coil shall only be allowed when specifically specified. Where specified segments shall be provided with factory installed bypass damper.

.6 Access shall be provided of at least 24" between coils. Access panel or door shall be easily operable and are easily removable with no special tools, as shown on drawings.

.7 Access doors shall be located to provide clearance for pipe insulation, connectors, and accessories. Space shall allow a minimum of 90 degrees of door swing.

.8 Coils shall be built in their own full perimeter frame. Tube sheets on each end shall have fully drawn collars to support and protect tubes. Horizontal coil casing and support members shall allow moisture to drain. Casing and support members shall not block finned area.

.9 Individual coils shall be removable from the side of the AHU. Removal of top coil may be required in order to remove bottom coil.

.10 Continuous aluminum or copper fins shall be provided for coils with die-formed fins. Fins shall have fully drawn collars to accurately space fins and protect tubes. Fins shall be 0.008" thick.

.11 DX Cooling Coils

.1 The coil shall be installed in a draw-through configuration, upstream of the supply air fan.

.2 **The coil shall be multirow, with a minimum of 6 rows**. All coils shall have interlaced coil circuiting that keeps the full coil face active at all load conditions.

.3 Direct expansion (DX) coils shall conform to UL-207, "Standard for Safety: Refrigerant - Containing Components and Accessories, Nonelectrical".

.4 Coils shall be provided with a tube OD of 1/2" or 5/8". Mechanically expand tubes shall form fin bond and provide burnished, work-hardened interior surface. This item may be manufacturer-specific.

.5 DX coils shall be provided with Venturi style brass distributor and solder-type connections. Suction and discharge connections shall be on the same end regardless of coil depth.

2.5 PRIMARY DRAIN PANS

.1 Unit(s) shall be provided with a drain pans under each cooling coil and where applicable, humidifier.

.2 Provide drain pan under the complete width and length of cooling coil and humidifier sections. Drain pan shall be full width and extend a minimum of 10" downstream of cooling coil.

.3 Drain pans for cooling coils and humidifiers shall meet the requirements of ASHRAE 62.

.4 Drain connection shall be made of same material as drain pan. Dissimilar metals shall not be used to mitigate risk of galvanic corrosion. Drain connection shall be welded to the drain pan.

.5 Drain pan shall allow visual inspection and physical cleaning on 100% of the pan surface without removal of the coil or humidifier.

.6 Provide a minimum of 1" clearance between the drain pan and any coil casing, coil support or any other obstruction.

.7 Provide drain pan that allows the design rate of condensate drainage regardless of fan status.

.8 Provide drain pan sloped in at least two planes by at least 1/8" per foot toward a single drain. Locate drain connection at the lowest point of the pan. Pan shall have no horizontal surfaces.

.9 Drain pans shall be stainless steel.

2.6 FANS

.1 General Description

.1 Units shall be provided with fans as shown on equipment schedule and drawings.

.2 Fans shall be rated in accordance with AMCA Standard Test Code, Bulletin 210. Fan manufacturer shall be a member of AMCA.

.3 The fan section shall be provided with an access door on the drive side of the fan.

.4 Mount the fan and motor assembly on a common adjustable base. This common base shall attach to vibration isolators, which mount to structural support channels. These channels shall span the AHU floor and mount directly to the AHU frame.

.1 Provide vibration isolation, as follows:

.1 ¼ hp thru to 1 ½ hp: Rubber isolation.

.2 Over 1 ½ hp: Internal Spring Isolation

.3 Rubber isolation is acceptable for direct drive plenum fans.

.5 DWDI fans shall be connected to the unit casing or bulkheads with canvas flexible connection.

.6 All fan assemblies shall be statically and dynamically balanced at the factory, including a final trim balance prior to shipment.

.2 Belt Drive Fan, Bearings, and Drives

.1 Fans shall be provided with polished steel shafts with first critical shaft speed at least 125% of the maximum operating speed for the fan pressure class. Shaft shall have an anti-corrosion coating.

.2 Fan wheels shall be keyed to the fan shaft to prevent slipping.

.3 Fan shall be provided with an OSHA-approved belt guard to deter incidental contact with rotating sheaves and belts.

.4 Forward-Curved (FC) Fan

.1 Fan shall be a double-width, double-inlet, multi-blade-type, forward-curved (FC) fan.

.2 Fan shall be equipped with self-aligning, antifriction bearings.

.3 Fan performance shall be certified as complying with AHRI Standard 430.

.5 Airfoil (AF) Fan

.1 Provide airfoil fans with blades formed of extruded aluminum, as scheduled. Bent sheet metal blades are not acceptable.

.2 Airfoil fans shall comply with AMCA standard 99 2408 69 and 99 2401 82. Provide an AMCA Seal on airfoil fans. Airfoil fan performance shall be based on tests made in accordance with AMCA standards 210 and comply with the requirements of the AMCA certified ratings program for air performance.

.6 Bearings and Drives

.1 Units fans shall be provided with bearings complying with ANSI/AFBMA 9 for fatigue life ratings and with an average life L10 of at least 200,000 hours, as scheduled.

.2 DWDI fans shall be belt driven complete with VFD. SWSI fans shall be belt drive or direct driven complete with VFD.

.3 Forward curved fans smaller than 18" shall be provided with permanently lubricated bearings. For other fans, manufacturer shall provide re-greaseable bearings with hydraulic grease fittings and lube lines extended to the motor side of the fan or to the exterior of the unit primary access side.

.4 Fans shall be provided drives selected with a 1.5 service factor. Sheaves shall be machined from a close grain cast iron and statically balanced by the manufacturer.

.5 Fixed pitch sheaves shall be provided on both the fan and motor. Fans with motors rated at 15 HP or less may be field balanced using variable pitch sheaves. Fixed pitch sheaves shall be provided when final balance is complete. Air balancer shall select and provide final set of sheaves.

.6 For Belt-driven fans with 10 HP motors or greater shall be provided with multiple belt drives. Belts shall be V-type, precision molded, raw edge construction, anti-static, oil- and heat-resistant.

.3 Direct Drive Fans

.1 Plenum (SWSI) Fan

.1 Plenum fan wheel shall be single-width, single-inlet.

.2 Plenum fan blades shall be aluminum backward-inclined airfoil.

.3 Plenum fan shall be direct-driven.

.4 Provide VFD with all direct drive fans.

.4 Fan Motors

.1 Fan motors shall be built in accordance and comply with the latest standards of the NEMA and IEEE.

.2 Fan motors shall be provided with the following characteristics:

.1 Voltage, Frequency and Phase, as scheduled.

.2 Motor RPM, maximum 1800 rpm.

.3 Minimum service factor of 1.15.

.4 Premium efficiency, or as required to meet ASHRAE 90.1.

.5 NEMA design ball bearing type.

.6 Rated for continuous duty at full load in a 104°F (40°C) ambient.

.7 Electronically Commutated (EC).

.8 Suitable for use in variable frequency application, per NEMA MG-1 Part 30.

.9 Premium Efficiency Inverter ready per NEMA STD MG1 PART 31.4.4.2.

.5 Axial Fans are not acceptale.

2.7 GAS HEAT SECTION

.1 The rooftop unit shall include a natural gas heating section. The assembly shall be an indirect fired type, having 80% minimum thermal efficiency.

.2 The gas furnace shall be factory installed downstream of the supply air fan in the heat section.

.3 The heat exchanger shall be constructed of stainless steel.

.4 The heating section shall have modulating control with minimum 8:1 turn down.

.5 The heating section shall have a variable flow combustion blower that will maintain a negative pressure in the heat exchanger tubes for the removal of the flue gases.

.6 The factory installed DDC unit control system shall control the gas heat module. The manufacturer's unit certification shall cover the complete unit including the gas heating modules.

.7 All operating controls and functions shall be factory tested prior to shipment.

.8 Operating natural gas pressure shall be 7" (1750 Pa) W.C.

2.8 PACKAGED MECHANICAL COOLING

.1 General

.1 Provide a thermostatic expansion valve to control liquid injection into evaporator.

.2 The refrigerant suction lines shall be fully insulated from the expansion valve to the compressors.

.2 Condensing Section

.1 Fan motors shall be an ECM type (or VFD driven) motor for proportional control. The unit controller shall proportionally control the speed of the condenser fan motors to maintain the head pressure of the refrigerant circuit from ambient condition of 0-120°F. Mechanical cooling shall be provided to 0º F. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase.

.2 The condenser fan shall be low noise blade design. Fan blade design shall be a dynamic profile for low tip speed. Fan blade shall be of a composite material

.3 The unit shall have scroll compressors. One of the compressors shall be a digital compressor providing proportional control. The unit controller shall control the compressor to maintain the discharge air temperature.

.4 Pressure transducers shall be provided for the suction pressure and head pressure. Temperature sensor shall be provided for the suction temperature and the refrigerant discharge temperature of the compressors. All of the above devices shall be an input to the unit controller and the values be displayed at the unit controller.

.5 Each circuit shall be dehydrated, and factory charged with R-32 Refrigerant and oil.

.6 Compressors shall be set on neoprene pads.

.7 Compressors shall be located on the side of the unit in a service enclosure complete with hinged access doors c/w lever lock handles for ease of service.

.8 Compressors shall have inbuilt overload and temperature protection.

.3 Hot Gas Reheat

.1 Unit shall be equipped with a fully modulating hot gas reheat coil with hot gas coming from the unit condenser.

.2 Hot gas reheat coil shall be a copper tube/aluminum fin design. Fins shall be brazed to the tubing for a direct bond. The capacity of the reheat coil shall allow for a 20°F temperature rise at all operating conditions.

.3 The modulating hot gas reheat systems shall allow for independent control of the cooling coil leaving air temperature and the reheat coil leaving air temperature. The cooling coil and reheat coil leaving air temperature setpoints shall be adjustable through the unit controller. During the dehumidification cycle the unit shall be capable of 100% of the cooling capacity. The hot gas reheat coil shall provide discharge temperature control within +/- 2°F.

.4 Each coil shall be factory leak tested with high- pressure air under water.

2.9 ENERGY RECOVERY WHEEL SECTION

.1 The rooftop unit shall be provided with an AHRI certified rotary wheel air-to-air heat exchanger in a cassette frame complete with seals, drive motor and drive belt. The energy recovery wheel shall be an integral part of the rooftop unit with unitary construction and does not require field assembly. Bolt-on energy recovery units that require field assembly and section to section gasketing and sealing are not acceptable.

.2 The wheel capacity, air pressure drop, and effectiveness shall be AHRI certified per AHRI Standard 1060. Thermal performance shall be certified by the manufacturer in accordance with ASHRAE Standard 84, Method of Testing Air-to-Air Heat Exchangers and AHRI Standard 1060, Rating Air-to-Air Heat Exchangers For Energy Recovery Ventilation Equipment.

.3 The unit shall be designed with a track so the entire energy recovery wheel cassette can slide out from the rooftop unit to facilitate cleaning.

.4 The unit shall have 2” Merv 8 filters for the return and outdoor air before the wheel to help keep the wheel clean and reduce maintenance. Filter access shall be by a hinged access door.

.5 The matrix design shall have channels to reduce cross contamination between the outdoor air and the exhaust air. The layers shall be effectively captured in aluminum and stainless steel segment frames that provide a rigid and self-supporting matrix. 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.

.6 The total energy recovery wheel shall be coated with silica gel desiccant permanently bonded without the use of binders or adhesives, which may degrade desiccant performance. The substrate shall be lightweight polymer and shall not degrade. 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.

.7 Wheels 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. Where segments are provided, segments shall be removable without the use of tools to facilitate maintenance and cleaning.

.8 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.

.9 Wheel seals shall be contact brush seal on both the periphery of the wheel and the face. Seals shall be easily adjustable.

.10 The control of the energy recovery wheel shall be an integral part of the rooftop unit's DDC controller. Provide terminal strips/connection points for the Building Automation System to have visibility of the outdoor air temperature, leaving wheel temperature, return air temperature, and exhaust air temperature.

.11 The rooftop unit DDC controller shall provide frost control for the energy recovery wheel. When a frost condition is encountered the unit controller shall (stop, slow down) the wheel. When in the frost control mode, the wheel shall be jogged periodically and not be allowed to stay in the stationary position.

.12 A mechanical purge shall be available and be field adjustable. Purge shall be capable of limiting Exhaust Air Transfer Ration (EATR) values to 0.4% through proper fan and purge adjustment.

.13 The energy recovery wheels shall have bypass dampers that allow for 100% outdoor air economizer operation of the unit.

2.10 FILTERS

.1 Filter sections shall be provided with adequately sized access doors to allow easy removal of filters. Filter removal shall be from one side as noted on the drawings.

.2 Units shall be provided with filter segments consisting of filters and frames as follows:

.1 A 2 inch (50mm) prefilter rack. Pre-filters shall be 2" throwaway.

.2 A 2 inch (50mm) final filter rack

.3 Filters shall be MERV 13.

.4 Two sets of filters, as well as a construction set of filters shall be provided.

.5 For units with filter banks 1825 mm (72") high or less, the filter modules shall be designed to slide out of the unit. Side removal filters shall slide into a formed metal track, sealing against metal spacers at each end of the track.

2.11 ECONOMIZER SECTION

.1 Unit shall be provided with an outdoor air economizer section.

.2 The economizer section shall include outdoor, return, and exhaust air dampers.

.1 Dampers provided shall be tested in accordance with AMCA 500.

.2 Dampers shall be formed damper blades or airfoil blades, extruded vinyl edge seals, and flexible metal compressible jamb seals.

.3 Dampers shall have a maximum leakage rate of 4 CFM/square foot at 1" w.g. and shall comply with ASHRAE 90.1.

.4 Damper frames shall be u-shaped galvanized metal sections securely screwed or welded to the air handling unit chassis. Pivot rods of 15 mm (1/2") aluminium, shall turn in bronze bushings, fabricated from self- oiling bronze. Rods shall be secured to the blade by means of straps and set screws.

.5 Blades shall be 1.3 mm (18 gauge) galvanized metal with two breaks on each edge and three breaks on centreline for rigidity. The pivot rod shall "nest" in the centreline break. Damper edges shall interlock. Maximum length of damper between supports shall be 1067 mm (42"). Damper linkage brackets shall be constructed of galvanized metal.

.6 Two position inlet dampers shall be parallel blade type complete with actuator.

.7 The outside and return air dampers shall be sized to handle 100% of the supply air volume.

.3 The economizer operation shall be fully integral to the mechanical cooling and allow up to 100% of mechanical cooling if needed to maintain the cooling discharge air temperature.

.4 An outdoor air hood shall be factory installed and constructed from galvanized steel finished with the same durable paint finish as the main unit. The hood shall include moisture eliminator filters to drain water away from the entering air stream. The hood shall also include a bird screen to prevent infiltration of foreign materials and a rain lip to drain water away from the entering air stream.

.5 A barometric exhaust damper shall be provided to exhaust air out of the unit. A bird screen shall be provided to prevent infiltration of rain and foreign materials. Exhaust damper blades shall be lined with vinyl gasketing on contact edges.

.6 Outdoor Air Damper Control

.1 Type: spring return close on fail.

.2 Control of the dampers shall be by the Building Automation Contractor. Provide terminal strips for BAS integration.

2.12 FAN MOTOR VARIABLE FREQUENCY DRIVES (VFDS)

.1 Manufacturer shall provide UL or ETL listed VFDs and associated components, as scheduled and shown on drawings. VFDs shall comply with applicable provisions of the National Electric Code.

.2 VFDs shall be mounted in a dedicated NEMA 3R compartment located on the primary access side of its associated fan section and wire VFD to motor, unless otherwise indicated on drawings.

.3 After unit installation, VFD shall be started and programmed by a factory trained and employed service technician.

.4 Unit(s) shall be provided with VFD disconnect and bypass.

.5 Unit(s) shall be provided with harmonic distortion feedback protection:

.1 Equivalent 5% impedance input line reactor.

.2 Integral RFI/EMI filtering to meet EMC EN61800-3 for First Environment.

.6 Unit(s) shall be provided with a user interface consisting of following features:

.1 30 Character multi-lingual alphanumeric display.

.2 Parameter set-up and operating data.

.3 Display data shall include:

.1 output frequency (Hz).

.2 speed (RPM)

.3 motor current

.4 calculated % motor torque

.5 calculated motor power (kW)

.6 DC bus voltage

.7 output voltage

.8 heat sink temperature

.9 elapsed time meter (re-settable)

.10 kWh (re-settable)

.11 input / output terminal monitor

.12 PID actual value (feedback) & error

.13 fault text

.14 warning text

.15 scalable process variable display

.7 VFD shall be provided with the following protection circuits:

.1 over current
.2 ground fault
.3 over voltage
.4 under voltage
.5 over temperature
.6 input power loss of phase
.7 loss of reference/feedback
.8 adjustable current limit regulator

.8 VFD shall be UL 508C approved for electronic motor overload.

.9 VFD shall be provided with features for high input transient protection and surge suppression, such as

.1 4 MOVs ahead of diode bridge.
.2 120 Joule rated 1600V diode module.
.3 Compliant with UL 1449 / ANSI 61.4.

.10 VFD shall be provided with the following communication features:

.1 Two programmable analog inputs.
.2 Six programmable digital inputs.
.3 Two programmable analog output.
.4 Three programmable digital relay outputs.
.5 Adjustable filters on analog inputs and outputs.
.6 Input speed signals, including 4-20 mA and 0-10 VDC.
.7 Accel/Decel contacts [floating point control].
.8 Auto restart [customer selectable and adjustable].

.11 VFD shall consist of the following functions:

.1 Pre-magnetization on start.
.2 DC braking/hold at stop.
.3 Ramp or coast to stop.
.4 Seven preset speeds.
.5 Three critical frequency lockout bands.
.6 Start function shall include ramp, flying start, automatic torque boost, and automatic torque boost with flying start.

2.13 ELECTRICAL WIRING

.1 Each unit shall be wired and tested at the factory before shipment. Wiring shall comply with CSA standards. All wiring shall be number coded per the electrical wiring diagrams. All electrical components shall be labeled according to the electrical diagram and be CSA recognized.

.2 A terminal block shall be provided for the main single point power connection. Knockouts shall be provided in the bottom of the main control panel for field wiring entrance. Branch short circuit protection, 115-volt control circuit transformer and fuse, system switches, and a high temperature sensor shall also be provided with the unit.

.3 Each compressor and condenser fan motor shall be furnished with contactors and internal thermal overload protection. Supply fan motors shall be supplied with external overload protection.

2.14 REFRIGERANT LEAK DETECTION

.1 The refrigerant detection system shall meet the requirements of CSA B52 and have the following functionality:

.1 Utilize a set point nonadjustable in the field to generate a digital output signal to initiative mitigation actions to both internal safeties and external components in the ductwork (dampers, electric coils etc.). Signal shall be generated in not more than 30 seconds from sensor exposure to refrigerant concentration of 25% LFL (+0$, -1%)

.2 Sensor within the equipment, near potential source of leaks.

.3 Field calibration of the system is not allowed.

.4 Be capable of detecting the refrigerant used in the system.

.5 Have self diagnostics.

.6 Energize fans upon failure of a self-diagnostic check.

.7 Activate refrigerant safety shut off valves in the event of a leak being detected.

2.15 UNIT CONTROLS

.1 The unit shall be equipped with a microprocessor based control system. The unit's control system shall include all required temperature and pressure sensors, input/output boards, main microprocessor and operator interfaces required for the operation of the unit.

.2 All factory wiring shall be internal to the unit to maintain product standards for less than 1% air leakage.

.3 All wiring at unit splits shall be connected with quick-connects - no field splicing of wiring is allowed.

.4 Control panels shall be factory mounted and all end devices shall be terminated either directly to the controller or to a terminal block.

.5 Control panels shall include integral 24VAC transformers with circuit breaker overloads.

.6 No low voltage controls or communication wiring shall be running in the same tray, conduit or proximity as any high voltage wiring.

.7 Averaging temperature sensors shall be mounted to cover as much cross-sectional area of the interior unit as possible. End and support brackets shall be provided to support sensing element and eliminate strain.

.8 For mounting probe temperature sensing elements at discharge and air inlet openings, support brackets shall be provided a solid mounting location to minimize vibration effects.

.9 All actuators for control dampers shall be mounted within the frame of the damper. Actuators shall be mounted on the access side of the damper to facilitate commissioning and servicing.

.10 Low temperature cut out sensors shall be mounted on downstream face of first water coil within the coil housing frame.

.11 High temperature cut out sensors shall be mounted, so that the manual reset switch is accessible from the fan section access door. The temperature sensor shall be mounted in the discharge air stream.

.12 High and low pressure cutout devices shall be mounted so that the manual reset switch is accessible from the fan section access door without putting operator at risk.

.13 Factory mounted control panels shall be mounted to the exterior wall of the supply fan section. Internal unit wiring is brought into the panel through a single rear knockout. The penetration shall be sealed to prevent air and leakage moisture leakage. Power shall be provided from the single point power connection on the unit.

.14 Factory packaged controls shall be factory tested using a functional test method. All inputs [AI, BI, DI] and outputs [AO, BO, DO] shall be tested. All sensors and switches shall be cycled through a change of state. All actuators shall be stroked to verify correct operation and rotation through the full operating range. The factory test data results shall be fully documented including all operational conditions. A factory test report document shall be available for each unit. The factory test report shall be provided to the commissioning agent.

2.16 BAS INTEGRATION

.1 Provide internal wiring to terminal strip in NEMA 1 enclosure, with space for future DDC controller by BAS contractor. Provide the following hardwire points.

.1 Supply Fan Start/Stop.

.2 Return Fan Start/Stop.

.3 Mixed Air Damper Modulation.

.4 Supply Air Temperature Reset.

.5 Heating Enable/Disable.

.6 Cooling Enable/Disable.

.7 Alarm Status.

.8 Outdoor Air Damper Modulation.

.2 Unit Controls:

1. Units shall be provided with factory mounted controls, wired and piped, to provide a fully automated start-up and accurately modulated discharge air temperature
2. Burner on/off, modulation or staging control, and all safeties as required, shall be by a unit-mounted micro-processor controller

3. O.E.M. furnished controller, on units equal to or exceeding 5 tons nominal cooling capacity and/or equal to or exceeding 400 MBH nominal heating capacity, must use the following inputs for control:
    1. 0 Vdc to 10 Vdc (or 4 mA to 20 mA) analogue signal from Building Automation System for Discharge Air Temperature set-point.
    2. Binary input from Building Automation System to command / enable / disable Mechanical Cooling
    3. Binary input from Building Automation System to command / enable / disable Heating
    4. Binary input from Building Automation System to command / enable / disable Supply Air Fan(s)
    5. 0 Vdc to 10 Vdc (or, 4 mA to 20 mA) analogue signal from Building Automation System for Outdoor Air Damper position
4. O.E.M. furnished controller, on units less than 5 tons nominal cooling capacity and/or less than 400 MBH nominal heating capacity, must use the following inputs for control:
    1. Binary input from Building Automation System to command / enable / disable Mechanical Cooling
    2. Binary input from Building Automation System to command / enable / disable Heating
    3. Binary input from Building Automation System to command / enable / disable Supply Air Fan(s)
    4. 0 Vdc to 10 Vdc (or, 4 mA to 20 mA) analogue signal from Building Automation System for Outdoor Air Damper position
5. In the event of power loss, the outdoor and exhaust air dampers are to close by way of mechanical spring, return air dampers shall open by way of mechanical spring.
6. Unit Control will be by the Building Automation contractor in accordance with Section 23 09 93.

2.17 ACCESSORIES

.1 Roof Curb

.1 Provide full perimeter roof mounting curb of heavy gauge sheet metal, minimum of **600 mm (24") high** and complete with wood nailer, neoprene sealing strip, and fully welded "Z" bar with 25 mm (1") upturn on inner perimeter, to provide a complete seal against the elements. Provide on the interior of the roof curb 100 mm (4") thick rigid foil faced insulation over entire surface. Foil tape all joints including joints at curb. External insulation of the roof mounting curb shall be provided by the Roofing Subcontractor.

.2 Roof curb shall be matched to the roof slope and be level in both axes.

2.18 CAPACITY

.1 Provide unit capacity indicated on schedules.

Part 3 Execution

3.1 INSTALLATION

.1 Fabricate to provide smooth air flow through all components. Limit air leakage to 1% of rated air flow at 2.5 kPa (10" w.c.) suction pressure.

.2 Apply sealer into all seams prior to assembly. Secure toe angles continuous along entire length of assembly.

.3 Install to manufacturers requirements.

3.2 FANS

.1 Install flexible connections at fan outlets. Ensure metal bands of connectors are parallel and not touching when fan is running and when fan is stopped. Ensure that fan outlet and duct are aligned when fan is running.

3.3 START-UP/COMMISSIONING

.1 Unit manufacturer shall perform start-up and commissioning.

3.4 SPARE PARTS

.1 Two (2) complete sets of filters.

.2 One (1) set of spare belts.

3.5 REFRIGERATION LEAK DETECTION SYSTEM

.1 This contractor shall provide all wiring between leak detection systems installed within the provided equipment and system components in the spaces served and ductwork system.

.2 Specifically, the following shall occur for each independent system on registration of a refrigerant leak:

.1 Open all zone dampers in the affected system.

.2 Disable all electric reheat coils within the affected system.

.3 Activate field installed safety shut off valves within the affected refrigeration system.

.4 Energize all fans within the affected ductwork system.

.5 Activate and refrigerant leak system specific ventilation systems.

.6 De-energize any other potential sources of ignition within the affected system.

.3 All interlocks between field installed detection systems and associated safety system components shall be tested and verified to operate as per the requirements of CSA B52.

3.6 TRAINING

.1 Provide 2 hours training to owner’s staff on the care, maintenance, and operation of the equipment. Dedicated visit to site is required as it will not be paired with equipment startup.

3.7 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.2 Warranty Duration:

.1 One (1) year on parts on all components.

.2 Five (5) years on Energy Recovery Wheel media.

.3 Ten (10) years on heat exchanger.

.3 Warranty Coverage:

.1 Applies to parts and labour.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASTM C553, Mineral Fiber Blanket, Thermal Insulation for Commercial and Industrial Applications.

.3 CSA B52, Mechanical Refrigeration Code.

.4 EPS 1/RA/2, Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with general conditions.

.2 Indicate major components and accessories including sound power levels of units.

.3 Type of refrigerant used.

1.3 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for incorporation into manual specified in general conditions.

1.4 WARRANTY

.1 Contractor hereby warrants refrigeration compressors for 5 years.

Part 2 Products

2.1 GENERAL

.1 System type:

.1 Air flow arrangement: horizontal

.2 Cooling: direct expansion

.3 Condensing: air cooled

2.2 OUTDOOR CONDENSING UNITS

.1 General: Factory-assembled, single piece, air-cooled condensing unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, compressor, refrigerant holding charge, and special features required prior to field start-up. Unit shall be rated in accordance with ARI Standard and be CSA approved.

.2 Unit Cabinet:

.1 Unit cabinet shall be constructed of galvanized steel, bonderized and coated with a prepainted baked enamel finish.

.2 A heavy gage roll-formed perimeter base rail with forklift slots and lifting holes shall be provided to facilitate rigging.

.3 Fans:

.1 Condenser fans shall be direct driven, propeller-type, discharging air horizontally.

.2 Fan blades shall be balanced.

.3 Condenser fan discharge openings shall be equipped with PVC coated steel wire safety guards.

.4 Condenser fan and motor shaft shall be corrosion resistant.

.4 Compressor:

.1 Compressor shall be mounted on vibration isolators.

.2 Compressors shall include overload protection.

.5 Condenser Coil:

.1 Condenser coil shall be air-cooled and circuited for integral subcooler.

.2 Coil shall be constructed of aluminum fins (copper fins optional) mechanically bonded to internally grooved seamless copper tubes which are then cleaned, dehydrated, and sealed.

.6 Refrigeration Components:

.1 Refrigeration circuit components shall include liquid line service valve, suction line service valve, liquid filter drier, a full charge of compressor oil, and a holding charge of refrigerant.

.7 Controls and Safeties:

.1 Minimum control functions shall include:

.1 Control wire terminal blocks.

.2 Five-minute recycle protection to prevent compressor short cycling.

.3 Compressor lockout on auto-reset safety until reset from thermostat.

.2 Minimum Safety devices which are equipped with automatic reset (after resetting first at thermostat), shall include:

.1 High discharge pressure cutout.

.2 Loss-of-charge cutout.

.8 Electrical Requirements:

.1 As indicated.

.2 Unit electrical power shall be single-point connection.

.3 Unit control circuit shall contain a 24-v transformer for unit control.

.9 Capacity: As indicated.

.10 Provide the following:

.1 Hail Guard Package.

.2 Winter Start Package.

.11 Acceptable materials:

.1 LG LSU

.2 Carrier

.3 Trane

.4 Lennox

.5 Daikin

2.3 WALL HUNG FAN COIL UNIT

.1 Indoor, direct-expansion, wall mounted fan coil, complete with cooling coil, fan, fan motor, piping connectors, electrical controls, microprocessor control system, and integral temperature sensing. Unit shall be furnished with integral wall-mounting bracket and mounting hardware.

.2 Cabinet discharge and inlet grilles shall be attractively styled, high-impact polystyrene. Cabinet shall be fully insulated for improved thermal and acoustic performance.

.3 Fan shall be tangential direct-drive blower type with air intake at the upper front face of the unit and discharge at the bottom front. Automatic, motor-driven vertical air sweep shall be provided.

.4 Coil shall be copper tube with aluminum fins and galvanized steel tube sheets. Fins shall be bonded to the tubes by mechanical expansion. A drip pan under the coil shall have a drain connection for hose attachment to remove condensate. Condensate pan shall have internal trap and auxiliary drip pan under coil header.

.5 Motors shall be open drip-proof, permanently lubricated ball bearing with inherent overload protection. Fan motors shall be 3-speed.

.6 Controls shall consist of a microprocessor based control system which shall control space temperature, determine optimum fan speed, and run self diagnostics. The temperature control range shall be from 18°C to 29°C (64°F to 84°F). The unit shall have the following functions:

.1 An automatic restart after power failure at the same operating conditions as at failure.

.2 A timer function to provide a minimum 24-hour timer cycle for system Auto. Start/Stop.

.3 Temperature-sensing controls shall sense return-air temperature. Indoor-air high discharge temperature shutdown shall be provided.

.4 Indoor coil freeze protection.

.5 Wall mounted thermostat to enter set points and operating conditions.

.6 Auto Stop features shall have integral setback control.

.7 Automatic airsweep control to provide on or off activation of airsweep louvers.

.8 Diagnostics shall provide continuous checks of unit operation and warn of possible malfunctions. Error messages shall be displayed at the unit.

.9 Fan speed control shall be user-selectable: high, medium, low, or microprocessor automatic operation during all operating modes.

.10 A time delay shall prevent compressor restart in less than three minutes.

.7 Filter track with factory-supplied cleanable filters.

.8 Capacity:

.1 As indicated.

.9 Acceptable materials:

.1 LG LSN

.2 Carrier

.3 Trane

.4 Lennox

.5 Daikin

2.4 FAN COILS (Heat Pump HP-6.1)

.1 Galvanized chassis, coil, fan housing(s) and wheel(s), fan deck, motor, insulated coil section, 3-speed switch, electrical junction box, galvanized drain pan, and plastic auxiliary drain pan.

.2 3-speed switch shall be supplied with units on the side opposite the piping connections.

.3 Exposed wiring shall be in flexible conduit on all ceiling hideaway units. Unit mounted electrical components shall be pre-wired to a junction box.

.4 Floor models shall have an externally insulated (304 SS optional) mounted directly below the coil for continuous condensate removal. Drain surfaces shall be separate from the fan deck assembly and shall carry condensate to a plastic auxiliary drain pan.

.5 Motors and fans shall be mounted on a removable galvanized steel fan deck assembly.

.6 All cabinets shall be of the type as shown on the drawings. Cabinets shall be manufactured from 16 gauge, epoxy powder coated, cold rolled steel panels with 14 gauge front panel. The entire cooling coil section shall be insulated with ¼" Armaflex insulation. Cabinet parts shall be cleaned and phosphatized before painting.

.7 Optional colors can be selected from the standard color chart.

.8 Cabinets shall have 8" end pockets on both sides of the internal cabinet for installation of electrical equipment or control valves. Floor and wall non-recessed top panels shall be supplied with two flush, hinged access doors with optional tamper-resistant fasteners.

.9 Adjustable rear mounting brackets shall be supplied with all cabinets to provide necessary adjustments to correct unit alignment during installation on untrue or non-square walls, studs, joints, and surfaces.

.10 A wall seal assembly shall be provided with all recessed units. The assembly shall provide a finished appearance to the ceiling or wall.

.11 The inlet plenum shall enclose the motor(s) and fan(s) and include a 1" filter rack.

.12 Provide bar grilles for exposed units with baked epoxy powder coated steel bars. All bar grilles are pencil-proof and mechanically fastened to the fan coil.

.13 All fan wheels shall be forward curve, tablock, centrifugal, and double-width galvanized steel. All fan housing shall be constructed of painted cold rolled steel including mounting flange.

.14 ECM Motors shall be permanent split capacitor, totally enclosed, tap wound for 3-speed, with integral thermal overload protection for 115V/60Hz/1Ph. All motors feature a standard shaft size of ½" diameter. Prior to shipping, all motors shall be assembled, factory tested and installed in the unit.

.15 Coils shall be constructed of 3/8” OD seamless copper tube mechanically bonded to aluminum fins. The entire coil assembly is factory tested to 450 psig air pressure when the coil is submerged in water. It shall have a maximum working pressure of 325 psig. Coil connections are ½”. Each coil shall be supplied with a manual air vent.

.16 Filters supplied shall be 1” MERV 8 disposable filters.

.17 Primary internal wiring and testing shall be conducted at the factory. All units shall be shipped with wiring diagrams.

.18 Capacity: as indicated.

2.5 REFRIGERANT

.1 Holding charge of refrigerant applied at factory.

2.6 UNIT CONTROLS:

.1 Units shall consist of a factory installed microprocessor-based control system, wired and piped, which shall optimize operation, and run self-diagnostics.

.2 O.E.M. furnished controller must use the following inputs for control:

.1 Binary input from Building Automation System to command / enable / disable Mechanical Cooling.

.2 Binary input from Building Automation System to command / enable / disable Heating.

.3 Binary input from Building Automation System to command / enable / disable Supply Air Fan(s).

.3 O.E.M. furnished controller must provide a binary output or dry contact set for indication of unit fault.

.4 Unit shall be equipped with a condensate overflow switch. Upon activation, the unit shall turn off the compressor.

.5 Unit Control will be by the Building Automation.

Part 3 Execution

3.1 GENERAL

.1 Install as indicated, to manufacturers' recommendations.

.2 Manufacturer to certify installation.

.3 Run drain line from cooling coil condensate drain pan to terminate over nearest floor drain.

.4 Provide concrete pad complete with 100 mm x 100 mm x 20 mm (4" x 4" x 3/4") neoprene type vibration isolation.

3.2 EQUIPMENT

.1 Preparation and Start-Up

.1 Provide services of manufacturer’s authorized factory trained mechanic to set and adjust equipment for operation as specified.

.2 Provide results in operation and maintenance manuals.

3.3 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.2 Warranty Duration:

.1 One (1) year warranty period applies.

.2 Contractor hereby warrants refrigeration compressors for five (5) years.

.3 Warranty Coverage:

.1 Applies to parts and labour.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ARI 210/240, Standard for Unitary Air Conditioning and Air-Source Heat Pump Equipment.

.3 ANSI/ARI 320, Standard for Water-Source Heat Pumps.

.4 ARI 325, Standard for Ground Water - Source Heat Pumps.

.5 CAN/CSA-C656, Performance Standard for Split-System and Single Package Central Air Conditioners and Heat Pumps.

.6 CAN/CSA-C13256-1, Water Source Heat Pumps – Testing and Rating for Performance – Part 1: Water-to-Air and Brine-to-Air Heat Pumps.

.7 CAN/CSA-C13256-2, Water-source Heat Pumps – Testing and Rating for Performance – Part 2: Water-to-Water and Brine-to-Water Heat Pumps.

.8 EPS 1/RA/2, Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.

.9 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with general requirements.

.2 Indicate:

- .1 Capacities.
- .2 ARI Ratings.
- .3 Sound Power levels.
- .4 Installation instructions.
- .5 Start-up Instructions.
- .6 O&M Instructions.

1.3 WARRANTY

.1 Contractor hereby warrants heat pumps in accordance with general requirements, but for 5 years.

Part 2 Products

2.1 GENERAL

.1 Heat pumps to be EPS 1/RA/2, CSA approved and carry ARI or CSA certification seal.

2.2 REFRIGERANTS

.1 Refrigerants: use only refrigerants approved by Environment Canada and conforming to intent of Montreal Protocol and all amendments.

2.3 DRAIN PANS

.1 Design and construct condensate drain pans under indoor coils so that no water can accumulate and install to allow for easy cleaning.

2.4 INCREMENTAL WATER SOURCE HEAT PUMP

.1 General:

- .1 Horizontal type, as indicated, consisting of factory-assembled package containing fan, air-to-refrigerant coil, compressor, 4-way reversing valve, water-to-refrigerant heat exchanger, controls for use with R22 for 1 ton units and R410A for units 1.5 tons and over.

.2 Performance:

- .1 Certified in accordance with CAN/CSA-C655.
- .2 As indicated on the drawings.
- .3 Ratings in accordance with CAN/CSA-C655.

.3 Basic unit:

- .1 Compressor: welded hermetic type with internal vibration isolation. Controls to prevent compressor short cycling.
- .2 Air-to-refrigerant coil: aluminum plate fins mechanically bonded to copper tubing with all joints brazed and with all controls factory installed.
- .3 Water-to-refrigerant heat exchanger: copper integral finned inner tube tested for maximum working pressure of 2 MPa (290 psi).
- .4 Refrigerant piping: factory assembled, tested charged with refrigerant sealed, with thermal expansion valve, pilot operated refrigerant reversing valve, high pressure and low temperature safety cut-outs.
- .5 Water piping within unit: factory assembled and tested to 1.4 MPa (203 psi).
- .6 NPT connections: gate valve tested to 1.4 MPa (203 psi) WOG (on supply line) and ball valve tested to 2.8 MPa (406 psi) WOG (on return line), flexible hose with threaded swivel connections on supply and return lines to heat exchanger.
- .7 Piping connections: arranged so that only one supply and return connections to hydronic system is required on site.

.8 Fan: centrifugal forward curved with double inlet, statically and dynamically balanced direct or belt driven from multi-speed, factory lubricated motor.

.9 Filters: 50 mm (2") thick disposal filter (MERV 13). Provide spare filter for each unit.

.10 Unit cabinet: constructed of heavy gauge die-formed galvanized steel with welded corner bracing, complete with provision for connection to return ductwork, hanger brackets and vibration isolators.

.1 Console cabinet to be acoustically insulated.

.2 Finish: oven baked enamel.

.11 Provide for field connection of water and electrical services.

.12 Condensate drain pan and piping designed to ensure complete removal of all water. Drain connections: minimum NPS 20 mm (3/4").

.13 Provide the following minimum hose kit, isolating valves, circuit balancing valves and strainers:

.1 up to and including 2½ ton unit: 20 mm (3/4").

.2 3 ton unit: 25 mm (1").

.3 3½ ton unit and over: 32 mm (1¼").

.4 Noise and vibration requirements:

.1 Sound ratings: measured from unit casing at unit inlet while in cooling mode.

.2 Maximum permissible outlet Sound Power Levels (DB re 10 to -12 Watts).

.3 Where manufacturer cannot meet specified Sound Power Levels, provide downstream or upstream silencer. Where radiated noise level exceeds specified PWL, provide special enclosure around entire unit, designed to fit in allotted space and still allow full access to unit for O&M.

.5 Acceptable materials:

.1 Daikin

.2 Carrier

.3 Water Furnace

.4 Bosch/Florida Heat Pumps

2.5 UNIT CONTROLS:

.1 Units shall consist of a factory installed microprocessor-based control system, wired and piped, which shall optimize operation, and run self-diagnostics.

.2 O.E.M. furnished controller must use the following inputs for control:

.1 Binary input from Building Automation System to command / enable / disable Mechanical Cooling.

.2 Binary input from Building Automation System to command / enable / disable Heating.

.3 Binary input from Building Automation System to command / enable / disable Supply Air Fan(s).

.3 O.E.M. furnished controller must provide a binary output or dry contact set for indication of unit fault.

.4 Unit shall be equipped with a condensate overflow switch. Upon activation, the unit shall turn off the compressor.

.5 Unit Control will be by the Building Automation.

Part 3 Execution

3.1 INSTALLATION

.1 Install where indicated and in accordance with manufacturers instructions.

.2 Secure with hold-down bolts.

.3 Make all duct connections through flexible connections.

.4 Level unit with fans running. Align ductwork. flexible connections. Misalignment with fan stopped not to strain or damage flexible connection.

.5 Make all piping connections.

.6 Nothing to obstruct ready access to all components or to prevent removal of components for servicing.

3.2 DRAIN PANS

.1 Install so that no water can accumulate and arrange so as to be easily accessible for cleaning.

3.3 START-UP AND COMMISSIONING

.1 Manufacturer to certify installation.

.2 Manufacturer to be present during start-up, and test and start up units, and certify

.3 Manufacturer to provide verbal and written instructions to operating personnel.

.4 Submit written report to Consultant.

3.4 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.2 Warranty Duration:

.1 One (1) year warranty period applies.

.2 Contractor hereby warrants heat pumps in accordance with general requirements, but for five (5) years.

.3 Warranty Coverage:

.1 Applies to parts and labour.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes: Packaged, air-source, electric-motor-driven, modular scroll water heat pump.

1.2 SUBMITTALS

.1 Product Data: Include refrigerant, rated capacities, operating characteristics, furnished specialties, and accessories.

.2 Certificates: For certification required in "Quality Assurance" Article.

.3 Startup service reports.

.4 Operation and maintenance data.

.5 Warranty.

1.3 QUALITY ASSURANCE

.1 ASHRAE Compliance: ASHRAE 15 for safety code for mechanical refrigeration.

.2 ASME Compliance: Fabricate and stamp air to water heat pump unit heat exchangers to comply with ASME Boiler and Pressure Vessel Code.

.3 Comply with NFPA 70.

.4 Air to water heat pump unit shall be manufactured in an ISO 9001 certified facility.

Part 2 Products

2.1 PACKAGED AIR-TO-WATER HEAT PUMPS

.1 Description: Factory-assembled and performance-tested air to water heat pump unit complete with base and frame, condenser casing, compressors, compressor motors and motor controllers, water-side heat exchanger, air-side coils, condenser fans and motors, electrical power, controls, and accessories.

.2 Capacity: Refer to schedule.

.3 Operating Range:

.1 Unit shall be capable of producing water up to 149°F.

.2 Unit shall be capable of heating in ambient air temperatures down to -4°F.

.4 Efficiency

.1 Heating COP of 2.9 at water temp of 120°F and external air temp of 47°F.

.2 Cooling EER of 10.18 (Btu/wh) and IFLV of 13.68 (Btu/wh) at water temp of 54°F/44.1°F and external air temp of 95°F.

.5 Cabinet:

.1 Base: Galvanized-steel base extending the perimeter of air to water heat pump unit. Secure frame, compressors, and evaporator to base to provide a single-piece unit.

.2 Frame: Rigid galvanized-steel frame secured to base and designed to support cabinet, condenser, control panel, and other air to water heat pump unit components not directly supported from base.

.3 Casing: Galvanized steel.

.4 Finish: Coat base, frame, and casing with rustproof polyester paint.

.6 Scroll Compressors:

.1 Description: Positive-displacement direct drive with hermetically sealed casing.

.2 Enhanced Vapor Injection

.3 Each compressor provided with suction and discharge service valves, crankcase oil heater, and suction strainer.

.4 Operating Speed: Nominal 3600 rpm for 60-Hz applications.

.5 Capacity Control: On-off compressor cycling.

.6 Oil Lubrication System: Automatic pump with strainer, sight glass, filling connection, filter with magnetic plug, and initial oil charge.

.7 Vibration Isolation: Individual compressors mounted on vibration isolators.

.8 Compressors must be enclosed in acoustically insulated and weatherproof thick galvanized steel compartment.

.9 Compressor compartment must be accessible from the front and both sides of the air to water heat pump unit via lift-off style access doors.

.10 Lead compressors within an individual unit shall switch to a lag position approximately every 100 hrs of unit operation.

.7 Compressor Motors:

.1 Hermetically sealed and cooled by refrigerant suction gas.

.2 High-torque, two-pole induction type with inherent thermal-overload protection on each phase.

.3 Compressor motors must not exceed 15 horsepower.

.8 Refrigeration:

.1 Refrigerant: Classified as Safety Group A1 or A2L according to ASHRAE 34.

.2 Refrigerant Compatibility: Parts exposed to refrigerants shall be fully compatible with refrigerants, and pressure components shall be rated for refrigerant pressures.

.3 Refrigerant Circuit: Each circuit shall include a thermal-expansion valve, refrigerant charging connections, a hot-gas muffler, compressor suction and discharge shutoff valves, a liquid-line shutoff valve, a replaceable-core filter-dryer, a sight glass with moisture indicator, a liquid-line solenoid valve, and an insulated suction line.

.4 Each module shall have two refrigeration circuits. Each refrigeration circuit must be limited to an aggregate compressor horsepower of 15.

.5 Refrigerant Isolation: Factory installed positive shutoff isolation valves in the compressor discharge line and the refrigerant liquid-line to allow the isolation and storage of the refrigerant charge in the air to water heat pump unit condenser.

.9 Water-side heat exchanger:

.1 Brazed Plate:

.1 Direct-expansion, single-pass, brazed-plate design.

.2 Type 316 stainless-steel construction.

.3 Heat exchanger shall have two independent refrigerant circuits, one cooling water circuit.

.4 Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code.

.2 Heater: Factory-installed and -wired electric heater with integral controls designed to protect the heat exchanger.

.3 Water-side heat exchangers shall be provided with a factory installed inlet strainers.

.10 Water Circuit and Modularity

.1 Modules must require clearance on only two sides in order to perform all service functions.

.2 Each module must be capable of being completely isolated electrically and hydraulically without impacting the operation of the rest of the modules on the set.

.3 Headers shall be provided with Victaulic connections between modules. Headers shall be factory installed and incorporated into the frame of the air to water heat pump unit. Headers that run outside the frame of the air to water heat pump unit and/or field installed headers are not acceptable.

.4 Shut off valves shall be provided between evaporator and header of each module.

.5 2-pipe hydraulic header system shall be for seasonal changeover air source heat pump.

.6 Each module shall be isolated from the others when not in operation with a motorized valve.

.11 Air-Side Heat Exchanger:

.1 Air-Side Heat Exchanger shall be aluminum copper.

.2 Fans: Direct-drive propeller type with statically and dynamically balanced fan blades, arranged for vertical air discharge.

.3 Fan Motors: Inverter driven totally enclosed non ventilating (TENV) or totally enclosed air over (TEAO) enclosure, with permanently lubricated bearings, and having built-in overcurrent- and thermal-overload protection. In order to avoid freezing of the fan motor shaft to the motor frame in weather below 34°F, the fan should be turned on in every 2 hours for 30 seconds to warm up the motor frame.

.4 Fan Guards: Steel safety guards with corrosion-resistant coating.

