BARRY BRYAN ASSOCIATES

Addendum No. 1

Project No.: 25237

Date: March 17, 2026

Tender No.: RFQ# 2526-002

Project: **CULINARY ARTS CLASSROOM AT EASTSIDE SECONDARY SCHOOL**
Hastings and Prince Edward District School Board

The following information supplements and/or supersedes the bid documents issued by Hastings and Prince Edward District School Board.

This Addendum forms part of the contract documents and is to be read, interpreted, and coordinated with all other parts. The cost of all contained herein is to be included in the contract sum. The following revisions supersede the information contained in the original drawings and specifications issued for the above-named project to the extent referenced and shall become part thereof.

DRAWINGS

1.1 DRAWING NO.A000 OBC Matrix, Key Plan, Site Plan, Drawing List

.1 Revise Architectural Drawing List to the following:

1. A000 DRAWING LIST, LOCATION MAP & SITE PLAN
2. A201 PART DEMOLITION PLANS
3. A202 PART FIRST FLOOR PLAN
4. A203 PART ROOF PLAN
5. A701 INTERIOR ELEVATIONS
6. A801 MILLWORK DETAILS
7. A802 MILLWORK DETAILS

.2 Revise Electrical Drawing List to the following.

1. E101 KEYPLAN & LEGEND
2. E201 DEMOLITION AND RENOVATION PLANS
3. E301 SCHEDULES & DETAILS
4. E401 SCHEDULES

GENERAL

1.2 Additional documents and drawings to be added to scope of work.

1. Specification document: Issued for Permit & Tender dated March 17, 2026
2. Structural drawings: S101 and S102, Issued for Permit & Tender dated March 17, 2026.

End of Addendum No. 1

250 Water St. Suite 201
Whitby, ON, L1N 0G5
(905) 666 – 5252
www.bba-archeng.com

SYSTEM CERTIFICATION ISO 9001 SGS

Yours very truly,

Barry Bryan Associates
Architects, Engineers, Project Managers

Rhonda Sukumaran, OAA

RS/sm

Attachments:	BBA Drawings S101 and S201	(2 Pages)
	Issued for Permit and Tender Specification Package	(477 Pages)

I/We hereby acknowledge receipt of this Addendum.

_____
Signature (signing officer of firm)

_____
Position

_____
Name of Firm

<u>One copy of the addendum must be signed and returned with the completed tender, or the tender submitted shall be rejected.</u>

GENERAL

1. ALL MATERIALS AND WORKMANSHIP SHALL CONFORM TO THE LATEST EDITION OF ALL RELEVANT CODES AND STANDARDS.
2. CONFORM TO OWNER'S GENERAL SPECIFICATIONS INCLUDING ALL SAFETY REQUIREMENTS.
3. SITE VERIFY ALL DIMENSIONS AND LEVELS.
4. KEEP THE SITE THROUGHOUT THE WORK AREA IN A CLEAN AND ORDERLY CONDITION AT ALL TIMES TO THE SATISFACTION OF THE OWNER.
5. ALL STRUCTURAL DRAWINGS ARE TO BE READ IN CONJUNCTION WITH OTHER CONSULTANTS DRAWINGS.

STRUCTURAL STEEL

1. ALL STRUCTURAL STEEL HSS AND W SECTIONS TO BE G40.21M–350W CLASS C. ALL OTHERS TO BE G40.21M–300W.
2. DESIGN FORCES INDICATED ON DRAWINGS FOR STRUCTURAL STEEL WORK ARE UN–FACTORED FORCES UNLESS NOTED OTHERWISE.
3. ALL CONNECTIONS TO BE DESIGNED BY FABRICATOR UNLESS NOTED OTHERWISE. ALL BEAM CONNECTIONS TO BE STANDARD SHEAR CONNECTIONS IN COMPLIANCE WITH CISC, UNLESS NOTED OTHERWISE.
4. PROVIDE SHOP DRAWINGS OF COMPONENTS AND CONNECTIONS DESIGNED BY THE FABRICATOR'S ENGINEER. DRAWINGS SHALL BE SIGNED AND SEALED BY THAT ENGINEER.
5. FABRICATOR'S ENGINEER MUST BE LICENSED IN THE PROVINCE OF ONTARIO.
6. ALL ERECTION BOLTS SHALL BE ASTM GRADE A325 MINIMUM, AND SHALL BE DESIGNED BY STEEL FABRICATOR'S ENGINEER FOR TRANSFER OF ALL LOADS.
7. BOLTED CONNECTIONS SHALL HAVE A MINIMUM OF TWO BOLTS IN EACH CONNECTION PIECE AND DESIGNED AS BEARING CONNECTIONS U.N.O.
8. FABRICATOR'S ENGINEER SHALL DESIGN TOP PLATES AND THEIR CONNECTIONS TO FULLY TRANSFER VERTICAL AND HORIZONTAL LOADS AS WELL AS MOMENTS WHEN REQUIRED PER CISC STANDARDS.
9. FABRICATION, ERECTION AND WORKMANSHIP SHALL CONFORM TO CSA S16.1.
10. ALL WELDING SHALL CONFORM TO CSA W59 AND SHALL BE PERFORMED BY A WELDER QUALIFIED UNDER CSA W47.
11. ALL STRUCTURAL STEEL SHALL BE PAINTED WITH ONE SHOP APPLIED COAT OF PRIMER. SPOT PRIME ALL WELDED AREAS.
12. REMOVE PAINT FILM FROM ALL STEEL SURFACES TO BE WELDED. SPOT PRIME AS REQUIRED.
13. ALL WELDED CONNECTIONS SHALL BE WITH CSA W48 SERIES ELECTRODES.
14. PROVIDE DRAINAGE HOLES TO ARCHITECT'S APPROVAL IN ALL EXPOSED EXTERIOR HSS FRAMING.
15. PROVIDE CAP PLATES ON ALL HSS FRAMING MEMBERS UNLESS NOTED OTHERWISE.
16. DO NOT CUT OR CORE ANY OPENINGS IN ANY STRUCTURAL STEEL MEMBERS WITHOUT PRIOR APPROVAL FROM THE STRUCTURAL ENGINEER.
17. WHERE A STRUCTURAL STEEL SHAPE SHOWN ON THE DRAWINGS IS UNAVAILABLE, A SHAPE OF EQUAL OR GREATER SECTION PROPERTIES AND STRUCTURAL CAPACITY SHALL BE SUBSTITUTED, UPON APPROVAL BY OWNER AND CONSULTANT AT NO EXTRA COST.

STEEL DECK

1. STEEL SHEET TO CSSB1–10M GRADE A STRUCTURAL QUALITY (fy=230 MPa).
2. SPAN DECK OVER AT LEAST 3 SPANS AND PROVIDE INCREASED MATERIAL THICKNESS TO COMPENSATE FOR DISCONTINUITY WHERE LESS THAN 3 SPANS OCCUR.
3. DO NOT SUPPORT CEILING, LIGHTS, DUCTS OR PIPE FROM STEEL DECK.
4. PROVIDE CELL CLOSURES AT SUPPORTS UNLESS NOTED OTHERWISE.
5. PROVIDE CLEAN FORMED EDGE AT ENDS OF COMPOSITE SLAB OPENINGS.
6. GROUT UNDERSIDE OF STEEL FLUTES SOLID WHERE FLOOR DECK SUPPORTS MASONRY WALLS.
7. STEEL DECK SHALL BE SPOT WELDED TO STRUCTURAL STEEL BY 19mm DIA. FUSION WELDS SPACED AT 300mm CENTRE, WITH A WELD ON EACH SIDE OF A SIDE LAPPED JOINT UNLESS OTHERWISE NOTED. SHEET TO BE BUTTON PUNCHED AT 610mm (24") c/c.
8. STEEL DECK SHALL HAVE ADEQUATE CAPACITY TO SUPPORT LOADS GIVEN ON DRAWINGS.
9. STEEL DECK SUB–CONTRACTOR SHALL REINFORCE DECK FOR ROOF OPENINGS 150mm (6") TO 300mm (12") SQUARE ON SITE.

TEMPORARY WORKS

1. THE CONTRACTOR SHALL DESIGN, PROVIDE, ERECT, MAINTAIN REMOVE AND ASSUME FULL AND SOLE RESPONSIBILITY FOR ALL TEMPORARY WORKS REQUIRED FOR THE SAFE AND COMPLETE EXECUTION OF THE WORKS.
2. IN THE EXECUTION OF THE TEMPORARY WORKS AND FOR THE DURATION OF THE CONTRACT, THE CONTRACTOR SHALL MAKE ADEQUATE PROVISION FOR ALL LIKELY CONSTRUCTION LOADING AND PROVIDE SUFFICIENT BRACING AND PROPS TO KEEP THE WORKS IN PLUMB AND ALIGNMENT AND FREE FROM EXCESSIVE DEFLECTION.
3. ACCESS OF HEAVY CONSTRUCTION EQUIPMENT AND ACCUMULATION OF CONSTRUCTION MATERIALS ON THE FLOORS ARE NOT PERMITTED, UNLESS SUCH HAVE BEEN CATERED FOR IN THE CONTRACTOR'S TEMPORARY WORK DESIGN TO THE SATISFACTION OF THE ARCHITECT.
4. SUBMIT SHOP DRAWINGS FOR ALL TEMPORARY WORKS FOR REVIEW BEFORE FABRICATION COMMENCES. SHOP DRAWINGS SHALL BE SEALED BY A PROFESSIONAL ENGINEER REGISTERED IN THE PROVINCE OF ONTARIO.

INSPECTIONS AND TESTING

1. THE FOLLOWING ITEMS SHALL BE INSPECTED OR TESTED BY INDEPENDENT INSPECTION/ TESTING AGENCIES DESIGNATED BY THE CLIENT. MATERIALS AND WORKMANSHIP NOT CONFORMING TO THE SPECIFICATIONS SHALL BE REJECTED BY THE CONTRACTOR. REPORTS AND TEST RESULTS SHALL BE PROMPTLY SUBMITTED TO THE ENGINEER FOR REVIEW. TESTING SHALL INCLUDE BUT NOT BE LIMITED TO:

STRUCTURAL STEEL

1. VISUAL INSPECTION OF ALL WELDS, TORQUE TESTING OF BOLTED CONNECTIONS AND CHECK ON BEARING, PLUMBNESS AND ALIGNMENT OF STEEL STRUCTURES.
2. NON–DESTRUCTIVE TESTING TO VERIFY THE QUALITY OF WELDING, WHERE DEEMED QUESTIONABLE BY VISIBLE DEFECTS OR WHERE REQUIRED BY THE ENGINEER.

SHOP DRAWINGS AND SUBMITTALS

GENERAL

1. REPRODUCTIONS OF THE STRUCTURAL DRAWINGS SHALL NOT BE ACCEPTED AS SHOP DRAWINGS. "PROFESSIONAL ENGINEER" IN THE FOLLOWING PARAGRAPHS SHALL BE REGISTERED AND LICENSED TO PRACTICE IN THE PROVINCE OF ONTARIO.
2. REVIEW OF DRAWINGS APPLIES TO GENERAL ARRANGEMENT ONLY FOR THE PURPOSE OF ASCERTAINING CONFORMANCE WITH THE GENERAL DESIGN CONCEPT. THIS REVIEW DOES NOT IMPLY APPROVAL OF DETAIL DESIGN OR QUANTITIES IN SUBMITTED DRAWINGS, NOR DOES IT RELIEVE THE CONTRACTOR OF HIS RESPONSIBILITY FOR MAKING THE WORK COMPLETE, ACCURATE AND IN ACCORDANCE WITH THE STRUCTURAL DRAWINGS. ALLOW 10 WORKING DAYS FOR SHOP DRAWING REVIEW.
3. DO NOT FABRICATE MATERIALS BASED ON REJECTED OR DISAPPROVED SHOP DRAWINGS.
4. SHOP DRAWING SUBMITTALS SHALL ALSO INCLUDE ANY ELEMENTS DESIGNED BY THE CONTRACTOR'S FORCES WHICH SHALL BE SIGNED AND STAMPED BY A PROFESSIONAL ENGINEER IN ACCORDANCE WITH N.B.C. SECTIONS 2.3.4.4 AND 2.3.4.5 LATEST EDITIONS.