.12 Electrical Power:

.1 Unit shall have single point power connection for each module.

.2 Factory-installed and wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to each module.

.3 House in a unit-mounted NEMA 250, Type 3R enclosure with hinged access door with lock and key or padlock and key.

.4 Electrical enclosure shall be mounted on hinges in order to maximize serviceability to components located behind.

.5 Wiring shall be numbered and color-coded to match wiring diagram.

.6 Install factory wiring outside of an enclosure in a raceway.

.7 Field power interface shall be heavy-duty, non-fused disconnect switch.

.8 Provide each motor with overcurrent protection.

.9 Overload relay sized according to UL1995, or an integral component of air to water heat pump unit control microprocessor.

.10 Phase-Failure and Undervoltage: Solid-state sensing with adjustable settings.

.11 Transformer: Unit-mounted transformer with primary and secondary fuses and sized with enough capacity to operate controls

.12 Control Relays: Auxiliary and adjustable time-delay relays.

.13 Indicate the following for air to water heat pump unit electrical power supply:

.1 Current, phase to phase, for all three phases.

.2 Voltage, phase to phase and phase to neutral for all three phases.

.3 Three-phase real power (kilowatts).

.4 Three-phase reactive power (kilovolt amperes reactive).

.5 Power factor.

.6 Running log of total power versus time (kilowatt hours).

.7 Fault log, with time and date of each.

.14 The electrical box can also be possible to install them from the back with accessory KREC, which should be factory mounted.

.13 Kilo Ampere Interrupting Capacity (kAIC) Rating

.1 **Equipment shall be rated a interrupting capacity rating of 25 kAIC.**

.2 **All products supplied to the site shall meet or exceed this kAIC rating.**

.3 **The kAIC rating may be lowered to match or exceed the available fault current indicated on the Short Circuit Co-ordination Study completed by the electrical trade.**

.14 Controls:

.1 Each modules shall be provided with a controller that will interface with each module's controller in order to stage capacity and orchestrate the operation of all modules in order to maximize efficiency and resiliency.

.2 Enclosure: Share enclosure with electrical power devices or provide a separate enclosure of matching construction.

.3 Operator Interface: Keypad or pressure-sensitive touch screen. Multiple-character, backlit, liquid-crystal display, or light-emitting diodes. Display the following:

.1 Date and time.

.2 Operating or alarm status.

.3 Operating hours.

.4 Outside-air temperature if required for chilled-water reset.

.5 Temperature and pressure of operating set points.

.6 Entering and leaving temperatures of chilled water.

.7 Refrigerant pressures in evaporator and condenser.

.8 Saturation temperature in evaporator and condenser.

.9 No cooling load condition.

.10 Elapsed time meter (compressor run status).

.11 Antirecycling timer status.

.12 Percent of maximum motor amperage.

.13 Current limit set point.

.14 Number of compressor starts.

.4 Control Functions:

.1 Manual or automatic startup and shutdown time schedule.

.2 Entering and leaving chilled-water temperatures, control set points, and motor load limit. **Hot water leaving temperature shall be reset up to 149F.**

.3 Current limit and demand limit.

.4 External air to water heat pump unit emergency stop.

.5 Antirecycling timer.

.6 Automatic lead-lag switching.

.5 Manual-Reset Safety Controls: The following conditions shall shut down air to water heat pump unit and require manual reset:

.1 Low evaporator pressure or high condenser pressure.

.2 Low chilled-water temperature.

.3 Refrigerant high pressure.

.4 High or low oil pressure.

.5 High oil temperature.

.6 Loss of water flow.

.7 Control device failure.

.6 Insulation:

.1 Material: Closed-cell, flexible elastomeric, thermal insulation complying with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

.2 Thickness: ¾ Inch

.3 Factory-applied insulation over cold surfaces of air to water heat pump unit components.

.1 Adhesive: As recommended by insulation manufacturer and applied to 100 percent of insulation contact surface. Seal seams and joints.

.4 Apply protective coating to exposed surfaces of insulation.

.7 Defrost

.1 The units must include intelligent defrost. This allows the unit to go in defrost only when is needed, avoiding unnecessary defrost cycles. This shall be achieved by monitoring the suction pressure decay and the OAT.

.2 Timed defrost is not allowed.

.3 Heat pumps performance and efficiency should take into consideration of defrost cycles.

.4 Defrost cycle should not usually be less than 2 minutes and not more than 6 minutes.

.5 During defrost cycle, condenser fan should be off.

.6 Defrost will start only when external air temperature is less than 50°F.

.7 Low pressure threshold on the coil should be less than 5.2 bar/75.42 Psi.

.8 When the pressure variations between clean and uncleaned coil is 0.6 bar/8.70 psi, defrost will start automatically.

.9 Minimum time between two defrost should be greater than 15 minutes.

2.2 OVERALL SYSTEM CONTROLLER

.1 Fully Programable Overall Air Source Heat Pump System Controller:

.1 Unit supplier shall provide a fully customized and programmable controller for the Air Source Heat Pump System.

.2 This system shall take BAS input of supply water set point and control the ASHP modules, glycol heating pumps, and heat exchanger circulator pump in order to provide a complete and operably system.

.3 All wiring and controllers shall meet the standards indicated in Division 25.

.4 The following points shall be received from the BAS system:

.1 Enable/Disable

.2 Glycol temperature set point

.5 The following points shall be passed through and provided to the BAS system:

.1 Glycol Circulator Command

.2 Glycol Circulator Status

.3 Glycol Supply Water Temp

.4 Glycol Return Water Temp

.5 Heath Exchanger Circulator Command

.6 Heat Exchanger Circulator Status

.7 ASHP System Alarm/Error

.8 ASHP Module Status (for each module)

.9 ASHP in Defrost Mode (for each module)

.10 ASHP entering water temp too low (for each module)

.2 Standard Multi-Module Controller

.1 Provide manufacturer's standard multi-module controller.

.2 Module shall be capable of BACnet integration to the BAS system.

2.3 SOURCE QUALITY CONTROL

.1 Air to water heat pump unit shall be manufactured in an ISO 9001 certified facility.

.2 Each module shall be factory performance tested on a third-party certified test stand to ensure proper operation, full load efficiency and full load capacity. Test reports shall be made available to owner and engineer upon request. AHRI certification does not preclude air to water heat pump unit from performance test requirement.

.1 Functional Test

.1 Pre-charge unit with nitrogen and test for leakage

.2 Establish a vacuum to remove all gas and to eliminate moisture inside the refrigerant circuit.

.3 Charge the unit with refrigerant.

.4 Connect the evaporator and condensers inlet and outlet water connections to the testing room plant.

.5 Set the water flow to the design flow rate.

.6 Connect power to the unit and carry out test of voltage and frequency on the electrical panel.

.7 Program the microprocessor control with basic working parameters.

.8 Set up the valves and trim the refrigerant charge.

.9 Start up each compressor and test electrical data.

.10 Set up all the pressure switches.

.11 Calibrate the various temperature and pressure probes on the circuit.

.2 Performance Test

.1 Test the following alarms on the microprocessor through run test:

.1 High pressure alarm

.2 Low pressure alarm

.3 Compressors alarm

.4 Evaporator freeze alarm

.2 Test probe failures.

.3 Run the air to water heat pump unit in the production climatic test chamber at full load conditions at design conditions (each circuit).

.4 Record the performance data on the test report sheet and provide a copy to engineer and owner.

.5 Each compressor circuit will be run separately.

.3 Sound Compliance: Air to water heat pump unit sound power levels shall be rated according to ISO 9614-2 and sound pressure levels rated to ISO 3744 standards. If alterations are made to a standard air to water heat pump unit to comply with the sound requirements, the manufacturer must provide a sound performance test in a certified facility.

2.4 APPROVED MANUFACTURERS AND MODELS

.1 Basis of Design:

.1 Aermec (using NYG Heat Pump)

.2 Alternate:

.1 Transom

2.5 WORK PLATFORM

.1 Provide raised galvanized steel work platform for equipment service complete with removal side rail, as indicated. Platform to be mounted on zero penetration supports

.1 Acceptable manufacturers:

.1 Skyline

.2 Ecofoot

Part 3 Execution

3.1 GENERAL

.1 Install equipment to manufacturer's recommendation.

.2 Secure equipment to structure and with vibration equipment.

.3 Provide isolation valve, strainers, thermometers, thermowells, pumps, etc. in the piping systems.

3.2 DELIVERY, STORAGE, AND HANDLING

.1 All outdoor units, indoor units, controls, and piping components shall be stored and handled according to the manufacturer's recommendation.

.2 All outdoor units, indoor units, refrigerant branch units, controls and piping components shall be stored and handled according to the manufacturer's recommendation.

3.3 CLEANING OF HYDRONIC SYSTEMS

.1 Bypass the piping system around the equipment for cleaning the hydronic system. Do NOT clean the hydronic system through the equipment.

.2 The equipment comes from the factory already clean. Keep all pipe connections plugged until final connection.

3.4 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.2 Warranty Duration:

.1 One (1) year warranty period applies.

.2 Five (5) year compressor warranty.

.3 Warranty Coverage:

.1 Applies to parts and labour.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 Ductwork Section.

.2 Installation of duct accessories and heaters Section.

1.2 PRODUCT DATA

.1 Submit product data in accordance with general requirements.

.2 Include:

.1 Element support details.

.2 kW rating, voltage, phase.

.3 Physical size.

.4 Unit support.

.5 Performance limitations.

.6 Clearance from combustible material.

.7 Internal components wiring diagrams.

.8 Minimum operating air flow.

.9 Pressure drop and minimum air flow.

Part 2 Products

2.1 ACCEPTABLE MANUFACTURERS

.1 Neptronic

.2 P.M. Wright

.3 Chromalox

.4 Thermolec

.5 Hazloc (EXPL)

2.2 DUCT HEATERS

.1 Duct heaters: flange type. Provide type (square or round) as indicated on drawings.

.2 Elements:

.1 Helical coils of nickel chrome alloy resistance wire.

.3 Staging:

.1 Built in Electronic controller (SCR) - ON/OFF components will not be accepted.

.4 Controls:

.1 Factory mounted and wired in control box. Use terminal blocks for power and control wiring to thermostat and sail switch.

.2 Controls mounted in a CSA enclosure and to include:

.1 Contactors.

.2 Control transformers.

.3 Controller.

.3 Where controls are mounted in heater, exercise care in mounting contactors to minimize switching noise transmission through ductwork.

.4 Controls must accept a low voltage input signal from a refrigerant leak detection system that de energizes the unit. Input must automatically reset.

.5 Safety Interlock

.1 Provide air proving pressure differential switch where pressure drop across the coil is within sensors range.

.2 For systems with inadequate pressure drop across the coil, provide a fan status relay for safety interlock.

Part 3 Execution

3.1 INSTALLATION

.1 Install as per manufacturers requirements.

.2 Power connection will be by Electrical Division. All control wiring shall be by this contractor.

.3 Wire refrigerant leak detection system to coil.

.4 Install air proving pressure switch/fan status relay as applicable.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Electrical general requirements section.

3.3 WARRANTY

.1 Warranty Start Date:

.1 Warranty period starts as of the date of Ready for Takeover.

.2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.

.2 Warranty Duration:

.1 One (1) year warranty period applies.

.3 Warranty Coverage:

.1 Applies to parts and labour.

END OF SECTION

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END OF SECTION

Part 1 General

1.1 INSTRUCTIONS TO BIDDERS

.1 The Electrical Supplemental Tender Form must be submitted to the Architect (admin@hossackarch.com) and Consultant (dei@deiassociates.ca) via email on or before 2:00 p.m. local time the following day of the tender close, or next business day. Electrical contractors shall identify all sub-contractors he/she intends to use and must complete all information requested. The requisite information shall be given at the office of the Consultant. Contractor shall sign and date this page and initial and date each page thereafter.

.2 Should the Electrical Supplemental Form not be submitted then the contractor shall use Basis of Design manufacturers as listed.

.3 CONTRACTOR

I/We certify that I/We have the authority to bind the company.

COMPANY NAME	AUTHORIZED SIGNATURE
ADDRESS	PRINTED SIGNATURE
CITY	TITLE
TELEPHONE NUMBER	DATE
FAX	

.4 SUB-CONTRACTORS

The Contractor shall state below the name of the Public Address, Security, Co-ordination Study, Computer Network, Life Safety Systems Commissioning Agent, Seismic Restraint Engineer Sub-contractor he intends to use, which shall not be changed without the consent of the Consultant.

Public Address _____

Security _____

Co-ordination Study _____

Computer Network _____

Life Safety Systems Commissioning Agent _____

Seismic Restraint Engineer _____

.5 The Stipulated Bid Sum shall be for the basis of design manufacturer or supplier equipment only, unless otherwise indicated. Where a choice of this equipment is given, this Contractor shall indicate the supplier or manufacturer he intends to use. **Where no choice is indicated, the basis of design supplier or equipment shall be used.**

.6 Equipment or materials manufactured by firms named in the following listing only shall be deemed equal to the equipment or material specified, provided the equipment or material will have capacity, performance, rating, construction, physical dimensions, accessories and features which, in the opinion of the Consultant, are equal to those of the specified equipment or material. The Electrical Contractor shall not indicate equipment, materials or suppliers which are not listed. If this is done, the base bid supplier shall be used.

.7 Where modifications to the work of other trades are required as a result or part of the alternative offered, include the cost of said modifications in the work.

.8 Submit the following list of basis of design and alternative suppliers in accordance with the bid requirements:

Spec. Reference Section	**Equipment**	**Basis of Design**	**Acceptable Alternate Manufacturer**	**Indicate Manufacturer Or Supplier**
26 29 13.13	Starters and Contactors	Schneider Electric	Allen Bradley Siemens Eaton Klockner-Moeller	
26 22 13.13	Dry –Type Transformers	Hammond	Rex Acme Delta Bemag	
26 24 13	Service Entrance Board	Schneider Electric	Siemens Eaton	
26 24 17	Molded Case Circuit Breakers	Schneider Electric	Siemens Eaton	
26 28 16	Disconnect Switches	Schneider Electric	Siemens Eaton	
26 24 16	Panelboards	Schneider Electric	Siemens Eaton	
26 28 13	Fuses – Low Voltage	Mersen	GEC Littlefuse	
26 51 13	LED Interior	Cooper	Lithonia Signify	
26 51 13	LED Exterior	Cooper	Lithonia Signify	
26 51 13	Exit Lighting	Aimlite	Lumacell Stanpro	
26 51 13	Emergency Battery Units	Aimlite	Lumacell Stanpro	
26 51 13	Emergency Fixtures	Aimlite	Lumacell Stanpro	

26 51 16	Digital Occupancy and Network Lighting Control Systems (wired)	Acuity (nLight)	Cooper (Wavelinx CAT) Legrand (Wattstopper)	
26 43 13	Surge Protection Devices	Innosys	n/a	
26 05 76	Electric Heating Equipment	Ouellet	Westcan Stelpro	
27 41 16	Public Address	Carehawk	Telecor Bogen Dukane	
27 41 16	Gym Sound Equipment	TOA	Dukane Rauland	
28 31 25	Fire Alarm System (Addressable)	Edwards	Simplex Notifier Mircom	
28 16 16	Security System	Keyscan		

.9 LABOUR RATES

.1 The following labour rates shall apply for calculating the cost of credit or extras on Change Notices. The rates shall include any employee benefits. The labour rates do not include overhead and profit.

Apprentice Electrician $_____/hr

Journeymen Electrician $_____/hr

1.2 ELECTRICAL TENDER PRICE (EXCLUDING HST)

.1 Having carefully examined all Drawings and Specifications and the Addenda to the Drawings and Specifications, and having carefully examined the sites and all conditions affecting the work, we, the undersigned thereby offer to provide all plant, labour, materials and incidentals required to complete the work of all trades for: All the work specified for herein for

the Total Stipulated Price of: $_____

_____

(in writing)

in lawful money of Canada; included in which are all applicable excise taxes, custom duties, freight, exchange, and all other charges. HST is not included.

END OF SECTION

Part 1 General

1.1 GENERAL INSTRUCTIONS

.1 Comply with the General Conditions, Supplementary Conditions, and all of Division 1.

.2 Allowances are indicated in Division 1 for this project. Refer to Division 1 to obtain allowance values.

1.2 CASH ALLOWANCE (HST EXCLUDED)

.1 Refer to current CCDC requirement and Division 1 for CASH ALLOWANCES.

.2 HST (Harmonized Sales Tax) is not included in cash allowance(s).

.3 Allowances are stated in Division 1 of this project specification. It is the responsibility of the Electrical Contractor to review all allowances. If no allowances are identified, the Electrical Contract Price shall include all costs associated for the full scope of work and materials related to Electrical Contract Documents prepared by the Consultant.

.4 Allowances shall be expended as the Owner directs through the Consultant. The Consultant will direct the Contractor(s) to **purchase** and perform work for which payment is made from an allowance.

.5 Unless otherwise noted, the stated allowances for equipment purchase include initial distributor mark-up for the material components. The installation of these allowance items, along with required power connections, device boxes, conduit, controls, cabling, cable terminations with testing, making operable, and warranty must be included in the electrical tender price. Therefore, the Contractor shall include any overhead and profit on the allowance value in their tendered price and not from within the allowance value.

.6 Where the actual cost of the Work under any cash allowance is less that the amount of the allowance, the Owner shall be credited for the unexpended portion of the cash allowance, but not for the Contractor's overhead and profit on such amount.

.7 Where the allowance is insufficient to cover the actual cost the difference in value will be addressed as a change order.

.8 The value of the work performed under a cash allowance is eligible to be included in progress payments.

1.3 EXPENDITURE OF CASH ALLOWANCES

.1 Owner, through Consultant, will provide Contractor with documentation required to permit pricing of a cash allowance item.

.2 Owner, through Consultant, may request Contractor to identify potential Suppliers or Subcontractors, as applicable, and to obtain at least three competitive prices for each cash allowance item.

.3 Owner, through Consultant, may request the Contractor to disclose originals of all bids, quotations, and other price related information received from potential Suppliers or Subcontractors.

.4 Owner, through Consultant, will determine by whom and for what amount each cash allowance item will be performed. Obtain Owner's prior written approval in the form of a Change Order before entering into a subcontract, amending an existing subcontract, or performing own forces work included in a cash allowance. Upon issuance of the Change Order, the Contractor's responsibilities for a cash allowance item shall be the same as for other work of the Contract.

.5 Refer to CCDC 2 – 2020, GC4.1.4. Where the actual cost of the Work under any cash allowance exceeds the amount of the allowance, and unexpended amounts from other cash allowance 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.

.6 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.

.7 Where the actual cost of all the Work under the cash allowances are less than the amount of the allowances, the Owner shall be credited for the unexpended portion of the cash allowances, but not for the Contractor's overhead and profit on such amount.

1.4 CASH ALLOWANCE CONTRACT REQUIREMENTS

.1 The Contractor accepts to provide all contract requirements for the products supplied in the allowances, this includes providing supervision to include the product into the contract, shop drawing submission, coordinating installation, accepting warranty, accepting instruction to the Owner, providing as-builts, including product literature in maintenance manuals, etc.

.2 All this work must be included in the Contractor's tender price.

Part 2 Not Used

Part 3 Not Used

END OF SECTION

Part 1 General

1.1 GENERAL

.1 This Section covers items common to Electrical Division 26, as well as Division 27 and Division 28.

.2 This section supplements requirements of Division 1.

.3 Furnish labour, materials, and equipment necessary for completion of work as described in contract documents.

1.2 INTENT

.1 Mention herein or indication on Drawings of articles, materials, operations, or methods requires: supply of each item mentioned or indicated, of quality, or subject to qualifications noted; installation according to conditions stated: and, performance of each operation prescribed with furnishing of necessary labour, equipment, and incidentals for electrical work.

.2 Where used, words “Section” and “Division” shall also include other Subcontractors engaged on site to perform work to make building and site complete in all respects.

.3 Where used, word “supply” shall mean furnishing to site in location required or directed complete with accessory parts.

.4 Where used, word “install” shall mean secured in place and connected up for operation as noted or directed.

.5 Where used, word “provide” shall mean supply and install as each is described above.

1.3 TENDERS

.1 Complete Supplemental Tender Form including list of equipment and materials to be used on this project and forming part of tender documents.

.2 Submit Supplemental Tender Form as noted.

.3 Submit tender based on specified described equipment or Alternates listed.

.4 State in Tender, names of all Subcontractors proposed for work under this Division.

1.4 LIABILITY INSURANCE

.1 This contractor must maintain and produce at the request of the consultant proof of proper insurance to fully protect the owner, the consultant and the contractor from any and all claims due to accidents, misfortunes, acts of God, etc.

1.5 ELECTRICAL SAFETY AUTHORITY

.1 The contractor is to determine general inspection fees with Electrical Safety Authority and include as part of tender.

.2 A submission has been made (if required by this scope of project) by the consultant to the Electrical Safety Authority for review of this project. The payment of the required review costs will be coordinated by the consultant. A copy of the Electrical Safety Authority review report will be forwarded to the successful contractor for information and action. Contractor will not be responsible for these review costs.

1.6 DRAWINGS

.1 Electrical Drawings do not show structural and related details. Take information involving accurate measurement of building from building drawings, or at building. Make, without additional charge, any necessary changes or additions to runs of conduits and ducts to accommodate structural conditions. Location of conduits and other equipment may be altered by the consultant without extra charge provided change is made before installation and does not necessitate major additional material.

.2 As work progresses and before installing fixtures and other fittings and equipment which may interfere with interior treatment and use of building, provide detail drawings or obtain directions for exact location of such equipment and fitments.

.3 Electrical drawings are diagrammatic. Where required work is not shown or only shown diagrammatically, install same at maximum height in space to conserve head room (minimum 2200 mm (88") clear) and interfere as little as possible with free use of space through which they can pass. Conceal wiring, conduits and ducts in furred spaces, ceilings and walls unless specifically shown otherwise. Install work close to structure so furring will be small as practical.

.4 Before commencing work, check and verify all sizes, locations, grades, elevations, levels and dimensions to ensure proper and correct installation. Verify existing/municipal services.

.5 Locate all electrical equipment in such a manner as to facilitate easy and safe access to and maintenance and replacement of any part.

.6 In every place where there is indicated space reserved for future or other equipment, leave such space clear, and install services so that necessary installation and connections can be made for any such apparatus. Obtain instructions whenever necessary for this purpose.

.7 Relocate equipment and/or material installed but not co-ordinated with work of other Sections as directed, without extra charge.

.8 Where drawings are done in metric and product not available in metric, the corresponding imperial trade size shall be utilized.

1.7 INTERFERENCE AND COORDINATION DRAWINGS

.1 Prepare interference and equipment placing drawings to ensure that all components will be properly accommodated within the constructed spaces provided.

.2 Prepare drawings to indicate co-ordination and methods of installation of a system with other systems where their relationship is critical. Ensure that all details of equipment apparatus, and connections are co-ordinated.

.3 Ensure that clearances required by jurisdictional authorities and clearances for proper maintenance are indicated on drawings.

.4 Upon consultant's request submit copies of interference drawings to the consultant.

.5 Due to the nature of the building and the complexity of the building systems provide the following:

.1 Interference drawings, showing coordination of architectural, structural, mechanical, and electrical systems for the consultant's review prior to fabrication.

.2 Detailed equipment room drawings clearly showing all distribution equipment.

.3 Detailed layout drawings clearly showing conduit/feeder runs 78mm diameter or larger, including hangers or tray.

.6 Provide CAD drawings (minimum file version AutoCAD 2013) in addition to hard copies.

1.8 QUALITY ASSURANCE

.1 The installations of the division must conform to the latest edition of the Electrical Safety Code as well as its supplemental bulletins and instructions. Provide materials and labour necessary to comply with rules, regulations, and ordinances.

.2 Complete underground systems in accordance with CSA C22.3 No. 7-94 except where specified otherwise.

.3 Abbreviations for electrical terms: to CSA Z85-1983.

.4 In case of differences between building codes, provincial laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern. Promptly notify consultant in writing of such differences.

1.9 ALTERNATES AND SUBSTITUTIONS

.1 Throughout these sections are lists of "Alternate Equipment" manufacturers acceptable to consultant if their product meets characteristics of specified described equipment.

.2 Each bidder may elect to use "Alternate Equipment" from lists of Alternates where listed. Include for any additional costs to suit Alternated used. Prices are not required in Tender for Alternates listed except where specifically noted as "Separate Price". Complete the Supplementary Tender Form.

.3 When two or more suppliers/manufacturers are named in the Bid Documents, only one supplier/manufacturer of the products named will be acceptable; however, it is the responsibility of this Division to ensure "Alternate Equipment" fits space allocated and gives performance specified. If an "Alternate Equipment" unit is proposed and does not fit space allotted nor equal specified product in consultant's opinion, supply of specified described equipment will be required without change in Contract amount. Only manufacturers listed will be accepted for their product listing. All other manufacturers shall be quoted as substitution stating conditions and credit amount.

.4 If item of material specified is unobtainable, state in Tender proposed substitute and amount added or deducted for its use. Extra monies will not be paid for substitutions after Contract has been awarded.

1.10 EXAMINATION

.1 Site Reviews

.1 Examine premises to understand conditions, which may affect performance of work of this Division before submitting proposals for this work.

.2 No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.

.2 Drawings

.1 Electrical Drawings show general arrangement of fixtures, power devices, equipment, etc. Follow as closely as actual building construction and work of other trades will permit.

.2 Consider Architectural, Mechanical, and Structural Drawings part of this work insofar as these drawings furnish information relating to design and construction of building. These drawings take precedence over Electrical Drawings.

.3 Because of small scale of Drawings, it is not possible to indicate all offsets, fittings, and accessories, which may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings and accessories required to meet conditions.

.3 Ensure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents. If approval is received by Addendum or Change Order to use other than originally specified items, be responsible for specified capacities and for ensuring that items to be furnished will fit space available.

1.11 SEQUENCING AND SCHEDULING

.1 It is understood that while Drawings are to be followed as closely as circumstances permit, this Division will be held responsible for installation of systems according to the true intent and meaning of Contract Documents. Anything not clear or in conflict will be explained by making application to consultant. Should conditions arise where certain changes would be advisable, secure consultant's approval of these changes before proceeding with work.

.2 Coordinate work of various trades in installing interrelated work. Before installation of electrical items, make proper provision to avoid interferences in a manner approved by consultant. Changes required in work specified in these sections caused by neglect to do so shall be made at no cost to owner.

.3 Arrange fixtures, conduit, ducts, and equipment to permit ready access to junction boxes, starters, motors, control components, and to clear openings of doors and access panels.

.4 Furnish and install inserts and supports required by these sections unless otherwise noted. Furnish sleeves, inserts, supports, and equipment that are an integral part of other Divisions of the Work to Sections involved in sufficient time to be built into construction as the Work proceeds. Locate these items and see that they are properly installed. Expense resulting from improper location or installation of items above shall be borne by the electrical trade.

.5 Adjust locations of ducts, conduits, equipment, fixtures, etc., to accommodate work from interferences anticipated and encountered. Determine exact route and location of each conduit and duct prior to installation.

.1 Make offsets, transitions, and changes in direction of ducts, and electrical raceways as required to maintain proper head room and pitch of sloping lines whether or not indicated on Drawings.

.2 Supply and install pull boxes, etc., as required to affect these offsets, transitions, and changes in direction.

1.12 REQUEST FOR INFORMATION (RFI) PROCEDURES

.1 RFIs shall be submitted to the consultant minimum two (2) weeks prior to answer being required. Failure to submit and RFI in a timely manner will forfeit delay claims and schedule extension requests by the contractor.

.2 All RFIs will be submitted with the following information:

.1 RFI number
.2 Name of project
.3 Date of initiation
.4 Date response required by (minimum two (2) weeks)
.5 Subject
.6 Submitter's name
.7 Drawing/specification reference
.8 Photograph of the issue (if applicable)
.9 Description of the issue
.10 Contractor's proposed resolution

1.13 DRAW BREAKDOWN

.1 This contractor MUST submit a breakdown of the tender price into classifications to the satisfaction of the consultant, with the aggregate of the breakdown totaling the total contract amount. **Each item must be broken out into material and labour costs.** Progress claims, when submitted are to be itemized against each item of the draw breakdown. This shall be done in table form showing contract amount, amount this draw, total to date, % complete and balance.

.2 Breakdown shall be as follows:

.1 Permits and fees
.2 Mobilization (maximum 1%)
.3 Switchboard

.4 Panelboards and miscellaneous distribution equipment
.5 Ductbank primary
.6 Ductbank secondary
.7 Secondary cables
.8 Feeder conduits
.9 Branch conduits
.10 Feeder cables
.11 Fire rated feeder cables
.12 Branch wiring
.13 Lighting fixtures (interior)
.14 Emergency lighting
.15 Exterior lighting
.16 Fire alarm system
.17 Public address system
.18 Master clock and program system
.19 Security system
.20 Voice/Data system
.21 Classroom control panels
.22 Starters, contactors, and control devices
.23 Electric heating
.24 Wiring for mechanical equipment
.25 Wiring for owner's equipment
.26 Integrated Life Safety System Testing
.27 Commissioning (minimum 3%)
.28 Electrical contractor closeout requirements (minimum of 3% but not less than $5,000.00)

.3 The breakdown must be approved by the consultant prior to submission of the first draw.
.4 Breakdowns not complying to the above will not be approved.
.5 Breakdown must indicate total contract amount.
.6 Mobilization amount may only be drawn when all required shop drawings have been reviewed by the consultant.

1.14 SHOP DRAWINGS AND PRODUCT DATA

.1 General

.1 Furnish complete catalog data for manufactured items of equipment to be used in the work to consultant for review within 14 days after award of Contract.
.2 Upon receipt of reviewed shop drawing, product is to be ordered immediately.
.3 Provide a complete list of shop drawings to be submitted prior to first submission.

.4 Before submitting to the consultant, review all shop drawings to verify that the products illustrated therein conform to the Contract Documents. By this review, the contractor agrees that it has determined and verified all field dimensions, field construction criteria, materials, catalogue numbers, and similar data and that it has checked and coordinated each shop drawing with the requirements of the work and of the Contract Documents. The contractor's review of each shop drawings shall be indicated by stamp, date and signature of a qualified and responsible person possessing by the appropriate authorization.

.5 If material or equipment is not as specified or submittal is not complete, it will be rejected by consultant.

.6 Additional shop drawings required by the contractor for maintenance manuals, site copies etc., shall be photocopies of the "reviewed" shop drawings. All costs to provide additional copies of shop drawings shall be borne by the contractor.

.7 **Submit all shop drawings for the project as a package. Partial submittals will not be accepted**.

.8 Catalog data or shop drawings for equipment, which are noted as being reviewed by consultant or his engineer shall not supersede Contract Documents.

.9 Review comments of consultant shall not relieve this Division from responsibility for deviations from Contract Documents unless consultant's attention has been called to such deviations in writing at time of submission, nor shall they relieve this Division from responsibility for errors in items submitted.

.10 Check work described by catalog data with Contract Documents for deviations and errors.

.11 Shop drawings and product data shall show:

- .1 Mounting arrangements.
- .2 Operating and maintenance clearances. e.g. access door swing spaces.

.12 Shop drawings and product data shall be accompanied by:

- .1 Detailed drawings of bases, supports, and anchor bolts.
- .2 Manufacturer test data where requested.
- .3 Manufacturer to certify as to current model production.
- .4 Certification of compliance to applicable codes.

.13 State sizes, capacities, brand names, motor HP, accessories, materials, gauges, dimensions, and other pertinent information. List on catalog covers page numbers of submitted items. Underline applicable data.

.14 If a shop drawing is returned "reviewed as noted" this contractor must provide written indication that the comments have been complied with.

.15 A partial list of shop drawings includes:

- .1 Switchboards, panelboards, and transformers
- .2 Fire alarm system
- .3 Luminaires and drivers
- .4 Emergency battery units, exit signs, and fixtures
- .5 Electrical heaters

.6 Intercom system
.7 Telecommunication system
.8 Master clock and program
.9 Security system
.10 Public address system
.11 Gym Sound System
.12 Classroom control panels
.13 Starters, contactors, and control devices
.14 Firestopping materials
.15 Surface raceways
.16 Hand dryers
.17 Wiring devices
.18 Clocks
.19 Cable management hangers
.20 Lighting controls
.21 Digital time switch
.22 Disconnect switches and fuses
.23 Surge protection devices
.24 Destratification fans and associated controls
.25 Roof cone
.26 Miscellaneous enclosures
.27 Co-ordination study and arc flash hazard analysis
.28 Seismic restraint study
.29 Integrated Life Safety System Testing Plan (ITP)

.2 Submissions shall be submitted electronically as per the following directions:

.1 Electronic Submissions:

.1 Electronically submitted shop drawings shall be prepared as follows:

.1 Use latest software to generate PDF files of submission sheets.
.2 Scanned legible PDF sheets are acceptable. Image files are not acceptable.
.3 PDF format shall be of sufficient resolution to clearly show the finest detail.
.4 PDF page size shall be standardized for printing to letter size (8.5"x11"), portrait with no additional formatting required by the consultant. Submissions requiring larger detail sheets shall not exceed 11"x17".
.5 Submissions shall contain multiple files according to section names as they appear in Specification.
.6 File names shall include consultant project number and description of shop drawing section submitted.

.7 Each submission shall contain an index sheet listing the products submitted, indexed in the same order as they appear in the Specification. Include associated PDF file name for each section.

.8 On the shop drawing use an "electronic mark" to indicate what is being provided.

.9 **Each file shall bear an electronic representation of the "company stamp" of the contractor. If not stamped the file submission will not be reviewed.**

.2 Email submissions shall include subject line to clearly identify the consultants' project number and the description of the shop drawings submitted.

.3 Electronic attachments via email shall not exceed 10MB. For submissions larger than 10MB, multiple email messages shall be used. Denote related email messages by indicating "1 of 2" and "2 of 2" in email subject line for the case of two messages.

.4 Electronic attachments via web links (URL) shall directly reference PDF files. Provide necessary access credentials within link or as username/password clearly identified within body of email message.

.5 On site, provide one (1) copy of the "reviewed" shop drawings in a binder as noted above.

.6 Contractor to print copies of "reviewed" shop drawings and compile into maintenance manuals in accordance with requirements detailed in this section.

1.15 CARE, OPERATION AND START-UP

.1 Instruct consultant and operating personnel in the operation, care and maintenance of equipment.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation and ensure that operating personnel are conversant with all aspects of its care and operation.

1.16 VOLTAGE RATINGS

.1 Operating voltages: to CAN3-C235-83.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.17 PERMITS, FEES, AND INSPECTION

.1 A submission has been made (if required by this scope of project) by the consultant to the Electrical Safety Authority for review of this project. The payment of the required review costs will be co-ordinated by the consultant. A copy of the Electrical Safety Authority review report will be forwarded to the successful contractor for information and action.

.2 The contractor is required to include in his tender all required inspection costs by the Electrical Safety Authority. Permit application is the responsibility of the contractor.

.3 Reproduce drawings and specifications required by Electrical Safety Authority at no cost.

.4 Notify consultant of changes required by Electrical Safety Authority prior to making changes.

.5 Furnish Certificates of Acceptance to consultant from Electrical Safety Authority and other authorities having jurisdiction upon completion of work.

.6 This contractor must furnish any certificates required to indicate that the work completed conforms with laws and regulations of authorities having jurisdiction.

1.18 ADDITIONAL INSTALLED EQUIPMENT

.1 The electrical contractor is to review all specification sections forming part of the electrical bid documents and include additional equipment or components, as well as all associated installation costs and testing costs as noted, in the electrical bid price.

1.19 MATERIALS AND EQUIPMENT

.1 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Safety Authority.

.2 Factory assemble control panels and component assemblies.

1.20 ELECTRIC MOTORS, EQUIPMENT, AND CONTROLS

.1 Supplier and installer responsibility is indicated in the Equipment Wiring Schedule on electrical drawings.

.2 Control wiring and conduit is specified in the Electrical specifications except for conduit, wiring and connections below 50 V, which are related to control systems specified in the Mechanical specifications.

1.21 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint outdoor electrical equipment "equipment green" finish.

.2 Paint indoor switchgear and distribution enclosures light grey.

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.3 Clean and prime exposed non-galvanized hangers, racks, fastenings, and conduits etc. to prevent rusting.

1.22 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates as follows:

.2 Nameplates:

.1 Lamicoid 3 mm (1/8") thick plastic engraving sheet, black face, white core, mechanically attached with self tapping screws.

NAMEPLATE SIZES

Size 1	9 mm x 50 mm (3/8" x 2")	1 line	3 mm (1/8") high letters
Size 2	12 mm x 70 mm (1/2" x 2 1/2")	1 line	5 mm (3/16") high letters
Size 3	12 mm x 70 mm (1/2" x 2 1/2")	2 lines	3 mm (1/8") high letters
Size 4	20 mm x 90 mm (3/4" x 3 1/2")	1 line	9 mm (3/8") high letters
Size 5	20 mm x 90 mm (3/4" x 3 1/2")	2 lines	5 mm (3/16") high letters
Size 6	25 mm x 100 mm (1" x 4")	1 line	12 mm (1/2") high letters
Size 7	25 mm x 100 mm (1" x 4")	2 lines	6 mm (1/4") high letters

.3 Wording on nameplates labels to be approved by consultant prior to manufacture.

.4 Allow for average of twenty-five (25) letters per nameplate.

.5 Identification to be English.

.6 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.7 Nameplates for disconnects, starters and contactors must indicate equipment being controlled and voltage.

.8 Nameplates for transformers must indicate transformer label as indicated and capacity, primary, and secondary voltages.

1.23 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour code: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

1.24 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes and metallic sheathed cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m (45') intervals.

.3 Colour bands must be 25 mm (1") wide.

	Prime
up to 208 V	yellow
209 to 600 V	white
Voice system	green
Data system	orange
Security	brown
Public address	black
Cable TV	blue
Fire alarm	red

.4 This contractor must paint all system junction boxes and covers in conformance with the above schedule.

1.25 PROTECTION OF OPENINGS

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

1.26 WIRING TERMINATIONS

.1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

1.27 MANUFACTURERS AND CSA LABELS

.1 All labels must be visible and legible after equipment is installed.

1.28 WARNING SIGNS

.1 To meet requirements of Electrical Safety Authority and consultant.
.2 Provide porcelain enamel signs, with a minimum size of 175 mm x 250 mm (7" x 10").

1.29 LOCATION OF OUTLETS

.1 Do not install outlets back-to-back in wall; allow minimum 150 mm (6") horizontal clearance between boxes.
.2 Change location of outlets at no extra cost or credit, providing distance does not exceed 3 m (10'), and information is given before installation.
.3 Locate light switches on latch side of doors. Locate disconnect devices in mechanical and elevator machine rooms on latch side of door.

1.30 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise. Coordinate with block coursing (if applicable).
.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install electrical equipment at following heights unless indicated otherwise.

.1 Local switches: 1100 mm (43.3").
.2 Wall receptacles:

.1 General: 400 mm (16").
.2 Above top of continuous baseboard heater: 200 mm (8").
.3 Above top of counters or counter splash backs: 100 mm (4").
.4 In mechanical rooms: 1200 mm (48").

.3 Panelboards: as required by Code or 1400 mm (56").
.4 Voice/Data outlets: At height of adjacent outlet or at 400 mm (16").
.5 Fire alarm stations: 1200 mm (3'-11").
.6 Fire alarm visual and signal devices: 2250 mm (88 ½").
.7 Television outlets: 400 mm (16").
.8 Thermostat: 1200 mm (3'-11").
.9 Clocks: 2100 mm (84").
.10 Heaters: 200 mm (8" AFF) to bottom of heater.
.11 Emergency call switches and/or pushbuttons: 900 mm (36").

1.31 LOAD BALANCE

.1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
.3 Submit, at completion of work, report listing phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

1.32 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete shall be schedule 40 steel pipe, sized for free passage of conduit, and protruding 50 mm (2") beyond either side.
.2 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

1.33 FIELD QUALITY CONTROL

.1 Conduct and pay for following tests:

.1 Power distribution system including phasing, voltage, grounding, and load balancing.
.2 Circuits originating from branch distribution panels.
.3 Lighting and its control.

.4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
.5 Systems: fire alarm system, communications, security.

.2 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.
.3 Insulation resistance testing.

.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
.3 Check resistance to ground before energizing.

.4 Carry out tests in presence of consultant.
.5 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
.6 Submit test results for consultant's review.

1.34 EQUIPMENT NAMEPLATE DATA

.1 Refer to the Equipment Wiring Schedule, Distribution Diagram(s) and Panel Schedules for information regarding the designed electrical connections for all equipment to be connected to the electrical distribution system.
.2 Refer to the shop drawing submissions of all project divisions and coordinate with all trades and equipment manufacturers throughout the construction period for equipment connection requirements.
.3 This electrical trade shall be responsible to coordinate any discrepancies on equipment minimum circuit ampacity, maximum overcurrent protection, voltage and phase, between the equipment manufacturer published literature, the equipment shop drawing submission, the project design drawings equipment wiring schedule, and the nameplate data on the equipment. The contractors installing and connecting all equipment shall be responsible for the coordination of this data through the construction period.
.4 Equipment shall not be connected where the specified maximum overcurrent protection and minimum circuit ampacity values do not meet the requirements of the equipment nameplate data on site.
.5 Electrical distribution equipment shop drawings shall not be submitted prior to approval of equipment to be connected including, but not limited to, mechanical units, pumps, elevators, etc. Electrical distribution equipment shall not be released into production until all connected equipment requirements are confirmed and included in approved shop drawings.
.6 Where nameplate data of equipment on site varies from that data listed in the approved equipment shop drawings, the consultant shall be notified in writing, and the equipment shall not be connected until the equipment connection details are confirmed. The final installation must meet the nameplate data of the equipment on site.

.7 No subsequent allowance for time or money for changes to breakers, wiring and conduit, or equipment sizes will be considered for any consequence related to failure by the electrical trade to coordinate final equipment connection requirements with nameplate data and electrical distribution equipment shop drawings.

1.35 COORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings as indicated on drawings or as determined from co-ordination study.

.2 Electrical connections to all equipment requiring connection to the electrical distribution system as part of this electrical tender have been specified according to the anticipated equipment manufacturer electrical requirements and the applicable sections of the OESC. This contractor must coordinate electrical connections to all equipment specified to be connected as part of this electrical tender.

.3 Prior to submitting electrical distribution shop drawings to the consultant, review all shop drawings for all equipment specified for connection to the electrical distribution system to verify that the product electrical connection requirements listed by the manufacturer conform to the equipment electrical connections specified on the electrical design drawings and specifications. Make necessary revisions to breaker ratings associated with the review of all product shop drawings and identify such changes as part of the electrical distribution equipment shop drawing submission.

.4 Prior to making final equipment connections, this electrical contractor shall examine equipment nameplates at the project site to confirm voltage and phase requirements, minimum circuit ampacity and maximum overcurrent protection values, and bring to the attention of the consultant in writing any connection requirements which may vary from the designed connections or approved electrical distribution shop drawings. No subsequent allowance for time or money for changes to breaker or wire and conduit sizes will be considered for any consequence related to failure to examine site conditions.

1.36 GUARANTEE AND WARRANTY

.1 At ready for takeover of this project this Contractor must provide a written guarantee indicating that any defects, not due to ordinary wear and tear or improper use which occur within the first year from the date of ready for takeover will be corrected at the contractor's expense.

.2 If the electrical sub-contractor's office is 50 kilometers (30 miles) or more from the project site, the sub-contractor is to provide a service/warranty work agreement for warranty period with a local electrical sub-contractor approved by consultant. Include copy of service/warranty agreement in warranty section of operation and maintenance manual.

.3 Warranty period shall start from date of ready for takeover completion.

.4 Refer to individual specification sections for information on any special manufacturer's equipment warranties.

1.37 SYSTEM START UP

.1 Provide consultant with written notice verifying all equipment operation and installation is complete prior to scheduled start-up period.

.2 Start up shall be in presence of the following: owner or representative, contractor, and manufacturer's representative. Each person shall witness and sign off each piece of equipment. Consultant's attendance will be determined by consultant.

.3 Arrange with all parties and provide 72 hours notice for start up procedure.

.4 Simulate system start up and shut down and verify operation of each piece of equipment.

.5 These tests are to demonstrate that the systems and equipment installed are operational as specified.

.6 The contractor must describe during the start up session the required maintenance for each piece of equipment according to the manufacturer.

.7 The contractor must provide all necessary tools (including a digital multimeter) to successfully complete the start up procedure.

1.38 OPERATION AND MAINTENANCE MANUAL

.1 Provide operation and maintenance data for incorporation into manual as specified in other Sections of this Division.

.2 Operation and maintenance manual to be approved by, and final copies deposited with, consultant before final inspection.

.1 Submit one (1) copy of Operation and Maintenance Manual to consultant for review and approval. Submission of individual data will not be accepted unless so directed by consultant. Submission can be done electronically in PDF format or as a hard copy.

.1 Electronic submission/PDF file is required to be bookmarked. Any submission received without bookmarking will be immediately returned as unacceptable.

.2 Hard copy submission shall be in a three-ring binder (minimum 50 mm (2") ring) and labelled as 'Operation and Maintenance Manual' with project name and location. Dividers are to be used for binder organization.

.2 Make changes as required and re-submit as directed by consultant.

.3 Each manual must include (in "tabbed" sections) the following:

.1 Index

.2 List of General, Mechanical, Electrical Contractors and all associated sub-contractor names, addresses and contact numbers.

.3 List of suppliers and equipment wholesalers local to the project.

.4 Letter of contractor's warranty and guarantee for all parts, equipment and workmanship.

.5 List of manufacturers, spare parts list and source.

.6 Copy of typewritten schedules for all new and renovated panels.
.7 Copy of all substantial performance final certificates.
.8 Copy of electrical shop drawings which have been stamped and reviewed by consultant.
.9 Electrical As-built drawings including contractor company's as built stamp.
.10 Coordination study/Arc flash hazard study shop drawings
.11 Any special warranties on equipment required (i.e. LED lighting, digital lighting control, SPDs, power generation).
.12 Certificate of completion from all associated sub-contractors.
.13 Cable test results and floor plans containing address labels.
.14 System commissioning certificate and report.

.4 Final Submittals:

.1 Upon acceptance of Operation and Maintenance Manual by the consultant, provide the following:

.1 Provide two (2) copies of final Operation and Maintenance Manuals, as well as a PDF file of the entire approved manual on a USB stick. Only one (1) USB stick is to be provided containing both the approved manual and as-built drawings.

1.39 AS-BUILT DRAWINGS

.1 Site records:

.1 Contractor shall provide two (2) sets of reproducible electrical drawings. Provide sets of white prints as required for each phase of the work. Mark thereon all changes as work progresses and as changes occur. This shall include field and contract changes to electrical systems.
.2 On a weekly basis, transfer information to reproducibles, revising reproducibles to show all work as actually installed.
.3 Use different colour waterproof ink for each service.
.4 Make available for reference purposes and inspection at all times.

.2 As-built drawings submittal for review:

.1 Identify **each drawing** in lower right-hand corner in letters at least 3 mm (1/8") high as follows: - "AS-BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW ELECTRICAL SYSTEMS AS INSTALLED" (Company Name) (Signature of Contractor) (date).
.2 Submit copy to consultant for approval. When returned, make corrections (if any) as directed.