STRUCTURAL STEEL

5. SUBMIT FOR REVIEW 2 PRINTS OF ERECTION DRAWINGS FOR ALL STRUCTURAL STEEL ELEMENTS. ALL MOMENT CONNECTIONS SHALL BE DESIGNED AND THE DRAWINGS STAMPED AND SIGNED BY A PROFESSIONAL ENGINEER.
6. SHOP DRAWING SUBMITTALS SHALL INCLUDE STEEL BEAM, COLUMN CONNECTIONS AND STEEL DETAILS, SIGNED AND STAMPED BY A PROFESSIONAL ENGINEER IN ACCORDANCE WITH N.B.C. SECTIONS 2.3.4.4 AND 2.3.4.5.

RECORD DRAWINGS

1. GENERAL CONTRACTOR SHALL MAINTAIN TWO SETS OF RECORD DRAWINGS WHICH SHOW AS–BUILT DETAILS OF ALL ASPECTS OF THE STRUCTURE, FOR REVIEW DURING CONSTRUCTION AND FOR SUBMISSION AT THE END OF THE PROJECT.

INSPECTIONS AND TESTING

1. THE FOLLOWING ITEMS SHALL BE INSPECTED OR TESTED BY INDEPENDENT INSPECTION/ TESTING AGENCIES DESIGNATED BY THE CLIENT. MATERIALS AND WORKMANSHIP NOT CONFORMING TO THE SPECIFICATIONS SHALL BE REJECTED BY THE CONTRACTOR. REPORTS AND TEST RESULTS SHALL BE PROMPTLY SUBMITTED TO THE ENGINEER FOR REVIEW. TESTING SHALL INCLUDE BUT NOT BE LIMITED TO:

STRUCTURAL STEEL

1. VISUAL INSPECTION OF ALL WELDS, TORQUE TESTING OF BOLTED CONNECTIONS AND CHECK ON BEARING, PLUMBNESS AND ALIGNMENT OF STEEL STRUCTURES.
2. NON–DESTRUCTIVE TESTING TO VERIFY THE QUALITY OF WELDING, WHERE DEEMED QUESTIONABLE BY VISIBLE DEFECTS OR WHERE REQUIRED BY THE ENGINEER.

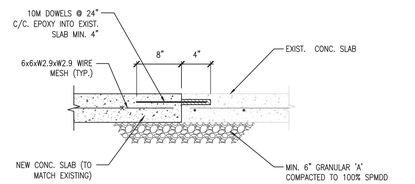
ROOF DESIGN LOADS

DEAD LOAD:

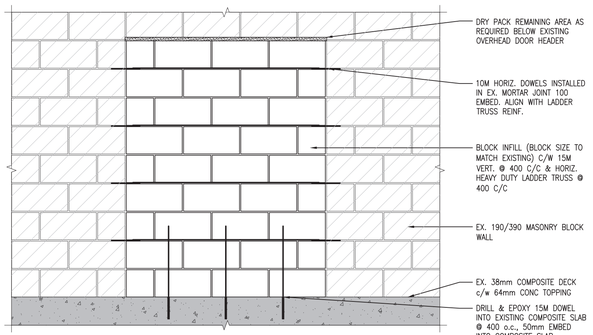
STEEL DECK	= 0.10 kPa
STEEL FRAMING	= 0.15 kPa
RIGID INSULATION	= 0.07 kPa
ROOFING	= 0.20 kPa
M/E	= 0.25 kPa
FIREPROOFING	= 0.07 kPa
MISCELLANEOUS	= 0.25 kPa
TOTAL	= 1.09 kPa + MECH UNITS
LIVE LOAD	= 1.00 kPa
SNOW LOAD	= 1.76 kPa + ASL (AS SHOWN ON PLAN)

STRUCTURAL DESIGN DATA MATRIX

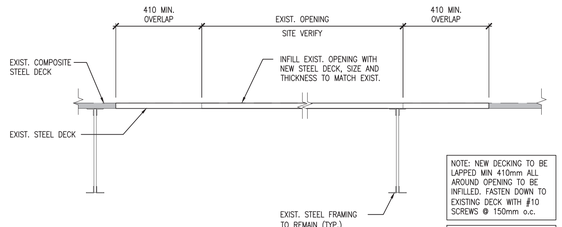
NO.	ITEM	DESCRIPTION				
1.	STRUCTURAL SYSTEM					
2.	DESIGN CODE	2024 OBC PART 4 (LATEST EDITION)				
3.	SNOW/ RAIN LOADS					
	A) IMPORTANCE (Is)	1.0 ULS, 0.9 SLS				
	B) GROUND SNOW ($S_{s\,\frac{1}{50}}$)	1.7 kPa				
	C) GROUND RAIN ($S_{r\,\frac{1}{50}}$)	0.4 kPa				
4.	WIND LOAD					
	A) IMPORT (Iw)	1.0 ULS, 0.75 SLS	TERRAIN: OPEN			
	B) WIND PRESSURE ($q_{\frac{1}{50}}$)	0.43 kPa				
5.	SEISMIC LOAD					
	A) IMPORTANCE (Ie)	1.0 ULS				
	B) SEISMIC DATA	Sa (0.2)	Sa (0.5)	Sa (1.0)	Sa (2.0)	
		0.356	0.345	0.208	0.0996	
	C) SITE DATA	SITE CLASS	SEISMIC CATEGORY			
		D (ASSUMED)	SC3			
		IeS(0.2)= 0.356				



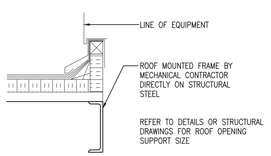
5 / S101 TYP. SLAB-TO-SLAB CONNECTION DETAIL
NTS



4 / S101 TYPCIAL WALL INFILL DETAIL
N.T.S.

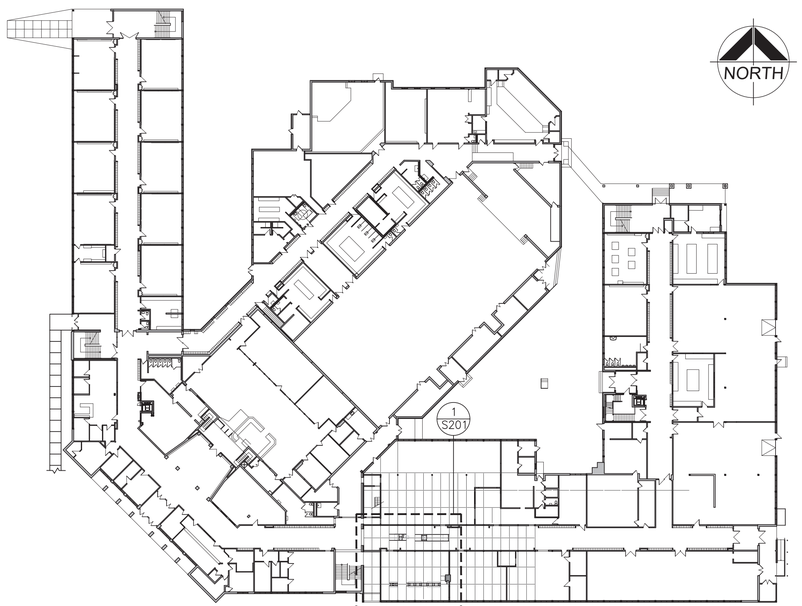


3 / S101 ROOF INFILL DETAIL
1:20



1. TOP OF ALL TRIMMING STEEL TO BE AT THE UNDERSIDE OF STEEL ROOF DECK, UNLESS OTHERWISE NOTED.
2. LOCATION OF ALL MECHANICAL UNITS AND OPENING THROUGH ROOF IS BASED ON INFORMATION SUPPLIED BY MECHANICAL DRAWINGS. THE STRUCTURAL STEEL CONTRACTOR MUST CONFIRM ALL THESE DIMENSIONS AND SIZES WITH THE MECHANICAL CONTRACTOR. IF LOCATION OR DETAILS VARY FROM THOSE SHOWN THE STRUCTURAL ENGINEER MUST BE INFORMED AND INSTRUCTIONS RECEIVED BEFORE PROCEEDING WITH THE WORK.
3. THE STRUCTURAL STEEL CONTRACTOR SHOULD SUBMIT ERECTION DRAWINGS TO THE MECHANICAL ENGINEER AND OR CONTRACTOR FOR APPROVAL OF SIZE AND LOCATION OF OPENINGS FOR MECHANICAL UNITS.
4. PROVIDE SOLID BLOCKING WITHIN DECK FLUTES BETWEEN UNIT CURB AND NEW SUPPORT FRAMING.

2 / S101 FRAMING FOR ROOF OPENING
N.T.S.



1 / S101 KEY PLAN
1:500

DO NOT SCALE THE DRAWINGS.
CHECK AND VERIFY ALL DIMENSIONS AT THE SITE.

ALL DRAWINGS, SPECIFICATIONS AND RELATED DOCUMENTS ARE THE COPYRIGHT PROPERTY OF THE CONSULTANT AND MUST BE RETURNED UPON REQUEST. REPRODUCTION OF DRAWINGS IN PART OR WHOLE WITHOUT THE PERMISSION OF THE CONSULTANT IS FORBIDDEN.

DRAWINGS ARE NOT TO BE USED FOR CONSTRUCTION UNTIL SIGNED AND SEALED BY THE CONSULTANT.