.3 As-built drawings final submittal:

.1 Once approved, submit completed, reproducible paper as-built drawings as well as a scanned PDF file copy on USB stick with Operation and Maintenance Manuals.

1.40 DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTIONS

.1 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
.2 Manufacturers or their representatives are to provide demonstrations and instructions.
.3 Use operation and maintenance manual, As-built drawings, audio visual aids, etc. as part of instruction materials.
.4 Instruction duration time requirements as specified in appropriate sections.
.5 Where deemed necessary, consultants may record these demonstrations on video tape for future reference.

1.41 READY FOR TAKEOVER

.1 Complete the following to the satisfaction of the consultant prior to request for ready for takeover.

.1 As-built Drawings
.2 Maintenance Manuals
.3 System Start up
.4 Instructions to Owners
.5 Public Address
.6 Security
.7 Coordination Study / Arc Flash Hazard (including photos of each breaker)
.8 Telecommunications Structured Cabling
.9 Lighting Control System
.10 Auxiliary Systems (A/V systems, stage & theatre lighting, sports field lighting, UPS, SPDs, etc.)
.11 Outlet cover circuit labels

1.42 TRIAL USAGE

.1 Consultant or owner may use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

1.43 REVISION TO CONTRACT

.1 Provide the following for each item in a given change notice:

.1 Itemized list of material with associated costs.
.2 Labour rate and itemized list of labour for each item.
.3 Copy of manufacturers/suppliers invoice if requested.

1.44 EQUIPMENT SUPPORTS

.1 Equipment supports supplied by equipment manufacturer: shall be installed by the electrical contractor.

.2 Equipment supports not supplied by equipment manufacturer: fabricate from structural grade steel meeting requirements of - Structural Steel Section. Submit structural calculations with shop drawings if necessary.

.3 Mount base mounted equipment on chamfered edge housekeeping pads, minimum of 100 mm (4") high and 150 mm (6") larger than equipment dimensions all around. This installation of this pad shall be the responsibility of the electrical contractor.

.4 This contractor shall be responsible for providing all anchor bolts and associated formed concrete bases for lighting standards as detailed.

1.45 SLEEVES

.1 Pipe sleeves: at points where pipes pass through masonry, concrete, or fire rated assemblies and as indicated.

.2 Schedule 40 steel pipe.

.3 Sleeves with annular fin continuously welded at midpoint:

.1 Through foundation walls.

.2 Where sleeve extends above finished floor.

.4 Sizes: minimum 6 mm (1/4") clearance all around, between sleeve and conduit.

.5 Terminate sleeves flush with surface of concrete and masonry walls, concrete floors on grade and 25 mm (1") above other floors.

.6 Through foundation walls PVC sleeves are acceptable.

.7 Fill voids around pipes:

.1 Caulk between sleeve and pipe in foundation walls and below grade floors with waterproof fire retardant non-hardening mastic.

.2 Where sleeves pass through walls or floors, provide space for firestopping. Where pipes/ducts pass through fire rated walls, floors and partitions, maintain fire rating integrity.

.3 Fill future-use sleeves with easily removable filler.

1.46 FIRESTOPPING

.1 Firestopping material and installation within annular space between conduits, ducts, and adjacent fire separation.

.2 Provide materials and systems capable of maintaining effective barrier against flame, smoke, and gases.

.3 Comply with the requirements of CAN4-S115-M35, and do not exceed opening sized for which they have been tested.

.4 Systems to have an F or FT rating (as applicable) not less than the fire protection rating required for closures in a fire separation.

.5 Provide “firewrap” blanket around services penetrating firewalls. Extent of blanket must correspond to ULC recommendations. In general wrap individual conduits with approved firewrap materials on each side of firewall. Refer to architectural drawings for FT ratings. Provide 1 and/or 2 layers of firewrap with transverse and longitudinal seams overlapped and/or butted (second layer offset from first layer). Cut edges are to be sealed with aluminum foil tape. Provide 50 mm stainless steel banding at 200 mm intervals. Install firewrap to manufacturers’ recommendations for proper FT rating. Acceptable manufacturers are 3M Firemaster ductwrap or approved equal.

.6 The firestopping materials are not to shrink, slump or sag and be free of asbestos, halogens and volatile solvents.

.7 Firestopping materials are to consist of a component sealant applied with a conventional caulking gun and trowel.

.8 Firestop materials are to be capable of receiving finish materials in those areas, which are exposed and scheduled to receive finishes.

.9 Firestopping shall be inspected and approved by local authority prior to concealment or enclosure.

.10 Install material and components in accordance with ULC certification, manufacturers instructions and local authority.

.11 Submit product literature and installation material on firestopping in shop drawing and product data manual.

.12 Acceptable manufacturers:

.1 Rectorseal Corporation (Metacaulk)
.2 Proset Systems
.3 3M
.4 Hilti
.5 STI Firestop

Note: Fire stop material must conform to requirements of local authorities having jurisdiction. Contractor to confirm prior to application and ensure material used is compatible with that used by other trades on site.

1.47 PAINTING

.1 Refer to Section Interior Painting and specified elsewhere.

.2 Apply at least one coat of corrosion resistant primer paint to ferrous supports and site fabricated work.

.3 Prime and touch up marred finished paintwork to match original.

.4 Restore to new condition, or replace equipment at discretion of consultant, finishes which have been damaged too extensively to be merely primed and touched up.

1.48 ACCESS DOORS

.1 Supply access doors to concealed electrical equipment for operating, inspecting, adjusting and servicing.

.2 Flush mounted 600 mm x 600 mm (24" x 24") for body entry and 300 mm x 300 mm (12" x 12") for hand entry unless otherwise noted. Doors to open 180º, have rounded safety corners, concealed hinges, screwdriver latches, and anchor straps.

.3 Material:

.1 Special areas such as tiled or marble surfaces: use stainless steel with brushed satin or polished finish as directed by consultant.
.2 Remaining areas: use prime coated steel.
.3 Fire rated areas: provide ULC listed access doors

.4 Installation:

.1 Locate so that concealed items are accessible.
.2 Locate so that hand or body entry (as applicable) is achieved.
.3 Installation is specified in applicable sections.

.5 Acceptable materials:

.1 Le Hage
.2 Zurn
.3 Acudor
.4 Nailor Industries Inc.

1.49 DELIVERY, STORAGE, AND HANDLING

.1 Follow Manufacturer's directions in delivery, storage, and protection, of equipment and materials. Contractor to include all costs associated with delivery storage and handling in tender price.

.2 Deliver equipment and material to site and tightly cover and protect against dirt, water, and chemical or mechanical injury, but have readily accessible for inspection. Store items subject to moisture damage (such as controls) in dry, heated space.

1.50 REPAIR, CUTTING, CORING AND RESTORATION

.1 Be responsible for required digging, cutting, and patching incident to work of this Division and make required repairs afterwards to satisfaction of consultant. Cut carefully to minimize necessity for repairs to existing work. Do not cut beams, columns, or trusses.

.2 Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown. Surface finishes shall exactly match existing finishes of same materials.

.3 Each Section of this Division shall bear expense of cutting, patching, repairing, and replacing of work of other Sections required because of its fault, error, tardiness, or because of damage done by it.

.4 Cutting, patching, repairing, and replacing pavements, sidewalks, roads, and curbs to permit installation of work of this Division is responsibility of Section installing work.

.5 Slots, cores and openings through floors, walls, ceilings, and roofs shall be provided by this contractor but performed by a trade specializing in this type of work. This Division shall see that they are properly located and do any cutting and patching caused by its neglect to do so.

1.51 CLEANING

.1 Clean interior and exterior of all electrical equipment provided including light fixture lenses.

.2 In preparation for final acceptance, clean and refurbish all equipment and leave in operating condition.

1.52 OWNER SUPPLIED EQUIPMENT

.1 Connect to equipment supplied by the owner and make operable.

.2 Design drawings are diagrammatic and do not necessarily indicate all specific final connection requirements. For the purposes of bidding, electrical trade shall include but not be limited to provision of a junction box to connect equipment wiring tail, provision of suitable disconnecting means, and flexible connection directly to equipment.

1.53 ENCLOSURES

.1 This contractor must ensure that all electrical equipment mounted in sprinklered areas is provided with an enclosure in conformance with the Electrical Safety Code.

1.54 ELECTRICAL SYSTEMS COMMISSIONING

.1 This electrical contractor shall work with the building commissioning agent to perform commissioning of all electrical systems.

1.55 INTEGRATED LIFE SAFETY SYSTEM TESTING

.1 The Integrated Life Safety System Testing Coordinator (ITC) shall be hired by the electrical trade as indicated in specification section 26 01 20.

.2 This electrical contractor shall work with the project Integrated Life Safety System Testing Coordinator (ITC) and participate in all phases of the Integrated Life Safety Systems testing process as specified within CAN/ULC S1001-11 (2024 Rev2 updates) as well as the electrical and architectural specifications.

.3 During the ***Planning Phase*** of the Integrated Life Safety Systems Testing process this electrical contractor shall review the Integrated Testing Plan (ITP) and give written confirmation of this review and acknowledgement of affected systems under his responsibility as required by the electrical specifications per the shop drawing submittal process.

.4 Prior to the building Integrated Life Safety Systems Testing this electrical contractor shall startup/commission/verify the operation of all systems under the responsibility of this electrical trade. This electrical trade shall give written indication of completed systems and provide copies of all inspection reports, start-up reports, commissioning reports, verification reports, etc. when requested by the ITC during the ***Implementation Phase***.

.5 Upon completion of the building Integrated Life Safety Systems Testing this electrical contractor shall rectify all deficiencies related to all systems under his responsibility during the ***Testing Phase*** in due time for the ITC to verify and document for the project team.

Part 2 **Not Used**

Part 3 **Not Used**

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

.1 Section 21 02 51 – FIRE PROTECTION GENERAL REQUIREMENTS and DIVISION 1
.2 Section 21 12 13 – FIRE SUPPRESSION STANDPIPE SYSTEM
.3 Section 21 13 13 – WET PIPE FIRE SUPPRESSION
.4 Section 21 22 11 – CLEAN AGENT FIRE SUPPRESSION SYSTEM and DIVISION 1
.5 Section 23 02 52 – HVAC GENERAL REQUIREMENTS and DIVISION 1
.6 Section 23 33 17 – SMOKE CONTROL DAMPERS
.7 Section 26 01 16 – ELECTRICAL GENERAL REQUIREMENTS and DIVISION 1
.8 Section 26 51 13 – LIGHTING EQUIPMENT
.9 Section 26 51 16 – DIGITAL OCCUPANCY & DAYLIGHT CONTROL SYSTEMS
.10 Section 28 31 25 – FIRE ALARM SYSTEM (ADDRESSABLE)
.11 Applicable building systems in item 1.3.10 and as included in all project DIVISIONS.

1.2 REFERENCES

.1 OBC-2024, Ontario Building Code Compendium.
.2 CAN/ULC-1001, Integrated System Testing of Fire Protection and Life Safety Systems.
.3 CAN/ULC-S524, Installation of Fire Alarm Systems.
.4 CAN/ULC-S537, Verification of Fire Alarm Systems.
.5 CAN/ULC-S573, Installation of Ancillary Devices Connected to Fire Alarm Systems
.6 CAN/ULC-S561, Installation and Service for Fire Signal Receiving Centres and Systems
.7 CAN/ULC-S112, Standard Method of Fire Test of Fire Damper Assemblies
.8 NFPA 13, Fire Sprinkler Systems
.9 NFPA 17A, Standard for Wet Chemical Extinguishing Systems
.10 NFPA 92, Standard for Smoke Control Systems
.11 NFPA 96, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations

1.3 OVERVIEW

.1 All work shall be performed in accordance with CAN/ULC-1001 Integrated System Testing of Life Safety and Fire Protection Systems, latest edition.
.2 The Building Code has adopted CAN/ULC-1001 as the standard to comply with Integrated System Testing of Life Safety and Fire Protection Systems. The scope of this project shall follow the strict guidelines laid out in CAN/ULC-1001 for Integrated Testing Planning, review, and implementation.

.3 The Integrated Testing Plan (ITP) will provide a full overview of all integration points of life safety and fire protection systems. The ITP will be submitted for review to the design professionals and Authority Having Jurisdiction (AHJ). Upon the successful completion of the ITP and all the respective systems, the Integrated Testing Coordinator (ITC) will provide a schedule to the design professionals, the AHJ, and all required participating members for the ITP to be conducted.

.4 The ITC will review all drawings, specifications, sequence of operations, and methodology prepared by the design professionals, complete with the contractor's shop drawings and manufacture requirements.

.5 The ITP shall be coordinated with all sub-contractors and suppliers as outlined in item 1.1.

.6 The ITC will conduct the ITP and will sign each integrated test form, complete with signatures from each participating member of the integrated systems.

.7 The ITC shall witness all integrations and not rely on the CAN/ULC-S537 Verification Inspection Report for fire protection system integration testing; however, the ITC may attend the verification to validate the testing.

.8 The ITC will provide all work and ITP including functional documentation, prescribed in CAN/ULC-1001. Such testing and documentation have been deemed to satisfy OBC 2024 Sentence 3.2.9.

.9 The ITC will provide PDF and digital media copy of the buildings ITP and Integrated System Report (ITR) for the building owner's use, re-testing, and reproduction purpose.

.10 The systems applicable to the function testing include but not limited to:

- .1 Fire Alarm System (including sequence of operations) and Monitoring
- .2 Elevators
- .3 Sprinkler Systems (wet, dry, window, garbage chute, standpipe)
- .4 Kitchen Fire Suppression Systems
- .5 Fixed Fire Suppression Systems
- .6 Magnetic Door Holds
- .7 Fire Curtain or Fire Shutter Release
- .8 Smoke and CO Alarms
- .9 Smoke Damper Assemblies
- .10 Emergency Lighting
- .11 HVAC Shutdown and ON/OFF/Auto Controls
- .12 Pressurization Fans and ON/OFF/Auto Controls
- .13 Smoke Exhaust System and ON/OFF/Auto Controls
- .14 CO System
- .15 A/V System Mute/Shutdown
- .16 Mass Notification System
- .17 HVLS Fan Shutdown
- .18 Freeze Protection (heat trace monitoring)
- .19 Dust Collector (spark arrest system)

Part 2 Products

2.1 TESTING AND PLANNING

.1 The Integrated Testing Process must include following:

- .1 Planning phase by the testing coordinator.
- .2 Integrated testing plan review by the design professionals.
- .3 Integrated testing plan review by the AHJ.
- .4 Review of sequence of operations.
- .5 System documentation.
- .6 Integrated System Testing Plan consisting of:
  - .1 Project description.
  - .2 Project contacts including applicable project responsibilities.
  - .3 Overview and description of each integrated system.
  - .4 System integrations and functional objective of each integrated system.
  - .5 Integration matrix of all integrated system complete with integration type, normal mode and off-normal mode.
  - .6 Test protocols and procedures of each integrated system,
  - .7 Notifications.
  - .8 Personnel safety.
  - .9 Phased occupancies.
  - .10 Pre-testing documentation checklist.
  - .11 Pre-testing documentation acknowledgement forms.
  - .12 Testing forms.
  - .13 Ongoing integrated system testing forms.
  - .14 Integrated system testing completion form.
  - .15 Integrated testing notes.

2.2 RESPONSIBILITIES

.1 General Contractor:

- .1 Coordinate with the ITC for schedule and witness testing.
- .2 Coordinate all responsible sub-contractors.
- .3 Confirm all respective systems listed in item 1.3.10 are complete and fully operational, prior to the ITC commencing the functional testing.
- .4 Provide reports for respective systems such as, but not limited to; TSSA elevator inspection reports, start-up reports, commissioning reports, verification reports.
- .5 Participate in the ITP and provide function testing of equipment within the mechanical, electrical, and fire protection contract packages.
- .6 Allow for any cost associated to re-testing of the ITP due to failures or insufficient work.
- .7 Allow for any cost associated with phased occupancy and phased Integrated Testing work.

.2 HVAC Contractor:

.1 The HVAC Contractor shall confirm all mechanical systems listed in item 1.3.10 are complete and fully operational, prior to the ITC commencing the functional testing.

.2 Provide system reports such as, but not limited to; air balancing reports, TSSA inspection reports, start-up reports, commissioning reports, verification reports. The Mechanical Contractor shall further provide written confirmation that all mechanical systems are installed and operating as intended by the contract documents and sequence of operations.

.3 Participate in the ITP and provide function testing of equipment within the mechanical contract package.

.4 Allow for any cost associated to re-testing of the ITP due to failures or insufficient work.

.5 Allow for any cost associated with phased occupancy and phased Integrated Testing work.

.3 Fire Protection Contractor:

.1 The Fire Protection Contractor shall confirm all fire protection systems listed in item 1.3.10 are complete and fully operational, prior to the ITC commencing the functional testing.

.2 Provide system reports such as, but not limited to; NFPA 13 letter, NFPA 20, letter, above ground sprinkler piping letter, below ground sprinkler letter, system designer letter, start-up reports, commissioning reports, verification reports. The Fire Protection Contractor shall further provide written confirmation that all fire protection systems are installed and operating as intended by the contract documents and sequence of operations.

.3 Participate in the ITP and provide function testing of equipment within the fire protection contract package.

.4 Allow for any cost associated to re-testing of the ITP due to failures or insufficient work.

.5 Allow for any cost associated with phased occupancy and phased Integrated Testing work.

.4 Electrical Contractor:

.1 Electrical Contractor to employ the services of the ITC firm as a sub-contractor and include in bid price. Refer to item 2.6.

.2 The electrical contractor shall confirm all electrical systems listed in item 1.3.10 are complete and fully operational, prior to the ITC commencing the functional testing.

.3 Provide system reports such as, but not limited to; ESA Inspection Certificate, Fire Alarm Verification, TSSA Inspection, Generator Start-up report, commissioning reports, and verification reports. The Electrical Contractor shall further provide written confirmation that all electrical systems are installed and operating as intended by the contract documents and sequence of operations.

.4 Participate in the ITP and provide function testing of equipment within the electrical contract package.

.5 Allow for any cost associated to re-testing of the ITP due to failures or insufficient work.

.6 Allow for any cost associated with phased occupancy and phased Integrated Testing work.

.5 Equipment Manufacturers:

.1 Where required, shall confirm all respective systems listed in item 1.3.10 are complete and fully operational, prior to the ITC commencing the functional testing.

.2 Participate in the ITP and provide function testing of equipment within the respective contract package.

.6 Design Professionals:

.1 The design professional shall include, but not be limited to, the project Architect, Electrical and Mechanical Consultants, Fire Protection Engineer, Elevator Consultant, etc.

.2 Shall review the ITP, and upon review, accept the ITP as the agreed ITP for implementation.

.3 The design professionals are responsible for design. Upon an unsuccessful test, the failure will be documented and provided to the respective design professionals for review and action.

2.3 NOTIFICATION OF TESTING PLANNING PROCESS

.1 The ITC shall work with the General Contractor, Owner, sub-contractors, design professionals, and the AHJ to provide a schedule for the implementation of the ITP.

.2 The ITC shall obtain contact names, contact details, and system responsibilities for all project design professionals.

.3 The ITC shall provide notification to the integrated testing participants seven (7) days prior to the date and time for the implementing of the ITP.

.4 Prior to testing, the ITC shall obtain written acknowledgement for acceptance and understanding of the ITP by all project design professionals and contractors per 1001 Section 5 and Appendix B. Include ITP Review & Acceptance acknowledgement sheet in the ITR. **Refer to Figure 1.**

.5 Prior to testing, the ITC shall obtain written acknowledgement for acceptance testing of site readiness from all project design professionals and contractors per 1001 Section 5 and Appendix B. Failure to obtain acknowledgement prior to implementation of integrated testing may invalidate the results and could result in delays by the design professionals issuing conformance. Include ITP Acceptance Testing acknowledgement sheet in the ITR. **Refer to Figure 2 and Figure 3.**

.6 In the event of building occupants, the ITC shall provide at a minimum, forty-eight (48) hour notice of the implementation of the integrated testing. Notification shall be provided via written notices posted at each building entrance.

.7 Partial occupancies shall employ this process for each individual occupancy and shall clearly identify the extent of to which the partial occupancy applies when obtaining written confirmations.

.8 Figures 1 through 3 of this specification section are indicated as informative and are for information only regarding the intent for required written acknowledgement gathering by the ITC. All designers and trades listed may not apply to all projects. The ITC shall be responsible for determining all required designers and contractors for the project based on the contact information from the ITP.

2.4 TESTING IMPLEMENTATION PROCESS

.1 Implementation of the integrated test shall follow all job site and personnel safety requirements set out in the contract and General Contractors requirements.

.2 The ITC shall define:

.1 Personnel safety protocols
.2 Special hazards
.3 Team communications
.4 Occupant notification of emergencies

.3 The integrated system test shall follow the methodology and process outlined in CAN/ULC-1001 as the requirement for this project.

.1 Provide the final ITP to the Consultant fourteen (14) days prior to scheduled implementation and test.

.4 The respective contractors and manufactures are responsible to start-up and function test their respective systems, for observation and witnessing by the ITC. The ITC will record the results, and the respective contractor and manufacture will restore the system to a normal condition. Upon successful testing the contractor and manufacture will initial the respective integrated testing from adjacent to their respective test.

.5 Upon a failure of a test, the ITC will document the failure and continue with the testing of other integrations. The respective contractor and manufacture will document the failure, notify they design professional, and correct the failure under the direction of the design professional.

.1 The ITC will re-test the unsuccessful integration after the correction has been documented and verified.

.6 Upon a failure of a device (such as a smoke detector), the contractor may immediately replace the device, and the ITC may continue to test the integration. The device failure maybe documented but shall not result in a failed integrated test.

.7 The ITC shall include in quote costs associated with site testing of all integrated devices. ITPs and testing procedures which include only for a sampling of devices will not be accepted. ITPs and testing procedures which rely solely on inspection reports, start-up reports, commissioning reports, or verification reports, etc. will not be accepted.

.8 Partial occupancies shall employ this process for each individual occupancy and shall clearly identify the extent to which the partial occupancy applies when obtaining written confirmations.

.9 Upon successfully completing the ITP, the ITC shall provide the ITR to the design professionals and building owner.

2.5 QUALITY CONTROL

.1 The ITC must meet the following criteria to be considered acceptable for this project:

.1 Firms regular engaged with contractors in function testing, fire alarm verification, sprinkler system testing, annual inspections and maintenance of fire and life safety systems.

.2 Firms knowledgeable and experience of the respective Codes and Standards of the particular project, including but not limited to; Building Codes, Fire Codes, ULC Standards, CSA Standards, and NFPA Standards.

.3 Firms must be a member in good standing of the Canadian Fire Alarm Association (CFAA).

.4 Vendors must be a 3rd party and independent from the fire protection and life safety system installation company present on the project in accordance with ULC Certification Bulletin 2020-08.

.5 Firms must maintain operations in the province of Ontario for at least five years.

.6 Vendors must be a ULC Listed Integrated Systems Testing Service Provider and posses a ULC Integrated Fire Protection and Life Safety Certification. The ULC Certificate must be valid from the date of project award until the completed Integrated Testing Report. The ULC certification level shall be that which is applicable to the building life safety systems level of complexity for the project.

.1 Submit the ULC Certificate upon project award to the Consultant's office complete with Applicant ID Number.

2.6 QUALIFIED INTEGRATED TESTING COORDINATOR

.1 Bidders may choose from the experienced ITC Firms listed below or local branches of these companies noted in the vicinity of this project and are acceptable as a sub-contractor to the Electrical Contractor:

.1 Lonergan Engineering
Aurora, Ontario L4G 3V5

.2 Great Lakes Fire Consulting & Engineering Group
Windsor, Ontario

.2 Other experienced ITC Firms must submit in writing, to the Consultant's office, confirmation of the items listed in the Quality Control criteria above, prior to tender close to be considered as an acceptable bidder.

END OF SECTION

Figure 1 – Example Pre-Test ITP Acknowledgement (Typical Design Professionals): Informative

INTEGRATED SYSTEMS WRITTEN ACKNOWLEDGEMENT REVIEW AND ACCEPTANCE OF INTEGRATED TEST PLAN (EXAMPLE)			
Per Item 5.2.8 and Section B9.1 of CAN/ULC S1001 (latest version), the respective design professionals shall indicate written confirmation to the Testing Coordinator acceptance of the Integrated systems Test Plan according to the intent of the project design documents.			
List of Design Professionals		Company/Representative	Design Responsibility
Architect	Company Name:		
	Designer Name:		
	Signature		
Electrical Engineer	Company Name:		
	Designer Name:		
	Signature		
Mechanical Engineer	Company Name:		
	Designer Name:		
	Signature		
Fire Protection Engineer (sprinkler)	Company Name:		
	Designer Name:		
	Signature		
(typical responsible consultant on project)	Company Name:		
	Designer Name:		
	Signature		

Figure 2 – Example Pre-Test Trade Site Ready Acknowledgement (Typical Project Trades): Informative

PRE-TESTING INTEGRATED SYSTEMS WRITTEN ACKNOWLEDGEMENT (EXAMPLE)			
Per Item 5.3.1.(B) and Section B8.1 of CAN/ULC S1001 (latest version), the respective installing contractors shall indicate written confirmation to the Testing Coordinator that their respective life safety systems have been installed in accordance with the design are ready for integrated testing as outlined within the Integrated Systems Testing Plan.			
List of Installing Trades		Company/Representative	System Responsibilities
General Contractor	Company Name:		
	Name:		
	Signature		
Electrical Contractor	Company Name:		
	Name:		
	Signature		
Mechanical Contractor	Company Name:		
	Name:		
	Signature		
Sprinkler Contractor	Company Name:		
	Name:		
	Signature		
Elevator Contractor	Company Name:		
	Name:		
	Signature		
(typical responsible trade on project)	Company Name:		
	Name:		
	Signature		

Figure 3 – Example Pre-Test Designer Site Ready Acknowledgement (Typical Design Professionals): Informative

PRE-TESTING INTEGRATED SYSTEMS WRITTEN ACKNOWLEDGEMENT (EXAMPLE)			
Per Item 5.3.1.(A) and Section B8.1 of CAN/ULC S1001 (latest version), the respective design professionals shall indicate written confirmation to the Testing Coordinator that the site is ready for integrated systems testing per the descriptions and integrations outlined within the Integrated Systems Testing Plan.			
List of Design Professionals		Company/Representative	Design Responsibility
Architect	Company Name:		
	Designer Name:		
	Signature		
Electrical Engineer	Company Name:		
	Designer Name:		
	Signature		
Mechanical Engineer	Company Name:		
	Designer Name:		
	Signature		
Fire Protection Engineer (sprinkler)	Company Name:		
	Designer Name:		
	Signature		
(typical responsible consultant on project)	Company Name:		
	Designer Name:		
	Signature		

Part 1 General

1.1 GENERAL

.1 This Section covers items common to Electrical Division 26, as well as Division 27 and Division 28.

.2 This section supplements requirements of Division 1.

1.2 OCCUPANCY REQUIREMENTS

.1 The contractor shall provide the following documentation to the consultant's satisfaction prior to receiving occupancy. Failure to provide the proper documentation will result in the occupancy not being granted. List of required documentation:

.1 Final Certificates (required prior to consultant's release of conformance letter).

.1 Electrical Safety Authority.
.2 Emergency Lighting.
.3 Smoke Alarm and Carbon Monoxide Detector Alarm.
.4 Testing of Integrated Fire Protection and Life Safety Systems Report.
.5 Electrical Seismic Restraint Engineers' Letter.
.6 Fire Alarm Verification Certificate.

Part 2 Not Used
Part 3 Not Used

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA C22.2 No.0.3-92, Test Methods for Electrical Wires and Cables.
.2 CAN/CSA-C22.2 No.131-M89(R1994), Type TECK 90 Cable.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Electrical General Requirements Section.

Part 2 Products

2.1 BUILDING WIRES

.1 Conductors: stranded for 10 AWG and larger.
.2 Minimum size: 12 AWG.
.3 Copper conductors: size as indicated, with 600 V insulation of chemically cross-linked thermosetting polyethylene material 90°C (194ºF) rated T90 for indoor above grade installations and RW90 for below grade installations.

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 Inner jacket: polyvinyl chloride material.
.4 Armour: aluminum.
.5 Overall covering: polyvinyl chloride material.
.6 Fastenings:

- .1 One hole steel zinc straps to secure surface cables 50 mm (2") and smaller. Two hole steel straps for cables larger than 50 mm (2").
- .2 Channel type supports for two or more cables at 1500 mm (60") centres.
- .3 Threaded rods: 6 mm (1/4") diameter to support suspended channels.

.7 Connectors must be suitable for:

- .1 Installed environment and approved for use with TECK cable.

2.3 ARMOURED CABLES

.1 Conductors: insulated, copper minimum size as indicated above.
.2 Type: AC90 (minimum size 12 AWG).
.3 Armour: interlocking type fabricated from aluminum strip.
.4 Connectors must be suitable for installed environment and approved for use with armoured cable.

Part 3 Execution

3.1 INSTALLATION OF BUILDING WIRES

.1 Install wiring from source to load through raceways as specified.
.2 Provide separate neutral conductors for all lighting circuits and circuits originating from surge protected panels. Size raceways accordingly.

3.2 INSTALLATION OF TECK CABLE 0 - 1000 V

.1 Group cables wherever possible on channels.
.2 Terminate cables in accordance with Wire and Box Connectors - 0 - 1000 V Section.

3.3 INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible.
.2 Terminate cables in accordance with Wire and Box Connectors - 0 - 1000 V Section.
.3 These cables are to be installed in concealed locations only. These concealed locations are considered to be stud walls and “drops” to stud walls, lighting fixtures, and ceiling mounted devices.
.4 These “drops” shall not be permitted to exceed 2.4 m (8'-0"). To limit these “drops” to lengths noted above provide additional branch wiring in conduit.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data for cabinets in accordance with Electrical General Requirements Section.

Part 2 Products

2.1 MATERIALS

.1 Splitters must conform to CSA C22.2 No. 76 (latest edition).
.2 Junction and pull boxes must conform to CSA C22.2 No. 40 (latest edition)

2.2 SPLITTERS

.1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
.2 Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.
.3 At least three spare terminals on each set of lugs in splitters less than 400 A.
.4 Splitter length must match arrangement of equipment unless indicated otherwise.

2.3 JUNCTION AND PULL BOXES

.1 Welded steel construction with screw-on flat covers for surface mounting.
.2 Covers with 25 mm (1") minimum extension all around, for flush-mounted pull and junction boxes.

Part 3 Execution

3.1 SPLITTER INSTALLATION

.1 Install splitters and mount plumb, true and square to the building lines on 21 mm (3/4") painted plywood backboards.

3.2 JUNCTION AND PULL BOXES INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.
.2 Install junction and pull boxes so as not to exceed 30 m (100') of conduit run between pull boxes and in conformance with the Electrical Safety Code.

3.3 IDENTIFICATION

.1 Provide equipment identification in accordance with General Electrical Requirements Section.

.2 Install size 2 identification labels indicating system name, voltage and phase.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Outlet boxes, conduit boxes, and fittings must conform to CSA C22.2 No. 18 (latest edition).

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.
.2 102 mm (4") square or larger outlet boxes as required for special devices.
.3 Gang boxes where wiring devices are grouped.
.4 Blank cover plates for boxes without wiring devices.
.5 347 V outlet boxes for 347 V switching devices.
.6 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 SHEET STEEL OUTLET BOXES

.1 Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76 mm x 50 mm x 64 mm (3" x 2" x 2½") or as indicated. 102 mm (4") square outlet boxes when more than one conduit enters one side with extension and plaster rings as required. Iberville 1104 Series.
.2 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit **in utility rooms**, minimum size 102 mm x 57 mm x 38 mm (4" x 2¼" x 1½"). Iberville 1110 Series.
.3 102 mm (4") square or octagonal outlet boxes for lighting fixture outlets.
.4 102 mm (4") square outlet boxes with extension and plaster rings for flush mounting devices in finished tile walls.

2.3 MASONRY BOXES

.1 Electro-galvanized steel masonry single and multi gang boxes for devices flush mounted in exposed block walls.

2.4 CONCRETE BOXES

.1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.5 FLOOR BOXES

.1 Flush floor boxes where indicated shall be complete with the following features:

.1 Four (4) independent wiring compartments.
.2 Flexible activation cover.
.3 Fully adjustable.
.4 Sixteen (16) Kos 12.7 mm (½ ") – 32 mm (1 ¼ ").
.5 Stamped steel construction (concrete-tight).

.2 Manufacturers:

.1 Wiremold Cat# RFB4-DTB-2-2T-RAKM11- flush floor box complete with two duplex receptacle brackets, 2 dual RJ brackets, and recessed activation with carpet trim plate.

Approved alternates:

.1 Hubbell Cat. #LCFBSS complete with LCFB XX (colour by architect), flush cover and internal faceplate to suit devices noted on the drawings.
.2 Wellmark Electric Inc. Cat. #400B-1-YY-XX-CRL.

2.6 CONDUIT BOXES

.1 Cast FS or FD feraloy boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle **in areas (other than utility rooms) where surface conduit is used.**

2.7 FITTINGS- GENERAL

.1 Bushing and connectors with nylon insulated throats.
.2 Knock-out fillers to prevent entry of debris.
.3 Conduit outlet bodies for conduit up to 32 mm (1- 1/4") and pull boxes for larger conduits.
.4 Double locknuts and insulated bushings on sheet metal boxes.

Part 3 Execution

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.
.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm (1/4") of opening.

.4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

.5 Outlets if unwired are to be provided with blank coverplates to suit related sections of this specification.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA C22.2 No.65-1956(R1965) Wire Connectors.

Part 2 Products

2.1 MATERIALS

.1 Pressure type wire connectors: with current carrying parts of copper sized to fit copper conductors as indicated.

.2 Fixture type splicing connectors: with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

.3 Clamps or connectors for armoured cable, mineral insulated cable, and flexible conduit, as required.

Part 3 Execution

3.1 INSTALLATION

.1 Remove insulation carefully from ends of conductors and:

- .1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.
- .2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.
- .3 Install fixture type connectors and tighten. Replace insulating cap.

END OF SECTION

Part 1 General

1.1 Not Applicable.

Part 2 Products

2.1 MATERIALS

.1 Grounding equipment must conform to CSA C22.2 No 41 (latest edition).

2.2 EQUIPMENT

.1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe and electrically conductive metal gas piping.
.2 Rod electrodes: copper clad steel 19 mm (3/4") diameter by 3 m (10') long.
.3 Plate electrodes: galvanized steel, surface area 0.2 m^2, minimum 1.6 mm thick.
.4 Insulated grounding conductors: green with insulation type that matches specified phase conductors. Gauge shall be in conformance with the latest edition of the Electrical Safety Code to suit required installation conditions.
.5 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.
.6 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:

.1 Grounding and bonding bushings.
.2 Protective type clamps.
.3 Bolted type conductor connectors.
.4 Thermit welded type conductor connectors.
.5 Bonding jumpers, straps.
.6 Pressure wire connectors.

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. **Where EMT is used, run ground wire in conduit.**
.2 Install connectors in accordance with manufacturer's instructions.
.3 Protect exposed grounding conductors from mechanical injury.
.4 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process inspectable wrought copper compression connectors to ANSI/IEEE 837.
.5 Use mechanical connectors for grounding connections to equipment provided with lugs.

.6 Soldered joints not permitted.
.7 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
.8 Install separate ground conductor to outdoor lighting standards.
.9 Ground pad mounted transformers as detailed on the drawings.

3.2 ELECTRODES

.1 Make ground connections to continuously conductive underground water pipe on street side of water meter. This shall apply to the installation or replacement of building water service.
.2 Install water meter shunt.
.3 Make ground connections to continuously conductive metal gas piping system. This shall apply to installation or replacement of gas appliances, as well as installation or modification of a building gas piping system.
.4 Corrugated metal tubing shall not be used as a bonding means for the gas piping system.
.5 Install concrete encased electrodes in building foundation footings, with terminal connected to grounding network.
.6 Install rod or plate electrodes and make grounding connections.
.7 Bond separate, multiple electrodes together.
.8 Use #2/0 copper conductors for connections to electrodes. Size in conformance with the Electrical Safety Code.

3.3 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, and outdoor lighting.

3.4 COMMUNICATION SYSTEMS

.1 Install grounding connections for telephone, sound, fire alarm, computer network systems as follows:

.1 Telephones: make telephone grounding system in accordance with telephone company's requirements.
.2 Sound, fire alarm, computer network systems as indicated.

3.5 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Electrical General Requirements Section.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests.

END OF SECTION

Part 1 General

1.1 APPLICATION

.1 Seismic restraint is becoming more prominent with improved soil testing equipment. Seismic requirement is not site specific by geographical area but determined by site soil conditions.

.2 Where the structural engineer or architect documents have Ie*Sa(0.2)*Fa<3.5 seismic is not required on the electrical systems.

.3 Where the structural engineer or architect documents have Ie*Sa(0.2)*Fa≥3.5 seismic is required on the electrical systems.

.4 Seismic will always be required on fire protection systems when required by NFPA codes.

.5 Seismic will always be required on any “Disaster Relief Building.” For example, hospitals, police stations, ambulance building, etc.

.6 When it is unclear in the tender documents request information from the structural engineer or architect for clarification.

1.2 SECTION INCLUDES

.1 Seismic Requirements for free standing equipment and other similar systems.

.2 Seismic Requirements for single rod hanger supports for conduit, and other similar systems.

.3 Seismic Requirements for trapeze type supports for bus tray, conduit, and other similar systems.

1.3 REFERENCES

.1 Building Officials and Code Administrators National Building Code (BOCA) (latest edition).

.2 Ontario Building Code (OBC), (latest edition).

1.4 QUALITY ASSURANCE

.1 The contractor shall provide pre-engineered seismic restraint systems to meet total design lateral force requirements for support and restraint of free standing electrical equipment, conduit, cable trays and other similar suspended systems and equipment as determined by seismic restraint designer.

.2 System Supports/Restraints: Firms regularly engaged in the manufacture of products of the types specified in this section, whose products have been in satisfactory use in similar service for not less than 5 years.

.3 Bolted framing channels and fittings shall have the manufacturers name, part number, and material heat code identification number stamped in the part itself for identification. Material certification sheets and test reports must be made available by the manufacturer upon request.

.4 Only companies experienced in performing the work of this section shall do the installation.

.5 All seismic restraint installations shall be independently reviewed by the Owner's representatives for compliance with project specifications.

1.5 SUBMITTALS

.1 Submit seismic force calculations according to forces chart located on structural engineer of record's drawings. Submit pre-approved restraint selections and installation details from acceptable manufacturer specified in this section or engineer approved equal.

.2 Restraint selection and installation details shall be pre-approved by a professionally licensed engineer with at least 5 years of experience in the design of seismic restraints.

.3 Submit manufacturer's product data on strut channels including, but not limited to, types, materials, finishes, gauge thickness, and hole patterns.

.4 Contractor to retain services of Professional Engineer, designated in local jurisdiction and submit stamped drawings. The same engineer shall provide periodic field review and final certification upon completion of the project.
The following companies are provided for information purposes:

.1 Tecoustics Limited - 1-888-714-9596
.2 Lampkin Structural Services – 613-830-6875
.3 Vibro Acoustics – 1-800-565-8401
.4 Tecoustics Vibration Control & Seismic Restraint – 905-681-6077
.5 Gerrits Engineering 705-737-3303

.5 All fees and associated costs for the engineering shall be the responsibility of this contractor.

1.6 SEISMIC BRACING AND SUPPORT DESIGN REQUIREMENTS

.1 Seismic restraint designer shall co-ordinate all attachments with the structural engineer of record.

.2 Design analysis shall include force calculations according to forces chart listed on the structural engineer of record's drawings and capacity of materials utilized for the connection of the equipment or system to the structure.

.3 Analysis shall detail anchoring methods, bolt diameter, and embedment depth.

.4 All seismic restraint devices shall be designed to accept without failure the calculated forces as pee the applicable Building Code.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Deliver strut systems, pipe hangers and components carefully to avoid breakage, denting, and scoring finishes. Do not install damaged equipment.

.2 Store strut systems, pipe hangers and components in original cartons and in clean dry space; protect from weather and construction traffic.

1.8 WORK FURNISHED BUT NOT INSTALLED

.1 The materials and systems specified in this section shall be purchased by the electrical contractor from a single seismic snubber restraint materials manufacturer to assure sole source responsibility for the performance of the seismic restraints used.

.2 The materials and systems specified in this section can, at the contractor's option, be installed by the subcontractor who installs the electrical equipment.

1.9 COORDINATION

.1 Coordinate size, shape, reinforcement and attachment of all housekeeping pads supporting seismically rated equipment. Concrete shall have a minimum compressive strength of 3,000 psi or as specified by the consultant.

.2 Coordinate with seismic restraint manufacturer to locate and size structural supports underneath seismically restrained equipment (e.g. switchboards, motor control centres, transformers, and other similar equipment).

1.10 DESCRIPTON OF SYSTEM

.1 It shall be understood that the requirements of this seismic restraint section are in addition to other requirements as specified elsewhere for the support and attachment of equipment and electrical services, and for the vibration isolation of same equipment. Nothing on the project drawings or specifications shall be interpreted as justification to waive the requirements of this seismic restraint section.

.2 The work under this section shall include furnishing all labour, materials, tools, appliances, and equipment, and performing all operations necessary for the complete execution of the installation of seismic snubber restraint assemblies as shown, detailed, and/or scheduled on the drawing and/or specified in this section of the specifications.

.3 All seismic snubber restraint assemblies shall meet the following minimum requirements:

.1 The snubber/restrained isolator for isolated equipment shall include a resilient element that will ensure that no un-cushioned shock can occur (this does not include cable restraints).

.2 It shall be possible to visually inspect the resilient material for damage and allow for replacement, if necessary.

.3 All snubbers are to include a maximum air gap of 0.25" (6 mm).

.4 Seismic restraint systems shall be designed to offer seismic restraint in all directions, unless otherwise noted.

.5 Seismic restraint capacities to be verified by an independent test laboratory or certified by a registered Professional Engineer to ensure that the design intent of this specification is realized. Verification shall be by one of the following methods:

.1 An NRTL (National Recognized Testing Laboratory), or laboratory recommended by VISCMA.

.2 Certified by a Professional Engineer with at least 5 years of experience, using industry standard methods of analysis, which employ common engineering practices. Adherence to the ratings standard within ASHRAE SPC171 and VISCMA 102-2007 is required.

.3 By a nationally recognized agency, such as VISCMA, that has reviewed and approved the restraint.

1.11 SYSTEM DESIGN

.1 Seismic restraint manufacturer shall be responsible for the structural design of attachment hardware as required to attach snubbers/restraints to both the equipment and supporting structure on vibration isolated equipment, or to directly attach equipment to the building structure for non-isolated equipment.

.2 The contractor shall furnish, to the seismic restraint manufacturer, a complete set of approved shop drawings of all equipment that is to be restrained, from which the selection and design of seismic restraint devices and/or attachment hardware will be completed. The shop drawings furnished shall include, at a minimum, basic equipment layout, length, and width dimensions, and installed operating weights of the equipment to be restrained.

.3 All conduit etc. is to be restrained to meet code requirements. At a minimum, the seismic restraint manufacturer shall provide documentation on maximum restraint spacing for various restraint sizes and anchors, as well as “worst case” reaction loads for each restraint and/or anchor size.

.4 The contractor shall ensure that all housekeeping pads used are adequately reinforced and are properly dowelled to the building structure, so as to withstand calculated seismic forces. In addition, the size or the housekeeping pad is to be coordinated with the seismic restraint manufacturer to ensure that adequate edge distances exist in order to obtain the desired equipment anchor capacities.

1.12 ALTERNATE SYSTEMS

.1 Provisions of the General Conditions and Supplemental Conditions of the specifications shall govern the use of alternate systems to those specified.

.2 Manufacturers not listed as approved in “Part 2 Materials” of this section must secure approval to bid a minimum of ten (10) days prior to the project bid date.

.3 Uncertified internal equipment seismic restraint systems are disallowed for use on this project.

1.13 INSTALLATION

.1 Installation of all seismic restraint materials specified herein shall be accomplished following the manufacturer’s written instructions. Installation instructions shall be submitted to the engineer for approval prior to the beginning of the work.

Part 2 Products

2.1 ACCEPTABLE MANUFACTURERS

.1 Cooper B-Line.
.2 Unistrut Building Systems.
.3 Kinetics Noise Control Inc.
.4 Mason Industries.
.5 Engineer approved equal.

2.2 SEISMIC BRACING COMPONENTS

.1 Steel strut and bracing components shall be utilized in combinations as required to meet designed load capacities.
.2 Fittings and accessories: Products shall be of the same manufacturer as strut and designed for use with that product.

2.3 BUILDING CODE REQUIREMENTS

.1 Seismic Zone Factors and coefficients shall be according to geographical area information table located on structural engineer of record's drawings.

2.4 SEISMIC SNUBBER TYPES

.1 GENERAL

(Isolator/Snubber Types contained herein are per ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.) Handbook, HVAC Applications, Seismic and Wind Restraint Design)

.2 Type J, Cable Restraints for Suspended Conduit and Trapeze

.1 Seismic wire rope cable restraints shall consist of steel wire strand cables, sized to resist project seismic loads, arranged to offer seismic restraint capabilities for conduit, trapeze assemblies, and suspended equipment in all lateral directions.
.2 Building and equipment attachment brackets at each end of the cable shall be designed to permit free cable movement in all directions up to a 45-degree misalignment. Protective thimbles shall be used at sharp connection points as required to eliminate potential for dynamic cable wear and strand breakage.
.3 Restraints shall be sized to the capacity of the cable or to the capacity of the anchorage, whichever is lesser.
.4 Seismic wire rope connections shall be made using overlap wire rope "U" clips or seismically rated tool-less wedge insert lock connectors.
.5 Vertical suspension rods shall be braced as required to avoid potential for buckling due to vertical "up" forces. Braces shall be structural steel angle uniquely selected to be of sufficient strength to prevent support rod bending. Brace shall be attached to the vertical suspension rod by a series of adjustable straps. Clips shall be capable of securely locking brace to suspension rod without the need for hand tools.

.6 Where clevis hanger brackets are used for seismic restraint attachment, they will be fitted with clevis internal braces to prevent buckling of the hanger brackets.

.7 Seismic cable shall be as manufactured by Kinetics Noise Control, or by other manufacturers who can meet the requirements as listed.

.8 Seismic cable building and equipment attachment brackets shall be Model KSCA, KSCU, or KSCC as manufactured by Kinetics Noise Control, or by other manufacturers who can meet the requirements as listed.

.9 Seismic cable concrete anchor bolts shall be Model KCAB Wedge, Model KCCAB Cracked Concrete, or Model KUAB Undercut, as manufactured by Kinetics Noise Control, or by other manufacturers who can meet the requirements as listed.

.10 Seismic wire rope connectors shall be (Model KWRC - 'U' clamp) / (Model KWGC - Tool-less wedge lock) as manufactured by Kinetics Noise Control, or by other manufacturers who can meet the requirements as listed.

.11 Seismic vertical suspension stiffener rod clips shall be Model KHRC as manufactured by Kinetics Noise Control, or by other manufacturers who can meet the requirements as listed.

.12 Clevis Internal Braces shall be Model KCHB as manufactured by Kinetics Noise Control, or by other manufacturers who can meet the requirements as listed.