HPE
HASTINGS AND PRINCE EDWARD DISTRICT SCHOOL BOARD

NO.	ISSUES/ REVISIONS	DATE	BY
1	ISSUED FOR PERMIT/TENDER	MAR. 17, 2026	BBA

BBA
BARRY BRYAN ASSOCIATES

PROJECT:
NEW CULINARY ARTS ROOM
EASTSIDE SS

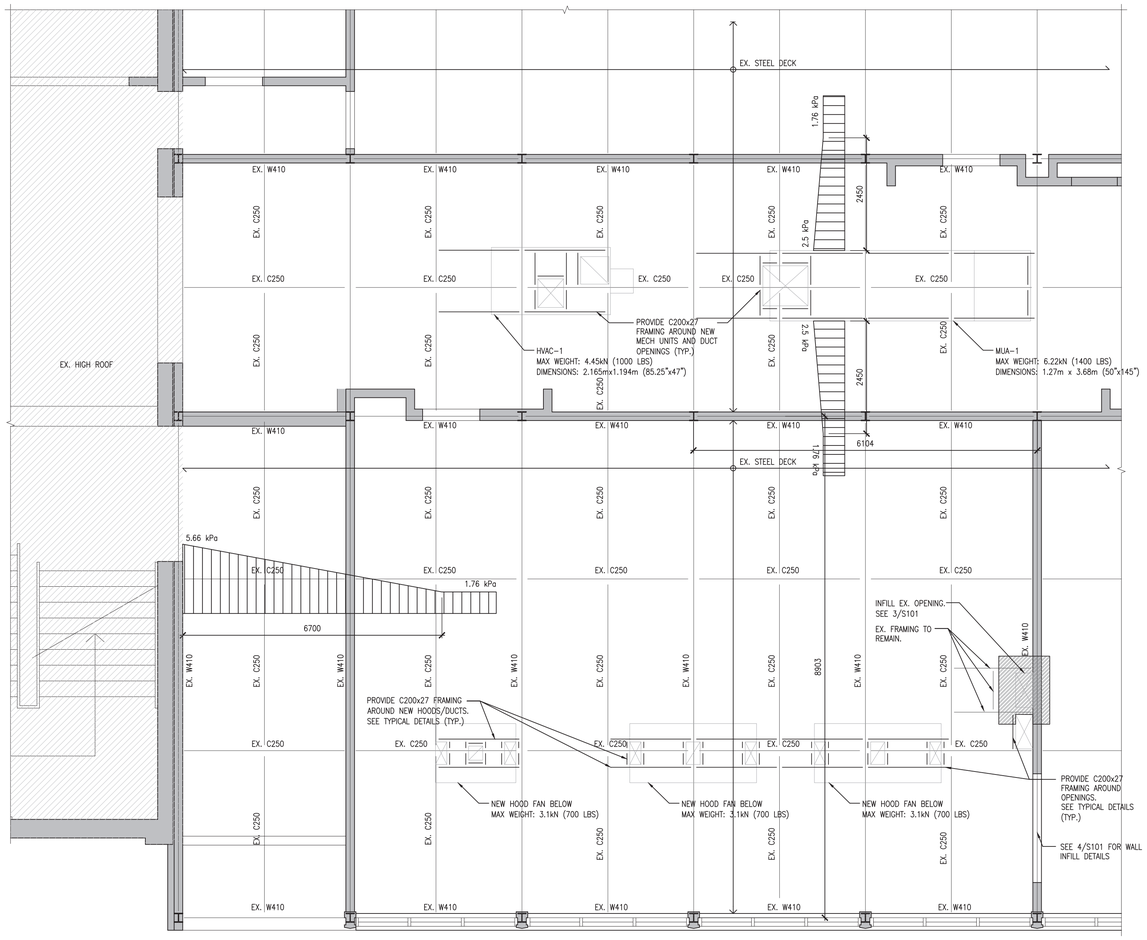
275 FARLEY AVENUE
BELLEVILLE, ON K8N 4M2
HPEDSB

DRAWING:
GENERAL NOTES, KEY PLAN, AND TYPICAL DETAILS

DESIGN BY: HM
DRAWN BY: LS
CHECKED BY: HM
DATE: 26-02-09
SCALE: AS NOTED

SEAL:
LICENSED PROFESSIONAL ENGINEER
S. J. B. A. JAAGUMAGI
100225530
MAR. 17, 2026
PROVINCE OF ONTARIO

PROJECT NO: 25237
DRAWING NO: S101



1 / S201 PART LOW ROOF FRAMING PLAN

1:50

DO NOT SCALE THE DRAWINGS.
CHECK AND VERIFY ALL DIMENSIONS AT THE SITE.

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HASTINGS AND PRINCE EDWARD DISTRICT SCHOOL BOARD

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1	ISSUED FOR PERMIT/TENDER	MAR. 17, 2026	BBA

BARRY BRYAN ASSOCIATES

PROJECT:
NEW CULINARY ARTS ROOM
EASTSIDE SS

275 FARLEY AVENUE
BELLEVILLE, ON K8N 4M2
HPEDSB

DRAWING:
PART ROOF FRAMING PLAN

DESIGN BY:	HM
DRAWN BY:	LS
CHECKED BY:	HM
DATE:	26-02-09
SCALE:	AS NOTED

SEAL:
LICENSED PROFESSIONAL ENGINEER
S. J. B. A. JAAGUMAGI
100225530
MAR. 17, 2026
PROVINCE OF ONTARIO

PROJECT NO: 25237

DRAWING NO: S201

Hastings Prince Edward District School Board

RFQ# 2526-002

Culinary Arts Classroom Renewal at Eastside Secondary School

275 Farley Avenue, Belleville, Ontario

"Issued for Permit & Tender"

Project 25040

March 16, 2026

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End of Section

LIST OF DRAWINGS

Dwg. No.	Title	Issue No.	Rev. No.	Issue Date
ARCHITECTURAL				
A000	OBC Matrix, Key Plan and Drawing List	1	-	Mar. 12, 2026
A201	Part Demolition Plans	1	-	Mar. 12, 2026
A202	Part First Floor Plan	1	-	Mar. 12, 2026
A203	Part Roof Plan	1	-	Mar. 12, 2026
A701	Interior Elevations	1	-	Mar. 12, 2026
A801	Millwork Details	1	-	Mar. 12, 2026
A802	Millwork Details	1	-	Mar. 12, 2026
STRUCTURAL				
S101	General Notes, Key Plan and Typical Details	1		Mar. 17, 2026
S102	Part Framing Plan	1		Mar. 17, 2026
MECHANICAL				Mar. 12, 2026
M101	Keyplan, Schedule & Legend I	3	-	Mar. 12, 2026
M102	Schedule	3	-	Mar. 12, 2026
M201	Demolition Plans	3	-	Mar. 12, 2026
M301	Renovation Plans	3	-	Mar. 12, 2026
M302	Ground Floor Part Plan – Piping Renovation	3	-	Mar. 12, 2026
M401	Roof Plan and Details	3	-	Mar. 12, 2026
M402	Details	3		Mar. 12, 2026
ELECTRICAL				
E101	Keyplan & Legend.	3	-	Mar. 12, 2026
E202	Demolition and Renovation Plans	3	-	Mar. 12, 2026
E301	Schedules & Details	3	-	Mar. 12, 2026
E401	Schedules	3	-	Mar. 12, 2026

End of Section

PART 1 GENERAL

1.1 Section Includes

.1 Work covered by contract documents
.2 Owner
.3 Location of the site
.4 Scheduling requirements
.5 Site access .
.6 Work sequence
.7 Contractor use of premises
.8 Pre-ordered materials and equipment
.9 Work by others
.10 Engineer design
.11 Designated substances: ACM and others
.12 Building smoking environment
.13 Special conditions
.14 Integrated systems testing
.15 Site security
.16 “By Others”
.17 Protection of Drawings

1.2 Work Covered by Contract Documents

.1 Work of this Contract comprises the Culinary Arts Classroom Renewal at Eastside Secondary School as indicated on the Contract Drawings and Specifications.

1.3 Owner

.1 Hastings & Prince Edward District School Board

1.4 Place of the Work

.1 The Work of this Contract is located at 275 Farley Avenue, Belleville, Ontario.

1.5 Scheduling Requirements

.1 Refer to Instructions to Bidders

1.6 Metric Project

.1 This project is to be based on The International System of Units (SI). Measurements are expressed in metric (SI) units.

.2 All dimensions are to be shown in meters and millimeters.

1.7 Site Access

.1 Access to the site to be arranged by the Owner.

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

.3 Provide secure construction fencing as specified and where indicated.

1.8 Work Sequence

.1 Construct Work continuously.

1.9 Contractors' Use of Premises

.1 Contractor has restricted use of site until Substantial Performance.

1.10 Engineer Design

.1 Where specifications require work to be designed by an engineer, engage an engineer licensed in the Province of Ontario to design such work. Refer to Section 01 78 00.

1.11 Designated Substances: ACM and Others

.1 The Owner shall provide any prospective constructor or contractor a copy of building ACM surveys and information on designated substances that are known or suspected of being present within the area or scope of work.

.2 The General Contractor shall ensure that a copy of the ACM survey is provided to each contractor and subcontractor who will be working on the Project.

.3 Any findings of undeclared ACM, or damaged ACM that could pose a risk to workers is to be brought to the attention of the Owner immediately, and work is to be stopped.

.4 All project design and construction activities must be carried out in compliance with the Regulations and the Owner's Asbestos Management Program.

.5 No asbestos-containing materials, as defined by O. Reg. 278/05, may be specified or used in any project.

1.12 Verification

.1 All dimensions shall be verified on site, and all necessary modifications and adjustments shall be made as necessary to suit.

1.13 Building Smoking Environment

.1 Smoking and vaping are prohibited in all work places within the Owner's buildings and on the Owner's property.

1.14 Special Conditions

.1 The following general and special conditions apply:
  .1 All existing surfaces and finishes are to be repaired wherever damaged during the course of the Work.
  .2 Wherever existing floor and wall finishes are to be removed, include full removal down to the existing substrate of all tile, base, mortars, grouts, waterproofing membranes and adhesives in accordance with TTMAC recommended procedures. Patch and repair existing substrate to the quality required by the new finish material manufacturer for the installation of their products.

.3 All openings in existing fire rated assemblies or fire separations which are created by the removal of existing services, plumbing, conduit, ductwork, fittings fixtures or accessories are to be firestopped to maintain the integrity of the existing construction.
.4 All exposed interior surfaces except prefinished surfaces shall be painted whether referred to in the specifications and drawings or not.

1.15 Integrated Systems Testing

.1 Test and verification in conformance with CAN/ULC S1001, Integrated Systems Testing of Fire Protection and Life Safety Systems. Provide a satisfactory Integrated Testing Report. Procure (engage, coordinate and pay for) an Integrated Testing Coordinator, responsible to develop and implement the Integrated Testing Plan. The systems which must be included as part of the integrated systems testing to be determined by the Integrated Testing Coordinator. All costs related to the integrated systems testing must be included as part of the base bid price. Provide all requirements to all required trades during the bid period.

.2 Include the following scopes of work as part of the base bid price specific to CAN/ULC S1001, Integrated Systems Testing of Fire Protection and Life Safety Systems:
.1 Fire Alarm Technician required for operations and resetting of the fire alarm control panel for the duration.
.2 Electrician required for operations and initiating alarms, demonstrating wiring, etc., for the duration.

1.16 Site Security

.1 Daily Inspection: Provide inspection of the work areas daily while the work is in progress and take whatever measures are necessary to secure the construction zones from theft, vandalism and unauthorized entry.

1.17 “By Others”

.1 The term "by others" where it is used in the contract documents means that work shown or described in the contract documents and labeled with this designation is not included in the specific sub-trade's scope of work but will be required to be done within the General Contractor's contract.

1.18 Use of Drawings

.1 Drawings are not to be scaled.

.2 Copies of architectural and structural “issued for construction” drawings in digital format will be made available for the contractors use under the following conditions.
.1 Copyright remains with BBA.
.2 The drawings will only be used for shop drawings for this project and not be put to any other use.
.3 BBA assumes no liability for errors or omissions in the drawings. The Contractor assumes all risk and expenses associated with the use of drawings in the production of his work.
.4 References to BBA and other Consultants must be deleted from the title block.
.5 The Contractor signs a release available from BBA that addresses the above items in more detail. (Sample attached as Appendix ‘A’)

.3 Arrangements for use of Sub-Consultant drawings must be made with the Appropriate Sub-Consultant.

1.19 Protection of Drawings

.1 Copyright of electronic document belongs to the Consultant. Electronic documents may not be forwarded to others, transmitted, downloaded or reproduced in any format, whether print or electronic, without the express, written permission of the copyright owner.

.2 Drawings, specifications and other contract related documents which are posted on Contractor controlled websites for access by sub-trades and suppliers, shall be posted only on password protected platforms with access only to those parties with an expressed interest in the Project.

.3 Provide Consultant and Owner with access to such websites as noted above.

PART 2 PRODUCTS

3.1 Not Used

.1 Not used

PART 3 EXECUTION

3.2 Not Used

.1 Not used

End of Section

SAMPLE

[Date]

[CONTRACTOR'S COMPANY

ADDRESS

CITY, PROVINCE, POSTAL CODE]

Attention: [INSERT CONTACT NAME]

At your request, BBA will provide electronic files for your convenience and use in the preparation of your shop drawings for Project Name, subject to the following terms and conditions:

Our electronic files are compatible with [AutoCAD 2020 (**)]. We make no representation as to the compatibility of these files with your hardware or your software beyond the specified release of the referenced drawings.

Data contained on these electronic files are part of our instruments of service, and at all times remain the exclusive property of Barry Bryan Associates and copyright is reserved. The electronic files shall not be used by you for any purpose other than as a convenience in the preparation of shop drawings for the referenced project. You further agree not to transfer these electronic files to others without the prior written consent of Barry Bryan Associates. Any other use or reuse by you or by others will be at your sole risk and without liability or legal exposure to us. You agree to make no claim and hereby waive, to the fullest extent permitted by law, any claim or cause of action of any nature against us, our officers, directors, employees, agents or other project consultants that may arise out of or in connection with your use of the electronic files.

Furthermore, you shall, to the fullest extent permitted by law, indemnify and hold us harmless against all damages, liabilities or costs, including reasonable attorneys' fees and defence costs, arising out of or resulting from your use of these electronic files, or from the use by others, should they have obtained them from you.