Part 3 Execution

3.1 INSTALLATION

.1 All seismic restraint systems shall be installed in strict accordance with the manufacturer's seismic restraint guidelines manual and all certified submittal data.

.2 Installation of seismic restraints shall not cause any change in position of equipment or piping, resulting in stresses or misalignment.

.3 No rigid connections between equipment and the building structure shall be made that degrade the noise and vibration isolation system specified.

.4 Do not install any equipment, piping, duct, or conduit that makes connections with the building unless isolation is not specified.

.5 Prior to installation, bring to the architect's/engineer's attention any discrepancies between the specifications and the field conditions, or changes required due to specific equipment selection.

.6 Bracing may occur from flanges of structural beams, upper truss cords of bar joists, cast in place inserts, or wedge-type concrete anchors. Consult structural engineer of record.

.7 Overstressing of the building structure shall not occur from overhead support of equipment. Bracing attached to structural members may present additional stresses. The contractor shall submit loads to the structural engineer of record for approval in this event.

.8 Brace support rods when necessary to accept compressive loads. Welding of compressive braces to the vertical support rods is not acceptable.

.9 Provide reinforced clevis bolts where required.

.10 Seismic restraints shall be mechanically attached to the system. Looping restraints around the system is not acceptable.

.11 Do not brace a system to two independent structures such as a ceiling and wall.

.12 Provide appropriately sized openings in walls, floors, and ceilings for anticipated seismic movement. Provide fire seal systems in fire-rated walls.

.13 Torque anchor bolts according to anchor manufacturer's written instructions to resist seismic forces.

.14 Do not install any seismic restraint for equipment, cable trays or conduit that compromises isolation specified.

.15 Hold down clamps must be used to attach conduits and/or cables to all trapeze members before applying restraints.

.16 Conduit crossing building seismic or expansion joints, passing from building to building, or supported from different portions of the building shall be installed to allow differential support displacements without damaging the conduit, equipment connections, or support connections. Conduit offsets, loops, anchors, and guides shall be installed as required to provide specified motion capability and limit motion of adjacent piping.

.17 Coring is not permitted for the installation of concrete anchors. Use ground penetrating radar or equivalent method of embedment item detection to locate all embed items including reinforcing steel and electrical conduits. Concrete reinforcing steel and electrical conduits shall not be cut or damaged under any circumstances.

3.2 EXECUTION

.1 Install vertical braces to stiffen hanger rods and prevent buckling per seismic restraint manufacturer's design. Clamp vertical brace to hanger rods. Requirements apply equally to hanging equipment. Do not weld vertical braces to hanger rods.

.2 If mounting hole diameter exceeds bolt diameter by more than 0.125" (3 mm), reduce clearance in hole with epoxy grout, flanged elastomeric bushings or welded washer.

.3 Housekeeping Pads must be adequately reinforced and adequately sized for proper installation of equipment anchors. Refer to seismic restraint manufacturer's written instructions.

3.3 INSPECTION

.1 The contractor shall notify the local representative of the seismic restraint materials manufacturer prior to installing any seismic restraint devices. The contractor shall seek the representative's guidance in any installation procedures with which he/she is unfamiliar.

.2 Upon completion of the installation of all seismic restraint devices herein specified, the local representative of the seismic restraint manufacturer shall, at the contractor's request, inspect the completed system and report in writing any installation errors, improperly selected snubber devices, or other fault in the system which could affect the performance of the system.

.3 The installing contractor shall submit a report upon request to the building architect and/or engineer, including the manufacturer's representative's final report, indicating that all seismic restraint material has been properly installed, or steps that are to be taken by the contractor to properly complete the seismic restraint work as per the specifications.

3.4 CONDUIT

.1 Seismically restrain all electrical conduit. Use Type J Cable Restraints for all conduit supported by vibration isolation hanger assemblies. Brace all conduit to code requirements (IBC or TI-809-04) or in conformance with SMACNA (Sheet Metal and Air Conditioning Contractors National Association, Inc.) "Seismic Restraint Manual Guidelines for Mechanical Systems", Second Edition (Remaining Codes).

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA)

- .1 CAN/CSA C22.2 No.18-92, Outlet Boxes, Conduit Boxes, and Fittings.
- .2 CSA C22.2 No.45-M1981(R1992), Rigid Metal Conduit.
- .3 CSA C22.2 No.56-1977(R1977), Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
- .4 CSA C22.2 No.83-M1985(R1992), Electrical Metallic Tubing.
- .5 CSA C22.2 No.211.2-M1984(R1992), Rigid PVC (Unplasticized) Conduit.
- .6 CAN/CSA C22.2 No.227.3-M91, Flexible Nonmetallic Tubing.

Part 2 Products

2.1 CONDUITS

- .1 Rigid metal conduit: to CSA C22.2 No.45, aluminum threaded.
- .2 Epoxy coated conduit: to CSA C22.2 No.45, with zinc coating and corrosion resistant epoxy finish inside and outside.
- .3 Electrical metallic tubing (EMT) with couplings: to CSA C22.2 No.83.
- .4 Rigid PVC conduit: to CSA C22.2 No.211.2.
- .5 Flexible metal conduit: to CSA C22.2 No.56, aluminum and liquid-tight flexible metal.
- .6 Flexible PVC conduit: to CAN/CSA C22.2 No.227.3, ENT.

2.2 CONDUIT FASTENINGS

- .1 One hole steel straps to secure surface conduits 53 mm (2") and smaller. Two hole steel straps for conduits larger than 53 mm (2").
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 1.5 m (5'-0") oc.
- .4 Threaded rods, 6 mm (1/4") diameter, to support suspended channels.

2.3 CONDUIT FITTINGS

- .1 EMT fittings shall be set screw style (zinc alloy).
- .2 Flexible metal conduit fittings shall be screw-in type.
- .3 Liquid type flexible metal conduit fittings shall be sealtite type.
- .4 PVC fittings shall be PVC type complete with PVC adaptors at all boxes.
- .5 Rigid conduit and mineral insulated conduit fittings shall be threaded type.

.6 Coating: same as conduit.
.7 Factory "ells" where 90° bends are required for 27 mm (1") and larger conduits.
.8 Where bushings are noted to be provided they must be “screwed” type fastened to a conduit connector. Push-fit or glued in place bushings will NOT be accepted.

2.4 FISH CORD

.1 Nylon twine.

Part 3 Execution

3.1 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
.2 Conceal conduits except in mechanical/ electrical service rooms and in unfinished areas. **Writer note**: Where devices are to be installed on existing walls in finished area, which cannot be “fished”, install feeds in a surface metal raceway equal to Wiremold V700 series. Co-ordinate surface installations with consultant prior to rough-in.
.3 Use electrical metallic tubing (EMT) for all branch circuits unless specified otherwise.
.4 Use rigid aluminum threaded conduit where specified and up to 2.1 m (7'-0") above finish floor where exposed to mechanical injury.
.5 Use rigid PVC conduit underground and in kitchen areas.
.6 Use flexible metal conduit for connection to motors in dry areas, connection to recessed fixtures without a prewired outlet box, connection to surface or recessed fixtures, work in movable metal partitions.
.7 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations and for connections to kitchen equipment.
.8 Conduits terminating at electrical equipment in sprinklered areas are to be provided rain-tight insulated compression style connectors.
.9 **Minimum conduit size for branch circuits shall be 21 mm (3/4").** Single drops from ceiling mounted junction boxes down to a light switch or duplex receptacle may be reduced to 16 mm (½").
.10 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
.11 Mechanically bend steel conduit over 27 mm (1") diameter.
.12 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
.13 Install fish cord in empty conduits.

.14 Run 2- 27 mm (1") spare conduits up to accessible ceiling space from each flush panel. Terminate these conduits in 152 mm x 152 mm x 102 mm (6" x 6" x 4") junction boxes in ceiling space.

.15 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.16 Dry conduits out before installing wire.

3.2 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m (5') clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on suspended or surface channels.

.5 Do not pass conduits through structural members except as indicated.

.6 Do not locate conduits less than 75 mm (3") parallel to steam or hot water lines with minimum of 25 mm (1") at crossovers.

.7 Do not fasten surface conduit to roof deck. Provide standoffs or supports as manufactured by Caddy or use unistrut trapeze fastened to structure.

3.3 CONCEALED CONDUITS

.1 Do not install horizontal runs in masonry walls.

.2 Do not install conduits in terrazzo or concrete toppings.

3.4 CONDUITS IN CAST-IN-PLACE CONCRETE

.1 Locate to suit reinforcing steel. Install in centre one third of slab.

.2 Protect conduits from damage where they stub out of concrete.

.3 Install sleeves where conduits pass through slab or wall.

.4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.

.5 Do not place conduits in slabs in which slab thickness is less than 4 times conduit diameter.

.6 Encase conduits completely in concrete with minimum 27 mm (1") concrete cover.

.7 Organize conduits in slab to minimize cross-overs.

3.5 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

.1 Run conduits 27 mm (1") and larger 300 mm (12") below slab (measured from top of slab to bottom of conduit) and encased in 78 mm (3") sand envelope.

3.6 CONDUITS UNDERGROUND

.1 Slope conduits to provide drainage.

END OF SECTION

Part 1 General

1.1 GENERAL PROVISIONS

.1 Conform to the General Provisions of Division 1 and Electrical General Requirements Section.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Electrical General Requirements Section.

Part 2 Products

2.1 MATERIALS

.1 Rigid PVC ducts must conform to CSA C22.2 No. 211.0, 211.1 and 211.2 (latest edition).
.2 Ducts and/or cables must be excavated, bedded, reinforced, encased and backfilled as per details on the drawings.

2.2 DUCT

.1 Ducts indicated for encasement in concrete must be type DB-2. Ipex “Super Duct” or approved equal.
.2 Ducts indicated for direct burial must be type SCEPTER. Ipex “Scepter” rigid PVC duct or approved equal.

2.3 DUCT FITTINGS

.1 Fittings required to provide a complete continuous ductbank installation shall include but not be limited to, couplings, bell end fitting, caps, adapters, base and intermediate spacers.
.2 Small or large angle couplings will be required where noted on the drawings.
.3 Expansion joints are to be provided when running ducts in concrete across expansion joints and where exposed on roofs or exterior of buildings.

Part 3 Execution

3.1 BASIC INSTALLATION

.1 Excavate trench along route as indicated and at a depth to suit cables and/or ducts as detailed.
.2 If required, trench is to be pumped to maintain excavation free of water.
.3 Import granular fill and place in bottom of trench. Compact to provide a firm level base.
.4 Quantity and arrangement of ducts must be provided according to drawing details.
.5 When ducts terminate at buildings or precast bases provide bell end fittings.

.6 **When ducts enter buildings below grade they shall be sealed inside and out at the building foundation and service entrance equipment with a suitable duct sealing compound to prevent the entrance of moisture or gases.**

.7 When terminating a ductbank for future extension terminate each duct with a coupling. If ducts are encased in concrete set coupling flush with end of concrete.

.8 Attach ducts to spacers using non-metallic materials.

.9 Provide concrete as detailed. Pour concrete down sides of ductbank to ensure spaces around and under ducts are filled first.

.10 Concrete must obtain 50% of its specified strength prior to backfilling.

.11 **Backfilling must be imported granular 'A' material.**

.12 Backfill must be placed as 150 mm (6") compacted lifts.

.13 Excess excavated material must be removed from site by this contractor.

.14 Ensure ducts indicated to be installed along a curb line are installed at least 600 mm (24") from that curb line.

3.2 DIRECT BURIAL OF DUCTS

.1 After sand bed specified is in place, lay ducts maintaining 75 mm (3") clearance from each side of trench to nearest duct. Do not pull cable into trench.

.2 Provide offsets for thermal action and minor earth movements. Offset ducts 150 mm (6") for each 60 m (200') run, maintaining minimum duct separation and bending radius requirements.

.3 Underground cable splices not acceptable.

.4 Duct separation:

.1 Provide separation of ducts in conformance with the details in the Electrical Safety Code.

3.3 CABLE INSTALLATION IN DUCTS

.1 Install cables as indicated in ducts.

.2 Do not pull spliced cables inside ducts.

.3 Install multiple cables in duct simultaneously.

.4 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.

.5 To facilitate matching of colour coded multi-conductor control cables reel off in same direction during installation.

.6 Before pulling cable into ducts and until cables are properly terminated, seal ends of cables with moisture seal tape.

.7 After installation of cables, seal duct ends with duct sealing compound.

3.4 FIELD QUALITY CONTROL

.1 Perform tests using qualified personnel. Provide necessary instruments and equipment.

.2 Check phase rotation and identify each phase conductor of each feeder.

.3 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 mega ohms.

.4 Pre-acceptance tests.

.1 After installing cable but before terminating, perform insulation resistance test with 1000 V megger on each phase conductor.

.5 Provide Consultant with list of test results showing location at which each test was made, circuit tested and result of each test.

.6 Remove and replace entire length of cable if cable fails to meet any of test criteria.

.7 The Consultant requires a minimum of 48 hours notice to inspect at his discretion the following; ductbank excavation, bedding and duct placement, pouring and/or placement of ductbank encasement.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The studies must be submitted to the Consultant prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment for manufacturing. If formal completion of the studies may cause delay in equipment manufacturing, approval from the Consultant may be obtained for a preliminary submittal of sufficient study data to ensure that the selection of device ratings and characteristics will be satisfactory.

.2 The studies shall include all portions of the electrical distribution system from the normal power source or sources down to and including the smallest adjustable trip circuit breaker in the distribution system, **as well as mechanical unit equipment.** Normal system connections and those, which result in maximum fault conditions, shall be adequately covered in the study.

.3 The firm should be currently involved in high- and low-voltage power system evaluation. The study must be performed, stamped and signed by a registered professional engineer in the Province of Ontario. Credentials of the individual(s) performing the study and background of the firm shall be submitted to the Consultant for approval prior to start of the work. A minimum of five (5) years experience in power system analysis is required for the individual in charge of the project.

.4 The firm performing the study should demonstrate capability and experience to provide assistance during start up as required.

1.2 DATA COLLECTION FOR THE STUDY

.1 The Contractor shall provide the required data for preparation of the studies. The Consultant performing the system studies shall furnish the Contractor with a listing of the required data immediately after award of the contract.

.2 The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to release of the equipment for manufacturing.

.3 Data collected for the study, including correspondence with local utility, shall be included with study report.

Part 2 Products

2.1 SHORT CIRCUIT AND PROTECTIVE DEVICE EVALUATION AND COORDINATION STUDY

.1 The short-circuit study shall be performed with the aid of a digital computer program and shall be in accordance with the latest applicable IEEE and ANSI standards.

.2 In the short-circuit study, provide calculation methods and assumptions, the base per unit quantities selected, one-line diagrams, source impedance data including power company system characteristics, typical calculations, tabulations of calculation quantities and results, conclusions, and recommendations. Calculate short-circuit interrupting and momentary (when applicable) duties for an assumed 3-phase bolted fault at each supply switchgear lineup, unit substation primary and secondary terminals, low-voltage switchgear lineup, switchboard, motor control center, distribution panelboard, pertinent branch circuit panelboard, and other significant overcurrent protective device locations throughout the system. Provide a ground fault current study for the same system areas, including the associated zero sequence impedance data. Include in tabulations fault impedance, X to R ratios, asymmetry factors, motor fault contribution, short circuit kVA, and symmetrical and asymmetrical fault currents.

.3 In the protective device coordination study, provide time-current curves graphically indicating the coordination proposed for the system, centered on conventional, full-size, log-log forms. Include with each curve sheet a complete title and one-line diagram with legend identifying the specific portion of the system covered by that particular curve sheet. Include a detailed description of each protective device identifying its type, function, manufacturer, and time-current characteristics. Tabulate recommended device tap, time dial, pickup, instantaneous, and time delay settings.

.4 Include on the curve sheets power company relay and fuse characteristics, medium-voltage equipment protective relay and fuse characteristics, low-voltage equipment circuit breaker trip device characteristics, pertinent transformer characteristics, pertinent motor and generator characteristics, and characteristics of other system load protective devices. In addition, include all devices down to the largest branch circuit and largest feeder circuit breaker in each motor control center, and main breaker in branch panelboards.

Include all adjustable settings for ground fault protective devices. Include manufacturing tolerance and damage bands in plotted fuse characteristics. Show transformer full load currents, transformer magnetizing inrush, ANSI transformer withstand parameters, and significant symmetrical fault currents. Terminate device characteristic curves at a point reflecting the maximum symmetrical fault current to which the device is exposed.

.5 Select each primary protective device required for a delta-wye connected transformer so that its characteristic or operating band is within the transformer characteristics, including a point equal to 58 percent of the ANSI withstand point to provide secondary line-to-ground fault protection. Separate transformer primary protective device characteristic curves from associated secondary device characteristics by a 16 percent current margin to provide proper coordination and protection in the event of secondary line-to-line faults. Separate medium-voltage relay characteristic curves from curves for other devices by at least a 0.4-second time margin.

.6 Include complete fault calculations as specified herein based on contract documents.

.7 Submit qualifications of individual(s) who will perform the work for approval prior to commencement of the studies. Provide studies in conjunction with equipment submittals to verify equipment ratings required. Submit the study to Consultant for review prior to delivery of the study to the Owner. Make all additions or changes as required by the reviewer.

.8 Utilize equipment load data for the study obtained by the Contractor from contract documents, including contract addendums issued prior to bid openings.

.9 Include fault contribution of all motors in the study. Notify the Consultant in writing of circuit protective devices not properly rated for fault conditions.

.10 Evaluate proper operation of the ground relays in 4-wire distributions with more than one main service circuit breaker, or when generators are provided, and discuss the neutral grounds and ground fault current flows during a neutral to ground fault.

.11 For motor control circuits, show the MCC full-load current plus symmetrical and asymmetrical of the largest motor starting current and time to ensure protective devices will not trip during major or group start operation.

.12 Evaluate proper rating of applicable mechanical unit equipment based on available fault at unit connection. Mechanical unit equipment in study shall include packaged assemblies identified as, but not limited to, AHUs, MUAs, DOAS, Chillers, and Cooling Towers.

2.2 ARC FLASH HAZARD ANALYSIS

.1 The contractor shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E – Standard for Electrical Safety in the Workplace, reference Article 130.3 and Annex D and CSA Z462-(latest edition).

.2 The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2004, Annex D.

.3 When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Alternative methods shall be presented in the proposal.

.4 The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.

.5 The Arc-Flash Hazard Analysis shall include all significant locations in 240 volt and 208 volt systems fed from transformers equal to or greater than 125 kVA.

.6 Safe working distances shall be specified for calculated fault locations based upon the calculated arc flash boundary considering an incident energy of 1.2 cal/cm2.

.7 The Arc Flash Hazard analysis shall include calculations for maximum and minimum contributions of fault current magnitude. The minimum calculation shall assume that the utility contribution is at a minimum and shall assume a minimum motor load. Conversely, the maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.

.8 Arc Flash computation shall include both line and load side of main breaker calculations, where necessary.

.9 Arc Flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584-latest edition section B.1.2.

.10 Arc Flash computation shall include arc flash current magnitude at each circuit breaker 1200A or higher (ARMS capable) to allow the Arc Flash Reduction Maintenance System pickups to be set based on multiples of the per unit secondary arc current monitored by the trip unit.

2.3 STUDY REPORT

.1 The results of the power system study shall be summarized in a final report. Submit report in accordance with Electrical General Requirements Section as a shop drawing.

.2 The report shall include the following sections:

.1 Descriptions, purpose, basis, and scope of the study.

.2 Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short-circuit duties, and commentary regarding same.

.3 Tabulations of mechanical unit equipment ratings as identified on equipment shop drawings versus calculated short-circuit, and commentary regarding same. Short-circuit calculations for mechanical equipment shall be based on unit MCA with conductor sizes as identified on electrical design drawings and not based on equipment MOCP.

.4 Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same.

.5 Fault current calculations including a definition of terms and guide for interpretation of computer printout.

.6 Incident energy and flash protection boundary calculations

.1 Arcing fault magnitude
.2 Device clearing time
.3 Duration of arc
.4 Arc flash boundary
.5 Working distance
.6 Incident energy
.7 Hazard Risk Category
.8 Recommendations for arc flash energy reduction
.9 Recommendations for Personal Protection Equipment (PPE) level.

Part 3 Execution

3.1 POWER COMPANY APPROVAL

.1 Copies of the final report must be submitted to the power company for their review and approval. Approved copies of the report shall be submitted to the Consultant.

3.2 FIELD SETTINGS

.1 The Contractor shall perform field adjustments of the protective devices as required to place the equipment in final operating condition. The settings shall be in accordance with the approved short-circuit study, protective device evaluation study, and protective device coordination study.

.2 Necessary field settings of devices and adjustments and minor modifications to equipment to accomplish conformance with the approved short-circuit and protective device coordination study shall be carried out by the Contractor at no additional cost to the Owner.

.3 At the completion of the project, configure settings and install equipment labels. On company letterhead, the contractor is to prepare a certification letter indicating at minimum:

.1 project
.2 date
.3 device designation
.4 certification of correct settings
.5 certification of correct device labels
.6 certification of arc flash hazard equipment labels
.7 digital image of each breaker indicating final settings and placement of labels

3.3 ARC FLASH WARNING LABELS

.1 The vendor shall provide a 3.5 in. x 5 in. thermal transfer type label of high adhesion polyester for each work location analyzed.

.2 The label shall have an orange header with the wording, “WARNING, ARC FLASH HAZARD”, and shall include the following information:

.1 Location designation
.2 Nominal voltage
.3 Flash protection boundary
.4 Hazard risk category
.5 Incident energy
.6 Working distance
.7 Personal Protection Equipment (PPE) level
.8 Engineering report number, revision number and issue date.

.3 Labels shall be machine printed, with no field markings.

.4 Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings.

.1 For each 600, 480 and applicable 208 volt panelboards, one arc flash label shall be provided.
.2 For each motor control center, one arc flash label shall be provided.
.3 For each low voltage switchboard, one arc flash label shall be provided.

.4 For each switchgear, one flash label shall be provided.
.5 For medium voltage switches one arc flash label shall be provided

.5 Labels shall be field installed by the firm providing the Arc Flashing Hazard Analysis.

3.4 SERIES RATING LABELS

.1 Provide lamacoid labels where recommended by study. **Labels for series rating with panelboards or equipment shall be indicated on feeder breaker as "SERIES RATING BREAKER" and at the panelboard or equipment as "SERIES RATING EQUIPMENT". Refer to section 26 24 16.**

3.5 ACCEPTABLE TESTING FIRMS

.1 MVA Engineering (519) 668-4698
.2 GT Woods (905) 272-1696
.3 Brosz & Associates (905) 472-6660
.4 K-Tek Electro-services Ltd. (905) 640-0660 ext. 228

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS

.1 Submit shop drawings for each system in Conformance with The Electrical General Requirements Section.

1.2 PRODUCT/MAINTENANCE DATA

.1 Submit product/maintenance data for each system for inclusion in maintenance manual conforming to The General Electrical Requirements Section.

1.3 SCOPE

.1 The scope of this Section will include the following systems.

- .1 Surface mounted raceway.
- .2 Hand dryers.
- .3 Cable management hangers.
- .4 Cable management system.
- .5 Auxiliary systems rough-in.
- .6 Security and access control rough-in.
- .7 Telecommunication network system rough-in.
- .8 Miscellaneous clocks.
- .9 Destratification fans and controls.
- .10 Classroom control panels.
- .11 Public address system rough-in.
- .12 Cable reels.
- .13 Digital time switch.
- .14 Photocontrol switch.
- .15 Line voltage power packs and low voltage occupancy sensors.

Part 2 Products

2.1 SURFACE MOUNTED RACEWAY

.1 The two compartment surface raceway shall be complete with the following features:

- .1 Surface non-metallic raceway is to be utilized in dry interior locations only.
- .2 The surface non-metallic raceway system specified herein for branch circuit wiring and/or data network, voice, video and other low-voltage wiring shall be the 5400 System as manufactured by the Wiremold Company.
- .3 The raceway and all system components must be UL Listed, and exhibit non-flammable self-extinguishing characteristics tested to comparable specifications of UL94V-0. The raceway base and cover shall be manufactured by rigid compound, available in ivory or white colours (Architect Selection).

.4 The raceway shall be a two-piece design with a base and a snap-on cover. Total width shall be 133 mm (5¼") by 44.5 mm (1¾") deep with an approximate thickness of 2.4 mm (1/12"). The base and cover shall be available in 2.4 m (8') lengths. The raceway shall be available with two multiple wiring channels formed by integral barriers in the base.

.5 The cover shall span the entire width of the base concealing all of the wiring channels.

.6 A full complement of fittings must be available including, but not limited to flat, internal and external elbows, tees entrance fittings, cover clips and end caps. They shall be manufactured of a rigid PVC compound. The fittings shall have a matte texture, in ivory or white colours to match the base and cover. They shall overlap the cover and base to hide uneven cuts. All fittings shall be supplied with a base where applicable to eliminate mitring. A transition fitting shall be available to adapt to other Wiremold series raceways.

.7 Device brackets shall be available for mounting standard devices in-line with the raceway. Faceplates shall match and fit flush in the device plate. They shall be manufactured of rigid PVC compound. They shall be ivory or white colours to match raceway base cover (Architect selection). Contractor is to provide devices as noted.

.8 The raceway manufacturer will provide a complete line of connectivity outlets and modular inserts for UTP (including Category 5e and 6), STP (150 ohm) Fibre Optic, Coaxial and other cabling types with face plates and bezels to facilitate mounting. The electrical contractor is to provide adapter plates for faceplates to be provided by the voice/data sub-contractor. The recommended plate is a Deco adapter 3-port plate style, confirm with voice/data sub-contractor.

.2 Acceptable alternate manufacturers include:

.1	Hubbell	Base Trak
.2	Panduit	Pan-Way

2.2 HAND DRYERS

.1 Hand dryers where noted on the drawings are to be supplied by the school board and installed by this Division.

2.3 CABLE MANAGEMENT HANGERS

.1 Hangers where noted are to be complete with the following features:

.1 Approximately 150 mm (6") high by 80 mm (3¼") protrusion.

.2 Constructed from 5 mm (3/16") x 20 mm (3/4") flat steel bar and formed to resemble the letter “G”.

.3 Seven 6 mm (1/4") diameter mounting holes are to be provided around the hanger perimeter.

.4 Matte black finish.

.5 Suitable for wall or suspended mounting.

.6 Acceptable Manufacturers:

.1 EMF Cat. #H-533-S

.7 Manufacturer Contact:
Electron Metal Fabricators Inc.
2160 Dagenais Boulevard West
Laval, Quebec
H7L 5X9
Phone: 450-625-8064 or 1-800-267-8064
Fax: 450-625-8004

.8 Acceptable Alternate:
Wiremold Cat. #GH030406
Mono System Cat. # The Hook H-433
Cablofil Cat. #CSGH-3-4-6
Eaton Cat. #B-Line

.2 As an alternate to the hanger system detailed the contractor may
a) Use as an equal one run of 50 mm (2") x 150 mm (6") wire mesh cable management system equal to Cablofil Cat. #CF 54/150 EZ complete with Cat. #FAS L 150 universal wall bracket where noted to be wall mounted and Cat. # FAS C 200 where noted to be hung. The hangers are to be installed at intervals as recommended by the manufacturer but no greater than 2.4 m (8'-0") on centre.

2.4 CABLE MANAGEMENT SYSTEM

.1 The system where noted shall be a continuous, rigid, welded steel wire mesh cable management system with the following features:

.1 Permits continuous ventilation of cable and maximum dissipation of heat.
.2 Continuous safety edge T-welded wire lip.
.3 Welded at all intersections.
.4 Straight sections 4" x 12" (100 mm x 300 mm) in configurations noted on the drawings.
.5 Constructed of carbon steel wire, ASTM A 510, grade 1008. Wire welded, bent, and surface treated after manufacture.
.6 Post fabrication finish of electro-plated zinc galvanizing: ASTM B 633, Type III, SC-1.
.7 Fittings: Field fabricated in accordance with manufacturer’s instructions from straight sections.

.2 The support system shall be Cablofil FAS CH hanger.
.3 The necessary hardware, including splice connectors and support components furnished by manufacturer.
.4 The product shall be Cablofil Cat. #CF105/300EZ complete with Cat. #FAS P300 CH at intervals as recommended by the manufacturer.

.5 The manufacturer shall be:

.1 Cablofil Inc.
Local representation by:
Cablofil
533 Galway Drive
Burlington, Ontario
L7L 2S6
Ph: 905-681-5380
Fax: 905-681-2206

.6 Approved equals:

.1 Eaton B-Line FT4x12x10 complete with 12 CTR HGR
Intralec Electrical Products Ltd.
1200 Cardiff Blvd.
Mississauga, Ontario
L5S 1P6
Phone: 905-670-0970

2.5 AUXILIARY SYSTEMS ROUGH-IN

.1 Outlets where noted shall be single gang boxes unless specified otherwise.
.2 Outlets if unwired are to be provided with blank coverplates to suit related sections of this specification.
.3 Coordinate final outlet locations, quantities, etc. with respective system vendor and owner's representative.

2.6 SECURITY AND ACCESS CONTROL ROUGH-IN

.1 Provide conduit from device and outlet locations to cable management systems as noted on drawings.
.2 Outlets if unwired are to be provided with blank coverplates to suit related sections of this specification.
.3 Provide grounding of equipment as noted on drawings.
.4 Refer to Security System sections for additional requirements

2.7 TELECOMMUNICATION NETWORK SYSTEM ROUGH-IN

.1 Outlets where noted shall be single gang flush mounted in wall or surface raceways.
.2 Outlets if unwired are to be provided with blank coverplates to suit related sections of this specification.
.3 Provide a #6 insulated green ground conductor from main service ground to voice equipment backboard located on drawings.
.4 Refer to Telecommunication Network Installations section for additional requirements.

2.8 MISCELLANEOUS CLOCKS

.1 Room and/or office clocks shall be surface mounted 300 mm (12") round style, battery operated. Finish to suit Architect.

.2 Library and general purpose room clocks shall be surface mounted 375 mm (15") round style, battery operated. General purpose room clocks must be provided with wire guard. Finish to suit Architect.

.3 Manufacturers shall be as follows:

.1 300 mm (12"):
Edwards Cat. #2941-2B
Simplex Cat. #BAT Series
American Time Cat. #E56BASD304

.2 375 mm (15"):
Edwards Cat. #2942-2B
Simplex Cat. # BAT Series
American Time Cat. # E66BADD304

.3 Wireguard for 375 mm (15") clock:
Edwards Cat. #2091A
Simplex Cat. # BAT Series
American Time Cat. #G2366

2.9 DESTRATIFICATION FANS AND CONTROLS

.1 General purpose fans in the gym to be provided with the following features:

.1 Metal construction.
.2 Baked white enamel.
.3 Down-blowing single direction.
.4 1400 mm (56") diameter blade combination.
.5 Minimum 400 mm (16") suspension with ball aligner and canopy.
.6 Suitable for 120V/1/60Hz operation.
.7 Provided with wire cage when installed in general purpose rooms.
.8 Manufacturer:

.1 Banvil Cat. #60F9-10 (FG60C where noted).

.2 Single fan variable speed controller shall be Banvil Cat. #100P c/w colour and coverplate to suit this specification.

.3 Multiple fan variable speed controller shall be Banvil Cat. [#105F (up to 4 fans), 150F (up to 8 fans), or 200F (up to 12 fans)] c/w colour and coverplate to suit this specification.

.4 Approved equal:

.1 Pleasantaire

.5 Decorative fans as indicated are to be provided with the following features:

.1 Metal construction.
.2 Blade, downrod and motor finish as directed by Architect.
.3 Down-blowing single direction.
.4 1300 (52") diameter blade combination.
.5 Minimum 400 mm (16") suspension with ball aligner and canopy.
.6 Suitable for 120V/1/60 Hz operation.
.7 Manufacturer: Big Ass Fans Cat. #K3127-A2-XX-XX-XX-03-C complete with multi-button wall mounted controller.

2.10 CLASSROOM CONTROL PANELS

.1 Provide surface mounted Classroom Hub Control Panels as detailed on the drawings.
.2 Modular control panels shall be constructed of structurally sound 6063 T5 alloy satin anodized aluminum frame .08mm thick with high pressure plastic laminate faced panels of lightweight particle core and 0.5mm thick plastic laminate backing sheet. Plastic laminate colour as selected by the Architect from Arborite or Formica, furniture finish, from manufacturer's standard colour range. Complete assembly to meet flame spread ratings in areas used.
.3 Units to be complete with backboxes fabricated from heavy gauge satin coat steel with suitable barriers and continuous knockouts. Satin anodized faceplates shall be pre-punched to accept detailed components.
.4 All panels shall be vandal resistant and removable with special tools for service access.
.5 Fabricate units in accordance with reviewed shop drawings with extruded aluminum frames and solid plastic laminated face panels.
.6 Panels to be removable from aluminum frames with rounded profile edging.
.7 Front panels to have colour finish as selected by the Architect.
.8 Panels to have all openings, mounting hardware, etc. for services as required for installation of mechanical and electrical services.
PANELS MUST BE COMPLETE WITH RECESSED OPENING FOR TELEPHONE HANDSET. REFER TO CONTROL PANEL DETAIL ON DESIGN DRAWINGS.
.9 Units to be full height from 200 mm off floor to underside of ceiling panels. Standard unit dimensions are 16" in width, 4" deep.
.10 Acceptable Manufacturer (basis of design):

.1 Swift Path Solutions.

.11 Acceptable Alternate (no other alternates accepted):

.1 Control Hub Solutions Inc.

2.11 PUBLIC ADDRESS SYSTEM ROUGH-IN

.1 Provide conduit from device and outlet locations to cable management systems as noted on drawings.

.2 Outlets if unwired are to be provided with blank coverplates to suit related sections of this specification.

.3 Provide grounding of equipment as noted on drawings.

2.12 CABLE REELS

.1 Cable reels are to be provided with the following features.

.1 Steel frame and yellow powder coat finish.
.2 Heavy duty welded mounting frame.
.3 Multi-position guide arm.
.4 Multi-directional nylon rollers on guide arm.
.5 12 AWG 3 conductor-SJEO cord.
.6 Positive-latch mechanism.
.7 Automatic spring retraction.
.8 Plug in power cord.
.9 Complete with FS type box, specification grade duplex receptacle and weatherproof cover.
.10 Must conform to UL 355/CSA C22.2 No. 21-M90.
.11 Acceptable Material:

.1 Hubbell Cat. #HBLI45123R20Y.

.12 Acceptable Alternate:

.1 Woodhead

2.13 DIGITAL TIME SWITCH

.1 Supply and install a digital time switch with 40 Amp SPST contacts.
.2 Unit shall be capable of 20 set points.
.3 Unit shall repeat the same schedule each day.
.4 Unit shall have automatic Daylight Savings Time and Leap Year compensation.
.5 Unit shall program in AM/PM format.
.6 Unit shall have LCD display.
.7 Unit shall have permanent schedule retention.
.8 Unit real time clock shall be retained by super capacitator for 100 hours in a power failure.
.9 Unit shall be capable of manual override ON and OFF either to the next scheduled event or permanently.
.10 Unit shall have a NEMA 3R indoor/outdoor plastic enclosure.

.11 Unit shall have Load Status indication.
.12 Unit shall have Power Failure indication.
.13 Acceptable Manufacturer:
Tork Cat. #EW/EWZ Series
Use EW for control of indoor devices and EWZ for control of outdoor devices.

2.14 PHOTOCONTROL SWITCH

.1 Supply and install photo control with rating of;

.1 (1000, 1800, 2000) Watts,
.2 (8.33, 14, 16.6) amperes tungsten at 120Volts.
.3 50 to 60 Hz. AC

.2 Sealed cadmium sulphide photocell operates in temperature range of:

.1 -34^{0}C. (-30^{0}F) to 60^{0}C. (140^{0}F)

.3 Lights switching on/off:

.1 On at (1.5, 2, 3) footcandles.
.2 Off at (4.5, 10) footcandles.

.4 Diecast aluminum enclosure, gasketted for maximum weatherproofing.
.5 Thermal inertia gives minimum time delay of fifteen (15) seconds to prevent false or nuisance switching due to light from vehicles, lightning etc.
.6 Control to have standard threaded pipe nipple.
.7 Control to have manually adjustable lever slide.
.8 Acceptable manufacturers:

.1 Paragon Cat. #CW201-00 Series.
.2 Tork Cat. #2101 Series.

2.15 LINE VOLTAGE POWER PACKS AND LOW VOLTAGE OCCUPANCY SENSORS

.1 Line voltage power packs and occupancy sensors shall be one manufacturer throughout the project.
.2 Line Voltage Power packs shall be provided to match the room lighting load, control requirements, and lighting voltage. Power packs shall have the following features:

.1 Mount to standard junction box.
.2 Simple replacement. It shall be capable to replace the unit without requiring any configuration or set-up.
.3 Plenum rated
.4 120VAC or 347V, 60HZ operation.

.5 Acceptable materials:

.1 Sensorswitch Cat. #PP20 Series
.2 Legrand Cat. #BZ-250 Series
.3 Greengate Cat. #SP15 Series

.3 Low voltage / analog occupancy sensors shall be complete with the following features:

.1 Coverage pattern to suit room ceiling height.
.2 Suitable to detect minor and medium motion patterns within rooms less than 2000 sq. ft.
.3 Mount to standard junction box.
.4 Simple replacement. It shall be capable to replace the unit without requiring any configuration or set-up.
.5 Relays shall not be integrated within the occupancy sensor. Relays shall be provided within separate power pack.
.6 Acceptable materials

.1 Sensorswitch Cat. #CM-PDT Series
.2 Legrand Cat. #CI-205
.3 Greengate Cat. #OAC-DT-2000

Part 3 Execution

3.1 SURFACE MOUNTED RACEWAY

.1 Raceway is to be supplied and installed complete with all necessary fittings, hardware and device brackets for configuration as noted in the drawings for a complete functional installation.
.2 Install conduit system, wiring and devices as indicated.
.3 Ensure raceway is installed as per manufacturer recommendations.
.4 Where the raceway ends at a wall install end cap.

3.2 HAND DRYERS

.1 Install and connect hand dryers in conformance with manufacturer's recommendations.
.2 Hand dryers are to be mounted at a height to suit age of expected users. Unless otherwise noted confirm height with manufacturer, owner, Architect, and/or consultant prior to rough-in.
.3 Once installed this contractor is to caulk the joint between dryer and wall surface with a bead of clear silicone.

3.3 CABLE MANAGEMENT HANGERS

.1 Install hangers as per details in configuration noted.
.2 Prior to installation co-ordinate location with other services within the ceiling space.

.3 Coordinate with noted sub-contractors to install cables noted to be utilizing these hangers. Cables are to be installed such that the maximum sag between hangers does not exceed 25 mm (1"). This electrical contractor is to coordinate.

.4 Attaching cable to any T-bar support rods is not acceptable.

3.4 CABLE MANAGEMENT SYSTEM

.1 Install cable management system at locations indicated on the drawings and in accordance with manufacturer's instructions.

.2 Support system every 2.4 m (8'-0") unless system is used within a telecommunication room. In that situation support every 1.5 m (5'-0").

.3 Cut wires in accordance with manufacturer's instructions.

.4 Cut wires with side action bolt cutters to ensure integrity of galvanic protective layer. Cut using side action bolt cutters (Cablofil Cat. #Coupfil).

.5 Cut each wire with 1 clean cut to eliminate grinding or touch-up.

.6 Install cable management system using hardware, splice connectors, support components, and accessories furnished by manufacturer.

.7 Suspend from structure or intermediate unistrut channel spanning across the corridor where access to structure is not available due to the concentration of mechanical ductwork and/or piping.

.8 Ground cable tray with continuous ground per O.E.S.C. and manufacturer instructions. Test to ensure minimum 5 ohms resistance.

.9 Locate cable management system minimum 9" from EMI sources including but not limited to fluorescent lights, transformers, motors, and power cables.

3.5 AUXILIARY SYSTEMS ROUGH-IN

.1 Provide backboard for each system use as noted complete with ground buss connection as specified.

.2 Outlets are to be installed complete with minimum 21 mm (3/4") conduit to accessible ceiling space or as otherwise detailed.

.3 Conduits terminated into ceiling spaces must be within 3m (10') of zone conduits when noted.

.4 Provide insulated bushings on all conduits terminated in ceiling space.

.5 Ensure specified zone or riser conduits are installed back to equipment backboard.

3.6 SECURITY AND ACCESS CONTROL ROUGH-IN

.1 Outlets are to be provided for devices with conduit as detailed on drawings.

.2 Conduits terminated into ceiling spaces must be within 1m of cable management of tray.

3.7 TELECOMMUNICATION NETWORK SYSTEM ROUGH-IN

.1 Install incoming service ducts and terminate as noted.
.2 Provide backboard as noted complete with ground connection to main service ground.
.3 Conduits terminated into ceiling spaces must be within 3m (10') of zone conduits (if applicable).
.4 Ensure specified zone conduits are installed back to service backboard.
.5 Outlets are to be installed complete with 25 mm (1") conduit to corridor ceiling space or nearest zone conduit (if applicable).
.6 Provide insulated bushings on all conduits terminated in ceiling space.
.7 A 25mm (1") conduit is to be installed from elevator machine room to voice service backboard.
.8 Refer to Telecommunication Network Installations Section for additional requirements.

3.8 MISCELLANEOUS CLOCKS

.1 Ensure clocks are installed where noted complete with batteries and all necessary mounting hardware.
.2 Set clocks to proper time of day and ensure all are operational at the time of final inspection.

3.9 DESTRATIFICATION FANS AND CONTROLS

.1 Ensure fans and controls are installed in conformance with manufacturer recommendations.
.2 Where noted install wireguards to be level. Fasten wireguards to structure NOT roof deck. Provide intermediate unistrut supports to suit.
.3 Demonstrate fan operation at the time of final inspection.
.4 Contractor is to remove manufacturer’s label prior to installation.

3.10 CLASSROOM CONTROL PANELS

.1 Electrical trade to supply and install units in accordance with manufacturers’ recommendations and reviewed shop drawings complete with all frames, cut outs, face panels, etc., to provide a complete installation.
.2 It is the electrical trade’s responsibility to coordinate complete installation of all mechanical, electrical and miscellaneous services in all control panels. Components within control panels will vary from room to room.

3.11 PUBLIC ADDRESS SYSTEM ROUGH-IN

.1 Conduits terminated into ceiling spaces must be within 1m (10') of cable management tray.
.2 Outlets are to be installed complete with 25 mm (1") conduit to corridor ceiling space or nearest cable management tray.

.3 Provide insulated bushings on all conduits terminated in ceiling space.
.4 Electrical contractor shall obtain speaker back boxes from School Board vender for installation into ceiling tiles, block walls, etc.

3.12 CABLE REELS

.1 Install as per manufacturer instructions securely to ceiling.
.2 Install duplex receptacle adjacent and connect to circuit noted.

3.13 DIGITAL TIME SWITCH

.1 Install electromechanical lighting controls as indicated and in accordance with manufacturer's instructions.
.2 Coordinate with owner's representative and install 'trippers' to suit.

3.14 PHOTOCONTROL SWITCH

.1 Turns photo-initiated controls on at dusk.
.2 Turns lights on at dusk and off at dawn.
.3 Install photoelectric controls as indicated and in accordance with manufacturer's instructions on suitable weatherproof junction box.

3.15 LINE VOLTAGE POWER PACKS AND LOW VOLTAGE OCCUPANCY SENSORS

.1 Install power packs in accessible maintenance areas.
.2 Provide access doors if power packs are installed above drywall ceilings.
.3 Install sensors in gym where noted on plan at mid height of wall.
.4 Sensors installed in areas of high abuse shall be complete with wire guards.
.5 It shall be the contractor's responsibility to locate and aim sensors in the correct location required for complete and proper coverage within the range of coverage as per the manufacturer's recommendations. The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective rooms.
.6 It is the contractor's responsibility to arrange a pre-installation meeting with the manufacturer's factory authorized representative, at the facility, to verify placement to sensors and installation criteria.
.7 The contractor shall also provide the on-site training necessary to familiarize the owner's personnel with the operation, use, adjustment and problem solving diagnosis of the occupancy sensing devices systems.

.8 Upon completion of the installation, the system shall be completely commissioned by the manufacturer's factory authorized technician who will verify all adjustments and sensor placement to ensure a trouble-free occupancy-based lighting control. Submit commissioning report with closeout documents.

.9 **All lighting controls shall be provided with functional testing and documentation conforming to Ashrae 90.1, latest adoption. This cost shall be included in the Tender Price.**

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Heaters must conform to CSA 22.2 No.46 (latest edition).

1.2 PRODUCT DATA

.1 Submit product data in accordance with the Electrical General Requirements Section.
.2 Product data to include:

- .1 Suspension of heating element.
- .2 Physical size.
- .3 Thermostat control if integral.
- .4 Finish.
- .5 kW rating, voltage, phase.
- .6 Cabinet thickness.
- .7 Cabinet surface temperature.
- .8 Mounting methods.
- .9 Auxiliary controls.
- .10 Replacement data for motor element, thermostat, and switch.

1.3 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for all heating system components for incorporation into manual as specified in the Electrical General Requirements Section.

Part 2 Products

2.1 BASEBOARD CONVECTORS

.1 Heaters shall be standard wattage density with connection box at one end. Element through-type fitted with aluminum convector vanes and resistor wire enclosed in mineral insulation in copper coated steel sheath.
.2 Element locked to cabinet and supported at additional points throughout length to allow for linear expansion with non-metallic supports.
.3 Cabinets shall be bottom inlet/outlet front panel 1.6 mm (3/32") thick, finished in baked enamel, (colour to suit architect). Integral air diffusion reflector with wireway at bottom.
.4 Blank cabinet sections where specified shall be complete with wireway in all sections including splice plates, to match heater cabinets in all respects for continuous baseboard effect as indicated.
.5 Controls shall be (as indicated) either wall mounted remote thermostats or integral 2 pole thermostats to control load of heater specified.

2.2 UNIT HEATERS

.1 Unit heater shall be horizontal discharge complete with adjustable louvers finished to match cabinet.
.2 Fan type unit heaters must be provided with built-in high-heat limit protection.
.3 Fan motor must be permanently lubricated ball bearing type with resilient mount. Built-in fan motor thermal overload protection.
.4 Hangers shall be as indicated on drawings.
.5 Elements shall be mineral insulated copper coated steel sheath with aluminum brazed fins.
.6 Cabinet shall be steel fitted with brackets for rod or wall mounting. Phosphatized and finished with baked enamel finish to suit architect.
.7 Controls shall be (as indicated) either wall mounted remote thermostats or integral 2 pole thermostats to control load of heater specified. Integral magnetic contactors (if specified) are to be provided to suit load.
.8 For the purposes of bidding, electrical trade shall include but not be limited to provision of a junction box to connect equipment wiring tail, provision of suitable disconnecting means, and flexible connection directly to equipment.

2.3 CABINET CONVECTOR HEATERS

.1 Wall mounted cabinet shall be front inlet/front outlet 1.6 mm (3/32") thick front steel panel. Phosphatized and finished with baked enamel. Finish colour to suit architect. Pre-drilled back for securing to wall.
.2 Elements shall be mineral insulated with copper sheath and pressed-on fins, secured and free-floating for expansion.
.3 Controls shall be (as indicated) either wall mounted remote thermostats or integral 2 pole thermostats to control load of heater specified.

2.4 FORCED AIR WALL HEATERS

.1 Forced air wall heaters, wall or ceiling mounted as noted complete with T-bar mounting frame. Heater shall be commercial type as follows:

.1 Enclosure:

.1 Steel: 18 gauge.
.2 Knockouts for 19 mm (3/4") diameter conduit left, right, bottom and rear.
.3 Grill and frame finished to suit architect.

.2 Elements and Fan:

.1 Mineral insulated.
.2 Motor: totally enclosed, shaded pole, impedance protected motor.

.2 Controls:

.1 Built-in tamperproof controls. 'On-Off-Fan Only' selector switch and temperature control knob.

2.5 THERMOSTATS

.1 Line voltage thermostats in finished areas as indicated shall be complete with the following features:

.1 Full load rating of maximum 18 A at 208 V
.2 Temperature range: 10ºC to 27ºC (50ºF to 80.6ºF)
.3 Temperature range shall be marked on face of thermostat in 5 degree increments.

2.6 APPROVED MANUFACTURERS

.1 Approved manufacturers shall be:

.1 Ouellet
.2 Stelpro
.3 Westcan

Part 3 Execution

3.1 INSTALLATION

.1 Install baseboard convector heaters, blank sections, and controls. When wireway is used, remove knock-outs and insert insulating bushing between each unit. Install grounding wire to maintain ground integrity between heating, blank, and auxiliary sections.
.2 Suspend unit heaters from ceiling or mount on wall as indicated. Provide local disconnecting means.
.3 Install cabinet convectors as indicated.
.4 Install force flow heaters as indicated.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Electrical General Requirements Section.
.2 Ensure that heaters and controls operate correctly.
.3 On fan powered units:

.1 Test cut-out protection when air movement is obstructed.
.2 Test fan delay switch to assure dissipation of heat after element shut down.
.3 Test unit cut-off when fan motor overload protection has operated.

END OF SECTION

Part 1 General

1.1 ROOF PENETRATIONS AND EQUIPMENT

.1 This Division shall supply and/or install miscellaneous sleeve flashings and supports for rooftop equipment and penetrations.

.2 Refer to Division 7 Specification Sections 07 51 00, 07 05 13, 07 50 16, 07 62 13, Roof Plans and Details for materials and procedures.

.3 Acceptable products are Altra Metal Industries Inc.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Dry type transformers must conform to CSA C22.2 No.47 and C9 (latest edition).
.2 **Dry type transformers must conform to CSA C802 (latest edition).**
.3 Dry type transformers must be in accordance with Ontario Green Energy Act 2018 (NRCan 2018) DOE 2016.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Electrical General Requirements Section.

Part 2 Products

2.1 TRANSFORMERS

.1 Transformers to be of one manufacturer throughout project.
.2 Ratings and characteristics shall be as indicated on riser diagrams.
.3 Aluminum winding.
.4 Transformers are to be ventilated dry type style with 4-2½% taps (2 F.C.B.N. and 2 F.C.A.N.)
.5 Maximum permissible sound levels shall be as follows:

Transformer Rating (KVA)	Sound Level (dBA)
≤50	45
51 to 150	50
151 to 300	55
301 to 500	60

.6 All transformers with a K factor of 4 or above must be electro-static shielded.
.7 Transformers with a K-factor of 4 or above must include a secondary neutral bus that is sized at twice the rated secondary phase current.
.8 Transformer enclosure shall be EEMAC/NEMA 3R ventilated complete with removable front panel.

.9 Provide vibration isolators equal to Korfund R series, Mason ND-B, or approved equal. "Colour" of vibration isolators shall be based on weight of transformers.

Transformer Weight (lbs)	Approximate Rating	Colour (Korfund)
540	15 – 75 kVA	Blue (RD2)
680	112.5 kVA	Black (RD2)
960	150 kVA	Red (RD2)
1,520	300 kVA	Green (RD2)
2,200	500 kVA	Gray (RD3)

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Electrical General Requirements Section.

.2 Label must indicate:

.1 transformer "tag" as per riser diagram

.2 primary and secondary voltage and phase.

2.3 ACCEPTABLE MANUFACTURERS:

.1 Acceptable manufacturers are as follows:

.1 Hammond
.2 Rex
.3 Delta
.4 Acme
.5 Bemag

Part 3 Execution

3.1 INSTALLATION

.1 Primary and secondary feeders are to be connected using flexible conduit.

.2 Transformers with a rating up to and including 75 KVA are permitted to be wall mounted provided mounting method is a suitably sized angle iron frame secured to structure (i.e. masonry wall, steel columns, etc. NOT metal siding).

.3 The above rating of transformers may also be suspended from **structure only** on a unistrut trapeze as detailed.

.4 Transformers above 75 KVA must be floor mounted.

.5 Floor mounted transformers are to be mounted/secured to a concrete pad suitably sized to suit the transformer. This pad is the responsibility of this contractor and must be provided in conformance with the standard of Division 1 specifications for poured in place concrete.

.6 All transformers must be mounted on vibration isolators selected based on transformer weight.

.7 Ensure adequate clearance around transformer for ventilation as per the Electrical Safety Code.

.8 Loosen isolation pad bolts until no compression is visible.

.9 Install transformers in level upright position.

.10 Remove shipping supports only after transformer is installed and just before putting into service.

.11 Make primary and secondary connections in accordance with wiring diagram.

.12 Energize transformers after installation is complete.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Electrical General Requirements Section.

.2 Indicate on shop drawings.

- .1 Floor anchoring method and foundation template.
- .2 Dimensioned cable entry and exit locations.
- .3 Dimensioned positions and size of bus.
- .4 Overall length, height and depth.
- .5 Dimensioned layout of internal and front panel mounted components.

1.2 MAINTENANCE DATA

.1 Provide maintenance data for service entrance board for incorporation into manual specified in the Electrical General Requirements Section.

.2 Submit 5 copies of maintenance data for complete assembly including components.

1.3 MAINTENANCE MATERIALS

.1 Include:

- .1 One can of touch-up paint.

1.4 SOURCE QUALITY CONTROL

.1 Consultant to witness final factory tests if requested.

.2 Notify Consultant in writing 5 days in advance that service entrance board is ready for testing.

.3 Submit 5 copies of certified test results.

Part 2 Products

2.1 SERVICE ENTRANCE BOARD

.1 Service entrance board must conform to CSA C222 No. 31 (latest edition).

.2 Rating: 600V, 3 phase, 4 wire, 1600A, short circuit current (kA rms symmetrical as noted on distribution riser).

.3 Cubicles: wall-mounted/free standing, dead front, size as indicated, hinged access panels with captive knurled thumbscrews (front access only), EEMAC2 rating (sprinkler hood).

.4 Main section to contain:
Breakers as noted complete with kA interrupting capacity to match mains.
Barriered section for supply authority metering components.
Digital metering unit as specified.
NOTE: Refer to Moulded Case Circuit Breakers section for specifications regarding the required breakers.

.5 Distribution section to contain breakers as noted complete with kA interrupting capacity to match mains.
NOTE: Refer to Moulded Case Circuit Breakers section for specifications regarding the required breakers.

.6 Bus bars and main connections: aluminum.

.7 Bus bars from load terminals of main device through metering section to distribution section.

.8 Bus bars are to have identified colour coded phases.

2.2 GROUNDING

.1 Aluminum ground bus extending full width of cubicles and located at bottom.

.2 Lugs at each end for grounding cable. Contractor to size lug.

2.3 POWER SUPPLY AUTHORITY METERING

.1 Separate compartment and rigid metal raceway for exclusive use of power supply authority metering.

.2 Mounting accessories and wiring for metering supplied by power supply authority:

.1 3 current transformers.

2.4 FINISHES

.1 Apply finishes in accordance with the Electrical General Requirements Section.

.1 Service entrance board exterior: grey.

2.5 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Electrical General Requirements Section.

.2 Nameplates:

.1 Black plate, white letters, and size 7.
.2 Complete board labeled: 347/600V.
.3 Main disconnect labeled: Main Breaker
.4 Branch disconnects labeled: as indicated.

2.6 ACCEPTABLE PRODUCTS

.1 Quick Ship

.1 Eaton Cat# CMP Series
.2 Siemens Cat# SMP
.3 Schneider Electric Cat# MDS

.2 Maximum 2000A

.1 Eaton Cat# POW-R-LINE-C
.2 Siemens Cat# SB
.3 Schneider Electric
Cat# MDS (1200A)
Cat# QED (6000A)

.3 Digital Metering Units

.1 Eaton Cat# IQ 260 (MOD BUS) or Power Xpert 2000 Series (BACnet)
.2 Siemens Cat# PAC 4200
.3 Schneider Electric Cat# PM-5563RD.

.4 Digital metering units shall be complete with MOD BUS (BACnet) communication module for interface of monitored parameters to BAS. Coordinate output with BAS contractor.

.5 Manufacturer is to include for representative to visit the site to fully commission the meter.

Part 3 Execution

3.1 INSTALLATION

.1 Locate service entrance board and fasten to wall/housekeeping pad.
.2 Connect main secondary service to line terminals of main device.
.3 Connect load terminals of distribution devices to feeders.
.4 Check factory made connections for mechanical security and electrical continuity.
.5 Run grounding conductors from ground bus to building ground to suit the Electrical Safety Code.
.6 Check trip unit settings against co-ordination study to ensure proper working and protection of components.
.7 Coordinate with local supply authority and board manufacturer for shipment and installation of metering components at board manufacture's fabrication plant.

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

.1 Submit product data in accordance with Electrical General Requirements Section.

.2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

Part 2 Products

2.1 PANELBOARDS

.1 Panel boards must conform to CSA C22.2 No. 29 (latest edition).

.2 Panelboards: product of one manufacturer.

.3 Install circuit breakers in panelboards before shipment.

.4 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand. **Series rating is acceptable – submit information with shop drawings. Provide lamicoid label on feeder breaker. Lamicoid label to state "Series Rating Breaker." Lamicoid label to be size 2.**

.5 Bus and breakers must be rated for interrupting capacity as indicated.

.6 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

.7 Panelboard mains, number of circuits, and number and size of branch circuit breakers as indicated.

.8 Two keys for each panelboard and key panelboards alike.

.9 Aluminum bus with neutral of same ampere rating as mains.

.10 Mains must be suitable for bolt-on breakers. Provide main (if applicable) and branch breakers as bolt-on style.

.11 Trim with concealed front bolts and hinges.

.12 Trim and door finish must be baked grey enamel.

.13 All panels regardless of voltage and amperage must be provided with a lockable door.

.14 Branch circuit panelboards (250 AMP or smaller) must be one of the following:

- .1 Eaton Cat # POW-R-LINE-C PRL-1 or PRL-2
- .2 Schneider Electric Cat # NQ Series for up to 240V or NF Series for up to 600V
- .3 Siemens Cat #Sentron P1 Series

.15 Branch circuit panelboards indicated to be complete with an external surge protective device shall include a suitably sized branch circuit breaker for the surge protective device as noted on panel schedule, and per surge protective device manufacturer recommendations. Surge protective device shall be provided as specified in section 26 43 13, unless noted otherwise.

.16 Power distribution circuit breaker panelboards (400 AMP or larger) must be one of the following:

- .1 Eaton CAT# POW-R-Line-C PRL-3A or PRL-4A
- .2 Schneider Electric CAT# I-Line Series (Bolt-On)
- .3 Siemens CAT# P2 Series (up to 600A mains and maximum 100A-3P branch breakers)
- .4 Siemens CAT# S5 Series (up to 1200A mains with branch breakers above 100A-3P)

2.2 BREAKERS

.1 Breakers: to Moulded Case Circuit Breakers Section.

.2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.3 Main breaker (as specified) must be separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

.4 Lock-on devices for fire alarm, stairway, exit and night light circuits.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Electrical General Requirements Section.

.2 Nameplate for each panelboard size 4 engraved description as indicated. In finished areas install label on inside of panel, and in service areas install label on exterior of panel.

.3 Nameplate for each circuit in distribution panelboards size 2 engraved “name of load” as indicated.

.4 Complete circuit directory with typewritten legend showing location of each circuit. **Include a copy of the directories in the maintenance manuals.**

Part 3 Execution

3.1 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Install surface mounted panelboards on plywood backboards. Where practical, group panelboards on common backboard. Plywood shall be 21mm (3/4”) fire rated or painted with intumescent fire block paint having a minimum of 1h rating, unless noted otherwise.

.3 Mount panelboards to height specified in Electrical General Requirements Section or as indicated.

.4 Connect loads to circuits.

.5 Connect neutral conductors to common neutral bus.

.6 Mount external surge protective devices as close as possible to panelboard and associated branch breaker to minimize lead lengths and per manufacturers recommendations. Provide modified panel trim for flush mount applications as required to suit.

.7 Install series rating lamicoids adjacent to all breakers utilized to achieve series ratings.

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

.1 Submit product data in accordance with Electrical General Requirements Section.

Part 2 Products

2.1 BREAKERS GENERAL

.1 Moulded case circuit breakers must conform to CSA C22.1 No.5.1-M91 (latest edition.)
.2 Bolt-on moulded case circuit breaker quick-make, quick-break type, for manual and automatic operation.
.3 Common-trip breakers: with single handle for multi-pole applications.
.4 Unless otherwise indicated moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.
.5 Moulded case circuit breakers 250 Amps and above are to operate by means of a solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, and long time, short time, instantaneous tripping for phase and ground fault short circuit protection (if indicated or applicable by the Electrical Safety Code versus the breaker amperage). Unless otherwise specified, complete system selective co-ordination shall be provided by the individually adjustable time/current curve shaping elements as following:

    .1 Breakers shall have fixed rating plug determining breaker continuous current rating.
    .2 All breakers shall have adjustable long delay pickup and time, L.
    .3 All breakers shall have individual adjustments for short delay pickup and time, S; including I2t settings in time adjustment.
    .4 Breakers shall have adjustable instantaneous pickup, I; that if required by co-ordination study can be turned off, (I).
    .5 If required by Electrical Safety Code breakers shall have individually adjustable ground fault current pick-up and time, G; including I2t settings in time adjustment.
    .6 Unless otherwise specified, for the low voltage systems provide an electronic trip unit as specified above for the following moulded case circuit breakers:

        .1 Mains or ties in main switchboard: LS trip unit with fixed instantaneous over-ride exceeding maximum value of fault at the point of installation.
        .2 Transformer feeder for the units 225kVA and above: LSI or LS trip unit with fixed instantaneous over-ride, where instantaneous trip setting or instantaneous over-ride allows for transformer inrush of 12xFLA at 0.1s and exceeds maximum value of fault at the transformer secondary.

.3 Feeders exceeding 250A trip setting: LS trip unit with fixed instantaneous over-ride exceeding maximum value of fault at downstream panelboard.

.4 Branch circuits or feeders for MCCs with fusible combination starters: LSI trip unit where instantaneous trip setting allows for maximum size downstream fuse total clearing time.

2.2 BREAKERS 1200A AND HIGHER

.1 Circuit breakers rated 1200A or higher must be equipped with Arc Flash Reduction Maintenance System (ARMS) in conformance with OESC 2024 2-306(3) to provide reduced arc fault clearing time.

.2 Unless otherwise indicated ARMS mode shall be enabled via integrated breaker mounted switch and indicating light.

.3 Arc Flash Reduction Maintenance System pickup settings shall be based on the project Arc Flash Hazard Reduction study.

Part 3 Execution

3.1 INSTALLATION

.1 Install circuit breakers as indicated complete with all necessary mounting hardware and filler panels if necessary.

.2 Provie lamicoid labels for series rating breakers. Lamicoid label to state “Series Rating Breaker.” Lamicoid to be size 2.

.3 Provie lamicoid labels for ARMS capable breakers. Lamicoid label to state “Arc Flash Reduction Maintenance System Breaker.” Lamicoid to be size 2.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Electrical General Requirements Section.

Part 2 Products

2.1 SWITCHES

.1 Line Voltage Wall Switches

- .1 AC switches must conform to CSA C22.2 No. 111 (latest edition).
- .2 AC switches with following features:
  - .1 Terminal holes approved for No. 10 AWG wire.
  - .2 Silver alloy contacts.
  - .3 Urea or melamine molding for parts subject to carbon tracking.
  - .4 Suitable for back and side wiring.
  - .5 Toggle style (Rocker style) (architect to select colour).
- .3 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.
- .4 AC Switches of one manufacturer throughout project.
- .5 Provide 2 keys per keyed switch.
- .6 Occupancy sensor switches shall be dual technology style (PIR and Ultrasonic) where noted on the drawings.
- .7 Acceptable Materials:
  - .1 Single Pole : Hubbell Cat #HBL1201
  - .2 Three Way: Hubbell Cat. #HBL1203
  - .3 Four Way: Hubbell Cat. #HBL1204
  - .4 Keyed: Hubbell Cat. #HBL1221 Series
    - .1 Keys: Hubbell Cat. #HBL1209
  - .5 Motor Rated: Hubbell Cat. #HBL1221PL
  - .6 Single Pole (Decora): Hubbell Cat #HBL2101
  - .7 Three Way (Decora): Hubbell Cat #HBL2103
  - .8 Four Way (Decora): Hubbell Cat. #HBL2124
  - .9 Single Relay Occupancy Sensor includes:
    - .1 Legrand Cat. #DW-100
    - .2 Greengate Cat. #ONW-D-1001
    - .3 Sensorswitch Cat. #WSXA Series

.10 Dual Relay Occupancy Sensor includes:

.1 Legrand Cat. #DW-200
.2 Greengate Cat. #ONW/VNW-D-1001-DMV-N
.3 Sensorswitch Cat. #WSXA Series

.8 Acceptable toggle switch alternate manufacturers include:

.1 Pass & Seymour
.2 Leviton.

.2 Line Voltage 0-10V Dimming Switches

.1 0-10V Dimmers are to be provided complete with the following features:

.1 Rating of 15A or 20A, 120V or 347V.
.2 0-10V dimming leads
.3 Capable of operation with four switch locations.
.4 DIP switches or local programming through switch buttons to change mode of operation.
.5 Integral on/off switch.
.6 Devices must mount in single gang box or multi-ganged where noted.
.7 Device and faceplate colour must match other wiring devices.
.8 Integral dual technology occupancy sensors (PIR and Ultrasonic).

.2 Acceptable Materials:

.1 0-10V Occupancy Wall Sensor Switch (Decora): Legrand Cat. #DW-311
.2 0-10V Dimming Switch: Leviton Cat. #ZS057 Series

.3 Acceptable alternative manufacturer's include:

.1 Legrand
.2 Leviton
.3 Lutron
.4 Sensor Switch
.5 Greengate

.3 Digital Interval Timer Switches

.1 Where noted supply and install a digital pre-set countdown time switch with the following features:

.1 minimum 1/6 HP rated contacts, mounted in recess single gang outlet box.
.2 Six (6) pre-set time selection buttons with options up to 1 hour.
.3 Unit shall be complete with activation indicator lights.
.4 Unit shall have integral On/Off button.
.5 White finish unless noted otherwise. (final finish selection by Architect).

.2 Acceptable Materials:

.1 Legrand Cat. #RT-50

.3 Acceptable alternative manufacturer's include:

.1 Leviton
.2 Lutron
.3 Hubbell

2.2 RECEPTACLES

.1 Receptacles, plugs, and other similar wiring devices must conform to CSA 22.2 No 42 (latest edition).

.2 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, with following features (20A where noted):

.1 Urea molded housing (Colour by architect).
.2 Suitable for No. 10 AWG for back and side wiring.
.3 Break-off links for use as split receptacles.
.4 Eight back wired entrances, four side wiring screws.
.5 Triple wipe contacts and rivetted grounding contacts.

.3 Other receptacles with ampacity and voltage as indicated.

.4 Receptacles of one manufacturer throughout project.

.5 Acceptable materials:

.1 Tamper resistant

.1 Tamper resistant ground fault protected receptacle: Hubbell Cat. #GFTR15
.2 Tamper resistant ground fault protected T-slot receptacle: Hubbell Cat. #GFTR20
.3 Tamper resistant duplex receptacle complete with dual USB ports: Hubbell Cat. #USB15XXX
.4 Automatically Controlled Tamper Resistant Receptacles (Green): Hubbell Cat. #BR15C2GNTR

.2 Hospital grade decora style duplex receptacle for patient care environments or as otherwise indicated on plans:
Hubbell Cat. #2172RW

.6 Acceptable alternate manufacturers include:

.1 Pass & Seymour
.2 Leviton

.7 Residential grade equivalents for materials noted above for use within residential dwelling units.

2.3 COVER PLATES

.1 Cover plates from one manufacturer throughout project.
.2 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.
.3 Stainless steel, brushed, 1 mm (1/32") thick cover plates for wiring devices mounted in flush-mounted outlet box.
.4 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.
.5 Weatherproof cover plates complete with gaskets and “heavy-duty in use” covers in conformance with the Electrical Safety Authority. Provide product equal to Intermatic Cat. #WP5100C.
.6 Where noted on plans for exterior weatherproof GFCI receptacles at grade, provide extra-duty single gang horizontal die cast receptacle covers. NEMA 3R rated complete with lockable hasp and reinforced hinge. Suitable for use with 12-gauge cord sets. Intermatic Cat. # WP1010HMXD or equal.
.7 Where noted on plans for exterior weatherproof cover plates at GFCI receptacles on residential balconies above grade, within 760mm of balcony railing, to avoid climbing hazard provide product equal to Intermatic Cat. #WP7000 (low-profile, in-use, extra-duty).
.8 Provide p-touch labels on cover plates for all receptacles. Labels shall include source panel and branch circuit, including switch leg indicator as applicable for automatically controlled receptacles.

Part 3 Execution

3.1 INSTALLATION

.1 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.
.2 Install switches in gang type outlet box when more than one switch is required in one location.
.3 Mount toggle switches at height specified in Electrical General Requirements Section or as indicated.

.2 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
.2 Mount receptacles at height specified in Electrical General Requirements Section or as indicated.
.3 Where split receptacle has one portion switched mount vertically and switch upper portion.

.3 Occupancy sensors:

.1 Occupancy sensors shall be set to 5 minutes “delay to off” unless otherwise noted.

.4 Occupancy sensors and dimmers:

.1 Switches with occupancy sensors and dimmers shall be programmed as follows:

.1 5 minutes “delay to off” unless otherwise noted.
.2 “Auto on” to 50% dimming level.

.5 Cover plates:

.1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
.2 Install suitable common cover plates where wiring devices are grouped.
.3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

.6 Dimmer:

.1 Dimming Switches

.1 Mount devices at height as specified in Electrical General Requirements Section.
.2 Install in upright position as per manufacturer’s installation instructions.
.3 Provide class II 0-10V control wiring from 0-10V dimming switch to each fixture driver in 21mmC.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA)

- .1 CSA C22.2 No.248.12/94, Low Voltage Fuses Part 12: Class R (Bi-National Standard with, UL 248-12 (1st Edition).
- .2 CSA C22.2 No. 106-M92 (latest edition).

1.2 MAINTENANCE MATERIAL

.1 Three spare fuses of each type and size installed.

1.3 DELIVERY AND STORAGE

.1 Ship fuses in original containers.
.2 Store fuses in original containers in moisture free location.

Part 2 Products

2.1 FUSES GENERAL

.1 Fuses: product of one manufacturer for entire project.
.2 Fuses specified below must conform to CSA C22.2 No. 106 (latest edition). Fuses conforming to standard C22.2 No. 106-1953 will be rejected.
.3 Fuses must provide a fully co-ordinated system for both overload and fault conditions.

2.2 FUSE TYPES

.1 Class L fuses (formerly HRC-L) for ratings 601-6000 A.

- .1 Time delay, capable of carrying 500% of its rated current for 10 s minimum.
- .2 Fast acting as noted.

.2 Class J fuses (formerly HRCI- J).

- .1 Time delay, capable of carrying 500% of its rated current for 10 s minimum.
- .2 Fast acting as noted.

.3 Class R fuses (formerly HRCI- R). For UL Class RK1 fuses, peak let-through current and I^2t values not to exceed limits of UL 198E-1982, table 10.2.

2.3 ACCEPTABLE PRODUCTS

.1 Service Entrance:
1-600 A: Mersen Type CJ
601-6000 A: Mersen Type CL

.2 Motor Protection:
1-600 A: Mersen Type AJT
601-2000 A: Mersen Type A4BT

.3 Other acceptable manufacturers:

.1 GEC

.2 Little Fuse

Part 3 Execution

3.1 INSTALLATION

.1 Install fuses in mounting devices immediately before energizing circuit.

.2 Ensure correct fuses fitted to physically matched mounting devices.

.1 Install Class R rejection clips for HRCI-R fuses.

.3 Ensure correct fuses fitted to assigned electrical circuit.

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

.1 Submit product data in accordance with Electrical General Requirements Section.

Part 2 Products

2.1 DISCONNECT SWITCHES

.1 Enclosed manual air break switches must conform to CSA C22.1 No.4 (latest edition).
.2 Fuseholder assemblies must conform to CSA C22.2 No.39 (latest edition).
.3 Fusible, and/or non-fusible, horsepower rated disconnect switches, size as indicated.
.4 Provision for padlocking in off switch position by three locks.
.5 Mechanically interlocked door to prevent opening when handle in ON position.
.6 Fuses: size as indicated, to Fuses - Low Voltage Section.
.7 Fuseholders: relocatable and suitable without adaptors, for type and size of fuse indicated.
.8 Quick-make, quick-break action.
.9 ON-OFF switch position indication on switch enclosure cover.
.10 Disconnects feeding elevator controllers must be equipped with two auxiliary contacts approved by the elevator supplier.
.11 Service entrance rated with fault bracing, fusing and barrier as required.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Electrical General Requirements Section.
.2 Indicate name of load controlled on size 4 nameplate.

2.3 ACCEPTABLE MANUFACTURERS

Manufacturer	General Purpose	Weather Proof
Eaton	IHD Series	3HD Series
Schneider Electric	Type A Series	Type R Series
Siemens	ID Series	NFR/FR Series

Part 3 Execution

3.1 INSTALLATION

.1 Install disconnect switches complete with fuses if applicable.

.2 Connect auxiliary contacts to elevator controller using conduit, wire and route approved by the elevator supplier.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with Electrical General Requirements Section.
.2 Indicate:

.1 Mounting method and dimensions.
.2 Starter/contactor size and type.
.3 Layout of identified internal and front panel components.
.4 Enclosure types.
.5 Wiring diagram for each type of starter.
.6 Interconnection diagrams.

1.2 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for incorporation into manual specified in Electrical General Requirements Section.
.2 Include operation and maintenance data for each type and style of starter/contactor.

1.3 MAINTENANCE MATERIALS

.1 Provide maintenance materials in accordance with Electrical General Requirements Section.
.2 Provide listed spare parts for each different size and type of starter:

.1 1 operating coil.
.2 3 fuses.
.3 10% indicating lamp bulbs used.

Part 2 Products

2.1 MATERIALS

.1 Starters: must conform to CSAC22.2 No. 14 (latest edition) and EEMAC E14-1.
.2 Control transformers must conform to CSAC22.2 No. 66 (latest edition).
.3 Auto-transformers must conform to CSAC22.2 No 47 (latest edition).
.4 Contactors must conform to CSA C22.2 No. 14 (latest edition).
.5 Half size starters will not be accepted. NEMA and IEC rated starters are acceptable.

2.2 MANUAL MOTOR STARTERS

.1 Single and Three phase manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:

.1 Switching mechanism, quick make and break.
.2 One or Three overload heaters, manual reset, trip indicating handle.
.3 Toggle switch: standard duty labeled “on”/“off”.
.4 Indicating light: standard duty type and red colour.
.5 Locking tab to permit padlocking in "ON" or "OFF" position.

2.3 FULL VOLTAGE MAGNETIC STARTERS

.1 Magnetic and combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:

.1 Contactor solenoid operated, rapid action type.
.2 Motor overload protective device in each phase, manually reset from outside enclosure.
.3 Wiring and schematic diagram inside starter enclosure in visible location.
.4 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.

.2 Combination type starters to include fused disconnect switch with operating lever on outside of enclosure to control disconnect, and provision for:

.1 Locking in "OFF" position with up to 3 padlocks.
.2 Independent locking of enclosure door.
.3 Provision for preventing switching to "ON" position while enclosure door open.

.3 Accessories:

.1 Pushbuttons Selector switches standard duty labeled as indicated.
.2 Indicating lights: standard duty type and color as indicated.
.3 1-N/O and 1-N/C spare auxiliary contacts unless otherwise indicated.
.4 1 red pilot light for “stop” or “off” and 1 green light for “start” or “on”.

2.4 CONTROL TRANSFORMER

.1 Single phase, dry type, control transformer with primary voltage as indicated and secondary voltage to suit remote control device, complete with secondary fuse, installed in with starter as indicated.
.2 Size control transformer for control circuit load plus 20% spare capacity.

2.5 CONTACTORS

.1 Electrically held and controlled by pilot devices as indicated and rated for type of load controlled.
.2 Complete with 2 normally open and 2 normally closed auxiliary contacts unless indicated otherwise.

.3 Mount in CSA Enclosure 1 unless otherwise indicated.
.4 Include following options in cover:

.1 Red indicating lamp.
.2 Hand - Off - Auto selector switch.

.5 Control transformer: mounted in contactor enclosure.
.6 Contactors must be definite purpose.

2.6 FINISHES

.1 Apply finishes to enclosure in accordance with Electrical General Requirements Section.

2.7 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Electrical General Requirements Section.
.2 Manual starter designation label: black plate, white letters, size 1, engraved as indicated.
.3 Magnetic starter designation label: black plate, white letters, size 2, engraved as indicated.
.4 Contactor designation label:
black plate, white letters, size 4, indicating name of load controlled.

2.8 ACCEPTABLE MANUFACTURERS

.1 The acceptable manufacturers are as follows:

.1 Allen Bradley
.2 Eaton
.3 Siemens
.4 Group Schneider
.5 Klockner Moeller

Part 3 Execution

3.1 INSTALLATION

.1 Install starters, connect power and control as indicated.
.2 Ensure correct fuses and overload devices elements installed.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Electrical General Requirements Section.
.2 Operate switches, contactors to verify correct functioning.
.3 Perform starting and stopping sequences of contactors and relays.
.4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.
.5 Install contactors and connect auxiliary control devices.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 The specifications in this section describe the electrical and mechanical requirements for a protection system provided by high-energy transient voltage surge suppressors. The specified system shall provide effective, high-energy surge current diversion and be suitable for application in ANSI/IEEE C62.4.1.1 Category A, B and C environments (as tested by ANSI/IEEE C62).

1.2 STANDARDS

.1 The specified system shall be designed, manufactured, tested and installed in compliance with the following codes and standards:

- .1 Institute of Electrical and Electronic Engineers (ANSI/IEEE C62.11, C62.41, C62.45)
- .2 American National Standards Institute
- .3 National Electrical Manufacturer Association (NEMA LS-1 1992 Peak Current Testing)
- .4 Electrical and Electronic Mfg. Association of Canada (EEMAC)
- .5 National Fire Protection Association (NFPA 75 and 780)
- .6 MIL Standard 220A Method of Insertion Loss Measurement
- .7 Ontario Electrical Code
- .8 Underwriters Laboratories UL 1283 and UL 1449 (latest edition)
- .9 Canadian Standards (CUL)

1.3 ENVIRONMENTAL REQUIREMENTS

.1 The operating temperature range shall be -40° to 70°C (-40° to 160°F).
.2 No appreciable magnetic fields shall be generated.

1.4 SUBMITTALS

.1 Product Data: Provide catalog sheets showing voltage, physical size, IEEE let through voltage for each waveform listed, UL1449 latest revision, latest edition, suppressed voltage ratings, dimensions showing construction, lifting and support points, enclosure details, per mode and per phase peak surge current, modes of discrete suppression circuitry, warranty period and replacement terms, conductor size, conductor type and lead length.
.2 Submit product data for all components and accessories per section 26 01 16 ‘Electrical General Requirements’.

.3 Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product. Indicate maximum size of circuit breaker or fuse to be connected for each unit.

.4 List and detail all protection systems such as fuses, disconnecting means and protective features.

.5 Provide verification that the SPD device complies with the required UL1449 latest edition, latest revision, and CSA approvals.

.6 Provide actual let through voltage test data in the form of oscillograph results for the ANSI/IEEE C62.41 Category C3 & C1 (combination wave) and A1 (ringwave) tested in accordance with ANSI/IEEE C62.45.

.7 Provide spectrum analysis of each unit based on MIL-STD-220A test procedures between 10 kHz and 100 kHz verifying the devices noise attenuation equals or exceeds 40 dB at 100 kHz.

.8 Provide test report from a recognized independent testing laboratory verifying the suppressor components can survive published surge current rating on a per mode basis using the IEEE C 62.41, 8x20 microsecond current wave. Test data must be on a complete SPD with internal fusing in place. Test data on an individual module is not acceptable.

1.5 QUALITY ASSURANCE AND WARRANTY

.1 The panel mounted SPD and supporting components shall be guaranteed by the manufacturer to be free of defects in material and workmanship for a period of thirty (30) years from the date of substantial completion of service and activation of the system to which the suppressor is attached. Additionally, during the applicable warranty period, any SPD which fails due to any electrical anomaly, including lightning, shall be repaired or replaced by the manufacturer without charge. Special or optional warranties in excess of the unit's standard warranty for purposes of this bid are not acceptable.

.2 The warranty must specifically provide for unlimited free replacements of the SPD in the event of failure caused by the effects of lightning and all other electrical anomalies. The warranty shall cover the entire device, not just various components, such as modules only. Special warranties for the purpose of this bid are not allowed.

.3 If the SPD units supplied do not meet the specifications as written, contractor will remove units and re-install approved SPD units to the satisfaction of the consultant. Contractor will be responsible for any and all costs associated with re-installation.

Part 2 Products

2.1 PERFORMANCE

.1 The SPD shall be listed by ETL, UL, or other nationally recognized test laboratory to UL's 1283 and UL's 1449 standards (latest edition), and not merely the components or modules. All SPDs shall be Type 1 for use in Type 1 and Type 2 locations.

.2 The SPD shall protect all modes L-G, L-N, L-L, and N-G, have discrete suppression circuitry in L-G, L-N and N-G, and have bidirectional, positive and negative impulse protection. Line-to-neutral-to-ground protection is not acceptable where line-to-ground is specified and accordingly reduced mode units with suppression circuitry built into only 4 modes are not acceptable. In delta systems, line-to-ground-to-line protection is not acceptable where line-to-line is specified.

.3 Obtain all surge suppression devices through one source from a single manufacturer.

.4 The maximum continuous operating voltage (MCOV) of all components shall not be less than 125% for a 120V system and 120% for 208 systems, and 115% for 347 and 600V systems.

.5 All SPDs shall be equipped with a comprehensive monitoring system which shall include a visual LCD panel display providing information on unit status and phase loss/protection loss.

.6 Each design configuration shall have the maximum single pulse surge current capacity per mode verified through testing at an independent, nationally recognized test laboratory. The manufacturer must submit a test report on a unit which was tested with internal over current fusing in place. The test shall include a UL1449 Second Edition surge defined as a 1.2 X 50 µsec 6000V open circuit voltage waveform and an 8 X 20 µsec 500A short circuit current waveform to benchmark the unit's suppression voltage, followed by a single pulse surge of maximum rated surge current magnitude with an approximated 8 X 20 µsec waveform. To complete the test, another UL1449 surge shall be applied to verify the unit's survival. Compliance is achieved if the suppression voltage found from the two UL1449 surges does not vary by more than +10%. Test data on an individual module is not acceptable.

.7 SPD manufacturer shall be Total Protection Solutions Canada, as provided by Innosys Power Inc. and represented by Medgar LCI (Contact Scott McGregor, Ph: 519-500-7120).

2.2 SERVICE ENTRANCE PROTECTION

.1 The SPD for this location shall be as indicated on project drawings. SPD shall be separate from panelboard. Integral SPD shall not be acceptable. SPDs shall be certified to UL1283 and UL 1449 (latest edition). Type 1 for use in Type 1 or Type 2 locations. All SPD units shall be RoHS compliant.
Medium to Low Exposure: Up to 1200 amps Service entrance panels shall be protected by a 240Ka Total Protection Solutions) panel mounted SPD, model TK-ST240-3Y600-L for 347/600 wye (4W+G) volt panels and model TK-ST240-3Y208-L for 120/208 wye (4W+G) volt panels.

.2 The manufacturer shall provide written specifications showing let-through voltage of the unit with six inches of lead length (at the module or at the lug data is not acceptable as it does not represent true "as installed" performance) pursuant to ANSI/IEEE C62.41 and C62.45, 2002, categories C1and C3 bi-wave, 90 degree phase angle, positive polarity, measurements in peak voltage from the zero reference, all dynamic tests except N-G, and UL suppressed voltage ratings, all of which shall be no higher than:

ANSI/IEEE C62.41-1991 Measured Limiting Voltage
B3/C1 Impulse (6kV, 3kA)

Voltage (Voltage Code)	L-N	L-G	L-L	N-G
120/208 (3Y208)	502V	627V	864V	568V
347/600 (3Y600)	1090V	1144V	2017V	1155V

C3 Impulse (20kV, 10kA)

Voltage (Voltage Code)	L-N	L-G	L-L	N-G
120/208 (3Y208)	907V	1173V	1267V	1090V
347/600 (3Y600)	1537V	1707V	2470V	1800V

UL Voltage Protection Ratings

Voltage (Voltage Code)	L-N	L-G	L-L	N-G
120/208 (3Y208)	800V	800V	1200V	800V
347/600 (3Y600)	1500V	1500V	2500V	1500V

.3 The unit shall have a peak surge current of no less than 200kA/mode, 8 X 20 us waveform, single impulse, independently verified.

.4 Internal Fusing - Over current Protection

.1 Each Metal Oxide Varistor, or other primary suppression component, shall be individually fused for safety and performance to allow the SPD to withstand the full rated single pulse peak surge capacity per mode without the operation or failure of the fuses. Over current fusing that limits the listed peak surge current of the SPD is not acceptable. Replaceable cartridge type per phase or per mode over current fusing is not acceptable where there is more than one MOV per mode.

.2 For arc quenching capability, minimization of smoke and contaminates in the event of a failure, and to ensure the safest possible design, all surge components, current carrying paths and fusing shall be packed in fuse grade silica sand.

.3 Fusing shall be present in every mode, including Neutral-to-Ground.

.4 The fusing shall be capable of interrupting up to a 200kA symmetrical fault current with 600VAC applied.

.5 The suppressor shall include Form C dry contacts (N.O. or N.C.) for remote monitoring capability, and shall have at minimum a EEMAC 2 steel enclosure.

.6 The SPD shall have an internal audible alarm with mute on front cover.

.7 SPDs for service entrance locations shall have a transient event counter with LCD panel display and reset button on the front cover.

.8 When SPD lead lengths exceed four (4) feet, low impedance cable (LIC) supplied by the SPD manufacturer shall be utilized. LIC shall have effective lead impedance min. 75% less than standard cable, and shall have nominal impedance, capacitance and inductance values that do not exceed the following:

Nominal Impedance (@10kHz, ohms/ft)	Nominal Capacitance (pf/ft)	Nominal Inductance (µH/ft)
Line	0.009	35.6	0.098
Neutral	0.004	52.6	0.041
Ground	0.004	571	0.021

SPDs shall be installed such that lead length is minimized.

2.3 DISTRIBUTION PANEL AND MOTOR CONTROL CENTER PROTECTION

.1 SPD(s) for this location shall be as indicated on project drawings. SPD shall be separate from panel board. Integral SPD shall not be acceptable. SPDs shall be certified to UL 1283 and UL1449 (latest edition). Type 1 for use in Type 1 and Type 2 locations.

.2 Distribution Panels and MCCs shall be protected by a Total Protection Solutions panel mounted SPD, model TK-ST160-600NN-FL for 600 (3W+G) volt panels, model TK-ST160-3Y600-FL for 347/600 (4W+G) volt panels and model TK-ST160-3Y208-FL for 120/208 (4W+G) volt panels.

.3 The manufacturer shall provide written specifications showing let-through voltage of the unit with six inches of lead length (at the module or at the lug data is not acceptable as it does not represent true "as installed" performance) pursuant to ANSI/IEEE C62.41 and C62.45, 2002, categories B3/C1 and C3 bi-wave, 90 degree phase angle, positive polarity, measurements in peak voltage from the zero reference, all dynamic tests except N-G, and UL suppressed voltage ratings, all of which shall be no higher than:

ANSI/IEEE C62.41-1991 Measured Limiting Voltage

B3/C1 Impulse (6kV, 3kA)

Voltage (Voltage Code)	L-N	L-G	L-L	N-G
120/208 (3Y208)	502V	627V	864V	568V
347/600 (3Y600)	1090V	1144V	2017V	1155V

C3 Impulse (20kV, 10kA)

Voltage (Voltage Code)	L-N	L-G	L-L	N-G
120/208 (3Y208)	907V	1173V	1267V	1090V
347/600 (3Y600)	1537V	1707V	2470V	1800V

UL Voltage Protection Ratings

Voltage (Voltage Code)	L-N	L-G	L-L	N-G
120/208 (3Y208)	800V	800V	1200V	800V
347/600 (3Y600)	1500V	1500V	2500V	1500V

.4 The unit shall have a peak surge current of no less than 160kA/phase, 80kA/mode, 8 X 20 us waveform, single impulse, verified by third party test reports.

.5 Internal Fusing - Over current Protection

.1 Each Metal Oxide Varistor, or other primary suppression component, shall be individually fused for safety and performance to allow the SPD to withstand the full rated single pulse peak surge capacity per mode without the operation or failure of the fuses. Over current fusing that limits the listed peak surge current of the SPD is not acceptable. Replaceable cartridge type per phase or per mode over current fusing is not acceptable where there is more than one MOV per mode.

.2 For arc quenching capability, minimization of smoke and contaminates in the event of a failure, and to ensure the safest possible design, all surge components, current carrying paths and fusing shall be packed in fuse grade silica sand.

.3 Fusing shall be present in every mode, including Neutral-to-Ground.

.4 The fusing shall be capable of interrupting up to a 200kA symmetrical fault current with 600VAC applied.

.6 The suppressor shall include Form C dry contacts (N.O. or N.C.) for remote monitoring capability, and shall have at minimum a Nema 4 steel enclosure.

.7 The SPD shall have an internal audible alarm with mute on front cover.

2.4 SUBPANEL AND LIGHTING PANEL PROTECTION

.1 SPD(s) for this location shall be as indicated on project drawings. SPD shall be separate from panel board. Integral SPD shall not be acceptable. SPDs shall be certified to UL1283 and UL1449 (latest edition). Type 1 for use in Type 1 and Type 2 locations.

.2 Subpanels and lighting panels shall be protected by a panel mounted SPD, TK-LP120-3Y208-L-F for 120/208 (4W+G) volt recessed panels and TK-TT2-065-3Y208-FL for surface mounted panels.

.3 The manufacturer shall provide written specifications showing let-through voltage of the unit with six inches of lead length (at the module or at the lug data is not acceptable as it does not represent true "as installed" performance) pursuant to ANSI/IEEE C62.41 and C62.45, 2002, categories A1 & A3 ring wave, 180 degree phase angle, category B3 Ringwave, and UL suppressed voltage ratings, 90 degree phase angle, positive polarity, measurements in peak voltage from the zero reference, all dynamic tests except N-G, which shall be no higher than:

ANSI/IEEE C62.41-1991 Measured Limiting Voltage

A1 Ring Wave (2kV, 67A)	Tested at 180 degree phase angle			
Voltage (Voltage Code)	L-N	L-G	L-L	N-G
120/208 (3Y208)	29V	46V	39V	40V

A3 Ring Wave (6kV, 200A)	Tested at 180 degree phase angle			
Voltage (Voltage Code)	L-N	L-G	L-L	N-G
120/208 (3Y208)	56V	61V	88V	112V

B3 Ring Wave (6kV, 500A)	Tested at 90 degree phase angle			
Voltage (Voltage Code)	L-N	L-G	L-L	N-G
120/208 (3Y208)	437V	592V	612V	324V

UL Voltage Protection Ratings

Voltage (Voltage Code)	L-N	L-G	L-L	N-G
120/208 (3Y208)	700V	700V	1000V	700V

.4 The unit shall have a peak surge current of no less than 120kA/phase, 60kA/mode, 8 X 20 us waveform, single impulse, verified by third party test reports.

.5 Internal Fusing - Over current Protection

.1 Each Metal Oxide Varistor, or other primary suppression component, shall be individually fused for safety and performance to allow the SPD to withstand the full rated single pulse peak surge capacity per mode without the operation or failure of the fuses. Over current fusing that limits the listed peak surge current of the SPD is not acceptable. Replaceable cartridge type per phase or per mode over current fusing is not acceptable where there is more than one MOV per mode.

.2 For arc quenching capability, minimization of smoke and contaminates in the event of a failure, and to ensure the safest possible design, all surge components, current carrying paths and fusing shall be packed in fuse grade silica sand.

.3 Fusing shall be present in every mode, including Neutral-to-Ground.

.4 The fusing shall be capable of interrupting up to a 200kA symmetrical fault current with 600VAC applied.

.6 The SPD shall be capable of attenuating internally generated ringing type transients and noise, and shall have an enhanced transient filter supported by a specification sheet which lists the IEEE A1 Ring Wave let-through levels no higher than those set forth above.

.7 Due to space limitations, the enclosure shall not exceed 4.0" D x 4.0" W x 10.3" H to allow close-to-the load installation on flush mount panels and between adjacent panel board. For recessed panels, a flush mount cover plate shall be provided with each unit along with a flush mount accessory kit Cat. #LP-FMP.

.8 The suppressor shall include Form C dry contacts (N.O. or N.C.) for remote monitoring capability, and shall have at minimum a Nema 1 steel enclosure.

.9 The SPD shall have an internal audible alarm with mute on front cover.

2.5 PHONE LINE PROTECTION

.1 The telephone line surge suppressors shall be Total Protection Solutions model TK-CT2-190TLP4-TB for 4 pair. Coordinate with owner IT representative for phone service characteristics. Provide a minimum of terminal block suppression units to handle a minimum of telephone lines.

.2 The unit shall be listed under UL 497A, Standard for Secondary Protectors for Communications Circuits.

.3 The unit shall have a data transmission rate up to 16.0 Mbps.

.4 Each conductor shall have less than 1 ohm of internal series resistance per wire.

.5 Each pair of conductors shall have a peak surge current of no less than 2,000 amps, 8 x 20 us waveform.

.6 The suppressor shall come standard with not less than a ten year warranty which provides for unlimited free replacements of damaged units. Special warranties in excess of the unit's standard warranty for purposes of this bid are not acceptable.

.7 The maximum let-through voltage on an IEC 10 x 700 us impulse (2kV/80A) shall be 240 volts tip-ring, 240 volts tip to ground, and 240 volts ring to ground.

.8 The response time of the components of the unit shall be less than one nanosecond.

.9 Obtain all surge suppression devices through one source from a single manufacturer.

.10 For quality assurance, manufacturer must provide proof that manufacturer has been regularly engaged in the design, manufacturing and testing of SPDs of the types and ratings required for a period of not less than five years.

Part 3 Execution

3.1 INSTALLATION

.1 Install the SPDs with the conductors as short and straight as practically possible.