These electronic files are not construction documents. Differences may exist between these electronic files and corresponding hard-copy construction documents. We make no representation regarding the accuracy or completeness of the electronic files you receive. In the event that a conflict arises between the hard-copy construction documents prepared by us and the electronic files, the hard-copy construction documents shall govern. You are responsible for determining if any conflict exists.

Due to the nature of the design and construction process, the drawings on these electronic files may not be fully coordinated, may change, and may not incorporate revisions, change orders, or addenda. By your use of these electronic files, you are not relieved of your duty to fully comply with the contract documents, including, and without limitation, the need to check, confirm and coordinate all dimensions and details, take field measurements, verify field conditions and coordinate your work with that of other contractors for the project.

Because information presented on the electronic files can be modified, unintentionally or otherwise, we require all indications of our ownership and/or involvement be removed from each electronic display.

We will furnish you electronic files upon your written request.

Under no circumstances shall delivery of the electronic files for use by you be deemed a sale by us, and we make no warranties, either express or implied, of merchantability of fitness for any particular purpose. In no event shall we be liable for any loss of profit or any consequential damages as a result of your use or reuse of these electronic files.

_____	_____
Barry Bryan Associates	[CONTRACTOR FIRM NAME]

PART 1 GENERAL

1.1 Consultants

.1 ARCHITECT:
Barry Bryan Associates
201 - 250 Water Street
Whitby, Ontario L1N 0G5
Tel: (905) 666-5252
Fax: (905) 666-5256
Attention: Ms Rhonda Sukumaran, OAA

.2 STRUCTURAL ENGINEER:
Barry Bryan Associates
201 - 250 Water Street
Whitby, Ontario L1N 0G5
Tel: (905) 666-5252
Fax: (905) 666-5256
Attention: Mr. David Bovill, P.E., P. Eng.

.3 MECHANICAL ENGINEER:
DEI Consulting Engineers.
55 Northland Road
Waterloo, Ontario N2V 1Y8
Tel: (519) 725-3555
Attention: Ms. Nicole Tudose, P.Eng.

.4 ELECTRICAL ENGINEER:
DEI Consulting Engineers.
55 Northland Road
Waterloo, Ontario N2V 1Y8
Tel: (519) 725-3555
Attention: Mr Jason Legacy, P.Eng.

PART 2 PRODUCTS

3.1 Not Used

.1 Not used

PART 3 EXECUTION

3.2 Not Used

.1 Not used

End of Section

PART 1 GENERAL

1.1 Section Includes

.1 Alternatives

1.2 References

.1 Canadian Construction Documents Committee (CCDC)
  .1 CCDC 23-2018 A Guide to Calling Bids and Awarding Contracts.

1.3 Requirements

.1 Referenced specification Sections stipulate pertinent requirements for products and methods to achieve Work stipulated under each Alternative.

.2 Co-ordinate affected related Work and modify surrounding Work to integrate Work under each Alternative.

1.4 Substitution of Materials Prior to Bid Closing

.1 Where products or systems have been specified by trade name, no substitution will be allowed except where alternatives have been approved by the Consultant prior to bid closing.

.2 Where a specified product or system is not available at the time of bid, the bidder must inform the Consultant in writing so that they may advise all bidders of proposed changes. In the event that the Bidder fails to do so, the Consultant will choose a substitute product suitable for the application at the time of construction.

1.5 Request for Approval of Alternates

.1 Contractors and suppliers of products or systems that have not been specified may apply for approval of their product or system as an "alternative".

.2 Requests for approval must reach the Consultant at least five working days prior to the bid closing. The Consultant will advise applicants of the status of their request two working days prior to bid closing.

.3 Request for approval shall include sufficient information for the Consultant to satisfactorily review the alternative. This may include the following:
  .1 Project name and number.
  .2 Specification sections to which the product or system applies.
  .3 Description of proposed substitution, including manufacturer's material specifications, manufacturer's preparation and application requirements and manufacturer's warranties.
  .4 Sample of product indicating surface finish and material thickness to be applied under this Contract.
  .5 Installation history of proposed alternative including:
    .1 projects and locations
    .2 approximate value of contract
    .3 approximate size of projects
    .4 number of years in use
    .5 type of usage
    .6 name of owner and consultant involved.

.4 When submitting alternatives to specified materials or equipment, Bidders shall include in their Bid any changes in the Work required to accommodate the alternatives. A later claim for an addition to the Contract Price due to changes in the Work that are necessitated by the use of the alternatives will not be considered.

1.6 Approval of Alternates

.1 An addendum will be issued prior to bid closing if an alternative is approved. No alternative materials or equipment will be considered after bid closing.

.2 Products or systems that have been approved as alternatives may be substituted for specified products and systems as outlined in the addendum.

.3 When substitution of any proposed alternative into the work, either in whole or in part, affects other parts of the work, the Contractor shall assume full responsibility and bear the associated costs. The Contractor will also be responsible for paying for any drawing changes required as a result of the substitution.

.4 Cost savings arising from approved alternative products or systems are to be credited to the Contract and the Contract Price will be adjusted accordingly.

.5 The Consultant reserves the right to reject any or all requests for approval.

.6 No substitutions will be permitted without the approval of the Consultant in the form of an addendum.

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 Requests for Substitution (RFS) prior to execution of Contract.
.2 Requests for Substitution (RFS) after execution of Contract.

1.2 Definitions

.1 Products Not Available: When all listed manufacturers products in the specification section are no longer manufactured.

.2 Proprietary Specification: a specification which includes one or more proprietary names of products or manufacturers, or both, and may also include descriptive, reference standard, or performance requirements, or any combination thereof.

.3 Non-proprietary Specification: a specification which includes descriptive, reference standard or performance requirements, or any combination thereof, but does not include proprietary names of products or manufacturers.

.4 Substitution: a product or manufacturer not specified by proprietary name, which may be acceptable in place of a product or manufacturer which, is specified by proprietary name.

1.3 Procedures

.1 Product Options:
  .1 For products specified by non-proprietary specification:
    .1 Select any product by any manufacturer, which meets requirements of Contract Documents.
  .2 For products specified by proprietary specification:
    .1 Select any product or manufacturer named, or
    .2 Substitute an unnamed product or manufacturer in accordance with Substitutions – Manufacturers article of this Section.
  .3 For products specified by proprietary specification and accompanied by words indicating that substitutions will not be accepted:
    .1 Select any product or manufacturer named; substitutions are not permitted.

.2 Substitution Requests Prior to Execution of Contract: Submit substitutions requests to Consultant no later than the time stated in the Instructions to Bidders.

1.4 Substitutions – Products

.1 Substitute Products: Where substitute products are permitted, unnamed products may be accepted by the Consultant, subject to the following:
  .1 Substitute products shall be the same type as, be capable of performing the same functions as, and meet or exceed the standards of quality and performance of the specified products.
  .2 Substitutions for Cause: Changes proposed by Subcontractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
  .3 Substitutions for Convenience: Changes proposed by Subcontractor or Contractor that are not required in order to meet other Project requirements but may offer advantage to Contractor or Subcontractor.

1.5 Substitutions – Manufacturers

.1 Substitute Manufacturers: Where substitute manufacturers are permitted, unnamed manufacturers will be accepted by the Consultant, subject to the following:
  .1 Substitute manufacturers shall have capabilities comparable to those of the named manufacturers.
  .2 In making a substitution Contractor and the Subcontractor represents that they have:
    .1 Investigated substitute product or manufacturer, or both, and determined it meets or exceeds the criteria of the specified product, and;
    .2 Will provide the same warranty for the Substitution as for the specified product.
    .3 Will make any changes to the Work necessitated by substitution as required for Work to be complete in all respects, and;
    .4 Waives claims for additional costs and time caused by substitution which may subsequently become apparent.
    .5 Will reimburse Consultant's services for review or redesign, additional studies, investigations, review of submittals, and associated contract administration.
    .6 Received necessary approvals of authorities having jurisdiction.
    .7 Investigated the proposed substitute to determine if license fees and royalties are pending.
    .8 If accepted, the substitution will not adversely affect the Construction Schedule.
  .3 Do not install requested Substitutions without Consultant's acceptance.
  .4 If, in the Consultant's opinion, a substitution does not meet requirements of Contract Documents, Contractor shall, at no extra cost to Owner, provide a product which, in the Consultant's opinion, does meet requirements of Contract Documents.

1.6 Proprietary Specifications

.1 Notwithstanding specified proprietary names of either or both products or manufacturers, products provided shall meet other applicable requirements of Contract Documents. Modify products if necessary, to ensure compliance with all requirements of Contract Documents.

1.7 Changes to Accepted Products and Manufacturers

.1 Products and manufacturers accepted by the Consultant for use in performance of Work of Contract shall not be changed without Consultant's written consent. .

.2 Submit requests to change accepted products and manufacturers to Consultant in writing, including product data indicated in Product Data article.

1.8 Product Data

.1 When requested by the Consultant, submit complete data substantiating compliance of a product with requirements of Contract Documents. Include the following:
  .1 Product identification, including manufacturer's name and address.
  .2 Manufacturer's literature providing product descriptions, applicable reference standards, performance and test data, in form consistent with the Contract Documents and readily comparable with product being substituted and can provide the specified and indicated requirements.
  .3 Samples, as applicable.
  .4 Name and address of projects on which product has been used and date of each installation.
  .5 Itemized comparison of substitution with named product(s). List significant variations.
  .6 Designation of availability of maintenance services and sources of replacement materials
  .7 Completed Substitutions Request Form. Incomplete forms will be rejected.

1.9 Consultant Procedure

.1 In reviewing the supporting data submitted for substitutions, Consultant will use, for purposes of comparison, all the characteristics of the specified material or equipment as they appear in the manufacturer's published data even though all the characteristics may not have been particularly mentioned in the Specifications.

.2 Consultant will review supporting data and will determine that the substitution in the Consultant's opinion is or is not able to meet or exceed the standards of quality, appearance and performance to the material specified.

.3 Consultant will sign, date and issue the RFS indicating acceptance or refusal, with applicable pre-contract or contract documentation, to affected participants.

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 Requests for Information.
.2 Submittal Procedures.
.3 Screening of RFI's.
.4 Response to RFI's.
.5 Response Timing.

1.2 Request for Information (RFI)

.1 A request for information (RFI) is a formal process used during the Work to obtain an interpretation of the Contract Documents or to obtain additional information.

.2 An RFI shall not constitute notice of claim for a delay.

1.3 Submittal Procedures

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Number RFI's consecutively in one sequence in order submitted, in numbering system as established by the Contractor.

.3 Submit one distinct subject per RFI form. Do not combine unrelated items on one form.

.4 RFI Form:
  .1 Submit a draft "Request for Information" form to be approved by the Owner and Consultant.
  .2 Submit RFI's to the Consultant on approved "Request for Information" form. The Consultant shall not respond to an RFI except as submitted on this form.
  .3 Where RFI form does not have sufficient space to provide complete information thereon, attach additional sheets as required.
  .4 Submit with RFI form all necessary supporting documentation.

.5 RFI Log:
  .1 Maintain log of RFI's sent to and responses received from the Consultant, complete with corresponding dates.
  .2 Submit updated log of RFI's at each construction meeting.

.6 Submit RFI's sufficiently in advance of affected parts of the Work so as not to cause delay in the performance of the Work. Costs resulting from failure to do so will not be paid by the Owner.

.7 Only the Contractor shall submit RFI's to the Consultant.

.8 RFI's submitted by Subcontractors or Suppliers directly to the Consultant will not be accepted.

1.4 Screening of RFI's

.1 Contractor shall satisfy itself that an RFI is warranted by undertaking a thorough review of the Contract Documents to determine that the claim, dispute, or other matters in question relating to the performance of the Work or the Interpretation of the Contract Documents cannot be resolved by direct reference to the Contract Documents. Contractor shall describe in detail this review on the RFI form as part of the RFI submission. RFI submittals that lack such detailed review

description, or where the detail provided is, in the opinion of the Consultant, insufficient, shall not be reviewed by the Consultant and shall be rejected.