.2 Follow the SPD manufacturer's recommended installation practice as outlined in the equipment installation manual. The electrical contractor shall ensure that all neutral conductors are bonded to the system ground at the service entrance or the serving isolation transformer prior to installation of the associated SPD.

.3 Main service entrance units shall be installed on a 60 amp breaker that meets or exceeds the fault current rating of the switchgear.

.4 Distribution, branch panel, and motor control center units shall be installed on 30 amp dedicated circuit breakers, or, where indicated, shall be wired directly to the main lugs or feed through lugs, or wired directly to the bus bars.

.5 The installing contractor shall comply with all applicable codes.

.6 SPD units shall be wired such that connection cable lead lengths are minimized. SPD manufacturer to advise installing contractor on required locations of low impedance cables (LICs).

.7 **SPD manufacturer shall include in tender for pre-installation visit to the job site to confirm recommended installation methods. Indicate provision for this visit on shop drawing submission.**

.8 **The entire SPD installation must be inspected by an authorized manufacturer's representative and supply certificate of completion. This cost shall be included in the tender price. Indicate provision for this inspection on shop drawing submission.**

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.1 ANSI/IEEE C62.41- 1991, Recommended Practices for Surge Voltages in Low-Voltage AC Power Circuits.

.2 American Society for Testing and Materials (ASTM)

.1 ASTM F1137- 88 (1993), Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.

.3 United States of America, Federal Communications Commission (FCC)

.1 FCC (CFR47) EM and RF Interference Suppression.

.4 IESNA LM-79-08, IES Electrical Method for the Electrical and Photometric Measurements of Solid State Lighting Products.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with Electrical General Requirements Section for all light fixtures supplied under this contract.

.2 Submit complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by Consultant.

.3 Photometric data to include: VCP Table spacing criterion.

1.3 SCOPE

.1 This contractor is responsible to supply and install all lighting fixtures as scheduled and/or indicated including lamp and those accessories required for a complete lighting system. This contractor must coordinate lighting installations with all other Divisions of this project.

.2 All fixtures must be CSA approved or approved at this contractor's expense by the Special Inspection Division of the Electrical Safety Authority.

1.4 GUARANTEE

.1 Guarantees for materials replacement shall be as follows from date of ready for takeover.

.1 LED lamps: 3 months

.2 LED fixtures, and driver: 5 years.

.2 The labour required to replace these ballasts, lamps or drivers must be included in the above guarantee, however only for the extent of the contract guarantee and warranty period as noted in Electrical General Requirements.

Part 2 Products

2.1 FIXTURE CONSTRUCTION

.1 Fixtures must be constructed of 20 gauge (minimum) cold rolled steel. All metal edges require smooth finish.
.2 Light leaks must be prevented by providing gasketting, stops, and barriers.
.3 Fixtures must be finished in high reflective baked white enamel. This surface must have a reflectance of not less than 85%.
.4 All fixtures operating on 347 Volts must be provided with an integral disconnecting means.

2.2 FIXTURE LENS

.1 Unless otherwise noted fixture lenses shall be as follows:

.1 Lens thickness: 3.2 mm (1/8")
.2 Material: injection moulded clear prismatic virgin acrylic
.3 Frame: hinged, latched, steel.

2.3 LED FIXTURES

.1 Fixture LEDs must be tested in conformance with IESNA LM80 standard.
.2 LEDs must be selected using a binning algorithm to ensure colour and lumen output of a given fixture are consistent, as well as meet or surpass ANSI C78.377 specification for the rated lifetime of the fixture. Colour accuracy between products must be within a 2-step MacAdam ellipse.
.3 Luminaires must be tested to IESNA LM79 by an independent approved laboratory.
.4 Luminaires must be tested prior to shipping.
.5 Luminaires must be ULC certified and approved for use in Canada.
.6 Fixtures must maintain a minimum of 90% of their initial light output for 60,000 hours. Submit test results upon request.
.7 Lumen values indicated for fixtures in the project documents are to be considered as “absolute” or “delivered” values.
.8 Other than for specialty fixtures, and unless otherwise indicated, the maximum driver current is to be 750 mA.

2.4 STANDARD EXIT LIGHTING UNITS

.1 Exit lighting units must conform to CSA C860, CSA 22.2 No. 141 (latest edition).
.2 Housing: extruded aluminum housing, white finish.
.3 Face and back plates: extruded aluminum.
.4 Lamps: 2W LED.
.5 Operation: 25 year.

.6 Units are to be provided with three (3) pictogram legends indicating “left from here”, “straight from here”, and “right from here”.
.7 Face plate to remain captive for relamping.

2.5 SELF-POWERED COMBINATION EXIT/EMERGENCY LIGHTING UNITS

.1 Exit lighting units must conform to CSA C860, CSA 22.2 No. 141 (latest edition).
.2 Housing: Extruded aluminum housing. White Finish.
.3 Face and back plates: Extruded aluminum.
.4 Lamps 2W LED (EXIT).
.5 Operation: 25 year life.
.6 Units are to be provided with three (3) pictogram legends indicating “left from here”, “straight from here”, and “right from here”.
.7 Face plate to remain captive for relamping.
.8 Supply voltage: As noted on drawings.
.9 Output voltage: 12 V DC.
.10 Battery: Sealed maintenance free 10 year life.

Note: Battery must be capable of supplying the wattage indicated for a minimum of 30 minutes.

.11 Charger: Solid state, voltage/current regulated, inverse temperature compensated, short circuit protected, with regulated output of plus or minus 0.01 V for plus or minus 10% V input variation.
.12 Solid state transfer circuit.
.13 Signal lights: “AC Power On” condition and “charging” condition.
.14 Lamp heads: Integral on unit, 345º horizontal and 180º vertical adjustment. Lamp type: minimum 4 watt LED.
.15 Mounting: Suitable for universal mounting directly on junction box and complete with knockouts for conduit. Removable or hinged front panel for easy access to batteries.
.16 Cabinet: finish: White.
.17 Auxiliary equipment:

.1 Test switch.

2.6 EMERGENCY LIGHTING UNITS

.1 Emergency lighting units must conform to CSA C22.2 No 141 (latest edition).
.2 Supply voltage: As noted on drawings.
.3 Output voltage: 12 V DC.

.4 Battery: Sealed, maintenance free, 10 year life.
Note: Battery units must be capable of supplying the wattage indicated for a minimum of 30 minutes.

.5 Charger: Solid state, multi rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01 V for plus or minus 10% input variations.

.6 Solid state transfer circuit.

.7 Low voltage disconnect: Solid state, modular, operates at 80% battery output voltage.

.8 Signal lights: "AC Power ON" condition and "charging" condition.

.9 Lamp heads: Integral on unit, 345º horizontal and 180º vertical adjustment. Lamp type: minimum 4 watt LED.

.10 Cabinet suitable for direct of shelf mounting to wall and complete with knockouts for conduit. Removable or hinged front panel for easy access to batteries.

.11 Auxiliary equipment:

.1 Test switch.
.2 Ac input and DC output terminal blocks inside cabinet.
.3 Shelf.
.4 Cord and plug connection for AC. **(Not applicable on 347 V units)**.

2.7 REMOTE EMERGENCY LIGHTING FIXTURES

.1 Remote emergency lighting fixtures must conform to CSA C22.2 No141 (latest edition).

.2 Fixtures shall be small "micro" size or recessed style as indicated in the Light Fixture Schedule.

.3 Fixtures must be adjustable type heads with canopy.

.4 Fixtures are to be provided with protective lexan cube when specified in the Light Fixture Schedule.

.5 Unless otherwise indicated surface mounted fixtures in washrooms, locker rooms, changerooms, and gymnasiums must be provided with wire guard.

2.8 ACCEPTABLE LIGHTING MANUFACTURERS

.1 Refer to the light fixture schedule as indicated on drawings.

2.9 ACCEPTABLE FIXTURE ENERGY LISTINGS (WRITER TO EDIT)

.1 Fixtures as noted on lighting fixture schedules are to be DLC or Energy Star listed as noted. Equal manufacturers shall supply proof of DLC/Energy Star listing as part of fixture approval and shop drawing process.

Part 3 Execution

3.1 INSTALLATION

.1 Locate and install luminaires as indicated. Luminaires are not to be supported from the roof deck. Provide additional unistrut support channel and/or support from structure. Co-ordinate with consultant on site.

.2 Ball align hangers must be provided for rod suspended fixtures.

.3 Fixtures surface mounted to suspended ceilings must be secured through ceiling assembly to cross member supports. These supports are to be steel channels or angles independently secured **to structure** using # 12 “jack” chain. Each chain must be secured so no fixture weight is added to the ceiling assembly.

.4 Plaster frames/flange kits must be provided by this Division for fixtures recessed in plaster and/or drywall ceilings.

.5 Where specified, fixtures to be chain hung shall be hung using “jack” chain with a capacity to suit the fixture weight. Branch circuit wiring feeding these fixtures shall be AC90 cable “ty-wrapped” at 900 mm (36") intervals along length of drop. Final appearance must be neat and professional.

.6 Install exit lighting units with illuminated faces and chevrons/arrows indicating path(s) of exit as indicated. Unless otherwise noted install exit fixtures at 2400 mm (8'-0") above finished floor.

.7 Install emergency lighting units and associated remote mounted fixtures as indicated.

.8 Direct “heads” on units and remote mounted fixtures to illuminate path(s) of exit.

.9 Install emergency lighting units and remote fixtures at 300 mm (12") below finished ceiling, unless indicated otherwise.

.10 Provide a 15 A 120 V duplex receptacle (connected to circuit indicated) adjacent to unit. **Not applicable on 347 V units. This receptacle connection is to be no lower than 8'-0" (2400 mm) AFF.**

.11 Special installation: Secure fixtures to structure to conform to the Electrical Safety Code using “jack chain” NOT ceiling suspension wire. Where coreslab is used, suspension point must be independent of the one used for suspension of the ceiling assembly. As an alternate to jack chain the contractor may use a pre-manufactured aircraft cable suspension and fastening system as manufactured by Gripple (Gripple Cat. #HF02-10F2). Provide minimum 2 per fixture.

.12 All battery units are to be provided with a visible lamicoid label indicating the unit number as per drawings.

3.2 WIRING

.1 Connect luminaires to lighting circuits as indicated.

.2 Connect exit fixtures to exit lighting circuits and unit equipment (if applicable).

.3 Connect unit equipment to circuits as indicated.

.4 All wiring of remote emergency fixtures shall be minimum #10 T90 for each circuit and run in conduit. Wiring must be sized in conformance with manufacturer's recommendations for distances required.

3.3 LUMINAIRE ALIGNMENT

.1 Align luminaires mounted in continuous rows to form straight uninterrupted line.

.2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

3.4 DELIVERIES

.1 Fixtures are to be completely assembled at the manufacturer's plant and delivered to the project site in original unitized containers. Ensure that a dry, protected and secure space is available for proper storage before scheduling delivery of fixtures.

3.5 TESTING/CERTIFICATION

.1 At the completion of the project and in the presence of the consultant, test all exit and emergency fixtures. On company letterhead, the contractor is to prepare a chart indicating:

.1 Project
.2 Date
.3 Equipment type
.4 Certification of correct connection
.5 Certification of correct operation
.6 Duration of test in minutes (minimum 30)
.7 Actual period of testing (time of day)

3.6 INTEGRATED LIFE SAFETY SYSTEM TESTING

.1 This electrical contractor shall participate in integrated testing of this life safety system in conformance with Electrical General Requirements. Include all associated costs in tender.

3.7 ADDITIONAL INSTALLED EXIT SIGNS

.1 The electrical contractor is to include in their bid the cost to add three (3) additional standard exit lighting units to be installed and tested in locations as directed by the consultant. Note: This installation and test will be occurring after the initial testing/certification testing is complete.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE).
.2 Underwriter Laboratories of Canada (ULC).
.3 International Electrotechnical Commission.
.4 International Organization for Standardization (ISO).
.5 National Electrical Manufacturers Association (NEMA).

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with Section 26 01 16.
.2 Submit composite wiring diagrams and control schedule for each room control circuit type as proposed to be installed. Include load type, sequence of operation, sensor parameters, time delays, sensitivities and daylighting set points.
.3 Catalog cut sheets with performance specifications demonstrating compliance with specified requirements.

1.3 SCOPE

.1 This contractor is responsible to supply and install all equipment and control wiring as specified for the digital occupancy and daylight control systems. This contractor must coordinate these control systems with the lighting fixtures being supplied for the project to ensure intended function as specified.
.2 Control Intent: Control Intent includes, but is not limited to:

.1 Defaults and initial calibration settings for such items as time delay, sensitivity, fade rates, etc.
.2 Initial sensor and switching zones.

.3 All equipment must be CSA approved or approved at this contractor's expense by the Special Inspection Division of the Electrical Safety Authority.
.4 Reference section 26 51 13 for Lighting information.
.5 Reference section 26 05 75 for line voltage occupancy sensors and switches (hard wired analog).

1.4 SYSTEM DESCRIPTION AND OPERATION

.1 The Digital Lighting Control (room level) as defined under this section covers the following equipment:

.1 Digital Room Controllers – Self-configuring, digitally addressable one, two or three relay controllers.

.2 Digital Occupancy Sensors – Self-configuring, digitally addressable and calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.

.3 Digital Switches – Self-configuring, digitally addressable pushbutton switches, dimmers, and scene switches with two-way active infrared (IR) communications.

.4 Digital Photosensors – Single-zone closed loop sensors with two-way active infrared (IR) communications can provide switching or dimming control for daylight harvesting.

.5 Configuration Tools – Handheld remote for room configuration provides two-way infrared (IR) communications to digital devices and allows complete configuration and reconfiguration of the device / room from an accessible location.

1.5 LIGHTING CONTROL APPLICATIONS

.1 Provide a minimum application of intended lighting control functions as detailed on design drawings and specified herein. Control functions shall include the following:

.1 Space Control Requirements – Provide occupancy/vacancy sensors with Manual-ON functionality in all spaces except toilet rooms, storerooms, or other applications where hands-free operation is desirable and Automatic-ON occupancy sensors are more appropriate. For spaces with multiple occupants, or where line-of-sight may be obscured, provide ceiling- or corner-mounted sensors.

.2 Bi-Level Lighting – Provide single zone, multi-level controls in any enclosed office, conference room, meeting room, and training room in all enclosed spaces except where variable dimming or multi-zone switching is used.

.3 Daylit Areas – All luminaries closest to the daylight source, and zoned separately from other fixtures in the space, shall be controlled separately from luminaires outside of daylit zones. Multiple-leveled switched daylight harvesting controls may be utilized for areas marked on drawings.

1.6 WARRANTY

.1 Provide a five-year complete manufacturer's warranty on all products to be free of manufacturers' defects.

.2 The labour required to replace these products must be included in the above warranty, however only for the extent of the contract guarantee and warranty period as noted in Electrical General Requirements.

1.7 QUALITY ASSURANCE

.1 Manufacturer: Minimum 10-years experience in manufacture of lighting controls.

Part 2 Products

2.1 MANUFACTURERS

.1 Basis of design product: WattStopper Digital Lighting Management (DLM). Acceptable alternates are subject to compliance and prior approval with specified requirements of this section, as one of the following:

.1 Cooper Controls (Wavelinx).
.2 Acuity Controls (nlight).

.2 Substitutions:

.1 All proposed substitutions (clearly delineated as such) must be submitted in writing for approval by the design professional a minimum of 7 working days prior to the bid date and must be made available to all bidders.
.2 By using pre-approved substitutions, the contractor accepts responsibility and associated costs for all required modifications to circuitry, devices, and wiring.

2.2 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR SYSTEM

.1 Wall or ceiling mounted (to suit installation) passive infrared (PIR), ultrasonic or dual technology digital (passive infrared and ultrasonic) occupancy sensor. Furnish the Company's system which accommodates the square-foot coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors and accessories which suit the lighting and electrical system parameters.

.2 Digital Occupancy Sensors shall provide calibration and electronic documentation for the following features:

.1 Digital calibration and pushbutton programming for the following variables:

.1 Sensitivity – 0-100% in 10% increments
.2 Time delay – 1-30 minutes in 1 minute increments
.3 Test mode – Five second time delay
.4 Detection technology – PIR, Ultrasonic or Dual Technology activation and/or re-activation.
.5 Walk-through mode
.6 Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.

.2 Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.

.3 Device Status LEDs including:

.1 PIR Detection
.2 Ultrasonic detection
.3 Configuration mode
.4 Load binding

.4 Manual override of controlled loads.

.5 One or two RJ-45 port(s) for connection to DLM local network.

.3 Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required. WattStopper product numbers: LMPX, LMDX, LMPC, LMUC, LMDC

2.3 DIGITAL WALL SWITCHES

.1 Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5, and 8 button configuration; colour per architect, compatible with wall plates with decorator opening. Wall switches shall include the following features:

.1 Two-way infrared (IR) transceiver for use with personal and configuration remote controls.
.2 Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.

.2 Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required to achieve multi-way switching.
.3 The following switch attributes may be changed or selected using a wireless configuration tool:

.1 Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
.2 Individual button function may be configured to Toggle, On only or Off only.
.3 Individual scenes may be locked to prevent unauthorized change.
.4 Switch buttons may be bound to any load on a room controller and are not load type dependent; each button may be bound to multiple loads.

.4 Two RJ-45 ports for connection to DLM local network.
.5 Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required to achieve multi-way switching.
.6 WattStopper product numbers: LMSW-101, LMSW-102, LMSW-103, LMSW-104, LMSW-105, LMSW-108, LMDM-101.

2.4 DIGITAL POWER PACKS (ROOM CONTROLLERS)

.1 Room Controllers automatically bind the room loads to the connected devices in the space without commissioning or the use of any tools. Room Controllers shall be provided to match the room lighting load and control requirements. The controllers will be simple to install and will not have, dip switches, potentiometers or require special configuration. The control units will include the following features:

.1 Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.
.2 Simple replacement – Using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf unit without requiring any configuration or setup.

.3 Device Status LEDs to indicate:

.1 Data transmission
.2 Device has power
.3 Status for each load
.4 Configuration status

.4 Quick installation features including:

.1 Standard junction box mounting

.5 Plenum rated
.6 Manual override and LED indication for each load
.7 120 VAC, 60 Hz operation.
.8 Zero cross circuitry for each load.

.2 On/Off Room Controllers shall include:

.1 One or multiple relay configuration to suit control details
.2 Efficient 150 mA switching power supply
.3 Sufficient sensor connection points to suit indicated function without the requirement for additional hardware
.4 Discrete model listed for connection to receptacles, for schedule-based control of plug loads within the space.

.1 One relay configuration only.
.2 Automatic-ON/OFF configuration.
.3 Optional Network Bridge for BACnet MS/TP communications

.5 Three RJ-45 DLM local network ports.
.6 WattStopper product numbers: LMRC-101, LMRC-102, LMPL-101, LMPL-201.

.3 On/Off Room/Dimming enhanced Room Controllers shall include:

.1 One or multiple relay configuration to suit control details.
.2 Efficient 250 mA switching power supply.
.3 One 0-10 volt analog output per relay for control of compatible ballasts and LED drivers.
.4 The following dimming attributes may be changed or selected using a wireless configuration tool:

.1 Establish preset level for each load from 0-100%.
.2 Set high and low trim for each load.
.3 Set lamp burn in time for each load up to 100 hours.

.5 Four RJ-45 DLM local network ports.
.6 Optional Network Bridge for BACnet MS/TP communications.
.7 WattStopper product numbers: LMRC-211, LRMC-212, LRMC-213, LMPL-201, LMRC-311, LMRC-312, LMRC-313.

2.5 DIGITAL PHOTO SENSORS

.1 Digital photosensors work with room controllers to provide automatic switching or dimming daylight harvesting capabilities for any load type connected to a room controller. Closed loop photosensors measure the ambient light in the space and control a single lighting zone.

.2 Digital photosensors include the following features:

.1 An internal photodiode that measures only within the visible spectrum and has a response curve that closely matches the photopic curve. The photodiode shall not measure energy in either the ultraviolet or infrared spectrums. The photocell shall have a sensitivity of less than 5% for any wavelengths less than 400 nanometers or greater than 700 nanometers.

.2 Sensor light level range shall be from 1-10,000 footcandles (fc).

.3 The capability of switching one-third, one-half or all lighting ON and OFF, or raising or lowering lighting levels, for each controlled zone, depending on the selection of room controller(s) and load binding to room controller(s).

.4 For switching daylight harvesting, the photosensor shall provide a deadband or a separation between the “ON Setpoint” and the “OFF Setpoint” that will prevent the lights from cycling after they turn off.

.5 For dimming daylight harvesting, the photosensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a user-selectable minimum level.

.6 Optional programmable wall switch override to allow occupants to reduce lighting level to increase energy savings or, if permitted by system administrator, raise and lower lighting levels for a selected period of time or cycle of occupancy.

.7 Infrared (IR) transceiver for configuration and/or commissioning with a handheld configuration tool, to transmit detected light level to wireless configuration tool, and for communication with personal remote controls.

.8 Configuration LED that blinks to indicate data transmission

.9 Status LED indicates test mode, override mode and load binding.

.10 Recessed switch to turn controlled load(s) ON and OFF.

.11 One RJ-45 port for connection to DLM local network.

.12 An adjustable head and a mounting bracket to accommodate multiple mounting methods and building materials. The photosensor may be mounted on a ceiling tile, skylight light well, suspended lighting fixture or backbox.

.3 Closed loop digital photosensors include the following additional features:

.1 An internal photodiode that measures light in a 100 degree angle, cutting off the unwanted light from bright sources outside of this cone.

.2 Automatic self-calibration, initiated from the photosensor, or a wireless configuration tool.

.3 Automatically establishes setpoints following self-calibration.

.4 A sliding setpoint control algorithm for dimming daylight harvesting with a "Day Setpoint" and the "Night Setpoint" to prevent the lights from cycling.

.5 WattStopper Product Number: LMLS-400.

2.6 DIGITAL ROOM CONTROL SYSTEMS

.1 Digital occupancy and daylight control system designed to control a small area of a building (room level). Digital devices connect to the room controller(s) using CAT 5e cables (LMRJ) with RJ-45 connectors which provide both data and power to room devices. Features of the system shall include:

.1 Plug n' Go automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.

.2 Simple replacement of any device in the system with a standard off the shelf unit without requiring commissioning, configuration or setup.

.3 Push n' Learn configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices which are part of the local system.

.4 Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.

2.7 CONFIGURATIONS TOOLS

.1 A configuration tool facilitates optional customization of digital lighting control system featuring infrared communications.

.2 Features and functionality of the wireless configuration tool shall include:

.1 Two-way infrared (IR) communication with DLM IR-enabled devices within a range of approximately 30 feet.

.2 Read, modify and send parameters for occupancy sensors, daylighting sensors, room controllers and buttons on digital wall switches.

.3 Save up to nine occupancy sensor setting profiles and apply profiles to selected sensors.

.3 WattStopper Product Numbers: LMCT-100, LMCI-100/LMCS-100

2.8 NETWORK BRIDGE

.1 Network bridge module connects a DLM local network to a BACnet-compliant segment network for communication between rooms, relay panels and a segment manager or BAS. Each local network shall include a network bridge component to provide a connection to the local network room devices. Network bridge shall use industry standard BACnet MS/TP network communication and an optically isolated EIA/TIA RS-485 transceiver.

.1 Network bridge shall be provided as a separate module connected on the local network through an available RJ-45 port.

.2 Provide Plug n' Go operation to automatically discover room devices connected to the local network and make all device parameters visible to the segment manager via the segment network. No commissioning shall be required for set up of the network bridge on the local network.

.3 Network bridge shall automatically create standard BACnet objects for selected DLM devices to allow any BACnet-compliant BAS to include lighting control and power monitoring features as provided by the DLM devices on each local network. BACnet objects will be created for the addition or replacement of any given DLM device for the installed life of the system. Products requiring that an application-specific point database be loaded to create or map BACnet objects are not acceptable. Systems not capable of providing BACnet data for control devices via a dedicated BACnet Device ID and physical MS/TP termination per room are not acceptable. Standard BACnet objects shall be provided as follows:

- .1 Read/write the normal or after hours schedule state for the room
- .2 Read the detection state of each occupancy sensor
- .3 Read the aggregate occupancy state of the room
- .4 Read/write the On/Off state of loads
- .5 Read/write the dimmed light level of loads
- .6 Read the button states of switches
- .7 Read total current in amps, and total power in watts through the load controller
- .8 Read/write occupancy sensor time delay, PIR sensitivity and ultrasonic sensitivity settings
- .9 Activate a preset scene for the room
- .10 Read/write daylight sensor fade time and day and night setpoints
- .11 Read the current light level, in foot-candles, from interior and exterior photosensors and photocells
- .12 Set daylight sensor operating mode
- .13 Read/write wall switch lock status
- .14 Read watts per square foot for the entire controlled room
- .15 Write maximum light level per load for demand response mode
- .16 Read/write activation of demand response mode for the room
- .17 Activate/restore demand response mode for the room
- .18 Wattstopper product numbers: LMBC-300

2.9 SEGMENT MANAGER

.1 For networked applications, the Digital Lighting Management system shall include at least one segment manager to manage network communication. It shall be capable of serving up a graphical user interface via a standard web browser utilizing either unencrypted TCP/IP traffic via a configurable port (default is 80) or 256 bit AES encrypted SSL TCP/IP traffic via a configurable port (default is 443).

.2 Each segment manager shall have integral support for at least three segment networks. Segment networks may alternately be connected to the segment manger via external BACnet-to-IP interface routers and switches, using standard Ethernet structured wiring. Each router shall accommodate one segment network. Provide the quantity of routers and switches as shown on the Drawings.

.3 Operational features of the Segment Manager shall include the following:

.1 Connection to PC or LAN via standard Ethernet TCP/IP via standard Ethernet TCP/IP with the option to use SSL encrypted connections for all traffic.

.2 Easy to learn and use graphical user interface, compatible with Internet Explorer 8, or equal browser. The Segment Manager shall not require installation of any lighting control software on an end-user PC.

.3 Log in security capable of restricting some users to view-only or other limited operations.

.4 Segment Manager shall provide two main sets of interface screens - those used to initially configure the unit (referred to as the config screens), and a those used to allow users to dynamic monitor the performance of their system and provide a centralized scheduling interface. Capabilities using the Config Screens shall include:

.1 Automatic discovery of DLM devices and relay panels on the segment network(s). Commissioning beyond activation of the discovery function shall not be required to provide communication, monitoring or control of all local networks and lighting control panels.

.2 Allow information for all discovered DLM devices to be imported into the Segment Manager via a single XML based site file from the Wattstopper LMCS Software, significantly reducing the time needed to make a system usable by the end user. Importable information can include text descriptions of every DLM component and individual loads, and automatic creation of room location information and overall structure of DLM network. Info entered into LMCS should not have to be re-entered manually via keystrokes into the Segment Manager

.3 After discovery, all rooms and panels shall be presented in a standard navigation tree format. Selecting a device from the tree will allow the device settings and operational parameters to be viewed and changed by the user.

.4 Ability to view and modify DLM device operational parameters. It shall be possible to set device parameters independently for normal hours and after hours operation including sensor time delays and sensitivities, and load response to sensor including Manual-On or Auto-On.

.5 Provide capabilities for integration with a BAS via BACnet protocol. At a minimum, the following points shall be available to the BAS via BACnet IP connection to the segment manager: room occupancy state; room schedule mode; room switch lock control; individual occupancy sensor state; room lighting power; room plug-load power; load ON/OFF state; load dimming level; panel channel schedule state; panel relay state; and Segment Manager Group schedule state control. Any of above items shall be capable of being moved into an "Export Table" that will provide any integrator with only the data they need, and by using the Export Table effectively create a firewall between the integrator's request for info and the overall system performance.

.5 Capabilities using the Segment Manager's Dashboard Screens shall include:

.1 A dynamic "tile" based interface that allows easy viewing of each individual room's lighting and plug load power consumption, and lighting and plug load power density (power consumption information requires Enhanced DLM Room and Plug Load Controllers with integral current transducers such as LMRC-21x).Tiles will be automatically organized according to location so a single tile for the building summarizes all information for tiles beneath it on every floor, in every area, in every room. Tiles use three color coded energy target parameters, allowing an owner to quickly identify rooms that are not performing efficiently. Tiles for rooms with occupancy sensors shall include an icon to indicate whether that room is occupied. Tiles shall be clickable, and when clicked the underlying hierarchical level of tiles shall become visible. Tile interface shall be accessible via mouse, or touch screen devices. Tiles shall be created automatically by the segment manager, based on the information found during the device discovery and/or information included in a file imported in from LMCS (such as tagged descriptions for each room) without any custom programming.

.2 Ability to set up schedules for DLM local networks (rooms) and panels. Schedules shall be capable of controlling individual rooms with either on/off or normal hours/after hours set controlled zones or areas to either a normal hours or after hours mode of operation. Support for annual schedules, holiday schedules and unique date-bound schedules, as well as astro On or astro Off events with offsets. Schedules shall be viable graphically as time bars in a screen set up to automatically show scheduled events by day, week or month.

.6 If shown on the Drawings, Segment Managers shall be integrated into a larger control network by the addition of a Network Supervisor package. The Supervisor is a server level computer running a version of the Segment Manager interface software with dedicated communication and networking capability, able to pull information automatically from each individual Segment Manager in the network. By using a Supervisor, information for individual Segment Managers can be accessed and stored on the Supervisor's hard drive, eliminating the risk of data being overwritten after a few days because of Segment Manager memory limits.

.7 Segment Manager shall allow access and control of the overall system database via Native Niagara AX FOX connectivity. Systems that must utilize a Tridium Niagara controller in addition to the programming, scheduling and configuration server are not acceptable.

.4 Segment Manager v2.2 and later shall support multiple DLM rooms as follows:

.1 Support up to 120 network bridges and 750 digital in-room devices (LMSM-3E).
.2 Support up to 200 network bridges and 1,100 digital in room devices, connected via network routers and switches (LMSM-6E).

.5 Wattstopper Product Numbers: LMSM-3E, LMSM-6E, LM-SUPERVISOR, NB-ROUTER, NB-SWITCH, NE-SWITCH-8, NB-SWITCH-16.

2.10 PROGRAMMING, CONFIGURATION AND DOCUMENTATION SOFTWARE

.1 PC-native application for optional programming of detailed technician-level parameter information for all DLM products, including all parameters not accessible via BACnet and the handled IR configuration tool. Software must be capable of accessing room-level parameter information locally within the room when connected via the optional LMCI-100 USB programming adapter, or globally for many segment networks simultaneously utilizing standard BACnet/IP communication.

.2 Additional parameters exposed through this method include but are not limited to:

.1 Occupancy sensor detection LED disable for performance and other aesthetic spaces where blinking LEDs present a distraction.
.2 Six occupancy sensor action behaviors for each controlled load, separately configurable for normal hours and after hours modes. Modes include: No Action, Follow Off Only, Follow On Only, Follow On and Off, Follow On Only with Override Time Delay, Follow Off Only with Blink Warn Grace Time, Follow On and Off with Blink Warn Grace Time.
.3 Separate fade time adjustments per load for both normal and after hours from 0 - 4 hours.
.4 Configurable occupancy sensor re-trigger grace period from 0 - 4 minutes separate for both normal hours and after hours.
.5 Separate normal hours and after hours per-load button mode with modes including: Do nothing, on only, off only, on and off.
.6 Load control polarity reversal so that on events turn loads off and vice versa.
.7 Per-load DR (demand response) shed level in units of percent.
.8 Load output pulse mode in increments of 1second.
.9 Fade trip point for each load for normal hours and after hours that establishes the dimmer command level at which a switched load closes its relay to allow for staggered On of switched loads in response to a dimmer.

.3 Generation of reports at the whole file, partial file, or room level. Reports include but are not limited to:

.1 Device list report: All devices in a project listed by type.
.2 Load binding report: All load controller bindings showing interaction with sensors, switches, and daylighting.

.3 BACnet points report: Per room Device ID report of the valid BACnet points for a given site's BOM.
.4 Room summary report: Device manifest for each room, aggregated by common BOM, showing basic sequence of operations.
.5 Device parameter report: Per-room lists of all configured parameters accessible via hand held IR programmer for use with O&M documentation.
.6 Scene report: All project scene pattern values not left at defaults (i.e. 1 = all loads 100 percent, 2 = all loads 75 percent, 3 = all loads 50 percent, 4 = all loads 25 percent, 5-16 = same as scene 1).
.7 Occupancy sensor report: Basic settings including time delay and sensitivities for all occupancy sensors.

.4 Network-wide programming of parameter data in a spreadsheet-like programming environment including but not limited to the following operations:

.1 Set, copy/paste an entire project site of sensor time delays.
.2 Set, copy/paste an entire project site of sensor sensitivity settings.
.3 Search based on room name and text labels.
.4 Filter by product type (i.e. LMRC-212) to allow parameter set by product.
.5 Filter by parameter value to search for product with specific configurations.

.5 Network-wide firmware upgrading remotely via the BACnet/IP network.

.1 Mass firmware update of entire rooms.
.2 Mass firmware update of specifically selected rooms or areas.
.3 Mass firmware upgrade of specific products

.6 Wattstopper Product Number: LMCS-100, LMCI-100

2.11 DLM SEGMENT NETWORK

.1 Provide a segment network using linear topology, BACnet-based MS/TP subnet to connect DLM local networks (rooms) and LMCP relay panels for centralized control.

.1 Each connected DLM local network shall include a single network bridge (LMBC-300), and the network bridge is the only room-based device that is connected to the segment network.
.2 Network bridges, relay panels and segment managers shall include terminal blocks, with provisions for separate "in" and "out" terminations, for segment network connections.
.3 Segment network utilizes 1.5 twisted pair, shielded, cable supplied by the lighting control manufacturer. Maximum cable run for each segment is 4,000 feet. Conductor-to-conductor capacitance of the twisted pair shall be less than 30 pf/ft and have a characteristic impedance of 120 Ohms.
.4 Network wire jacket is available in high visibility green, white, or black.
.5 Substitution of manufacturer-supplied cable is not permitted and may void the warranty, if non-approved cable is installed, and if terminations are not completed according to manufacturer's specific requirements.

.6 Network signal integrity requires that each conductor and ground wire be correctly terminated at every connected device.

.7 Segment networks shall be capable of connecting to any of the following: BACnet-compliant BAS (provided by others) directly via MS/TP, or BACnet/IP via an NB-ROUTER or LMSM Unit. Systems whose room-connected network infrastructure require gateway devices to provide BACnet data to a BAS are unacceptable.

.2 Wattstopper Product Number: LM-MSTP, LM-MSTP-W, LM-MSTP-B, LM-MSTP-DB

2.12 SYSTEM INPUT/OUTPUT

.1 Provide a means to allow seamless integration with third party devices to provide additional functionality to the Digital Lighting Management system via low voltage input/output interface. Wattstopper Product Number: LMIN-104.

.2 Provide a means to integrate analog occupancy sensors to the Digital Lighting Management system via low voltage analog sensor input module. Wattstopper Product Number: LMIO-201.

Part 3 Execution

3.1 INSTALLATION

.1 Install the work of this Section in accordance with manufacturer's printed instructions unless otherwise indicated.

.2 When using wire for connections other than the DLM local network (LMRJ Cat 5e with RJ-45 connectors), provide detailed point to point wiring diagrams for every termination. Provide wire specifications and wire colors to simplify contactor termination requirements.

.3 Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings.

.1 Adjust time delay so that controlled area remains lighted for 5 minutes after occupant leaves area.

.4 Install power packs in accessible maintenance areas unless noted otherwise. Provide access doors if power packs are installed above drywall ceilings.

.5 Install sensors in gym where noted on plan at mid-height of wall.

.6 It shall be the contractor's responsibility to locate and aim sensors in the correct location required for complete and proper coverage within the range of coverage as per the manufacturer's recommendations. The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective rooms.

.7 Provide written or computer-generated documentation on the commissioning of the system including room by room description including:

.1 Sensor parameters, time delays, sensitivities, and daylighting setpoints.
.2 Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
.3 Load Parameters (e.g. blink warning, etc.)

.8 Re-commissioning – After 30 days from occupancy re-calibrate all sensor time delays and sensitivities to meet the Owner's Project Requirements. Provide a detailed report to the Architect / Owner of re-commissioning activity.

3.2 FACTORY COMMISSIONING

.1 Upon completion of the installation, the system shall be commissioned by the manufacturer's factory authorized representative who will verify a complete fully functional system.
.2 The electrical contractor shall provide both the manufacturer and the electrical engineer with ten working days written notice of the system startup and adjustment date.
.3 Upon completion of the system commissioning the factory-authorized technician shall provide the proper training to the owner's personnel on the adjustment and maintenance of the system.
.4 Factory commissioning shall include functional testing and documentation of the control system conforming to the "Functional Testing" requirements included in the current ASHRAE standard. This cost shall be included in the Tender Price.

3.3 INTEGRATED LIFE SAFETY SYSTEM TESTING

.1 This electrical contractor shall participate in integrated testing of this system in conformance with Electrical General Requirements. Include all associated costs in tender.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 SCOPE OF WORK

.1 **The cost for this board selected sub-contractor to supply and install this system will be included in electrical bid. The electrical contractor is to provide all power, raceways, and grounding as noted on the drawings and within these documents.**

.2 This section includes minimum requirements for product design, quality, and performance, including preparation and installation of Category 6 channel systems. A structured cabling channel include jacks, patch panels, cable, cross-connect jumpers, patch cords, and faceplates, all connected together.

.3 Category 6 modular jacks are used to terminate Category 6 balanced unshielded twisted pair (UTP) copper cable in workstation outlets. Category 6 patch panels are used for cross-connect distribution of UTP cabling. Patch panels in the main cross-connect (MC) distribute backbone cabling from the equipment room (ER) to each telecommunications room (TR). Patch panels in the TR distribute cabling from the horizontal cross-connect (HC) to the communications outlet. Category 6 patch cords are used to connect workstation equipment to communications outlets. Patch cords are also used for cross-connections in the ER and TR. Category 6 UTP cable is used for horizontal or backbone infrastructure. Cabling is fully deployed prior to jack and panel termination. Compliance to codes and standards, as well as manufacturer's recommended best practices, is required for installation, cable deployment, and connector termination.

.4 This section includes specific requirements for the following:

.1 27 15 43 Connectors – Jacks - Category 6
.2 27 11 19 Patch Panels – Loaded or Unloaded - Category 6
.3 27 16 19 Patch Cords - Category 6
.4 27 15 13 UTP Cable - Category 6

.5 Related Sections from Division 27: Communications

.1 27 05 26 Grounding and Bonding for Communications Systems
.2 27 05 28 Pathways for Communications Systems
.3 27 05 53 Identification for Communications Systems

.6 Related Sections from Division 01: General Requirements

.1 01 11 00 Summary of Work
.2 01 25 13 Product Substitution Procedures
.3 01 33 00 Submittal Procedures
.4 01 43 00 Quality Assurance
.5 01 45 00 Quality Control
.6 01 60 00 Product Requirements
.7 01 86 29 Communications Performance Requirement

1.2 QUALITY ASSURANCE

.1 Installation of Category 6 channel systems shall be according to manufacturer's instructions.

.2 Category 6 channel systems shall be installed according to recognized Category 6 installation best practices, and applicable codes and standards.

.3 Installed channel system cable and components shall be manufactured by an ISO 9001 Certified facility.

.4 Installed channel system cable and components shall be free from defects in material or workmanship from the manufacturer, and shall be of the quality indicated.

.5 Specified channel system components are based on listed manufacturer or approved equal.

.6 All methods of construction that are not specified in the contract documents shall be subject to control and approval by the Owner or Owner's Representative.

.7 Note: Low grade or substandard Category 6 cable shall not be an acceptable substitute in Category 6 channel systems specified in this document.

.8 Materials and work specified in this document shall comply with, and are not limited to, the most current version of the applicable requirements of standards, codes, and publications listed below, as well as any issued addenda:

Reference Standards:

.1 ANSI/TIA EIA-568-E.0 – Generic Telecommunications Cabling for Customer Premises;

.2 ANSI/TIA EIA-568-D.1 – Commercial Building Telecommunications Cabling Standard;

.3 ANSI/TIA EIA-568-D.2 – Balanced Twisted-Pair Telecommunication Cabling and Components Standard;

.4 ANSI/TIA EIA-568-D.3 – Optical Fiber Cabling and Components Standard

.5 ANSI/EIA-310 - Cabinets, Racks, Panels and Associated Equipment;

.6 IEEE 802.3 - Specification for 10 Gb/s operation over Category 6 or higher 4-Pair Balanced Twisted Pair Cabling;

.7 ANSI/TIA/EIA-569 (CSA T530) - Commercial Building Standard for Telecommunications Pathways and Spaces;

.8 ANSI/TIA/EIA-606 (CSA T528) - Administration Standard for Commercial Telecommunications Infrastructure;

.9 ANSI J-STD-607 (CSA T527) - Commercial Building Grounding and Bonding Requirements for Telecommunications;

.10 EIA/TIA TSB-36 – Technical systems Bulletin – Additional Cable Specifications for Unshielded Twisted Pair Cables;

.11 EIA/TIA TSB-67 – UTP End-to-End System Performance Testing;

.9 The Category 6 channel communications system (voice/data) shall be provided by the communications system sub-contractor. The board selected communications sub-contractor contact info is as follows:

Network Telecom
Dave Waddle
519 749 3699

1.3 SUBMITTALS

.1 Section 27 10 00 Specification Text
.2 Product Data Sheets
.3 Product Drawings
.4 Manufacturer's Instructions (upon request)
.5 Third party verification certificates (upon request)

1.4 REFERENCES

.1 Master Format, 2004 Ed., The Construction Specifications Institute, 2004.
.2 The Project Resource Manual, CSI Manual of Practice, 5th Ed., The Construction Specifications Institute, 2005.

1.5 WARRANTY

.1 Category 6 channel systems are warranted free of defects in material or workmanship.
.2 Category 6 channel systems are warranted to perform the intended function within design limits.
.3 Installed Category 6 channel systems may be granted a full link or channel warranty by Hubbell Premise Wiring under the conditions stated below.

.1 Construction is performed by an installer that is certified by the Hubbell Mission Critical 25 year warranty training program.
.2 Contractors performing the certified installation are properly registered and in good standing with the Hubbell Mission Critical warranty program.
.3 The channel components are supplied entirely by Hubbell Canada.
.4 Cable used in the installation is supplied by Hubbell Canada.
.5 Installed channel systems are properly documented and tested with a green "PASS" result.
.6 Required test results and project documentation is submitted to Hubbell Canada by the registered contractor.

Part 2 Products

2.1 CONNECTORS - CATEGORY 6 MODULAR JACKS

.1 Design Requirements

.1 Jacks shall be standard 8-position, Keystone, RJ-45 style.
.2 Jacks shall be designed for 4-pair, 100 ohm balanced unshielded twisted pair (UTP) cable.
.3 See chart (section 2.7) for required colours.
.4 Each jack shall be single unit construction, with snap – fit to industry standard keystone opening (.760" x .580").
.5 Jack termination method shall follow the industry standard 110 IDC punch-down.
.6 Jacks shall have the Category 6 designation, visible from the front when installed.
.7 Jacks shall not require special cords, specialty tools or special installation requirements.
.8 Category 6 jacks shall be backward compatible with existing Category 3, 5, and 5e cabling systems for fit, form, and function.
.9 Approved Manufacturers:

.1 Hubbell Premise Wiring NEXTSPEED Ascent **HJS6x** (x=color code) with "COBRA-LOCK" termination is the specified Category 6 jack.
.2 Hubbell Premise Wiring Xcelerator Category 6 Jack **HXJ6x** (x=color code)

2.2 PATCH PANELS – CATEGORY 6 – LOADED OR UNLOADED

.1 Design Requirements

.1 Loaded Category 6 patch panels shall be standard 8-position, RJ-45 style, un-keyed receptacle, in 24-, 48-and 96-port configurations. Panel frames shall be black powder coated 14-gage steel with rolled edges top and bottom for proper stiffness. Unloaded patch panels will accommodate Keystone Category 6 jacks, in 24-, and 48- port options.
.2 Panels shall accommodate a minimum of 24 ports for each rack mount unit (1 RMU = 1.75 in.).
.3 Panels shall be designed for 4-pair, 100 ohm balanced unshielded twisted pair (UTP) cable.
.4 Panels shall have individual port identification numbers printed on the front and rear of the panel and have label holders for client specific port identification on the front.
.5 Loaded panel adapter modules shall be 110-style termination with tin lead solder plated IDC contacts.
.6 Loaded panels shall have the Category 6 designation, visible from the front when installed.

.7 Approved Manufacturers:

.1 Hubbell Premise Wiring HPJxx (xx=port count, 24, 48, 72) is the specified "Unloaded" Jack Panel.

.2 Hubbell Premise Wiring HP6xx (xx=port count, 24, 48, 72) is the specified "loaded" Jack Panel.

.3 The Hubbell Premise Wiring HPRCMB Rear Cable Management Bars should be used to support and manage terminated cable at the rear of the unloaded jack panels.

2.3 PATCH CORDS – CATEGORY 6

.1 Design Requirements

.1 Category 6 patch cords shall be constructed with a smoke-colored polycarbonate 8-position plug, having vertically staggered, trifurcated contacts, each having 50 micro-inches of gold plating.

.2 Patch cords shall have a snag-less feature, integral to the strain relief boot on each end.

.3 Patch cords shall be constructed with category 6 patch cable, with 24 AWG 7/32 tinned copper stranded conductors, each insulated with polyethylene, and overall jacket with UL flame-retardant PVC.

.4 Patch cords shall be manufactured using a T568B wiring format and shall function suitably for either T568A or T568B wiring schemes.

.5 See chart (section 2.7) for required colours.

.6 Category 6 patch cords shall be backward compatible with existing Category 3, 5, and 5e cabling systems for fit, form, and function.

.7 Acceptable manufacturers:

.1 The Hubbell Premise Wiring HC6xxyy (xx=color, yy=length) is the specified Equipment and Patch Cord

2.4 CATEGORY 6 100 OHM BALANCED UTP CABLE – PLENUM FT6

.1 Design Requirements

.1 Category 6 UTP cable construction shall be four twisted pairs of 23 AWG insulated solid copper conductors, with a ripcord, surrounded by a tight outer jacket. Cable construction also includes a pair divider along the cable center to maintain separation of individual pairs

.2 Plenum FT6 cable shall be premium grade, tested out to 550 MHz.

.3 Plenum FT6 cable conductor insulation diameter shall be 0.039" ± .0005" high performance fluoro-copolymer.

.4 Outer jacket diameter shall be 0.220" ± .008" with a nominal wall thickness of 0.015".

.5 Plenum FT6 cable jacket material shall be low smoke PVC.

.6 Cable shall be marked: "HUBBELL PREMISE WIRING ((LINK6)) CATEGORY 6 – [PLENUM] -- 4 PR 23 AWG c(UL)US <CMP> – (UL) VERIFIED TO TIA/EIA-568-C.2 -- Z/YY (XXXX) – NNNN".

.1 Frequency of marking shall be every 2.0 ft.
.2 (()) denotes NextSpeed Link6 series
.3 [ ] denotes PLENUM or RISER
.4 < > denotes CMP or CMR
.5 'Z' represents the month of manufacture.
.6 'YY' indicates the year of manufacture.
.7 'NNNN' indicates the sequential footage markers.
.8 'XXXX' indicates the job number.
.9 'NNNN' indicates the sequential footage markers.