1.5 Response to RFI's

.1 Consultant shall review RFI's from the Contractor submitted in accordance with this section with the following understandings:
  .1 Consultant's response shall not be considered as a Change Order or Change Directive, nor does it authorize changes in the Contract Price or Contract Time or changes in the Work.
  .2 Only the Consultant shall respond to RFI's. Responses to RFI's received from entities other than the Consultant shall not be considered.

1.6 Response Timing

.1 Allow 5 Working Days for review of each RFI by the Consultant.

.2 Consultant's review of RFI commences on date of receipt of RFI submission by the Consultant from Contractor and extends to date RFI returned by Consultant.

.3 When the RFI submission is received by Consultant before noon, review period commences that day. When RFI submittal is received by Consultant after noon, review period begins on the next Working Day.

.4 If, at any time, the Contractor submits a large enough number of RFI's or the Consultant considers the RFI to be of such complexity that the Consultant cannot process these RFI's within 5 Working Days, the Consultant will confer with the Contractor within 3 Working Days of receipt of such RFI's, and the Consultant and the Contractor will jointly prepare an estimate of the time necessary for processing same as well as an order of priority among the RFI's submitted. The Contractor shall accommodate such necessary time at no increase in the Contract Time and at no additional cost to the Owner.

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 Preconstruction Conference
.2 Project Meetings
.3 On Site Documents
.4 Cost Breakdown

1.2 Preconstruction Conference

.1 The Consultant will call for and administer a Preconstruction Conference at time and place to be announced.

.2 Contractor, all major Subcontractors, and major suppliers shall attend the Preconstruction Conference.

.3 Agenda will include, but not be limited to, the following items.
.1 Lines of communication and contact information
.2 Submittal and RFI procedures
.3 Schedules
.4 Personnel and vehicle permit procedures
.5 Use of premises
.6 Location of any Contractor on-site facilities
.7 Security
.8 Housekeeping
.9 Inspection and testing procedures, on-Site and off-Site
.10 Control and reference point survey procedures
.11 Health and safety
.12 Contractor's Schedule of Values
.13 Contractor's Schedule of Submittals

.4 The Consultant will distribute copies of minutes to attendees. Attendees shall have seven days to submit comments or additions to minutes. Minutes will constitute final documentation of results of Preconstruction Conference.

1.3 Project Meetings

.1 The Contractor will arrange project meetings and assume responsibility for setting times and recording and distributing minutes.

.2 Meetings will be held minimum bi-weekly.

1.4 On-Site Documents

.1 Maintain at job site, one copy each of the following:
.1 Contract drawings.
.2 Specifications.
.3 Addenda.
.4 Reviewed shop drawings.
.5 Requests for Information (RFI's)
.6 Change orders.
.7 Other modifications to Contract.
.8 Field test reports.

.9 Geotechnical reports
.10 DSS reports
.11 Approved Work schedule.
.12 Manufacturers' installation and application instructions.
.13 Safety Data Sheets (SDS).
.14 Health and Safety Plan and other safety related documents.
.15 Other documents as specified.

1.5 Cost Breakdown

.1 Submit a detailed cost breakdown to Consultant at least ten working days prior to the submission of the first progress claim. After approval by Consultant the cost breakdown will be used as basis for progress payment.

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 Submittals.
.2 Schedules.
.3 Format.
.4 Submission.
.5 Critical Path Scheduling.
.6 Submittals Schedule.

1.2 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

1.3 Schedules Required

.1 Submit schedules as follows:
  .1 Construction Progress Schedule.
  .2 Submittal Schedule for Shop Drawings and Product Data.
  .3 Submittal Schedule for Samples.
  .4 Product Delivery Schedule.
  .5 Cash Allowance Schedule for purchasing Products or Services.
  .6 Shutdown or closure activity.

1.4 Format

.1 Prepare schedule in form of a horizontal bar chart using Microsoft Project 2016 or later.

.2 Provide a separate bar for each major item of work, trade or operation.

.3 Split horizontally for projected and actual performance.

.4 Provide horizontal time scale identifying first work day of each week.

.5 Format for listings: chronological order of start of each item of work.

.6 Identification of listings: By Systems description.

1.5 Submission

.1 Submit initial format of schedules within 10 working days after award of Contract.

.2 Submit schedules in electronic format, by email as PDF files.

.3 Consultant will review schedule and return reviewed copy within 10 days after receipt.

.4 Resubmit finalized schedule within 7 days after return of reviewed copy.

.5 During progress of Work revise and resubmit schedule as directed by Consultant.

.6 Submit revised progress schedule with each application for payment.

.7 Distribute copies of revised schedule to:
.1 Job site office.
.2 Subcontractors.
.3 Other concerned parties.
.4 Instruct recipients to report to Contractor within 10 days, any problems anticipated by timetable shown in schedule.

.8 Table current and up to date schedule at each regular site meeting.

1.6 Critical Path Scheduling

.1 Include complete sequence of construction activities.

.2 Schedules shall represent a practical plan to complete the work within the Contract period, and shall convey the plan to execute the work. Schedules as developed shall show the sequence and interdependencies of activities required for complete performance of the work.

.3 The submittal of schedules shall be understood to be the Contractor's representation that the schedule meets the requirements of the Contract Documents and that the work will be executed in the sequence and duration indicated in the schedule.

.4 Failure to include any element of work required for performance of the Contract or failure to properly sequence the work shall not excuse the Contractor from completing all work within the Contract Time.

.5 All schedules shall be developed utilizing industry standard 'best practices' including, but not limited to:
.1 No open-ended activities.
.2 No use of constraints other than those defined in the Contract Documents without the prior approval of the Consultant.
.3 No negative leads or lags.
.4 No excessive leads or lags without prior justification and approval from the Consultant.
.5 For individual schedule construction activities, do not exceed 14 days in duration without prior approval of the Consultant. Subdivide activities exceeding 14 days in duration to an appropriate level.
.6 Sufficiently describe schedule activities to include what is to be accomplished in each work area. Express activity durations in whole days. Clearly define work that is to be performed by subcontract.
.7 Create the schedule in conformance with the work-hours and constraints set forth in these Contract Documents.

.6 Include dates for commencement and completion of each major element of construction.

.7 Show projected percentage of completion of each item as of first day of month.

.8 Indicate progress of each activity to date of submission schedule.

.9 Show changes occurring since previous submission of schedule:
.1 Major changes in scope.
.2 Activities modified since previous submission.
.3 Revised projections of progress and completion.
.4 Other identifiable changes.

.10 Provide a narrative report to define:
- .1 Problem areas, anticipated delays, and impact on schedule.
- .2 Corrective action recommended and its effect.
- .3 Effect of changes on schedules of other prime contractors.

1.7 Submittals Schedule

.1 Include schedule for submitting shop drawings, product data, and samples. Indicate manufacture and delivery lead times into the shop drawing submittal schedule.

.2 Indicate dates for submitting, review time, resubmission time, and last date for meeting fabrication schedule.

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 Documentation.

1.2 Construction Documentation

.1 This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
.1 Daily construction reports.
.2 Material location reports.
.3 Field condition reports.
.4 Special reports.

1.3 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Field Condition Reports: Submit at time of discovery of differing conditions.

.3 Special Reports: Submit at time of occurrence.

1.4 Coordination

.1 Coordinate preparation and processing of reports with performance of construction activities and with reporting of separate Contractors.

1.5 Reports

.1 Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project Site:
.1 List of Subcontractors at Project Site.
.2 Approximate count of personnel at Project Site.
.3 Equipment at Project Site.
.4 Material deliveries.
.5 High and low temperatures and general weather conditions.
.6 Accidents.
.7 Meetings and significant decisions.
.8 Stoppages, delays, shortages, and losses.
.9 Meter readings and similar recordings.
.10 Emergency procedures.
.11 Orders and requests of authorities having jurisdiction.
.12 Change Orders received and implemented.
.13 Work Change Directives received and implemented.
.14 Clarifications requested, received, and implemented.
.15 Services connected and disconnected.
.16 Equipment or system tests and startups.

.2 Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project Site. List shall be cumulative, showing materials

previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project Site.

.3 Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a request for interpretation. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

1.6 Special Reports

.1 Prepare Coordination Memoranda for distribution to each Contractor involved outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings. Provide copy to the Consultant.

.2 Prepare similar memoranda for the Owner and separate Contractors where coordination of their Work is required. All such memoranda must be directed through the Consultant.

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 Administrative
.2 Requests for Information
.3 Shop Drawings and Product Data
.4 Interference Drawings
.5 Progress Photographs
.6 Samples
.7 Mock-Ups
.8 Certificates and Transcripts

1.2 Administrative

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

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

.3 Present shop drawings, product data, samples and mock-ups in metric units.

.4 Where items or information is not produced in metric units converted values are acceptable.

.5 Verify field measurements and affected adjacent work are coordinated.

.6 Contractor's responsibility for errors and omissions in submission is not relieved by Consultant's review.

.7 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Consultant’s review.

.8 Keep one reviewed copy of each submission on site.

1.3 Requests for Information (RFI’s)

.1 Refer to Section 01 26 15 – Requests for Information

1.4 Shop Drawings and Product Data

.1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures, product data and other data which the Contractor provides to illustrate details of a portion of Work.

.2 Coordinate each submission with requirements of Work and Contract Documents. Individual submissions will not be reviewed until all related information is available.

.3 Submit shop drawings bearing stamp and signature of qualified professional Engineer registered or licensed in the Province of Ontario where required by the individual specification sections. Each submittal and each resubmittal must bear the stamp of the Engineer

.4 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where

articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

.5 Prior to submission to Consultant, review all submitted drawings. By this review, Contractor represents to have determined and verified field measurements, site conditions, materials, catalogue number and similar data and to have checked and coordinated each drawing with the requirements of Work and of Contract Documents. Contractor's review of each drawing shall be indicated by stamp, date and signature of a responsible person.

.6 At time of submission, notify Consultant in writing of any deviations in drawings from the requirements of the Contract Documents.

.7 Allow ten days for Consultant's review of each submission.

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

.9 Make any changes in submitted drawings which Consultant may require, consistent with Contract Documents and resubmit unless otherwise directed by Consultant. When resubmitting, notify Consultant in writing of any revisions other than those requested by Consultant.

.10 Accompany submissions with transmittal letter containing:
- .1 Date.
- .2 Project title and number.
- .3 Contractor's name and address.
- .4 Identification and quantity of each shop drawing, product data and sample.
- .5 Other pertinent data.

.11 Submissions shall include:
- .1 Date and revision dates.
- .2 Project title and number.
- .3 Name and address of:
  - .1 Subcontractor.
  - .2 Supplier.
  - .3 Manufacturer.
- .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
- .5 Details of appropriate portions of Work as applicable:
  - .1 Fabrication.
  - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
  - .3 Setting or erection details.
  - .4 Capacities.
  - .5 Performance characteristics.
  - .6 Standards.
  - .7 Operating weight.
  - .8 Wiring diagrams.
  - .9 Single line and schematic diagrams.
  - .10 Relationship to adjacent work.

.12 After Consultant's review, distribute copies.

.13 Submit one electronic copy in PDF format of shop drawings for each requirement requested in specification Sections and as Consultant may reasonably request.

.14 Submit electronic copy in PDF format of product data sheets or brochures for requirements requested in Specification Sections and as requested by Consultant where shop drawings will not be prepared due to standardized manufacture of product.

.15 Delete information not applicable to project.

.16 Supplement standard information to provide details applicable to project.

.17 If upon review by Consultant, no errors or omissions are discovered or if only minor corrections are made, copies will be returned, and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

.18 The review of shop drawings by the Consultant is for sole purpose of ascertaining conformance with general concept.
- .1 This review shall not mean that the Consultant approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.
- .2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

1.5 Interference Drawings

.1 Prepare interference drawings to coordinate the installation of the work of all sections, within available space. Conflicts between trades which could be determined beforehand, by the careful coordination and preparation of interference drawings, shall be corrected at no expense to the Owner.

.2 Prepare interference drawings of all buried services as necessary to avoid conflicts with new or existing structures, foundations or services.

.3 Submit interference and equipment placing drawings as specified in Section 01 71 00, when requested by the Consultant.

1.6 Progress Photographs

.1 Progress photograph to be electronically formatted and labelled as to location and view.

1.7 Samples

.1 Submit for review samples as requested in respective specification Sections. Label samples with origin, manufacturer, product information, applicable specification section, and intended use.

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

.3 Where colour, pattern or texture is criterion, submit full range of manufacturer’s samples.

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

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

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

1.8 Mock-Ups

.1 Erect mock-ups in accordance with 01 45 00 - Quality Control.

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 Administrative
.2 Fires
.3 Disposal of Wastes
.4 Drainage
.5 Site Clearing and Plant Protection
.6 Pollution Control
.7 Unanticipated Soil Contamination

1.2 References

.1 Statutes of Canada 1999 Chapter 33.
  .1 Canadian Environmental Protection Act 1999.
  .2 SOR/2003-289. Federal Halocarbon Regulations, 2003.
  .3 Transportation of Dangerous Goods Act, 1992 (1992, c. 34)
.2 OPSS 805 “Construction Specification for Temporary Erosion and Sediment Control Measures”.
.3 Province of Ontario Environmental Protection Act, R.S.O. 1990, c. E.19
.4 Ontario Regulation O Reg 406/19 On-Site and Excess Soil Management

1.3 Administrative

.1 Comply with all federal, provincial, and municipal regulatory requirements and guidelines for environmental protection and natural resource conservation, including those referenced above.

.2 Failure to comply with environmental requirements may result in a stop work order or assessment of damages commensurate with repair of damage.

.3 It is the Contractor’s responsibility to be aware of environmental requirements and the best management practices and pollution control measures necessary to meet them.

.4 It is the Contractor’s responsibility to obtain and abide by permits, licenses and compliance certificates at appropriate times and frequencies as required by the authorities having jurisdiction.

.5 All hazardous materials are to be stored with secondary containment

1.4 Fires

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

1.5 Disposal of Wastes

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

1.6 Drainage

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

.2 Do not pump water containing deleterious substances into waterways, sewer or drainage systems.

.3 Protect storm drains against entry by sediment, debris, oil, or chemicals.
.4 Control disposal or runoff of water containing deleterious substances or other harmful substances in accordance with local authority requirements.

1.7 Site Clearing and Plant Protection

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

.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.

.4 Restrict tree removal to areas indicated.

.5 Prevent unnecessary disturbance of topsoil and underlying soil from vehicles and heavy equipment.

.6 Minimize stripping of topsoil and vegetation.

.7 Comply with the requirements of Ontario Regulation O. REG 406/19, “On-Site and Excess Soil Management”, for the importation of new soils and fill materials and the exportation, removal and disposal off-site, of excavated materials. Complete testing of imported and exported materials as required. Unless noted elsewhere, costs for such testing is the responsibility of the contractor and is not included in any allowances. Maintain and submit to authorities having jurisdiction all required test reports, certificates and documentation.

1.8 Pollution Control

.1 Maintain, inspect, and repair temporary erosion and pollution control features installed under this contract on a weekly basis. Submit inspection logs to the Owner when requested.

.2 Control emissions from equipment and plant to conform to federal, provincial, and municipal requirements.

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

.4 Take all measures necessary to prevent material and mud tracking on adjacent roads and streets.

.5 Use mechanical sweepers as often as necessary to keep adjacent roads and streets clean of material and mud that is deposited from this project.

.6 On site disposal or clean out of concrete trucks is not permitted. Any spillage of concrete onto asphalt or other surfaces must be cleaned up before spillage sets.

1.9 Unanticipated Soil Contamination

.1 Should unanticipated soil contamination be discovered:
  .1 Stop work and assess the situation for safety.
  .2 If situation does not appear to be safe, evacuate workers from area.
  .3 If safe to do so, take immediate steps to control any spread of contamination, in accordance

with Contractor's spill prevention and response plan.

.4 Immediately contact the Consultant.

.2 Removal and disposal off site of contaminated materials shall comply with the requirements of Ontario Regulation O Reg 406/19 On-Site and Excess Soil Management.

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 References
.2 Owner's Regulations
.3 Standards and Definitions
.4 Designated Substances
.5 Hazardous Materials
.6 Spills Reporting
.7 Protection of Water Quality
.8 Potable Water Systems
.9 Soils Management
.10 Access for Inspection and Testing
.11 Other Regulatory Requirements

1.2 References

.1 Perform Work in accordance with Ontario Building Code (OBC), National Fire Code of Canada (NFC), the Canadian Electrical Code CSA C22.1:21, including all Supplements and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.

.2 Where a material is designated in the Contract Documents for a certain application, unless otherwise specified, that material shall conform to standards designated in the Code. Similarly, unless otherwise specified, installation methods and standards of workmanship shall also conform to standards invoked by the aforementioned Code.

.3 Meet or exceed requirements of:
.1 Contract documents.
.2 Specified standards, codes and referenced documents.
.3 Manufacturer's instructions.

.4 Where requirements of Contract Documents exceed Code requirements provide such additional requirements.

.5 Where the Building Code or the Contract Documents do not provide all information necessary for complete installation of an item, then the manufacturer's instructions for first quality workmanship shall be strictly complied with.

1.3 Owner's Regulations

.1 Conform to requirements, regulations and procedures of the Owner.

1.4 Standards and Definitions

.1 Where a reference is made to specification standards produced by various organizations and agencies, conform to latest edition of standards, as amended and revised to date of Contract.

.2 Have a copy of each specified standard which relates to your work available on the site to be produced immediately on Consultant's request.

1.5 Designated Substances

.1 Known designated substances are identified in the Designated Substance Report provided by the Owner.

.2 Stop work immediately when material resembling asbestos, mould or any other designated substance which is not identified in the Designated Substance Report is encountered during the course of the work. Notify Owner and Consultant immediately.

.3 The Owner will arrange for independent testing of suspected designated substances and removal of such substances encountered on the site during the course of the work which are not identified in the Designated Substance Report.

1.6 Hazardous Materials

.1 Definition: "Hazardous Material" is material, in any form, which by its nature, may be flammable, explosive, irritating, corrosive, poisonous, or may react violently with other materials, if used, handled or stored improperly. Included are substances prohibited, restricted, designated or otherwise controlled by law.

.2 Provide SDS for all materials brought to the Place of Work.

.3 Hazardous Materials will not be introduced for experimental or any other use prior to being evaluated for hazards.

.4 Make known to the Consultant those hazardous materials or designated substances intended to be used in the workplace and receive permission to use before introducing to the Owner’s property.

.5 Many common construction materials such as asbestos pipe and various insulations are designated substances and shall not be used under any circumstances.

1.7 Spills Reporting

.1 Spills or discharges of pollutants or contaminants under the control of the Contractor, and spills or discharges of pollutants or contaminants that are a result of the Contractor's operations that cause or are likely to cause adverse effects shall forthwith be reported to the Consultant. Such spills or discharges and their adverse effects shall be as defined in the Environmental Protection Act R.S.O. 1999.

.2 All spills or discharges of liquid, other than accumulated rain water, from luminaries, internally illuminated signs, lamps, and liquid type transformers under the control of the Contractor, and all spills or discharges from this equipment that are a result of the Contractor's operations shall, unless otherwise indicated in the Contract, be assumed to contain PCB's and shall forthwith be reported to the Consultant.

.3 This reporting will not relieve the Contractor of his legislated responsibilities regarding such spills or discharges.

1.8 Protection of Water Quality

.1 No waste or surplus organic material including topsoil is to be stored or disposed of within 30 metres of any watercourses. Run-off from excavation piles will not be permitted to drain directly into watercourses. Where this measure is not sufficient or feasible to control sediment entering the watercourses, sedimentation traps or geo-textile coverage will be required.

.2 If de-watering is required, the water shall be pumped into a sedimentation pond or diffused onto vegetated areas a minimum of 30 metres from any watercourses and not pumped directly into the

watercourses.

.3 Provide all de-watering and sedimentation control required to properly complete the work of this contract.

.4 Supply, install and maintain silt/sediment control fencing along the edge of the site to intercept construction runoff silt, to the satisfaction of the Owner.

1.9 Potable Water Systems

.1 Potable water systems in completed buildings must meet criteria and guidelines established by Provincial and Municipal authorities, prior to occupancy by the Owner.

.2 Upon completion, submit testing certificates verifying water quality and water systems meets all applicable Provincial and Legislated Standards

1.10 Soils Management

.1 Comply with the requirements of Ontario Regulation O. REG 406/19, “On-Site and Excess Soil Management”, for the importation of new soils and fill materials and the exportation, removal and disposal off-site, of excavated materials. Complete testing of imported and exported materials as required. Unless noted elsewhere, costs for such testing is the responsibility of the contractor and is not included in any allowances. Maintain and submit to authorities having jurisdiction all required test reports, certificates and documentation.

1.11 Access for Inspection and Testing

.1 Cooperate fully with and provide assistance to, all outside authorities including Building Inspectors, utilities, testing agencies and consultants, with the inspection of the Work.

1.12 Other Regulatory Requirements

.1 Conform to the requirements of the Ontario Ministry of Transportation, Regional and Local authorities regarding transportation of materials.

.2 Obtain required road occupancy permits.

.3 Pay any required roadway damage deposits required by the local municipality.

.4 Conform to the requirements of the Ontario Ministry of the Environment.

.5 Conform to the requirements of the Ontario Ministry of Labour.

.6 Conform to the requirements of the local Conservation Authority.

.7 Conform to all applicable local by-laws, regulations and ordinances.

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
.2 Independent Inspection Agencies.
.3 Access to Work
.4 Procedures
.5 Rejected Work
.6 Reports
.7 Contractors Responsibilities
.8 Tests and Mix Designs
.9 Mock-Ups
.10 Equipment and Systems.

1.2 Inspection

.1 Contractor is responsible for Quality Control (QC).

.2 Allow Owner and 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.

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

.4 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.

.5 Consultant will order 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. If such Work is found in accordance with Contract Documents, Owner shall pay cost of examination and replacement.

1.3 Independent Inspection Agencies

.1 Independent Inspection and Testing Agencies will be engaged by Contractor for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by the Contractor and paid from the cash allowances specified in Section 01 21 13. Refer to Section 01 29 83 - Payment Procedures for Testing Laboratory Services.

.2 Provide equipment required for executing inspection and testing by appointed agencies.

.3 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.

.4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Consultant at no cost to Owner. Pay costs for retesting and re-inspection.

1.4 Access to Work

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

plants.

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

1.5 Procedures

.1 Notify Owner and Consultant 48 hours 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 orderly sequence to not cause delays 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

1.6 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 work damaged by such removals or replacements promptly.

.3 If in opinion of Consultant it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Consultant will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by Consultant.

1.7 Reports

.1 Submit electronic .pdf format inspection and test reports to Consultant.

.2 Provide copies to Subcontractor of work being inspected or tested or manufacturer or fabricator of material being inspected or tested.

1.8 Contractors Responsibilities

.1 Be responsible for the execution of the Construction Quality Plan and is to pay all costs for the execution of the Construction Quality Plan. Designate an experienced site representative for carrying out the Construction Quality Plan.

.2 Provide the Owner with a completed quality product for the Work. Contractor shall be responsible for any costs associated with re-testing and reperforming the Work as a result of the Contractor's poor performance or workmanship or other failure to comply with the Contract Documents.

.3 All Work shall be done by persons qualified in their respective trades, and the workmanship shall be first-class in every respect. Contractor is responsible for ensuring employees are appropriately trained. All materials and equipment furnished shall be the best of their respective kinds for the intended use and unless otherwise specified, same shall be new and of the latest design.

.4 The Consultant will have the authority to reject Work that does not conform to the Contract Documents or may require special inspection or testing, whether or not such Work is to be then fabricated, installed or completed.

.5 Failure by a Contractor to conduct its operations, means and methods and coordinate proper sequencing of the Work may cause the Owner to withhold payment or any other means deemed necessary to correct non-conforming Work.