.7 UL, ETL, or CSA agency certification or verification markings shall be marked on the cable jacket according to the certifying agency's requirements.

.8 Color coding of the pairs shall be as follows:

.1 Pair 1: White/Blue; Blue
.2 Pair 2: White/Orange; Orange
.3 Pair 3: White/Green; Green
.4 Pair 4: White/Brown; Brown

.9 Cable shall be supplied in 1000 ft Reelex boxes.

2.5 PERFORMANCE REQUIREMENTS: CATEGORY 6 CHANNEL SYSTEMS

.1 All cable and component transmission performance parameters shall be independently verified by a UL or ETL third party testing organization.

.2 Category 6 channel cable and components shall individually exceed Category 6 transmission requirements of ANSI/TIA/EIA-568-C.2-1, Transmission Performance Specifications for 4-Pair 100 ohm Category 6 Cabling Components.

.3 Category 6 channel system shall exceed 10 Gb/s transmission requirements for connecting hardware, per the requirements of ANSI/TIA-TSB-155 (current draft).

.4 The manufacturer shall provide Category 6 component compliance certificates from third party testing organization upon request.

.5 Channel cable and components shall be UL LISTED 1863 and CSA certified.

.6 Installed channel system shall exceed IEEE 802.3 DTE Power specification to 4 times the rated current limits with no degradation of performance or materials.

.7 Channel system shall be third party verified, error free Gigabit Ethernet performance to IEEE 802.3 standard.

.8 Channel system shall exceed 4 Gb/s data transmission capacity within the bandwidth of 1 – 250 MHz when configured in a 4-connector channel.

2.6 PRODUCTS SPECIFIED – SPECIFIC SYSTEM COLOUR REQUIREMENTS

.1 DATA – PATCH CORDS, STRUCTURED CABLING AND JACKS - **BLUE**
.2 VOICE – PATCH CORDS, STRUCTURED CABLING AND JACKS - **WHITE**
.3 WAN CONNECTION PATCH CORDS - **ORANGE**
.4 CAMERA – PATCH CORDS, STRUCTURED CABLING AND JACKS - **GREEN**
.5 WIRELESS ACCESS POINT(WAP) – PATCH CORDS, STRUCTURED CABLING AND JACKS - **ORANGE**

Part 3 Execution

3.1 PREPARATION

.1 Horizontal and backbone cable pathway infrastructure (conduit, cable tray, raceway, etc.) shall be fully deployed according to applicable codes and standards.
.2 Metallic horizontal cable pathways shall be bonded to an approved ground according to ANSI-J-STD-607-A.
.3 Racks, cabinets, and enclosures shall be installed in the proper locations, and bonded to an approved ground according to ANSI-J-STD-607-A.
.4 Prior to jack termination in the workstation outlet, horizontal cabling of the proper category shall be fully deployed from the TR to each outlet location according to applicable codes and standards.
.5 Prior to panel termination in the TR and ER, backbone and horizontal cabling shall be fully deployed.

3.2 INSTALLATION – CATEGORY 6 CABLE

.1 Using approved methods, pull cable into conduits, or place into raceway or cable tray as specified. Do not exceed 25 Lb pull force per cable. Use appropriate lubricants as required to reduce pulling friction.
.2 All exposed wiring shall be installed in surface raceway.
.3 All wiring above ceilings or below access floors shall be installed in cable tray or open-top cable hangers (J-hooks).
.4 Cable slack and service coils shall be stored properly above the ceiling or under the access floor.
.5 Cable ends for termination shall be clean and free from crush marks, cuts, or kinks left from pulling operations.
.6 Pathway fill ratio in conduit, tray, raceway, etc. shall not exceed 40% of pathway cross-sectional area.
.7 Follow industry recommendations for cable bend radius. Avoid kinking or twisting the cable during installation.
.8 No plastic cable ties allowed. Velcro straps are to be used.

.9 Maximum spacing of cable supports above the ceiling shall be 60".

.10 Maintain the following clearances from EMI sources:

- .1 Power cable in parallel: 12" minimum
- .2 Power cable intersections: 6" minimum (at 90 degrees)
- .3 Florescent lights: 12" minimum
- .4 Transformers and electrical service enclosures: 36" minimum

.11 Communications cabling that must cross power cables or conduit shall cross at a 90-degree angle, and shall not make physical contact.

.12 Length of each horizontal cable run from the TR to the wall outlet shall not exceed 90 meters.

.13 Leave sufficient slack for 90 degree sweeps at all vertical drops.

.14 Do not install cable in wet areas, or in proximity to hot water pipes or boilers.

.15 Installed cables shall have no abrasions with exposed conductor insulation or bare copper 'shiners". The installer is responsible to replace damaged cables.

.16 Fire-stop all cable penetrations through fire-rated barriers per local codes.

3.3 INSTALLATION – CATEGORY 6 JACKS

.1 Terminate jacks according to manufacturer's instructions.

.2 To maximize transmission performance, maintain wiring pair twists as close as possible to the point of termination. The length of wiring pair un-twist in each termination shall be less than 0.5" (13 mm).

.3 Jacks shall be properly mounted in plates, frames, or housings with stuffer cap fully installed over IDC contacts.

.4 Horizontal cables extending from mounted jacks shall maintain a minimum bend radius of at least 4 times the cable diameter.

.5 Cable terminations shall have no tensile or bending strain on IDC contacts after assembly of faceplate or housing to the wall outlet.

3.4 INSTALLATION – CATEGORY 6 PATCH PANELS

.1 Properly mount patch panels into the designated rack, cabinet, or bracket locations with the #12-24 screws provided.

.2 Terminate cables into the patch panel according to manufacturer's instructions.

.3 To maximize transmission performance, maintain wiring pair twists as close as possible to the point of termination. The length of wiring pair un-twist in each termination shall be less than 0.5" (13 mm).

.4 Horizontal or backbone cables extending from the panel terminations shall maintain a minimum bend radius of at least 4 times the cable diameter.

.5 Cable terminations shall have no tensile or bending strain on panel IDC contacts in each installed location.

.6 For horizontal cabling, jacks shall be terminated with faceplates assembled complete and properly mounted.

.7 Consolidation point equipment, where applicable, shall also be fully installed and terminated prior to testing.

.8 Panels shall be properly labeled on front and back with the cable number and port connections for each port.

3.5 INSTALLATION – CATEGORY 6 PATCH CORDS

.1 Remove patch cords from bags and apply channel or port identification labels per specification. Patch cord lengths should match the distance between connection points, with enough slack for cable management and bend radius control.

.2 For cross-connect panels in the ER or TR, place the patch cords properly into the installed front cable organizer. Plug each end into the respective panel and equipment ports. Push the plug into the receptacle until the latch clicks into position. Installed patch cords should be neat, with no kinks, tangles, or tight bends.

.3 To connect workstation equipment to the outlet, route the patch cord behind furniture and plug into the network port. Patch cords should not interfere with the operator space or electrical cords. Note: workstation cords are normally installed after placement of office furniture.

3.6 FIELD QUALITY CONTROL – TESTING

.1 Category 6 channel systems shall be tested as an installed horizontal or backbone cabling system. Jacks and faceplates are assembled complete and properly mounted. Panels are terminated and fully dressed with proper cable management. Patch cords are connected on each end of channels.

.2 Each channel in the horizontal or backbone channel system shall be identified and tested individually, using an industry standard level III tester with correct settings.

.3 Each horizontal and backbone channel is tested for the parameters listed below.

Wire Map / Continuity	Length	Insertion Loss
NEXT	PSNEXT	ELFEXT
PSELFEXT	Delay and Delay Skew	Return Loss

.4 A green “PASS” indication shall be obtained for each channel or link, using a level III tester.

.5 Completed test reports shall be submitted per contract requirements.

END OF SECTION

Part 1 General

1.1 COORDINATION

.1 **The cost for this board selected vendor to supply and install this system will be covered by an allowance noted in Division 1. The electrical contractor is to provide all power, raceways, and grounding as noted on the drawings and within these documents.**

.2 The following specifications are provided as a guideline for the electrical contractor to understand the work of this vendor.

.3 The electrical contractor is to include in the tender all costs required to co-ordinate work with this vendor.

1.2 SHOP DRAWINGS

.1 Submit shop drawings and product data in accordance with the Electrical General Requirements Section.

.2 This data is to include a full system riser diagram indicating every proposed device including wiring requirements.

1.3 OPERATION AND MAINTENANCE DATA

.1 Submit data for inclusion in maintenance manuals specified in the Electrical General Requirements Section.

.2 Data must include parts list, maintenance and manufacturer contact numbers.

1.4 SYSTEM REQUIREMENTS

.1 The core school system shall be a complete fully integrated communication system capable of providing a complete operational Public Address, Intercom System and Clock System which **MUST** be integrated/connected to owner provided telephone system as part of this contract.

.2 This system must include:

- .1 Voice paging to selected areas from administrative consoles or room telephones.
- .2 Broadcast of pre-recorded music and programs from local AM/FM tuner/ CD player/pre-amp.
- .3 Lockdown buzzer system containing strobes, dedicated handset, emergency pushbutton, PA console and connections to various building auxiliary systems.
- .4 Other capabilities as listed following.

.3 The central gymnasium system shall consist of a mobile rack mounted amplifier, CD player, speakers, microphone outlets, auxiliary device outlets, and FM assistive listening system.

.4 The system must be complete with a software program for setting up and editing time and school program scheduling. This program must be loaded on at least one secretarial workstation. Use of the program must be included in the training session. Systems not having this program will NOT be considered.

.5 The public address system (including gym sound system & lockdown systems) shall be provided by public address system sub-contractor. The board approved public address system contact info is as follows:

.1 Hamilton Video & Sound Ltd.
Hamilton, Ontario
Contact: Mr. Gord Faulkner
(T) (905) 522-1200 or
(T) (905) 528-0633
(F) (905) 528-5269
(E-Mail) sales@hvs.on.ca

Part 2 Products

2.1 SYSTEM CRITERIA

.1 The system shall consist of the Central Control Unit, Administrative Control Consoles, Speakers, Secondary Clocks, Master Clock, and all other necessary auxiliary devices to provide the operation specified herein.

.2 The system specified is based on equipment manufactured by CareHawk and is meant to establish a standard of quality. It is not intended to discourage other equipment manufacturers (who meet the specification) from bidding. However, only manufacturer authorized and certified dealers are to install, connect and program the specified equipment.

2.2 CENTRAL MICROPROCESSOR CONTROL PAGING/INTERCOM SYSTEM

.1 This system shall be a CareHawk Cat. # CH1000 Series and shall provide the following features and functions:

.1 The system shall contain natively RS232, RS485, USB, and Ethernet ports for communication to any third party system. Systems that do not contain all of the above communication ports or require additional equipment shall not be considered.

.2 The system shall contain five open collectors, three dry contacts, and six general purpose inputs for third party system integration or for general panic buttons. It shall be possible to expand inputs or outputs to any number needed. Systems not supporting the minimum inputs and outputs or able to expand to any number shall not be considered.

.3 The system central cabinet shall be a wall mounted rack style. Total weight of the central cabinet shall not exceed 35 lbs. Install in a rack similar to Mid-Atlantic DWR series.

.4 The system shall have integrated surge protection for all audio ports and switching/line card ports. Said surge protection shall be replaceable in the field with no need to return parts for repair.

.5 The system shall use Class D digital amplifier with at least 250 Watts RMS and 300 Watts peak output. Amplifier distortion shall not exceed 0.2% at 90% load. The Class D amplifier shall be direct drive 25V constant voltage type. Systems using Class B amplifiers or amplifiers not capable of 0.2% maximum distortion shall not be considered.

.6 The system shall filter all voice signals through a Digital Signal Processor (DSP) to maximize voice intelligibility.

.7 The system shall have 45 Ohm conversion modules available on a switching/line cards basis to convert the 25V audio signal to 45 Ohm for use with 45 Ohm speakers.

.8 The system amplifiers shall have a built in pink noise generator for testing speaker quality and audio levels.

.9 The system shall have at least 25 tones available for bells, reminders, and other events.

.10 The system shall support WAV type audio files. The user shall be able to add 25+ custom WAV files for use as pre-recorded announcements, bells, reminders, pre-announce tones, or any other system tone. Systems not allowing users to add WAV files or do not allow for the use of WAV files for any system tone shall not be considered.

.11 The system shall support remote switching/line cards with 16 and 32 audio ports sizes available. A single central cabinet shall support up to eight 32 port cards. The switching/line card shall be powered from the central cabinet out to 2700 feet away from the central cabinet.

.12 The system shall support up to eight FXS Caller-ID enabled telephone ports. FXS ports shall be added as needed in single port configurations. FXS ports shall be used to interface with system Administrative phones, standard telephones, and PBX/KSU/iPBX/VoIP telephone systems. Systems that use proprietary telephone ports for Administrative phones or cannot provided eight FXS ports for PBX/KSU/iPBX/VoIP telephone system integration shall not be considered.

.13 The system shall contain an integral master clock. Systems that do not have an integral master clock shall not be considered.

.14 The system master clock shall be capable of being synchronized by a Network Time Sever (NTP).

.15 The system master clock shall provide for automatic daylight saving time adjustment with leap year programming. Systems that require user intervention for daylight savings events shall not be considered.

.16 The system master clock shall support unlimited schedules with unlimited events on said schedules.

.17 The system master clock shall be calendar based capable of future event programming at least 30 years in the future.

.18 The system master clock shall allow for scheduling tone events, output events, program source events, and video camera events. Systems not capable of scheduling all of the above event types shall not be considered.

.19 The system shall not require an Administrative console to operate. All system functions shall be accessible via telephone codes from any internal or external telephone.

.20 The system shall allow for the use of normally open, normally closed, wireless, and virtual call buttons.

.21 The system shall allow for user-programmable room number assignment in the form of 3, 4, 5 or 6-digit alphanumeric format for architectural room numbering and a 60 character alpha-numeric caller ID description associated with each audio port.

.22 The system shall allow for a minimum of 64 page/time/program zones that can be assigned and configured as desired.

.23 The system shall allow for the assigning of each call-in button to one or more of 32 distinct call-in destination groups.

.24 The system administrative telephone shall allow for the user to view the alphanumeric room address and the caller-ID information of the calling station and the call priority (e.g., emergency, normal) on the display. The administrative telephone shall use distinctive ringing patterns to annunciate the type of call.

.25 The system shall operate under the following audio priority scheme. Systems not following the audio priority scheme listed below shall not be considered.

- .1 An emergency page suspends all other audio
- .2 An emergency tone suspends all other audio except the above
- .3 A normal page suspends all other audio except the above
- .4 A tone suspends all other audio except the above
- .5 A program source audio event suspends nothing
- .6 Interrupted lower priority functions shall be restored after conclusion of the higher priority function.

.26 The system shall allow a call-in to be escalated from a normal call-in to an emergency call-in at any time by pressing the call button twice within 2 seconds.

.27 The system shall allow for any connected telephone to place an emergency voice paging announcement.

.28 The system shall use a PC based GUI scheduling tool for schedules and tone management. This tool shall not allow access to any system configuration controls. This tool shall not prevent the system from operating when being used. This tool shall allow the user to schedule events and manage tones over the local LAN/WAN and the Internet. It shall not be required to be directly connected to the central system to use this tool.

.29 The system shall have a built in 30 day log of every system function and access.

.30 The system shall have a built in real time system diagnostics application.

.31 The system shall allow for system diagnostics, system log access firmware updates, and programming over the local LAN/WAN or over the Internet.

.32 The system must be compatible with latest windows operating systems.

2.3 CONTROL SYSTEM

.1 The Microprocessor Control System shall accommodate up to three Administrative Control Consoles with all control consoles having identical functions and control features. Each and every control console can be programmed for specific functions for particular secretarial or administrative needs.

.2 The Microprocessor Control System shall perform the following minimum functions:

.1 The Administrative Control Console shall be microprocessor-based, desktop console, occupying no more than 84 square inches of desk space. It shall be manufactured of a beige, high impact, molded plastic enclosure with a moisture-proof mylar faceplate, providing the following colour-coded function keys:

.1 Room Select Keypad
.2 Push-to-talk
.3 Hold
.4 Page
.5 Cancel
.6 Emergency
.7 Program Distribution
.8 Ten Function Keys
.9 Five Programming Keys
.10 Display Calls
.11 Enter
.12 Custodian Call

Note: The above keys shall be organized in logical colour-coded graphic format, permitting operators with little or no training to operate the basic administrative functions. The console shall feature a fully menu-driven, 16-character, alpha/numeric LCD display for ease of operation.

.2 The following system programmable function shall be programmed from the master console keypad - secured by an access code:

.1 Architectural alpha/numeric room numbers with option to program call-in registering only at specific Administrative Control Centre.
.2 Room call-in priority levels.

2.4 ACC5 ADMINISTRATIVE CONTROL CONSOLE

.1 The Administrative Control Centre shall incorporate a telephone handset, microphone, speaker, volume control, alpha/numeric LCD display, and keypad controls. The Control Centre allows the operator to establish two-way communications between any room station and the control console as well as answer incoming calls; to select external program sources and simultaneously distribute them on a selected bases, all-call or group basis; to provide voice paging to a group, all-call or group or emergency all-call basis. A special touch point key shall provide a janitorial call, which provides a tone call through the corridor or designated speakers only.

.2 User programmable functions shall be programmed from the control console keypad. Alpha/numeric architectural room numbering, call-in priority levels, user programmable time clock with 256 events up to eight zone program clock. The event is to be day selectable with two time schedules, speaker paging zone assignment and selection of eight tone types. The control console LCD display shall provide full user prompting and format instruction as well as visual indications of regular and/or emergency incoming calls, paging zone selection, room selection. The system shall provide as a minimum, simultaneous intercom to any speaker location plus intercom between control console plus program distribution to any one, group or all speaker locations.

.3 Capacity:

.1 256 circuits, three control consoles, and one TELEPEX card per system.

.4 Display:

.1 Large 16-character LCD alpha/numeric read-out provides:

.1 100% queuing of call room numbers, sequential displays of call "waiting".
.2 Display of current time in idle state.
.3 Full display of programmer prompting.
.4 Full display of operating function dialing.
.5 LED's indicate function keys on/off.

.5 Control:

.1 Main Channel
.2 Emergency key with LED On/Off indication
.3 Page key with LED On/Off indication
.4 Program key (tuner or tape) with LED On/Off indication
.5 Custodian key (tone only) with LED On/Off indication
.6 Intercom channel
.7 Display Calls
.8 Hold key with LED On/Off indication
.9 Function Keys
.10 Push-to-talk
.11 Cancel key
.12 Enter key
.13 Programmable Functions
.14 Console with LED On/Off indication
.15 System with LED On/Off indication
.16 Next
.17 Select
.18 Exit

2.5 MAIN EQUIPMENT CABINET

.1 The cabinet shall be rack-mounted with louvers and locking door. The cabinet shall have mounting rails and power strip. Proper size shall be determined by the manufacturer to accommodate all of their equipment **with 20% expansion capability**.

.2 The racks must be a wall mounted swing out style similar to a Mid Atlantic DWR series.

2.6 AMPLIFIER

.1 Rack Mount Power Amplifier - The Hybrid modular, all solid-state power amplifier is designed for continuous heavy-duty operation and is fully capable of withstanding varying conditions and abuses experienced in institutional and commercial applications.

.1	Rated Output:	60 Watts RMS
.2	Gain:	64 dBl
.3	Noise Level:	90 dB below rate output
.4	Distortion:	Less than 2% at rated output
.5	Frequency Response:	2 dB, 50 to 15,000 cycles
.6	Input Sensitivity:	5V for rate output
.7	Output Impedance:	10.4 OHMS (Balanced 25 volt line)
.8	Dimensions:	19" panel, 3.5" space
.9	Weight:	15 lbs
.10	Finish:	Smokey black spatter, baked enamel
.11	Termination:	Plug-in

.2 The public address vendor is to confirm the required wattage based upon devices indicated on the drawings.

2.7 MIXER/AM/FM TUNER/CD PLAYER

.1 TOA Cat. #DT 930 AM/FM Tuner Denon Cat. #DN-C615 /CD Player complete with pre-amp section providing the following:

.1 one priority microphone input
.2 three low-impedance microphone inputs
.3 three selectable auxiliary high impedance inputs
.4 two bridging inputs
.5 master gain control
.6 output level graph
.7 monitor speaker
.8 Cabinet dimensions are 13-1/2" wide X 7-1/2" deep X 3-1/4" high.

.2 AM/FM Tuner

.1	AM: Frequency range	535 to 1605 KHz
.2	Usable sensitivity	20 UV at S/N 20 dB
.3	FM: Frequency Range	88 to 108 KHz
.4	Usable sensitivity	UV at S/N 30 dB

.5	Frequency response:	dB 50-10,000
.6	Distortion:	Less than 1.5%
.7	Antenna:	Standard RG-59U connector
.8	Controls:	AM/FM switch, tuning control, off/on & tone control

.3 CD Player

.1 Digital optical output.
.2 MASH 1-bit DAC system and advanced digital servo system.
.3 ID scan.
.4 Easy to read disc location display.
.5 Program memory.
.6 Quiet loading mechanism.
.7 Infra-red remote control unit supplied with 10-key direct access and power on/standby button.
.8 Frequency response 2Hz-20Hz (+/-1dB).
.9 Dynamic range 92db.
.10 S/N 100 db.
.11 Rack mounting capability.

.4 These units along with a RDL Cat. # RU-MX4 (mixer), Cat. # RU-SP1 (monitor speaker), Cat. # RU-PA5218 (audio power amplifier) c/w rack adapters are to be installed in a counter mounted equipment rack located in the reception area of the main office. This rack should be equal to MID Atlantic RK/BRK Series complete with backplate and unit sized to suit components.

2.8 DESKTOP MICROPHONE

.1 The desktop microphone shall be complete with the following features;

.1 Tailored frequency response for intelligible voice reproduction.
.2 Omnidirectional dynamic.
.3 Frequency response of 150 to 6000 Hz.
.4 Locking push-to-talk switch.
.5 Combination of black and stainless steel finish.

.2 Acceptable manufacturer shall be:

.1 TOA Cat. #PM-660U

2.9 AM/FM RECEPTION

.1 Provide suitable equipment in the system so that the T.V. coaxial cable in the building can be used for AM/FM reception.

2.10 CALL-IN SWITCHES

.1 The call-in switch shall enable staff to initiate a call to a designated Administrative Control Console or console display unit. It shall be used with an associated speaker assembly.

.2 The call-in switches shall be a momentary contact spring return type. Mounted on a stainless steel plate suitable for flush surface mounting on a single gang back box. Colour by architect.

.3 The call-in switches shall be Dukane Cat. #PCS499 or equal as required.

2.11 NON-DIAL TELEPHONE SYSTEMS

.1 Provide non dial telephone handsets in locations as indicated on the drawings. The handsets shall operate in conjunction with the local room speaker or paging horn. Removing the handset from it's cradle shall "take over" intercom communications being transmitted to the speaker and provide full duplex communications between the two parties.

.2 The handset shall have a standard carbon granular transmitter, and associated dynamic receiver with built in varistor anti-click circuit.

.3 The telephone shall also include an anti-side tone balancing network of the transformer type to improve clarity and intelligibility and to provide balanced line transmission. Telephones without the balancing network of the transformer type will not be accepted.

.4 The handset faceplate must be complete with a call in switch matching the previously noted specification.

.5 The telephone handsets shall be a Carehawk Cat. #HS-140 and shall be supplied and installed as indicated on the plans. The handsets installed in the general purpose room must be mounted in a recessed enclosure equal to:
Hoffman Cat. #A-FDF1212P complete with the following features:

.1 Continuous hinge.

.2 14 gauge galvanized steel door frame with ANSI 61 grey polyester powder finish.

.3 Rugged black composite slide latch.

2.12 DIGITAL DISPLAY

.1 Provide rectangular digital clocks in all locations as shown on design drawings as part of the central clock system.

.2 Clocks shall be equal to Carehawk Cat. #CLKMSL10. Gym clocks to be c/w wire guard by STI USA.

2.13 SPEAKERS

.1 Flush mounted wall speaker in noted room consoles shall consist of a McBride model # 8LS821-19 speaker complete with a matching transformer McBride model # MCT7025.

.2 Flush ceiling speakers shall be a McBride model # 8LS821-19 speaker complete with a matching transformer McBride model # MCT7025, flush round back box McBride model # MC10E, one pair of support rails McBride model # MC100, and a round speaker baffle McBride model # MC11W.

.3 Surface speakers (other than those in the gym) shall be a McBride model # 8LS821-19 speaker complete with a matching transformer McBride model # MCT7025, surface square back box McBride model # SMC20E, and a square speaker baffle McBride model# MC25W.

.4 In the gym surface speakers shall be a McBride model # 810CXBT speaker complete with a matching transformer, surface square back box McBride model # SMC20E, and a square speaker baffle McBride model# MC25W.

.5 All speaker baffles are to be **bright white**.

2.14 GENERAL PURPOSE ROOM AMPLIFIER

.1 The general purpose room amplifier must be 120 watt rated complete with the following features and/or components:

.1 Eight mixer input ports and shall be capable of operation from a 120V, 50/60Hz line.

.2 Each input port shall be usable with microphone, or high-level devices.

.3 Power output shall be 120W at less than 0.5% THD from 20 to 20,000Hz (direct output) or 50 to 20,000Hz.

.4 Frequency response shall be 3dB from 20 to 20,000Hz.

.5 Source impedance shall be 200/50k ohms with a D-001T input module. Load impedance shall be 4, 8, 5.2 (25V line) or 40.8 (70V line) ohms. Load voltage shall be 21.9, 31.0, 25 or 70 volts.

.6 Equivalent input noise shall be -126dBm with a Lo-Z microphone preamplifier. Output noise shall be 90dB below rated output when all gain controls are off.

.7 All software based settings shall be accessible via the front panel controls. Thirty memory presets shall be available to store event or scene data. Programming of the following functions will be possible channel on/off ducking status, ducking depth, input to output routing and remote contact activation and eight priority levels. The digital mixer/amplifier will also have an RS-232 port for programming via a PC or Control by a third party serial based control system.

.8 The A-9120S mixer power amplifier shall utilize the latest in surface mount component technology and include the following modules D-001T input module, T-001T output module for this application. All modules will be 24 bit with on board processing. The D-001T Microphone/Line Input module with the following features priority, ducking on/off, input to output routing, remote contact activation, VOX trigger threshold, high pass filters, 10 band parametric EQ, compression, bass, treble and loudness. The T-001T Output Module with high and low pass filters, 10 parametric equalization, compression, bass and treble, loudness compensation and preprogrammed speaker equalization settings.

.9 The amplifier's dimensions shall be 16.54"(W) x 4.24"(H) x 14"(D) (420 x 107.6 x 358mm) and its weight shall be 28.66Ibs. (13kg).

.10 The amplifier is to be provided with a 3-zone speaker selector switch labelled as follows: “gym, community room, both rooms”.

.2 The mixer power amplifier shall be TOA model A-9120S complete with four (4) D-001T dual microphone/line input modules and rack mount kit.

2.15 SYSTEM ZONING

.1 The gymnasium system shall be designed in such a way that two (2) zones are provided and may be used in any combination and at the same time. The general sound system can mute the gymnasium system if being used.

2.16 GENERAL PURPOSE ROOM COMPACT DISC PLAYER

.1 The player shall be Tascam Cat. #CD-200I or equal complete with the following features and specification:

.1 2U 19" rack-mount CD player.
.2 +/- 12% pitch control for dance and exercise studios.
.3 Optical digital output for CD changer.
.4 Parallel port for external control of automated playback.
.5 Full function infrared remote control.
.6 Plays audio CD's, MP3 CDs and WAV file CD's.
.7 Dock connector for Apple Ipod charging and playback.
.8 Ipod video playback from S-video or composite output.
.9 Continue, Random, and Program play modes.
.10 Repeat All and Repeat Single play modes.
.11 Index Search.
.12 RCA unbalanced line outputs (CD and Ipod)
.13 Coaxial and Optical S/PDIF digital out (CD only).
.14 1/4" stereo headphone output.
.15 19" W x 3.72" H x 11.73" D
.16 9.3 lbs

.2 This player is to be mounted in both the general purpose room, and cafeteria sound carts.

2.17 ASSISTIVE LISTENING SYSTEM

.1 The assistive listening system shall be a self-contained, fixed-single channel FM base station transmitter with built-in antenna to enhance the signal from the General Purpose room sound system.
.2 The transmitter shall operate in the VHF frequency range of 72-76 MHz with specified channel selection shall suit site requirements.
.3 The transmitter unit shall include internal audio processing chain, Apex aural emitter and signal to noise ratio of 60 dB.
.4 The system must include input and output level adjustment controls and rear panel connector strip and be suitable (with adapter) for 120 volt power supply.

.5 The FM receivers shall be fixed single channel belt clip style with on/off, volume control and on LED mounted on top.

.6 Each of the four (4) required receivers are to be provided with two (2) AA batteries and head phones with cord and plug.

.7 The transmitter must be installed within the sound system racks and connected to the amplifiers noted above.

.8 Provide remote antennas as noted on the drawings.

.9 Assistive listening system components shall be as follows:

.1 Transmitter: Gentner Cat. #TX-37A

.2 Receivers: Gentner Cat. #RX-1A

.3 Approved Equal: Williams Cat. # PPA-375E
Cat. #RPK-005
Cat. #ANT 029

2.18 SOUND SYSTEM MOBILE CART

.1 The sound system mobile cart is to contain the amplifier, compact disc player and assistive listening system as specified above and a custom “patching” coverplate mounted on the rear of the unit.

.2 The cart is to be complete with the following features:

.1 16 gauge steel construction with corner braces.

.2 500 lb capacity.

.3 Keylocked front and rear doors.

.4 Spring loaded recessed handles.

.5 Smooth rolling 100 mm (4") cushion locking casters.

.6 Advanced cable management.

.7 Black textured powder coat finish.

.8 21 space racking height.

.3 The cart shall be Middle Atlantic PTRK-21 complete with PD915R power bar, PTRK-RR21 rear rackrail kit and UNI-1 universal connector panel or UCP modular custom panel to suit “patched” components.

NOTE: The cart is to be provided with 3M (10') patch cords for each of the speakers, each microphone and assistive listening system antenna “output ports” mounted on the custom coverplate on the rear panel of the cart. Components within the cart are to be prewired to this custom coverplate.

The cart is to be provided with a ‘D’ ring and 2.4 M (8') of chain complete with locking hooks at each end. At each “cart patch point” as indicated on the drawings, provide a similar ‘D’ ring. Confirm location on site with the consultant.

2.19 FLOOR STAND MICROPHONE

.1 Three microphones are to be provided with uni-directional cardoid dynamic distribution and integral on/off switch.

.2 Each microphone is to be provided with adjustable floor stand and 15 m (50 foot) cord, which must include an audio connector with grounding provisions.

.3 As indicated around the perimeter of the general and multi-purpose rooms provide microphone outlets mounted on a single gang coverplate. Coverplate finish must match specification standard.

.4 Components shall be as follows:

.1 Microphone: TOA Cat. #DM 1300 US
.2 Floor Stand: K&M Cat. #260/1
.3 Microphone Outlet: JF Series
.4 Provide one TOA WT-4820 UHF wireless microphone receiver c/w one WTU 16 channel receiver module, one MB-WT3 rack mount kit and one WM-5220 16 channel hand held wireless microphone. The receiver is to be rack mounted in the portable Gymnasium Sound Rack.

2.20 INTERIOR HORN SPEAKERS

.1 Interior horn speakers where noted shall be complete with the following features:

.1 15 watt continuous power capacity.
.2 375-14, 000 Hz. Frequency response.
.3 Universal bracket for complete horizontal and vertical adjustment.
.4 Grey baked epoxy finish.

.2 Acceptable manufacturer shall be TOA Cat. #SC-615T.

2.21 EXTERIOR HORN SPEAKERS

.1 Speakers shall be weatherproof rated suitable for surface wall mounting and be compact horn style with variable tap line matching transformer and sealed driver unit. Finish shall be textured white. Speakers to be complete with strobe as part of lockdown system as specified following.

.2 This contractor is to ensure that each speaker is wired as a home run to core school public address control panel.

.3 The electrical contractor is responsible to have these speakers painted with a baked on enamel at the manufacturer’s factory or at a facility of his choice. Colour and colour chip will be provided by the Architect.

.4 Acceptable product: Fourjay Cat. #1S4T16

2.22 EXTERIOR PROGRAM BELL (IN RECESSED ENCLOSURE)

.1 Exterior program bells where noted shall be complete with the following features:

.1 10" (250mm) size.
.2 Recessed backbox.

.3 Overall flush mounting with steel grille.
.4 Acceptable manufacturer shall be GE Cat. #513-A c/w #340-10G5.

2.23 EMERGENCY CALL STATION

.1 Provide where noted on the drawings, an emergency call station consisting of latching call switch complete with nylon pull cord and stainless steel faceplate. Station may only be reset by attending the "call site".
.2 Acceptable product shall be Dukane Cat. #9A2225.

2.24 CABLE

.1 All required cable is to be supplied and installed by public address vendor and in a conduit network supplied and installed by the electrical contractor.
.2 Cable shall be as indicated on the system riser diagram or as indicated on the public address vendor riser diagram submitted as a shop drawing.

2.25 LOCKDOWN BUZZER SYSTEM

.1 Provisions shall include interface to public address system, relay to surveillance system, lockdown handset, emergency pushbutton, strobes, and exterior horns with integral strobes.
.2 Locate Lockdown Buzzer System devices as indicated on floor plans.
.3 Locate Lockdown Buzzer System handset (red), emergency pushbutton & public address system console in secure interior location without windows as indicated on floor plans. Coordinate final location with school board.

Part 3 Execution

3.1 INSTALLATION

.1 Confirm all necessary wiring requirements with manufacturer/vendor prior to tender close.
.2 All wiring for this section must be installed in conduit.
.3 Install wiring and components in accordance with manufacturers' recommendations.
.4 Interface gym and general purpose room amplifiers with respective hearing assist systems specified.

3.2 TESTING

.1 The public address vendor must provide inspection, initial test, required adjustments, commissioning verification and certification of the system. **Confirm room numbers with Board representative.**
.2 All lines shall be tested for continuity, ground and shorts. An impedance test shall be done on each and every speaker and a report shall be submitted to the Engineer.
.3 The Supplier shall test the system to ensure proper operation and make any changes or corrections to the system if any defects occur at no cost to the owner.

.4 The Contractor shall include in his Tender price, all costs required for the Suppliers Technician's visit and testing.

.5 All junctions shall be documented and shown on as built drawings showing locations.

.6 Furnish upon completion of work, a letter as evidence that such tests and instructions have been performed to owners satisfaction, and to indicate that:

.1 System complies with system supplier's recommendations.

.2 The warranty on all new equipment installed on the public address system is for a one year period from the date of project substantial completion.

.3 The warranty will include replacement on materials including all labour charges.

3.3 PROGRAMMING

.1 Programming of "paging access" and "call status" to the various areas of the facility must be co-ordinated between the users at the commissioning stage of the project. This vendor is to account for this.

3.4 INSTRUCTION TO OPERATORS

.1 Perform a final test of all circuits in the presence of the owner's representative and instruct his operating personnel on operation of various equipment. All final tests must be performed at the convenience of these individuals. (Allow a minimum of four hours).

.2 Supply three (3) booklets and complete schematic of the system for future maintenance of the equipment.

.3 Provide three (3) copies of complete operating manuals of each system installed.

3.5 SERVICE AND MAINTENANCE

.1 The contractor shall, at the owner's request, make available a service contract offering continuing factory authorized service of this system after the initial warranty period.

.2 The system manufacturer shall maintain engineering and service departments capable of rendering advice regarding installation and final adjustment of the system.

3.6 IN-SERVICE TRAINING

.1 The public address vendor shall provide a minimum of four hours of in-service training for this system.

.2 Operators Manuals and Users Guides shall be used at the time of this training.

.3 This training is for all system users to become familiar with all operating aspects of the system. Schedule session with owner to ensure all required individuals are present.

.4 Once the training session is complete to the satisfaction of the owner obtain a "confirmation of training session" and include in the appropriate section of the maintenance manual.

END OF SECTION

Part 1 General

1.1 REFERENCE DOCUMENTS

.1 CAN/ULC-S302- (latest edition) - Standard for Installation and Classification of Burglar Alarm Systems for Financial and Commercial Premises, Safes and Vaults
.2 CAN/ULC-S303, Local Burglar Alarm Units and Systems.
.3 CAN/ULC-S304, Intrusion Detection.
.4 CAN/ULC-S306, Intrusion Detection Units.
.5 CAN/ULC-S304-(latest edition), Signal Receiving Centre and Premise Burglar Alarm Control Units.
.6 CAN/ULC-S3-1-(latest edition) Standard for Central and Monitoring Station Burglar Alarm systems.
.7 ORD-C634, Connectors and Switches for Use with Burglar Alarm Systems. UL 1076 - (latest edition)], Standard for Safety for Proprietary Burglar Alarm Units and Systems.
.8 ULC-S318, Power Supplies for Burglar Alarm Systems.
.9 CAN/ULC-S524-(latest edition) – Installation of Fire Alarm Systems
.10 CAN/ULC-S559-(latest edition) – Equipment for Fire Signal Receiving Centers and Systems
.11 CAN/ULC-S561-(latest edition) – Installation and Services for Fire Receiving Centers and Systems.
.12 UL294- (latest edition) Standard for Safety for Access Control System units.

1.2 CO-ORDINATION

.1 The cost for this board selected sub-contractors to supply and install this system will be is to be included in the electrical bid. The electrical contractor is to provide all power, raceways, and grounding as noted on the drawings and within these documents.
.2 The following specifications are provided as a guideline for the electrical contractor to understand the work of this vendor.
.3 The electrical contractor is to include in the tender all costs required to co-ordinate work with this vendor.

1.3 SHOP DRAWINGS

.1 Submit shop drawings for each system in conformance with General Requirements Section.
.2 This data is to include a full system riser diagram indicating every proposed device including wiring requirements.

1.4 PRODUCT/MAINTENANCE DATA

.1 Submit product/maintenance data for inclusion in maintenance manual conforming to General Requirements Section.

1.5 SCOPE

SECURITY SYSTEM

.1 The work of the security vendor will include supply and installation of:

- .1 All required cabling in a conduit network provided by the electrical contractor.
- .2 Control panel and associated detection and signalling components.
- .3 Communication to monitoring station via a ULC listed communicator.
- .4 All required system testing and commissioning.
- .5 All required staff and Board training.

.2 All cable and wiring must conform to Electrical Safety Code and applicable Building codes.

.3 All wiring shall be installed in conduit provided.

.4 No exposed wiring is permitted, wiring must fished where technically possible, and if not concealed it must be installed in raceway.

.5 The electrical contractor is to be in attendance during inspection and testing of the system installation.

.6 Detection of an alarm from motion detectors, or alarm operation of fire alarm system, shall be zone annunciated in the control panel and initiate a programmed signal to be transmitted to a central station (of the owner specification) over a Bell Canada telephone system.

.7 All cable and wiring must conform to Electrical Safety Code and applicable Building codes.

.8 The required conduit network and rough-in is to be included in the electrical contractor's tender.

ACCESS CONTROL SYSTEM

.1 The keyscan access control system is to consist of an 8-port controller, proximity readers and door relays at doors to be controlled and all associated wiring for a complete installation. Door strikes are the responsibility of the door hardware supplier.

.2 The access control system (including Aiphone intercom systems) shall be provided by the access control system sub-contractor. Board approved security access control system contact info is as follows:

Hamilton Video and Sound
Gord Faulkner
905 522 1200

Part 2 Products

2.1 CONTROL PANEL

.1 The control panel shall be Keyscan Cat. #CA8500 (for every 8 doors) complete with zone expander, power supply and all necessary batteries and transformers for a complete installation.
.2 The keypad shall be Keyscan Cat. #iClass Series
.3 The keypads located at Daycare entrances are to be Keyscan Cat.#WSSKP1
.4 The alarm control is mandatory and may not be substituted.
.5 The system shall be capable of partitioning. The school and any partitions will report to the central station on different account numbers. Each system will transmit signals for opening, closing, and alarms. All trouble signals will be transmitted on the account identification of the school.
.6 Further information of the system programming will be supplied to the contractor by the monitoring company.
.7 All end of line resistors for the detection circuits are to be installed inside the detector.
.8 All detection devices shall be connected to a zone by itself.
.9 All doors with automatic door operators are to be provided with Camden Cat.# CX-33 Logic Relay for door interface.
.10 The intercom system shall be AIphone Cat.# JP Series.

2.2 INTRUSION DETECTION DEVICES

.1 All existing detection devices installed in the present school are to remain operational at all times during system modifications and additions.
.2 All detectors shall be Dual element Passive infrared detectors, provided by PasWord Protection.
.3 Detectors installed in areas susceptible to damage must have protective cages installed. (i.e. Gymnasium).
.4 All intrusion detection devices shall be programmed as instant zones.
.5 Allowance should be made for automatic bypassing of 5 Zones by a programmable time clock. Notification of zones to be shunted will be given prior to installation completion.

2.3 LOW TEMPERATURE SENSOR

.1 Supply and install low temperature sensors as indicated.
.2 These detectors are to be programmed as a 24-hour silent cold alarm zones.

2.4 FIRE ALARM

.1 The Fire Alarm system shall be connected to the main control panel. The zone is to be programmed as a 24-hour audible fire zone. The fire trouble is to be connected to the system and programmed as a 24-hour trouble zone. The fire trouble alarm is to reset automatically upon its restoration without requiring the main control keypad being reset.

2.5 SIGNALLING DEVICES

.1 When the system is armed there shall be sound emitted in both the main entrance areas of the school and by a piezo buzzer.

.2 When the system detects an intrusion, two (2) new interior 15 watt sirens shall sound. The sirens will be on a 4 minute reset timer. The sirens shall have a cut-off switch installed at the control location. When the siren cut-off switch is in the off position, a programmed burglary zone on the control will be in violation.

2.6 DOOR CONTACTS

.1 The proposed door contacts shall be recessed and be provided by PasWord Protection.

2.7 WIRING

.1 A complete conduit system shall be provided by the Electrical Contractor.

.2 All necessary cable will be supplied by the security vendor for installation by the Electrical Contractor. Label wiring for each device to suit security vendor. All wiring requirements must be confirmed with the security vendor prior to tender close.

2.8 MONITORING

.1 Monitoring of the system shall be by way of a dual line digital dialer communicator installed and operating in conformance with the standards noted in OBC 3.2.4.7.4. **Submit ULC certificate certifying installation and monitoring**. In addition, a Keyscan Cat. # NETCOM2P LAN interface module will be installed at the control panel to allow remote communication to the system.

.2 Monitoring company shall be provided by the intrusion system sub-contractor. Board approved security intrusion system and monitoring company contact info is as follows:

PasWord Protection
Dean Lloyd
905 522 6680

Part 3 Execution

3.1 INSTALLATION

.1 Install conduit network as indicated.

.2 Cable to be supplied and installed by security vendor.

.3 Stub conduit flush on wall at detector locations shown (do not provide box). Confirm locations on site with system supplier.

.4 All equipment shall be mounted and connected in complete accordance with the system supplier's specifications.

.5 Install low temperature sensors in an outlet box mounted horizontally 300 mm (1' 0") below finished ceiling (where installed in a room with exposed ceiling install at ¾ the height of the room).

.6 All final device connections, installations and testing shall be performed by the security vendor.

.7 Install door video intercom system in accordance with manufacturer's gridlines and schematics AND provide training for users (minimum 1.5 hours) over two (2) separate sessions.

3.2 SYSTEM PROGRAMMING

.1 The Contractor is required to provide all system programing including but not limited to:

- .1 All system(s) configuration.
- .2 Offsite monitoring and communication parameters
- .3 User enrolment and setup

.2 All system naming conventions shall be presented by the Contractor for approval by the School Board.

.3 The Contractor is required to conduct and chair pre-installation meetings as required with the School Board or their representative to identify specific requirements of the system programming.

.4 The Contractor shall be responsible to document all decided on software configuration parameters and submit for approval to the School Board.

.5 All field-defined programs shall be stored in non-volatile memory and shall not be lost if AC mains and/or battery is lost.

.6 All programming may be accomplished through the standard LCD keypad. As well through using a PC.

.7 All programming or editing of the existing program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the Fire Alarm Control Panel and / or the IDS.

.8 Provide partitioning of the system to suit the multiple building users and their schedules. Co-ordinate all requirements with Board representatives.

3.3 TESTING AND COMMISSIONING

.1 Acceptance Test Procedures

- .1 A minimum of 5 days prior to on-site testing, prepare and submit two (2) copies of a proposed Acceptance Test Plan (ATP) for review by the School Board.

.2 The School Board reserves the right to request that tests completed be repeated or to request any additional tests required to demonstrate compliance with this standard.

.3 Upon approval of the ATP by the School Board Contractor shall perform all tests and forward the documented results to the School Board.

.2 Site Acceptance Tests (SAT)

.1 After a review of the preliminary tests as outlined in the ATP, a Site Acceptance Test date shall be established. A date will not be established until all equipment is available for testing. The School Board shall be entitled to witness testing on the agreed date.

.2 On the date of Site Acceptance the Contractor shall be present to perform testing. The School Board or their representative shall be present to witness all of the tests performed.

.3 In the event that the School Board or their representative proceed to the site for Site Acceptance Testing, on the agreed date, and finds the system incomplete or not operational the Contractor shall cover all costs associated with returning for repeat testing.

.4 The Contractor shall demonstrate that all equipment and its configuration is compliant to the School Board standards. All deficiencies identified shall be corrected by the Contractor prior to Final System Acceptance.

.5 The system and all devices shall be tested by the Contractor back to the Alarm Monitoring Station. At the end of testing the Contractor shall request and receive from the monitoring station, a hard copy print out of all alarms received by the monitoring station during the test period. The Contractor shall forward a copy of this test report to the School Board for review, as well as provide an additional copy with their As–Built documentation.

.3 Final System Acceptance

.1 After successful completion of the SAT, the Contractor shall prepare a deficiency list. The Contractor shall correct all deficiencies and notify the School Board when all on-site work is completed.

.2 The School Board will provide final acceptance of the work only when all requirements of this specification have been fulfilled, the hand over report has been received and all noted deficiencies have been corrected.

3.4 TRAINING

.1 Training shall be provided on site and conducted by Contractor. All associated training cost shall be carried by the Contractor under his cost. Training shall consist of the following minimum requirements:

.1 User Training – Shall consist of typical system operations including but not limited to: Arming, Disarming, Bypass of zone(s), Changing individual user code, trouble conditions.

.2 Administrative Training

.2 The training shall be performed in two (2) stages:

.1 Stage I: Contractor conducted training. Training shall be provided at two (2) different times in two separate groups. Each group shall consist of 5 individuals for a total of 10. Dates and times are subject to approval by the the School Board.

.2 Stage II: A minimum of 4 hours of follow-up on-site training conducted by the Contractor, at a time convenient to both parties to reinforce the Stage I training and answer any questions that may arise in the interim. A portion of this training may take the form of telephone support during the first few months of operation. (This telephone support will be at the discretion of the Board rep).

3.5 SYSTEM AS-BUILT DOCUMENTATION

.1 Deliver three (3) hard and soft copies of each manual within two (2) weeks of receiving formal system acceptance.