.6 The Owner shall engage a testing firm to perform such engineering laboratory services and on-site inspection as deemed necessary by the Owner. The testing firm will determine compliance with the requirements of the Contract Documents. This Work will not be a service to the Contractors for the performing of tests and checking of materials required of the Contractors.

.7 Copies of test and inspection reports will be furnished to the Contractor. The laboratory and its representatives will be instructed to promptly call to the attention of the Contractor, any instance of non-compliance with the requirements of the Contract Documents. Failure to so notify the Contractor shall not relieve the Contractor of any of its responsibilities for compliance or making good workmanship or materials which are not in compliance with the requirements of the Contract Documents. The agency shall notify the Consultant and the Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services

.8 Contractor's construction materials, procedures and work shall be subject to specified testing procedures and shall be in conformance with the Contract Documents as verified by Testing Agency.

.9 Cooperate with the testing firm and provide labor to assist with sample preparations where applicable.

.10 Except where specifically indicated to be provided by another entity as identified, inspections, tests, and similar quality control services including those specified to be performed by independent agency are the Contractor’s responsibility, and costs thereof are not to be included in contract sum.

.11 Cooperate with independent agencies performing required inspections, tests, and similar services. Provide auxiliary services as reasonably requested, including access to Work, the taking of samples or assistance with the taking of samples, delivery of samples to test laboratories, and security and protection for samples and test equipment at Project site.

.12 Coordination: Contractor and each engaged independent agency performing inspections, tests, and similar services for project are required to coordinate and sequence activities so as to accommodate required services with minimum delay of Work and without the need of removal/replacement of work to accommodate inspections and tests. Scheduling of times for inspections, tests, taking of samples, and similar activities is Contractor’s responsibility.

.13 Where sampling and testing is required for Sections of Work listed in the Contract Documents, the tests shall be performed by an independent testing lab and paid for by the Contractor.

.14 Test procedures to be used shall be submitted for approval of the Consultant where other than those specified are recommended by the testing agency.

.15 Testing Agency Duties: The independent Testing Agency engaged to perform inspections, sampling and testing of materials and construction specified in individual Specification Sections shall cooperate with the Owner, the Consultant and Contractors in performance of its duties, and shall provide qualified personnel to perform required inspections and tests.

.16 Contractor is responsible for scheduling times for inspections, tests, taking samples and similar activities.

1.9 Tests and Mix Designs

.1 Furnish test results and mix designs as requested.

1.10 Mockups

.1 Prepare mockups for Work specifically requested in specifications.

.2 Construct in locations acceptable to Consultant.

.3 Prepare mockups for Consultant's review with reasonable promptness and in orderly sequence, to not cause delays in Work.

.4 Failure to prepare mockups in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.

.5 Mock-ups may remain as part of Work unless indicated otherwise.

1.11 Equipment and Systems

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

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 Appointment and payment.
.2 Manufacturer's field review.

1.2 Related Sections

.1 Particular requirements for testing and inspection to be carried out by testing laboratory designated by the Consultant are specified under various sections of the specifications.

.2 Balancing and testing of systems under Divisions 21 through 28.

1.3 Appointment and Payment

.1 From time to time during the progress of the Work, the Owner will require that testing and inspection be performed to determine that materials provided in the Work meet the requirements of the Contract Documents.
  .1 Subcontractors shall verify with Contractor, in writing, portions of the Work that will require testing and/or inspection prior to commencing such affected work.

.2 The Owner will appoint testing and inspection companies, representing, reporting and responsible to the Owner. Cost of testing and inspection will be authorized as a disbursement of the Cash Allowances as specified in Section 01 21 13 unless otherwise indicated or specified and except for the following:
  .1 Testing and inspection required by laws, ordinances, rules, regulations or orders of public authorities.
  .2 Testing and inspection performed exclusively for Contractor's convenience.
  .3 Testing, adjusting and balancing of conveying systems, mechanical and electrical equipment and systems. Refer to mechanical specifications for in-contract air-balancing.
  .4 Mill tests and certificates of compliance.
  .5 Tests specified to be carried out by Contractor under supervision of the Consultant.
  .6 Where tests or inspections by designated testing laboratory reveal work not in accordance with the Contract requirements, Contractor shall pay costs for additional tests or inspections as Consultant may require to verify acceptability of corrected work.
  .7 Additional testing required because of changes in materials, proportions of mixes, requested by the Contractor or Subcontractors as well as any extra testing of materials occasioned by lack of identification or failure of such materials being replaced to meet requirements of the Contract Documents or testing of structure or elements including load testing, shall be ac carried out at no additional cost to the Owner.
  .8 Where evidence exists that defective workmanship has occurred or that the Work has been carried out incorporating defective materials, the Consultant reserves the right to have tests, inspections or surveys performed, analytical calculation of structural strength made and the like in order to help determine the extent of defect and whether such work must be replaced. Tests, inspections or surveys carried out under these s circumstances will be made at the Contractor's expense and will not be paid for by the Owner.
  .9 Testing and compliance letters specified in other Sections.

.3 Inspection and testing company shall submit monthly invoice original to the Contractor for review, relating invoices to tests and inspection reports. Provide original receipts for disbursements. Invoices will be forwarded by Contractor to the Consultant for inclusion in progress payment application.

.4 The Consultant will work with the Owner's representative and the Contactor's commissioning team to review the work of the Contract during closeout procedures. The Contractor shall be responsible to correct all deficiencies as reported by the Consultant and Owner's representative, and in accordance with the Contract documents. Refer to Sections 01 77 00 and 01 91 13 for additional closeout requirements.

.5 Testing and Inspection shall be performed by qualified and/or certified personnel under professional supervision or performed directly by a professional engineer qualified in conformance with applicable codes and certification programs.

.6 Requirements of regulatory agencies:
- .1 Testing shall be conducted in accordance with the requirements of the Building Code.
- .2 Obtain certification where required by the building code and standards.

.7 Cooperation with testing and inspection company.
- .1 Provide inspection company with materials and installation information as required or as requested.
- .2 Provide access to the work for representatives of the inspection and testing companies.
- .3 Provide storage on site for laboratory's exclusive use to store equipment and cure test samples.
- .4 Cooperate with testing and inspection companies and give adequate notification of any changes in source of supply, additional work shifts or other proposed changes.
- .5 No Product nor part of the Work shall be installed before it is tested when a test is specified or required, nor shall work be executed where a test or inspection is required and the inspector cannot attend. Pay costs for uncovering and making good work that is covered before required inspection or testing is completed and approved by the Consultant.
- .6 Cooperate in permitting access to the Work for testing and inspection company wherever Work is in progress, or wherever Products, materials or equipment are stored prior to shipping.
- .7 Supply labour required to assist testing and inspection company in sampling and making tests.
- .8 Repair work damaged as a result of testing and inspection work.
- .9 Costs of above labour and material shall be borne by applicable Subcontractors.
- .10 The testing and inspection service does not relieve the Contractor of responsibility for normal shop and site inspection, and quality control of production.
- .11 Pay costs for removal and replacement of Work, or for remedial measures necessitated by faulty workmanship and materials which fail to meet requirement specified.

.8 Prepare schedule for testing and inspection in accordance with Section 01 33 00 and as follows:
- .1 Establishing Schedule:
  - .1 By advance discussion with the selected testing laboratory, determine the time required by the laboratory to perform its tests and issue each of its findings.
  - .2 Allow required time within Construction Schedule
- .2 Adherence to Schedule:
  - .1 Contractor shall advise testing and inspection laboratory in advance when testing of the Work is required.
  - .2 When testing and inspection laboratory is ready to test according to predetermined schedule, but is prevented from testing or taking specimens due to incompleteness of the parts of the Work scheduled for testing and inspection, extra costs for testing attributable to the delay may be back-charged to the Contractor at no increase in the Contract Price.
- .3 Notify Contractor and inspection company at least 3 Working Days before work required to be inspected commences, and arrange for a meeting at the Place of the Work, to be held one Working day before the work starts with the following present:
  - .1 Contractor, a principal of the Sub-contractor whose work is to be inspected or tested,

testing and inspection company, manufacturer's res presentative and Consultant.

.4 Give 2 Working Days prior notice to inspection company of the commencement of each phase of the Work requiring inspection and provide inspection company with materials and installation information.

.9 Reports and Documents:

.1 Testing and Inspection companies shall submit shop inspection and site inspection reports within 5 Working days of each inspection.

.2 Distribute reports as follows:

.1 Owner.

.2 Consultant.

.3 Contractor.

.4 Consulting engineers as applicable.

.3 Inspectors shall submit a written report on each inspection or test, including pertinent data such as conditions at the Place of the Work, dates, test references, locations of tested materials, actual product identification, procedures and descriptions, site instructions given, recommendations and/or any other information required by standard applicable reporting of tests and inspections.

.4 Clearly indicate in report failure of Product or procedures to meet applicable standards, give recommendations for retesting or correction. Contact Consultant immediately when Product or procedure fails to meet applicable standards.

.5 Upon completion of those parts of the Work subject to independent testing and inspection, submit to the Consultant duplicate certificates of acceptance of the installation issued by independent testing and inspection company.

.10 Inspection and Test Specimens:

.1 Testing and inspection will generally consist of procedures listed in the following paragraphs, but additional tests may be performed as required to verify conformance to Contract Documents.

.2 Specimens and samples for testing, unless otherwise specified in the Contract Documents, will be taken by the testing laboratory; sampling equipment and personnel will be provided by the testing laboratory; and deliveries of specimens and samples to the testing laboratory will be performed by the testing laboratory.

.3 Testing and inspection company shall take samples necessary to verify quality as specified by applicable standards or as specified herein. Taking of samples shall not endanger the structure or life and shall be taken so as to best represent the Work as a whole.

.4 Samples shall be handled, packaged, stored and delivers so as to best ensure the validity of tests that will be performed on them. Sample handling where required shall duplicate conditions at the Place of the Work (such as site cured concrete cylinders).

1.4 Manufacturer's Field Review

.1 Where manufacturer's field review is specified, manufacturer's representative shall review the relevant parts of work at the Place of Work, or wherever such affected work is in progress, to end sure that work is being executed in accordance with manufacturer's written recommendations.

.2 Manufacturer's field review is to ensure that the Products specified are being used in the Work and are being applied on surfaces prepared in accordance with their recommendations and the requirements of the Contract Documents.

.3 Manufacturer's representative shall undertake such review weekly, or additionally as necessary, to determine that the work is in accordance with manufacturer's written recommendations.

.4 Manufacturer's representative shall submit a type written report on manufacturer's letterhead

within 2 Working Days after each field review. Report shall document manufacturer's representative's field observations and recommendations.

.5 Manufacturer's field review reports to be prepared and distributed following the procedures specified for pe reparation and submittal of testing and inspection reports given above.

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 Water Supply

.1 Existing sources of water can be made available to the Contractor at no charge, subject to operational requirements. Arrange for connection and pay all costs for installation, maintenance and removal. Conversions or alterations to existing sources of water to meet construction requirements are the responsibility of the Contractor.

.2 The points of delivery and limits on amount available will be determined on site by the Owner whose written permission must be obtained before any connection is made.

1.3 Temporary Heating and Ventilation

.1 Provide temporary heating required during construction period, including attendance, maintenance and fuel.

.2 Construction heaters used inside building must be vented to outside or be flameless type. Solid fuel salamanders are not permitted, unless prior approval is given by the Consultant.

.3 Provide temporary heat and ventilation in enclosed areas as required to:
- .1 Facilitate progress of Work.
- .2 Protect Work and products against dampness and cold.
- .3 Prevent moisture condensation on surfaces.
- .4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
- .5 Provide adequate ventilation to meet health regulations for safe working environment.

.4 Maintain temperatures of minimum 10° C in areas where construction is in progress.

.5 Ventilating:
- .1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
- .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
- .3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
- .4 Ventilate storage spaces containing hazardous or volatile materials.
- .5 Ventilate temporary sanitary facilities.
- .6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.