.2 Final documentation soft copies shall be prepared and submitted in the native (editable) electronic format (.vsd, .dwg, .xls, .doc). All documents produced shall be property of The School Board Contractor shall have no rights over the entire documentation package or any parts of the documentation package.

END OF SECTION

Part 1 General

1.1 COORDINATION

.1 **The cost for this board selected sub-contractor to supply and install this system will be included in the electrical bid. The electrical contractor is to provide all power, raceways, and grounding as noted on the drawings and within these documents.**

.2 The following specifications are provided as a guideline for the electrical contractor to understand the work of this vendor.

.3 The electrical contractor is to include in the tender all costs required to co-ordinate work with this vendor.

1.2 SHOP DRAWINGS

.1 Submit shop drawings and product data in accordance with the Electrical General Requirements Section.

.2 This data is to include a full system riser diagram indicating every proposed device including wiring requirements.

1.3 OPERATION AND MAINTENANCE DATA

.1 Submit data for inclusion in maintenance manuals specified in the Electrical General Requirements section.

.2 Data must include parts list, maintenance and manufacturer contact numbers.

.3 The video surveillance system shall be provided by the surveillance system sub-contractor. Board approved security surveillance system contact info is as follows:

.1 Hamilton Video & Sound Ltd.
Hamilton, Ontario
Contact: Mr. Gord Faulkner
(T) (905) 522-1200 or
(T) (905) 528-0633
(F) (905) 528-5269
(E-mail) sales@hvs.on.ca

Part 2 Products

2.1 CAPTURE STATION

.1 The capture station is to function as a video transmitter which collects and digitally records video input from various video cameras, as well it manages this information via an onboard software program, then sends it over a pre-determined network to remote surveillance station.

.2 The features of the capture station include:

.1 Support for minimum of 9 cameras.

.2 Up to 8 alarm inputs.

.3 Simultaneous transmission to multiple surveillance stations.
.4 Digital recording of event video.
.5 Adjustable pre and post event recording.
.6 Archive and management of event video.
.7 Video-based motion detection.
.8 Video compression.
.9 LAN/WAN/Dial-up connectivity.
.10 Telemetry control for pan-tilt-zoom cameras.
.11 Resolutions of 160 by 120, 320 by 240, and 640 by 480 are supported.
.12 Windows 98/NT4.0 operating system.
.13 Minimum Intel Celeron 433 MHZ CPU.
.14 Dial-up, ISDN, cable modem and ethernet network connections.
.15 160 GB hard drive storage space minimum.
.16 Internal 16 camera board.
.17 On board capture station software.

.3 Acceptable product shall be Axis Cat.# S2224 camera capture station or approved equal complete with capture station software.

2.2 CAMERAS

.1 Cameras shall be complete with the following features:

.1 1/3" colour CCD high resolution style.
.2 Built-in digital signal processing circuit.
.3 Weather/impact/power protected.
.4 Vandal resistant design.
.5 Mounts onto electrical boxes.
.6 Rustproof anodised aluminium.
.7 Tough polycarbonate smoked dome.
.8 Universal 180 degree CCD rotation.
.9 Compact 5.29" (134 mm) diameter.
.10 24VAC operation.
.11 Conduit ready.
.12 Approved Manufacturers:

.1 Axis Cat. #M3085-V IP flush mount camera for indoor applications.
.2 Axis Cat. #P3265-LVE IP camera for outdoor applications.
.3 Or approved equal with the same features and performance.

2.3 WIRING

.1 The homerun wiring from each camera is to consist of;

VIDEO: one FT6 plenum rated video cable equal to Provo Cat. #995911.
POWER: one FT6 one pr. #18 power cable equal to Provo Cat. #999182.

2.4 SIGNAGE

.1 This contractor is to provide six (6) lamacoid signs Halton District School Board Blue in colour (12" L x 9" H), which indicate “Premises Monitored by Video Surveillance”.

Acceptable Manufacturer:
Custom by Hamilton Video & Sound.

.2 These signs are to be located as directed by Board personnel.

.3 Signs are to be mechanically fastened.

Part 3 Execution

3.1 INSTALLATION

.1 The system is to include all necessary labour, material, components, wiring, commissioning, and training for complete operational and user understood video surveillance system.

.2 Licensing documentation for each capture station must be completed and forwarded to the Boards’ Computer System Engineer. Include copies in the maintenance manuals for each school.

.3 All cable for this project must be supplied by the system vendor and installed in a conduit network by the electrical contractor.

.4 This contractor is to co-ordinate all installations with the electrical vendor at each school.

.5 This contractor is to load/install the surveillance software on one (1) administrative work station as directed by the Board personnel.

.6 The wiring to each camera is to include an allowance that the camera may be moved +/- 30 feet in the field (prior to rough-in) to allow optimum performance and positioning.

.7 Cameras are to be installed and connected by this contractor. Mounting of cameras is to be secure and in ceiling mounted locations be mounted to structure (independent of ceiling).

.8 This contractor and the electrical contractor are to coordinate the installation of signage and monitor.

.9 This contractor is to coordinate with the successful voice/data vendor for the installation of a network address for the digital recording device.

3.2 TESTING

.1 This contractor, in the presence of the consultant, is to co-ordinate camera set-up on site with school administration personnel.

.2 This contractor is to provide a minimum of four (4) hours of on site training to administrative personnel that will be operating the CCTV system. Obtain receipt of training and include in maintenance manual.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CAN/ULC-S524 (latest edition), Installation of Fire Alarm Systems.
.2 ULC-S525 (latest edition), Audible Signal Appliances for Fire Alarm Systems.
.3 CAN/ULC-S526 (latest edition), Visual Signal Appliances, Fire Alarm.
.4 CAN/ULC-S527 (latest edition), Control Units, Fire Alarm.
.5 CAN/ULC-S528 (latest edition), Manual Pull Stations.
.6 CAN/ULC-S529 (latest edition), Smoke Detectors.
.7 CAN/ULC-S530 (latest edition), Heat Actuated Fire Detectors, Fire Alarm.
.8 CAN/ULC-S531 (latest edition), Smoke Alarms.
.9 CAN/ULC-S536 (latest edition), Inspection and Testing of Fire Alarm Systems.
.10 CAN/ULC-S537 (latest edition), Verification of Fire Alarm Systems.
.11 CAN/ULC-S552 (latest edition), Inspection, Testing and Maintenance of Smoke Alarms.
.12 CAN/ULC-S553 (latest edition), Installation of Smoke Alarms.
.13 OBC-2024, Ontario Building Code Compendium.

1.2 DESCRIPTION OF SYSTEM

.1 System includes:

.1 Control panel to carry out fire alarm and protection functions including receiving alarm signals, initiating general alarm, supervising system continuously, actuating zone annunciators, and initiating trouble signals.
.2 Trouble signal devices.
.3 Power supply facilities.
.4 Addressable manual alarm stations.
.5 Addressable and conventional automatic alarm initiating devices.
.6 Audible and visual signal devices.
.7 End-of-line devices.
.8 Annunciators.
.9 Ancillary devices.
.10 Interface and zone modules.
.11 Remote trouble indicator.

1.3 REQUIREMENTS OF REGULATORY AGENCIES

.1 This system is subject to review by local building department officials, local fire department officials. **Therefore, submission of verification certificate and field technician device verification sheets is required prior to inspection by these officials. Schedule accordingly.**

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Electrical General Requirements Section.
.2 Include:

.1 Layout of equipment.
.2 Zoning.
.3 Complete wiring diagram.

1.5 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for Fire Alarm System for incorporation into manual specified in Electrical General Requirements Section.
.2 Include:

.1 Operation and maintenance instructions for complete fire alarm system to permit effective operation and maintenance.
.2 Technical data - illustrated parts lists with parts catalogue numbers.
.3 Copy of approved shop drawings.
.4 List of recommended spare parts for system.

1.6 MAINTENANCE MATERIALS

.1 Include:

.1 10% spare glass rods for total number of manual pull box stations if applicable.

1.7 TRAINING

.1 Arrange and pay for on-site demonstrations by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system. **Obtain written receipt of training session and include in maintenance manual.**

1.8 SYSTEM OPERATION

.1 The system shall be configured for single stage or two stage **(WRITER TO EDIT)** operation as outlined on the design drawings. Refer to Fire Alarm Sequence of Operation for specific fire alarm sequence functions which generally include the following:

.1 Activation of audible and visual signal devices.
.2 Cause alarm and supervisory zone of alarm device to be indicated on control panel and remote annunciator(s).
.3 Cause system trouble indications.
.4 Activate auxiliary functions.

.5 Transmit signal to fire department via monitoring station.
.6 Log the alarm in the historical alarm log file.
.7 System silence parameters.
.8 System reset parameters.

1.9 PERFORMANCE CRITERIA

.1 These specifications describe the minimum functional requirements for an electronically supervised, microprocessor based, fully integrated system. The initial installation shall include all the necessary electronic hardware, software and memory for a completely operable system in accordance with these specifications.

1.10 QUALITY ASSURANCE

.1 Each and all items of the fire alarm system shall be listed as the products of a single manufacturer under the appropriate category by the Underwriter's Laboratories of Canada and shall bear the "U.L.C." label.
.2 Each and all items of the fire alarm system shall be covered by a one year parts and labour warranty covering defects resulting from faulty workmanship and materials. The warranty shall be deemed to begin on the date the system is accepted by the Project Manager on issuance of the substantial performance certificate for the project.
.3 All control equipment must have Transient Protection Devices to comply with U.L.C. requirements.

Part 2 Products

2.1 GENERAL

.1 The fire alarm system shall be an addressable, single stage (**WRITER TO SELECT**), zoned, non-coded, indicating, fully integrated fire alarm.
.2 The fire alarm control panel shall allow for loading or editing of special instructions and operating sequences as required. The system shall be capable of on site programming to accommodate expansion, and changes required by local codes. All software operations shall be stored in a non-volatile programmable memory within the fire alarm control panel. Loss of primary and secondary power shall not erase the instructions stored in memory.
.3 The ability to selectively program input/output control functions based on ANDing, ORing, NOTing, Timing and Special Coded Operations is also to be incorporated in the resident software programming of the system.
.4 The system shall have the ability to manually disable and enable any device/circuit individually for maintenance or testing purposes.
.5 It shall be possible to reprogram selected or all smoke detector initiating zones for alarm verification.
.6 It shall be possible to program an adjustable time delay circuit for each waterflow initiating circuit to prevent false alarms that may be caused by erroneous pressure surges in the sprinkler system.

.7 All on site programming changes to the fire alarm system shall be password protected.

.8 Wiring to any remote annunciator shall be supervised for open and ground conditions. A separate annunciator trouble indicator must be provided at the control panel, which shall illuminate and an audible trouble signal shall sound at the control panel upon the detection of an open or ground condition.

.9 All Control Panels and Remote Annunciator Cabinets are to be properly grounded to building ground. Conduit ground will not be acceptable. The green coloured grounding loop shall be a minimum #14 AWG insulated copper conductor run in conduit. The ground loop shall be connected to building water supply to the line side of the water meter. Ground wire must not be run in the same conduit as the Fire Alarm wiring.

2.2 POWER REQUIREMENTS

.1 The control panels shall receive 120 VAC power via a dedicated overcurrent protected circuit. The incoming power to the system shall be supervised so that any power failure must be audibly and visually indicated at the control panel and the remote annunciator. A green `Power On' LED shall be displayed continuously while incoming power is present.

.2 Control Panel output power supply shall have the following operating characteristics:

- .1 Rated for five Amps continuous duty
- .2 24 VDC filtered and regulated
- .3 Power limited with a range of 20.4 VDC to 32 VDC.
- .4 Automatic "Brownout" transfer to standby batteries when supply voltage falls to 102 VAC

.3 The system shall be provided with sufficient standby capacity to operate the entire system upon loss of normal 120 VAC power in a normal supervisory mode for a period of twenty-four hours with two hours of alarm operation at the end of this period. The system shall automatically transfer to the standby batteries upon power failure. All battery charging and recharging operations shall be automatic. **WRITER NOTE: Select .3 or .4 not both.**

.4 Standby power for the system shall be produced by dual-sealed, lead acid, gelled cell batteries, series connected with sufficient Amp. Hour capacity to operate the system under supervisory conditions with AC power disconnected for 24 hours and at the end of this period operate the alarm devices for thirty consecutive minutes. The batteries shall be dual-sealed, maintenance free type. **WRITER NOTE: Select .3 or .4 not both (high buildings).**

.5 The system batteries shall be supervised so that a low battery condition or disconnection of the batteries shall be audibly and visually annunciated at the control panel.

.6 Battery charger shall have the following operating characteristics:

- .1 Ability to charge a range up to 33 AH to 70% of their capacity within 12 hours.
- .2 Compatible with either lead acid or nicad batteries.

.7 All circuits requiring system operating power shall be individually fused at the control panel.

.8 The system shall be modular in design to allow future expansion with a minimum of hardware additions and system interruptions.

2.3 FIRE ALARM CONTROL PANEL

.1 The fire alarm control panel construction shall be modular in design with solid state microprocessor based electronics. An 80 character Liquid Crystal Display shall indicate alarms, supervisory service conditions and any troubles. The panel shall include but not be limited to the following:

- .1 80 character LCD display
- .2 Local Energy, Shunt Master Box, or Reverse Polarity Remote Station Connection
- .3 Form C Trouble Contact
- .4 Earth Ground Supervision Circuit
- .5 Basic 8 A power supply
- .6 Automatic Battery Charger
- .7 Standby Batteries
- .8 Resident non-volatile programmable operating system memory for all operating requirements.
- .9 Five Programmable Multi-Function keys with status LED's
- .10 Red Alarm LED and Acknowledge Button
- .11 Yellow Supervisory Service LED and Acknowledge Button
- .12 Yellow Trouble LED and Acknowledge Button
- .13 Green Power on LED
- .14 Alarm/Signal Silence Button
- .15 System Reset Button
- .16 Operator Interface Keypad for Manual Control and System Information Access
- .17 Addressable Interface Control Card
- .18 Supervised Annunciator Circuit

.2 The control Panel shall be capable of chronologically logging and storing 300 events in an alarm log and 300 events in a trouble log. The historical logs shall be stored in the CPU's memory and shall be protected by a lithium battery that is supervised for a low battery condition. Each recorded event shall include the time and date of that event's occurrence. The alarm log file must be separate from the trouble log file. It shall be possible for the user to generate a report of both logs upon request.

.3 All auxiliary manual controls shall be supervised so that all switches must be returned to the normal automatic position to clear system trouble.

.4 Signal Circuits shall be independently supervised and fused such that a fault on one circuit shall not affect the operation of any of the other circuits. All signal circuits shall be configured as follows:

.1 Class “B” wiring, current limited.
.2 Rated at two Amps of continuous power.
.3 Capable of powering polarised 24 VDC audible and visual signalling appliances.

.5 Provide dry contact auxiliary control circuits as follows:

.1 Central Station alarm output.
.2 Central Station trouble output.
.3 SPDT Form C relays fused at 2 A @ 24 VDC.

.6 System Expansion Modules connected by ribbon cables shall be supervised for module placement. Should a module become disconnected the system trouble indicator must illuminate and audible trouble signal must sound.

.7 The Fire Alarm Control Panel shall be capable of supporting RS-232-C I/O ports. CPU data output to the I/O ports shall be in a parallel ASCII format at field adjustable baud rates of 220, 300, 1200, 2400 and 4800.

.8 A walk test feature must be provided.

.9 All system controls shall be housed in a surface wall mounted steel cabinets. Finish shall be according to the manufacturer's standards.

.10 All modules shall be secured behind hinged locked door with a full viewing tempered plastic window. The hinged locked doors shall give access to all the operating controls but shall not expose live connections.

.11 All internal wiring, control circuits, connections and terminals shall only be accessible behind a removable metal retainer plate.

.12 All Cabinets are to be properly grounded to building ground. Conduit ground will not be acceptable.

.13 The system must provide communication with addressable initiating devices. All of these devices will be annunciated on the control panel’s main LCD display. Annunciation shall include the following conditions for each point:

.1 40 Character Zone/Device Location
.2 Type of Device
.3 Detector Status (Normal/Alarm/Trouble)
.4 Device Missing/Failed

.14 The communication format must be a completely digital poll/response protocol to allow tapping of the circuit wiring. A high degree of communication reliability must be obtained by using parity data bit error checking routines for address codes and check sum routines for the data transmission portion of the protocol.

.15 Each addressable device must be uniquely identified by an address code entered on each device base at time of installation. The use of jumpers to set address will not be acceptable due to the potential of vibration and poor contact.

.16 It shall be possible for the owner's representative to change a smoke detector without any special tools or programming.

.17 The system shall support 100% of addressable devices in alarm or operated at the same time, under both primary (AC) and secondary (battery) power conditions. Systems, which cannot support 100% of their point capacity in alarm simultaneously, cannot assure appropriate system response and are not acceptable.

.18 **The appropriate quantity of isolator modules shall be installed so that a wiring fault (short, open or ground) within one floor area shall not prevent the normal operation of other addressable devices on other floor areas.**

.19 The system shall maintain the sensitivity level set, for each sensor, over time by automatically compensating for environmental factors such as dust and dirt accumulations in a smoke sensor's chamber. The smoke sensor shall be a smoke density measuring device having no self-contained set-point. **The control panel shall determine the alarm decision for each sensor.**

.20 The system shall automatically indicate when an individual sensor needs cleaning. When a sensor's average value reaches a predetermined value a `Dirty Sensor' trouble condition shall be audibly and visually indicated at the control panel for the individual sensor.

.21 All data transmissions, **including the analogue value**, between the smoke sensors and the control panel shall be digitally transmitted and incorporate parity and checksum digital data checks of each transmission.

.22 An operator from the control panel, having a proper access level, shall have the ability to:

- .1 Manually access and print the following information for each sensor in a report format that can be easily understood by the user:
  - .1 Primary Status
  - .2 Device Type
  - .3 Present Average Value
  - .4 Present Sensitivity Selected
  - .5 Highest Peak Detection Values
  - .6 Sensor Chamber Status (Normal, Almost Dirty, Dirty, Excessively Dirty)
- .2 Manually control the following of each sensor:
  - .1 Clear Peak Detection Values
  - .2 Enable or Disable the Point
  - .3 Clear Verification Tally
  - .4 Control a Sensor's Relay Driver Output

.23 It shall be possible to program the control panel to **automatically** change the sensitivity settings of each sensor based on **time-of-day** and **day-of-week**.

2.4 ADDRESSABLE MANUAL ALARM STATIONS

.1 Manual alarm stations shall be addressable, single action, non-coded, semi-flush mounted type. Pull stations shall be break-glass style. Contacts are to activate when the handle is pulled down.

.2 Addressable pull station electronics shall be mounted to the back plate of the station. The station's address will be set at the time of installation. Device addressing shall be accomplished by either an electrical or mechanical means.

.3 Where noted on drawings, stations are to be equipped with tamperproof guard equal to Stopper II Cat. # STI-1100. **(WRITER TO SELECT)**

2.5 CONVENTIONAL MANUAL ALARM STATIONS

.1 Manual alarm stations: pull lever, style, wall mounted semi-flush type, non-coded single pole normally open contact for single stage, English signage.

2.6 INTELLIGENT DETECTORS-GENERAL OPERATION

.1 Addressable devices shall use simple to install and maintain decade, numbered 0 to 9, address switches. Detectors that have expanded addressing will have decade switch numbered from 0 to 15 for the most significant digit to allow detector addressing from 1 to 250.

.2 Device addressing shall be accomplished by either an electrical or mechanical means.

.3 Detectors shall be intelligent (analog) and addressable and shall connect with two wires to the fire alarm control panel signalling line circuits.

.4 Addressable smoke detectors shall provide dual alarm and power/polling LEDs. Both LEDs shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. If required, the LED flash shall have the ability to be removed from the system program. An output connection shall also be provided in the base to connect an external remote alarm LED.

.5 The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. Sensitivity shall be automatically adjusted by the panel on a time-of-day basis.

.6 Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance.

.7 The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature.

.8 The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel.

.9 Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (PHOTO, THERMAL).

.10 Detectors will operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The FACP software, not the detector, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector to be set in the FACP program and allowing the system operator to view the current analog value of each detector.

.11 Detectors shall provide address-setting means using decimal switches and shall also store an internal identifying code that the control panel shall use to identify the type of device. LEDs shall be provided that shall flash under normal conditions, indicating that the device is operational and is in regular communication with the control panel.

.12 Addressable devices shall provide address-setting means using decimal switches and shall also store an internal identifying code that the control panel shall use to identify the type of device. LED(s) shall be provided that shall flash under normal conditions, indicating that the device is operational and is in regular communication with the control panel.

.13 The sensors shall be of a low profile design and ULC listed for both ceiling and wall mount applications.

.14 Automatic smoke sensors shall be equipped with a dust cover, which shall be removed at the time of verification to prevent dust and dirt entering the smoke chamber during construction.

.15 A magnetic test switch shall be provided to test detectors and modules. Detectors shall report an indication of an analog value reaching 100% of the alarm threshold.

2.7 INTELLIGENT MULTI-DETECTOR

.1 The intelligent multi-detector shall be an addressable device, which is designed to monitor photoelectric, ionization, and thermal technologies in a single sensing device. This detector shall utilize advanced electronics which react to smaller products of combustion found in fast flaming fires (ionization), slow smouldering fires (photoelectric), and heat (thermal) all within a single sensing device.

.2 The multi-detector shall include two bicolor LEDs, which flash green in normal operation and turn on steady red in alarm.

.3 Detectors are to be provided with relay base where noted on the drawings.

.4 Separately mounted photoelectric ionization and heat detectors in the same location are not acceptable alternatives.

2.8 FIXED TEMPERATURE HEAT DETECTOR

.1 These heat detectors shall have a low mass thermistor heat sensor and operate at a fixed temperature. It shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the/ time required to process an alarm. The integral microprocessor shall determine if an alarm condition exists and initiate an alarm based on the analysis of the data. The heat detector shall have a nominal alarm point rating of 57ºC (1 35ºF). The heat detector shall be rated for ceiling installation at a minimum of 21.3m (70') centres and be suitable for wall mount applications.

2.9 FIXED TEMPERATURE / RATE OF RISE HEAT DETECTOR

.1 These heat detectors shall have a low mass thermistor heat sensor and operate at a fixed temperature and at a temperature rate-of-rise. It shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the time required to process an alarm, The integral microprocessor shall determine if an alarm condition exists and initiate an alarm based on the analysis of the data. Systems using central intelligence for alarm decisions shall not be acceptable. The intelligent heat detector shall have a nominal fixed temperature alarm point rating of 57ºC (135ºF) and a rate-of-rise alarm point of 9ºC (15ºF) per minute. The heat detector shall be rated for ceiling installation at a minimum of 21.3m (70') centres and be suitable for wall mount applications.

2.10 PHOTOELECTRIC SMOKE DETECTOR

.1 The intelligent photoelectric detector shall utilize a light scattering type photoelectric smoke sensor to sense changes in air samples from its surroundings. The integral microprocessor shall dynamically examine values from the sensor and initiate an alarm based on the analysis of data. The detector shall continually monitor any changes in sensitivity due to the environmental affects of dirt, smoke, temperature, aging, and humidity. The photo detector shall be rated for ceiling installation at a minimum of Soft (Olin) centres and be suitable for wall mount applications.

.2 The percent smoke obscuration per foot alarm set point shall be field selectable to any of five sensitivity settings ranging from 1.0% to 3.5%. The photo detector shall be suitable for operation in the following environment:

.1 Temperature: 0ºC to 49ºC (32ºF to 120ºF)
.2 Humidity: 0-93% RH, non-condensing
.3 Elevation: no limit

.3 Detectors are to be provided with relay base where noted on the drawings.

2.11 STANDARD DETECTOR MOUNTING BASES

.1 Provide standard detector mounting bases suitable for mounting on North American 1-gang, 85mm (3 ½ ") or 100 mm (4") octagon box and 100 mm (4") square box. The base shall, contain no electronics, support all detector types and have the following minimum requirements:

.1 Removal of the respective detector shall not affect communications with other detectors.
.2 Terminal connections shall be made on the room side of the base. Bases which must be removed to gain access to the terminals shall not be acceptable.

2.12 INTELLIGENT DUCT SMOKE DETECTOR

.1 The smoke detector housing shall accommodate an intelligent photoelectric detector (as noted above) that provides continuous analog monitoring and alarm verification from the panel.

.2 When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system.

.3 Duct smoke detector sensor assemblies shall be complete with duct housing, photoelectric smoke detector, and sampling tubes as required. The duct-housing base shall come complete with an auxiliary set of form C dry contacts rated at 120 VAC, 3 Amps.

.4 The system shall automatically indicate when an individual duct sensor needs cleaning.

2.13 CONVENTIONAL AUTOMATIC ALARM INITIATING DEVICES

.1 Thermal fire detectors: fixed temperature, non-restorable, rated 57°C (135ºF) or 88°C (194ºF) as indicated.

.2 Thermal fire detectors, combination fixed temperature and rate of rise, non-restorable fixed temperature element, self-restoring rate of rise, fixed temperature 57°C (135ºF) or 88°C (194ºF), rate of rise 8.3°C (15ºF) per minute.

.3 Smoke detector: ceiling mounted, photo electric type, visual alarm indicator, complete with relay base where noted.

.4 Smoke detector: photo electric type air duct type with sampling tubes with protective housing.

.1 Plug-in type with fixed base.

.2 Wire-in base assembly with integral red alarm LED, and terminals for remote alarm LED.

2.14 AUDIBLE/VISUAL SIGNAL DEVICES

.1 150 mm (6") Bells: surface mounted bell, vibration type 24Vdc, 150 mm (6"), 92dBA rating at 3 m (10'), red finish, FM and ULC listed.

.2 250 mm (10") Bells: surface mounted bell, vibration type 24Vdc, 250 mm (10"),94dBA rating at 3 m (10'), red finish, FM and ULC listed.

.3 Horn: flush mounted temporal horn, 24Vdc operation, 94 dBA rating at 3 m (10'), red finish, FM and ULC listed.

.4 Mini Horns: flush mounted temporal mini horn, 24Vdc operation, selectable HIGH/LOW setting 94.5 dBA (high)/89.8 dBA (low) at 3 m (10'), white or red coverplate, FM and ULC listed. Suitable for mounting on a single gang box.

.5 Speakers/strobes: Ceiling surface mounted speaker/strobe devices, white finish complete with “FIRE” marking, speaker to be 25 V RMS complete with selectable wattages (¼, ½, 1, or 2 watt), strobe to be 15 to 95 cd and 16 – 33 VDC, FM and ULC listed.

.6 Speakers/Strobes: Recessed wall mounted speaker or speaker/strobe devices, red finish complete with “FIRE” marking, speaker to be 25 V RMS complete with selectable wattages (¼, ½, 1, or 2 watt), strobe to be selectable 15 to 110 cd and 16 – 33 VDC, FM and ULC listed.

.7 Strobe: semi-recessed, 24Vdc operation, complete with selectable 15/30/75/110 candela output (unless otherwise noted set at 75 cd), synchronized strobe, red finish, FM and ULC listed. Suitable for mounting on a single gang box.

.8 Mini Horn/Strobe: flush mounted temporal combination mini horn/strobe, 24 Vdc operation, selectable HIGH/LOW setting 94.5 dBA (high)/89.8 dBA (low) at 3 m (10') selectable 15/30/75/110 candela output (unless otherwise noted set at 75 cd), synchronized strobe white or red coverplate, FM and ULC listed. Suitable for mounting on a single gang box.

NOTES:

.1 Signal devices with integral strobe lights in high abuse areas (i.e. gymnasium, change rooms, etc.) must be provided with protective wireguards.

.2 Any surface mounted signal devices must be provided with suitable backboxes supplied by the manufacturer.

.3 Provide synchronization modules to suit signal devices (if required by manufacturer).

.4 Set signal devices in classrooms to LOW setting.

2.15 END OF LINE RESISTORS

.1 End-of-line resistors for signalling circuits shall be sized to ensure the correct supervisory current flows in each circuit.

.2 End-of-line resistors shall be mounted on a stainless steel plate for mounting on a standard single gang box and bear the ULC label.

2.16 REMOTE ANNUNCIATOR PANELS

.1 Each remote panel in the installed system shall include remote control display annunciators. These annunciators shall have integral membrane style, tactile push-button control switches for the control of system functions, and LED-s with programmable (software-controlled) flash rates and slide-in labels for annunciation of system events.

.2 The remote control display annunciators shall provide the system with individual zone and device annunciation.

.3 Annunciator must be keyed similar to control panel.

2.17 GRAPHIC DISPLAY (PASSIVE)

.1 Colour graphic layout of facility showing all zones as specified/indicated. Zones shall each have descriptions and zone number indications per fire alarm zone schedule.

.2 Display is to be found behind Plexiglas, approximate size: 500 mm x 500 mm (20" x 20"). Adjust frame size of graphic accordingly to clearly display building zones and zone labels clearly. Max frame size shall be coordinated with available wall space at indicated mounting location. Electrical trade to confirm final graphic location on site.

.3 Finish frame to architects' direction.

2.18 GRAPHIC DISPLAY (ACTIVE)

.1 The colour graphic display shall be computer printed on archivable film. The film must be dimensionally stable, and the inks utilized shall offer UV protection with no fade characteristics. The graphic image shall be electronically stored for easy access and future alterations. Electronic version of the floor plan is available from the Consultant for an agreed fee.

.2 The building outline and zone area designations shall be depicted by a blank border. Each alarm zone shall be identified by a red LED and each supervisory zone shall be identified by a yellow LED. A ”You Are Here” notation shall be shown in red at the annunciator location and proper directional orientation must be observed.

.3 The computer-printed film shall be placed on a 3 mm(1/8") thick white matte acrylic sheet and be protected by a 1/8" thick clear acrylic outer shield. The active display shall come complete with window to view the graphic display LED’s.

.4 The annunciator must be flush mounted at the location indicated and keyed similar to control panel.

.5 In addition to the above, the graphic display shall be provided with:

.1 Lamp test button.
.2 Green power on LED.
.3 Yellow system trouble LED.

.6 The annunciator shall be complete with an LCD display indicating alarm, supervisory and trouble conditions complete with status of all system conditions.

2.19 ANCILLARY DEVICES

.1 Relay unit to initiate fan shutdown on units noted on fire alarm riser.

.2 Relay unit to facilitate elevator recall functions as indicated.

2.20 INTELLIGENT MODULES – GENERAL OPERATION

.1 The modules shall have a minimum of 2 diagnostic LED’s mounted behind a finished coverplate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes, which can be retrieved for troubleshooting assistance. Input and output circuit wiring shall be supervised for open and ground faults. The module shall be suitable for operation in the following environment:

.1 Temperature: 0ºC to 49ºC (32ºF to 120ºF).
.2 Humidity: 0-93% RH, non-condensing.

2.21 MONITOR MODULE

.1 The monitor modules shall have the following operating characteristics:

A flashing LED indicates that the module is in communication with the control panel. The LED latches steady on alarm (subject to current limitations on the loop).

.2 The monitor modules shall have the following features:

Nominal operating voltage:	15 to 32 VDC.
Maximum current draw:	5.1 mA (LED on)
Average operating current:	400 uA (LED flashing)
EOL resistance:	47K ohms.
Temperature range:	0°C to 49°C (32°F to 120°F)
Humidity range:	10% to 93% noncondensing
Dimensions:	114.3mm (4.5") high x 101.6 mm (4") wide x 31.75 mm (1.25") deep. Mounts to a 101.6 mm (4") square x 53.975 mm (2.1/8") deep box.

2.22 ISOLATOR MODULE

.1 Fault isolator modules shall be provide to automatically isolate wire-to-wire short circuits on an SLC loop. The fault isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop. If a wire-to wire short occurs, the fault isolator module shall automatically open-circuit (disconnect) the SLC loop. When the short circuit condition is corrected, the fault isolator module shall automatically reconnect the isolated section of the SLC loop. The fault isolator module shall not require any address-setting, and its' operations shall be totally automatic. It shall not be necessary to replace or reset a fault isolator module after its normal operation. The fault isolator module shall mount in a standard 10.16 cm (4") deep electrical box, in a surface-mounted backbox, or in the fire alarm control panel. It shall provide a single LED which shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

2.23 CONTROL MODULE

.1 Addressable control modules shall be provided to supervise and control the operation of one conventional NACs of compatible, 24 VDC powered, polarized audio/visual notification appliances. For fan shutdown and other auxiliary control functions, the control module may be set to operate as a dry contract relay.

.2 The control module NACs may be wired for Style Z or Style Y (Class A/B) with up to 1 Amp of inductive A/V signal, or 2 Amps of resistive A/V signal operation, or as a dry contact (Form-C) relay. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to ensure that 100% or all auxiliary relay or NACs may be energized at the same time on the same pair of wires.

.3 The control module shall be suitable for pilot duty applications and rated for a minimum of 0.6 Amps at 30 VDC.

2.24 DOOR HOLD OPEN DEVICES

.1 Units to be complete with the following features:

.1 Wall mounted style.
.2 Long life electromagnet.
.3 Low current operation.
.4 Completely silent operation.

.5 25 lbf (111N) minimum holding force.
.6 Adjustable swivel contact plate.
.7 Brushed zinc finish.
.8 Maintenance free operation.
.9 Water resistant design.
.10 ULC, CSA, and FM approved.

2.25 SPRINKLER AND SUPERVISED VALVE CONNECTIONS

.1 Sprinkler and standpipe system contacts shall be provided by the mechanical/sprinkler contractor but connected into the fire alarm system by this Division.

2.26 REMOTE TROUBLE INDICATOR

.1 A system remote trouble indicator where noted on the drawings shall be provided complete with the following features:

.1 Flush mounted in a double gang box.
.2 Trouble LED.
.3 Trouble buzzer.

2.27 SMOKE ALARMS 120V HARDWIRED

.1 Photoelectric sensor 3-in-1 smoke alarm unit c/w LED strobe and CO alarm.
.2 Integral 177 candela strobe with ability to synchronize to other interconnected strobe alarms during an alarm event.
.3 120V hardwired with 10-year sealed battery backup (sealed 3V lithium battery on smoke and CO alarm portion only).
.4 Low profile construction.
.5 Auxiliary relay for use with smart building systems as specified.

2.28 SYSTEM WIRING

.1 The system wiring must be FSA rated in conformance with the Electrical Safety Code to suit the type of installation.
.2 Wiring shall be minimum #18 AWG twisted shielded pair in conduit. “Securex 2” armoured cable will be permitted to be used for “drops” to devices on accessible ceilings.
.3 As indicated on system riser diagram initiating device wiring shall be run in a loop with a home run from the last device to the control panel (Class ‘A’ configuration). Wiring from the “loop” module to conventional devices must be supervised, run in conduit, and conform to the standards of the Electrical Safety Code.
.4 Signal wiring is to be cross connected in a class ‘B’ configuration.
.5 Install isolator modules and end of line resistors in service rooms no higher than 2.4 M AFF. Provide location of these devices at the time of shop drawing submission.

.6 **These are the basic wiring requirements for system operation. Prior to tender close manufacturer and contractor are to confirm all necessary wiring specifications and requirements.**

2.29 APPROVED EQUIPMENT

DEVICE	**NOTIFIER**	**EDWARDS**	**SIMPLEX**	**MIRCOM**
Control Panel				
	NFS2-3030 1-10 loops 318 add/loop	EST 4 or EST 3X	4010-ES -2 loop -250 add	FX-4000 Series
	NFS2 640 2 loops 636 add	EST 3X or I/O Series		
	NFS 320C 1 loop 318 add	I/O Series	4100-ES	
Intelligent Devices				
Manual Alarm Stations 1-Stage	NBG 12LX	SIGA-270	4099-9001	MS-401AD
Addressable Multi-Sensor	FSP-851TA	SIGA2-PS		MIX-2251TB
Addressable Base	B710LPA	SIGA-SB	4098-9792	B21OLPA
Addressable Base c/w Relay	B224RBA	SIGA-RB	4098-9791 c/w 2098-9737	B224RBA
Heat Sensor	FST-851RA	SIGA2-HRS or SIGA2-HFS	4098-9733	MIX-5251RBA Series
Smoke Detectors	FSI-851A	SIGA-PS	4098-9714	MIX-2251BA

Duct Type Smoke Detector (c/w Air Sampling Tubes)	FSD-751PA + ST-X	SIGA-SD c/w SIGA-PS	4098-9755 and 4098-9714	DNRA (Housing) MIX-2251BRA (Detector) DST (Tubes)
Monitor Module	FMM-1A	SIGA-CT Series	ZAM-Monitor 4090-9001	MIX-M500MA
Control Module	FCM-1 or FRM-1	SIGA-CR	ZAM-Control 4090-9002	MIX-M500RA
Isolator Module	ISO-XA	SIGA-IM	4090-9116	M500XA
Annunciator	ACM-32 AEM-32 ACM-32AY	EST3-6ANN	4603-9101 (GEO-7000 Series flush enclosure)	RAX-LCD RAM-1032TZ/RAM-1016TZ RAX-1048
Conventional and Auxiliary Devices				
Manual Alarm Stations	MPS-950 Series	270 Series	2099-9754	MS-400 Series
Thermal Detectors	CR Series	280-PL Series	4255-51/54	5600 Series
Smoke Alarms 3-in-1 (120V hardwired) complete with Strobe, 10 Year Sealed Battery and CO Alarm	KIDDE Cat. # P4010ACLEDSCOCA	KIDDE Cat. # P4010ACLEDSCOCA	KIDDE Cat. # P4010ACLEDSCOCA	KIDDE Cat. # P4010ACLEDSCOCA
Smoke Alarms 3-in-1 (120V hardwired) complete with Strobe, 10 Year Sealed Battery, CO Alarm, and RM4 relay	Kidde P4010ACLED-SCOCA c/w SM120X	Kidde P4010ACLED-SCOCA c/w SM120X	Kidde P4010ACLED-SCOCA c/w SM120X	Kidde P4010ACLED-SCOCA c/w SM120X

Carbon Monoxide Alarm 120V with Battery Backup	Kidde 900-0128-001 (Pro Series CO)	Kidde 900-0128-001 (Pro Series CO)	Kidde 900-0128-001 (Pro Series CO)	Kidde 900-0128-001 (Pro Series CO)
Smoke Detectors (System Type)	C2W-BA Series	C2M-PDC	4098-9601C 4098-9788C	C2W-BA
Smoke Detectors (System Type c/w Relay Base)	C2WR-BA	C2M-PDHRC	4098-9601C 4098-9682C	C2WTR-BA
Duct type Smoke Detector (c/w Air Sampling Tubes.)	DH100PA / ST-X	6260A-CU/ EC30DU-3	4098-9685C	D2A (Housing) 2151A (Detector) DSTSeries (Tubes)
Horn	Spectralert Series	757 Series	True Alert Series	FH-340
Mini Horn	MHRA (System Sensor)	Genesis G1R-HD	4901-9858	FH-340R
Door Holder	FMM Series	1500 Series	2088 Series	DH Series
Mini Horn complete with strobe	P2RA (System Sensor)	Genesis G1R-HDVM	4906-9127	FHS-340R
Low Frequency Mini Horn complete with strobe (residential suites)	Equal	Genesis G4LFV	Equal	Equal
Strobe	SRA (System Sensor)	G1R-VM	4906-9101	FS-340R
Remote Trouble Indicator	RTB	RTU	RT1-1C	RTI-1

Part 3 Execution

3.1 INSTALLATION

.1 The entire system shall be installed in accordance with CAN/ULC-S524 (latest edition) and approved manufacturers manuals and wiring diagrams. The contractor shall furnish all conduit, wiring, outlet boxes, junction boxes, cabinets and similar devices necessary for the complete installation, All wiring shall be of the type recommended by the Electrical Safety Code, approved by local authorities having jurisdiction for the purpose, and shall be installed in dedicated conduit throughout.

.2 Install main control panel and connect to ac power supply.

.3 Locate and install manual alarm stations and connect to alarm circuit wiring.

.4 Locate and install detectors and connect to alarm circuit wiring. **Do not mount detectors within 1 m (39") of air outlets.** Maintain at least 600 mm (24") radius clear space on ceiling, below and around detectors. Locate duct type detectors in straight portions of ducts.

.5 Connect alarm circuits to main control panel.

.6 Locate and install signal devices and connect to signalling circuits.

.7 Connect signalling circuits to main control panel.

.8 Install end-of-line devices at end of applicable alarm and signalling circuits.

.9 Install remote annunciator panels and connect to annunciator circuit wiring.

.10 Locate and install door releasing devices.
Note: Door holders must release by way of local smoke detector and signal from main control panel. Provide additional relays to suit.

.11 Locate and install remote relay units to control fan shut down.

.12 Sprinkler system: wire alarm and supervisory switches and connect to control panel.

.13 Connect fire suppression systems to control panel.

.14 Elevator controllers are to be connected with 4 #14 conductors in conduit from fire alarm control panel to signal elevator recall in the event of a general alarm.

.15 **Connect each combination fire/smoke damper integral detector outputs to individual monitor modules for alarm condition and for AC power to damper assembly trouble condition at the fire alarm panel based on module address.**

.16 Where more than one smoke alarm is installed within a space or dwelling unit, interconnect smoke alarms to each other such that audible signal sounds throughout the space upon activation of any smoke alarm. Smoke alarms are to be interconnected with 3#12 conductors in conduit and connected per manufacturers recommendations.

3.2 PROTECTION

.1 Contractor is to ensure all fire protection system detectors are protected from dust, dirt, humidity, and water at all times during construction. This applies to detectors installed, stored on site or stored in storage containers. Any detectors that are damaged or dirty shall be replaced at the contractor’s expense.

3.3 FIELD QUALITY CONTROL

.1 The system shall be installed and fully tested under the supervision of trained manufacturer's representative. The system shall be demonstrated to perform all the functions as specified.

3.4 ACCEPTABLE INSTALLER

.1 The fire alarm / life safety system specified herein shall be installed by an Authorized Electrical Contractor who is CFAA certified.

3.5 EXAMINATION

.1 Prior to the commencement of any of the work detailed herein, an examination and analysis of the area(s) where the Fire Alarm / Life Safety System and all associated components are to be installed shall be made.

.2 Any of these area(s) which are found to be outside the manufacturers' recommended environments for the particular specified products shall be noted on a Site Examination Report which shall be given to the Building Owners Representative, and the Consultant.

.3 Any shorts, opens, or grounds found on existing wiring shall be corrected prior to the connection of these wires to any panel component or field device.

3.6 DEMONSTRATION

.1 Each of the intended operations of the installed Fire Alarm / Life Safety System shall be demonstrated to the Building Owners' Representative and the Consultant.

3.7 SYSTEM TEST

.1 Perform tests in accordance with General Electrical Requirements Section and CAN/ULC-S537-(latest edition) Standard for the Verification of Fire Alarm Systems.

.2 Fire alarm system:

.1 Test each device and alarm circuit to ensure noted devices transmit alarm to control panel and actuate general alarm and ancillary devices.

.2 Check annunciator panels to ensure zones are shown correctly.

.3 Simulate grounds and breaks on alarm and signalling circuits to ensure proper operation of system.

.4 Class A circuits.

.1 Test each conductor on all circuits for capability of providing alarm signal on each side of single open-circuit fault condition imposed near middlemost point of circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.

.2 Test each conductor on all circuits for capability of providing alarm signals during ground-fault condition imposed near middlemost point of circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.

.5 Class B circuits

.1 Test each conductor on all circuits for capability of providing alarm signal on line side of single open-circuit fault condition imposed at electrically most remote device on circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.

.3 The control panel shall continuously perform as automatic self-test routine on each sensor, which will functionally check the sensor electronics and ensure the accuracy of the valves being transmitted to the control panel.

.4 Automatic testing will occur at a rate of one sensor every four minutes.

.5 The sensor's average analogue value is the average of the last 2000 recorded analogue entries of its chamber.

.6 Any sensor that fails this test shall indicate a '**SELF-TEST ABNORMAL'** trouble condition with the sensor's address at the control panel.

.7 The system shall automatically indicate when an individual sensor needs cleaning. When the sensor's average value reaches a predetermined value, a **'DIRTY SENSOR'** trouble condition shall be audibly and visually indicated at the local control panel for that sensor. IF a **'DIRTY SENSOR'** indication is left unattended and its average value increases to a second predetermined value, an **'EXCESSIVELY DIRTY SENSOR'** trouble condition shall be indicated at the local control panel for that sensor. To prevent false alarms, these **'DIRTY'** conditions shall in no way decrease the amount of smoke obscuration necessary to generate an alarm condition.

.8 An operator having a proper access level, shall have the capability to manually access the following information from the control panel:

.1 Primary Status
.2 Device Type
.3 Present Average Value
.4 Present Sensitivity Selected*
.5 Highest Peak Detection Values (HVP)*
.6 Sensor Range (Normal, Dirty, Excessively Dirty)

* Values shall be in 'percent of smoke obscuration' format so that no interpretation is required by the operator.

3.8 AUDIBILITY TESTING

.1 Audibility Testing:

.1 The contractor is to coordinate an audibility test prior to occupancy of the facility. The test is to be performed by the representatives of the fire alarm manufacturer in the presence of the consultant. The test report is to be in chart form indicating:

.1 Project
.2 Date of test
.3 Room name and number
.4 Ambient dB level

.5 Alarm dB level
.6 Name of testing technician

.2 The test results are to be submitted to the consultant for review prior to issuing to owner's representatives and/or authorities having jurisdiction.

3.9 SMOKE ALARM TESTING

.1 Perform tests on smoke alarms in accordance with CAN/ULC-S552-(latest edition) Standard for Inspection, Testing and Maintenance of Smoke Alarms, and in accordance with manufacturer's instructions.
.2 Smoke testing shall be completed for each smoke alarm device installed (not button testing).
.3 Each smoke alarm shall be individually tested. Smoke alarm interconnections shall also be tested such that all connected smoke alarms will sound when any one of the smoke alarms is tested.
.4 At the completion of the project and in the presence of the consultant, test all smoke alarms. On company letterhead, the contractor is to prepare a chart indicating:

.1 project
.2 date
.3 equipment type
.4 certification of test completion of each individual device
.5 certification of testing conducted with smoke producing device
.6 certification of correct operation
.7 confirmation for all smoke alarms functioning together (integration between multiple smoke alarms in common space).
.8 actual period of testing (time of day)

3.10 INTEGRATED LIFE SAFETY SYSTEM TESTING

.1 This electrical contractor shall participate in integrated testing of this life safety system in conformance with Electrical General Requirements. Include all associated costs in tender.

3.11 ADDITIONAL INSTALLED FIRE ALARM SYSTEM COMPONENTS

.1 The electrical contractor is to include in their bid the cost to add five (5) additional signaling devices to be installed and verified in locations as directed by the consultant. Note: This installation and verification and subsequent audibility test will be occurring after the initial audibility testing is complete.
.2 The electrical contractor is to include in their bid the cost to add three (3) additional fire detection devices (heat or smoke detectors) to be installed and verified in locations as directed by the consultant.
.3 The electrical contractor is to include in their bid the cost to add three (3) additional fire alarm zones with associated zone modules and including six (6) additional isolation modules to be installed and verified as directed by the consultant.

.4 The electrical contractor is to include in their bid the cost to add five (5) additional fire smoke damper connections and 120V loss of power trouble signal with associated module and including ten (10) additional isolation modules to be installed and verified as directed by the consultant.

END OF SECTION