.6 Permanent heating system of building may not be used when available, unless there are savings to the Contract Price and Consultant's written permission is obtained stating conditions of use, provisions relating to guarantees on equipment and operation and maintenance of system. Be responsible for damage to heating system if use is permitted.

.7 On completion of Work for which permanent heating system is used, replace filters.

.8 Ensure Date of Substantial Performance and warranties for heating system do not commence until entire system is in as near original condition as possible and is certified by Consultant.

.9 Pay costs for maintaining temporary heat, when using permanent heating system. Owner will pay utility charges when temporary heat source is existing building equipment.

.10 Maintain strict supervision of operation of temporary heating and ventilating equipment to:
- .1 Conform to 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.

.11 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

1.4 Temporary Power and Light

.1 Existing sources of electric power can be made available to the Contractor. Conversions or alterations to existing sources of electric power to meet construction requirements are the responsibility of the Contractor.

.2 The points of delivery and limits on amount available will be determined on site by the Owner whose written permission must be obtained before any connection is made.

.3 Electrical power and lighting systems installed under this Contract may be used for construction requirements only with prior approval of Consultant provided that guarantees are not affected.

.4 Provide and maintain temporary lighting throughout project. Lighting levels shall be sufficient to complete work including inspections. Provide minimum lighting levels of 400 lux at work areas. Lighting levels at floors and stairs not within work areas shall be not less than 160 lux at all times during construction activity.

.5 All equipment used shall be CSA approved.

.6 Wiring and method of installation shall conform to local power requirements and shall be reviewed by a licensed inspector prior to use.

1.5 Temporary Communication Facilities

.1 Provide and pay for temporary telephone, fax, cellular data, lines and all equipment necessary for Contractor's own use.

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 Site storage.
.3 Construction parking
.4 Offices
.5 Equipment, tool and material storage.
.6 Sanitary facilities.
.7 Signage.
.8 Shoring

1.2 References

.1 CSA Group (CSA)
  .1 CAN/CSA Z321-96 (R2006) Signs and Symbols for the Workplace
  .2 CAN/CSA Z797-18 Code of Practice for Access Scaffold

1.3 Installation and Removal

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

.2 Remove from site all such work after use.

1.4 Scaffolding

.1 Scaffolding in accordance with CSA Z797.

.2 Provide and maintain scaffolding, ramps, ladders, swing staging, platforms and temporary stairs.

.3 Enclose and heat scaffolding during cold weather.

1.5 Hoisting

.1 Provide, operate and maintain hoists and cranes required for moving of workers, materials and equipment.

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

1.6 Site Storage/Loading

.1 Do not unreasonably encumber premises with products.

.2 Do not load or permit to load any part of Work with a weight or force that will endanger the Work.

1.7 Construction Parking

.1 Parking will be permitted on site at areas designated by the Owner provided it does not disrupt performance of Work or ongoing Owners operations.

.2 Provide and maintain adequate access to project site.

.3 If authorized to use existing roads for access to project site, maintain such roads for duration of

Contract and make good damage resulting from Contractors' use of roads.

1.8 Offices

.1 General Contractor and Subcontractors may provide their own offices as necessary and subject to site constraints. Owner will assign a designated area to serve as a temporary office space during the summer as allowed by school year scheduling.

1.9 Equipment, Tool and Material 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.

1.10 Construction Signage

.1 Direct requests for approval to erect a Contractor signboard to Consultant.

.2 Signs and notices for safety and instruction shall be in English. Graphic symbols shall conform to CAN/CSA Z321.

.3 Post "Construction Zone" signage outside barrier and entrance to all work areas.

.4 Maintain approved signs and notices in good condition for duration of project and dispose of off-site on completion of project.

.5 Install signage to direct site traffic and deliveries to the Construction work areas.

1.11 Shoring

.1 Examine the site to determine the conditions under which work will be performed.

.2 Contractor shall formulate his own conclusions as to the extent of the existing conditions and shoring required.

.3 The method of shoring shall be according to the Contractor's and his Engineer's directions.

.4 All existing loads must be shored prior to commencement of demolition and removal of load bearing elements.

.5 All shoring and frame braces must be supplied with a safe load rating which must not be exceeded. Install in accordance with manufacturer's recommended procedures and safety guidelines. Ensure that the safe load conditions of the shoring are not exceeded by dead, live or construction loads.

.6 All shoring shall be subject to the Consultant's review and approval prior to commencing demolition work.

.7 Completely remove all shoring after new structure is installed and all concrete is set.

.8 Submit shoring drawings and a proposed installation procedure stamped by a professional engineer registered in the Province of Ontario. Procedures shall follow the information provided

on these drawings. The shoring design engineer shall be retained and paid for by the Contractor. The shoring engineer shall review all existing conditions on site prior to completing shoring design.

.9 Removal of existing materials without proper engineered shoring is a safety hazard and will not be permitted.

.10 Make good all damage to the existing structure and adjoining structures and bear full responsibility for failure to provide adequate shoring.

.11 The failure or refusal of the Consultant to suggest the use of shoring, shall not in any way or to any extent relieve the Contractor of any responsibility concerning the condition of the work or of any of their obligations under the Contract, nor impose any liability on the Owner or their agents; nor shall any delay, whether caused by any action or want of action on the part of the Contractor, or by any act of the Owner, or their agents, or employees, relieve the Contractor from necessity of properly and adequately protecting the existing structure from collapse or damage, nor from and of his obligations under the Contract relating to injury to persons or property, nor entitle him to any claims for extra compensation or an extension in schedule.

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 Environmental Controls.
.3 Traffic Controls.
.4 Fire Routes.

1.2 Installation and Removal

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

.2 Remove from site all such work after use.

1.3 Site Fencing

.1 Contractor's lay-down area or designated by the Owner must be secure and there must be no access by unauthorized persons. Provide temporary fencing around whole work site. Use modular free-standing fencing: galvanized, minimum 1.8m high, chain link or welded steel mesh, pipe rail. Provide one lockable truck entrance gate and at least one pedestrian door as directed. Equip all gates with locks and keys. Maintain fence in good repair.

1.4 Hoarding

.1 Erect temporary site enclosure using modular freestanding fencing: galvanized, minimum 1.8 m high, chain link or welded steel mesh, pipe rail. Provide one lockable truck entrance gate and at least one pedestrian door as directed and conforming to applicable traffic restrictions on adjacent streets. Equip gates with locks and keys. Maintain fence in good repair.

1.5 Guard Rails and Barricades

.1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs and wherever else necessary to prevent accidental falls.

.2 Provide as required by governing authorities.

1.6 Traffic Barriers

.1 Where indicated, provide precast concrete barriers conforming to ASTM C825 - 19 Standard Specification for Precast Concrete Barriers.

.2 Provide sufficient barriers as necessary to protect the public and Owner from construction traffic.

.3 Remove barriers on completion.

1.7 Weather Enclosures

.1 Provide weather tight closures to unfinished door and window openings, tops of shafts and other openings in floors and roofs.

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

.3 Design enclosures to withstand wind pressure and snow loading.

1.8 Dust Tight Screens

.1 Provide dust tight screens or partitions to localize dust generating activities, and for protection of workers, finished areas of Work and public.

.2 Maintain and relocate protection until such work is complete.

1.9 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.

1.10 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 3 days prior to installation.

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

1.11 Protection of Surrounding Work

.1 Provide protection for finished and partially finished Work from damage.

.2 Provide necessary cover and protection.

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

1.12 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.

1.13 Fire Routes

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

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 Product quality, availability, storage, handling, protection, and transportation.
.2 Manufacturer's instructions.
.3 Quality of Work, coordination and fastenings.
.4 Dielectric Separation
.5 Tolerances for Execution of Work.
.6 Protection of Work in progress.
.7 Existing Utilities

1.2 Definition – Basis of Design

.1 Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.
  .1 Evaluation of Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. Manufacturer's published attributes and characteristics of basis-of-design product also establish salient characteristics of products for purposes of evaluating comparable products.

.2 Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:
  .1 Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.

.3 Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 01 33 00 -Submittal Procedures.

1.3 Quality

.1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality (compatible with specifications) for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.

.2 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.

.3 Should any dispute arise as to quality or fitness of products, decision rests strictly with Consultant based upon requirements of Contract Documents.

.4 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.

.5 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.4 Availability

.1 Review product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of products are foreseeable, notify Consultant of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

.2 In event of failure to notify Consultant at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Consultant reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

1.5 Storage, Handling and Protection

.1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.

.2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.

.3 Store products subject to damage from weather in weatherproof enclosures.

.4 Store cementitious products clear of earth or concrete floors, and away from walls.

.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.

.6 Store sheet materials and lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.

.7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.

.8 Remove and replace damaged products at own expense and to satisfaction of Consultant.

.9 Touch up damaged factory finished surfaces to Consultant's satisfaction. Use touch up materials to match original. Do not paint over name plates.

1.6 Transportation

.1 Pay costs of transportation of products required in performance of Work.

.2 Transportation cost of products supplied by Owner will be paid for by Owner. Contractor shall be responsible for the unloading, handling and storage of such products.

1.7 Manufacturer’s Instructions

.1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.

.2 Notify Consultant in writing, of conflicts between specifications and manufacturer's instructions, so that Consultant may establish course of action.

.3 Improper installation or erection of products, due to failure in complying with these requirements,

authorizes Consultant to require removal and re installation at no increase in Contract Price or Contract Time.

1.8 Quality of Work

.1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed.

.2 Immediately notify Consultant if required Work is such as to make it impractical to produce required results.

.3 Do not employ anyone unskilled in their required duties. Consultant reserves right to require dismissal from site, workers deemed incompetent or careless.

.4 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Consultant, whose decision is final.

1.9 Coordination

.1 Ensure cooperation of workers in laying out Work. Maintain efficient and continuous supervision.

.2 Be responsible for coordination and placement of openings, sleeves and accessories.

1.10 Concealment

.1 In finished areas, conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.

.2 Before installation, inform Consultant if there is interference. Install as directed by Consultant.

1.11 Remedial Work

.1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Coordinate adjacent affected Work as required.

.2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.12 Location of Fixtures

.1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.

.2 Inform Consultant of conflicting installation. Install as directed.

1.13 Fastenings

.1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.

.2 Prevent electrolytic action between dissimilar metals and materials.

.3 Use non corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.

.4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.

.5 Keep exposed fastenings to a minimum, space evenly and install neatly.

.6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

1.14 Fastenings – Equipment

.1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.

.2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.

.3 Bolts may not project more than one diameter beyond nuts.

.4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

1.15 Dielectric Separation

.1 Ensure that a dielectric separator is provided in a permanent manner over entire contact surfaces to prevent electrolytic action (galvanic corrosion) between dissimilar materials. Similarly, prevent corrosion to aluminum in contact with alkaline materials such as contained in cementitious materials.

1.16 Tolerances for Execution of Work

.1 Unless specifically indicated otherwise, Work shall be installed plumb, level, square and straight.

.2 Unless acceptable tolerances are otherwise specified in specification sections, or are otherwise required for proper functioning of equipment, site services and mechanical and electrical systems:
- .1 “Plumb and level” shall mean plumb or level within 1 mm in 1m.
- .2 “Square” shall mean not in excess of 10 seconds lesser or greater than 90 degrees.
- .3 “Straight” shall mean within 1 mm under a 1 m long straight edge.
- .4 “Flush” shall mean within:
  - .1 6 mm for exterior concrete, masonry and paving materials.
  - .2 1 mm for interior concrete, masonry, tile and similar surfaces.
  - .3 0.5 mm for other interior surfaces.

.3 Allowable tolerances shall not be cumulative

1.17 Protection of Work in Progress

.1 Adequately protect Work completed or in progress. Work damaged or defaced due to failure in providing such protection is to be removed and replaced, or repaired, as directed by Consultant, at no increase in Contract Price or Contract Time.

.2 Prevent overloading of any part of building. Do not cut, drill or sleeve any load bearing structural member, unless specifically indicated without written approval of the Consultant.

1.18 Existing Utilities

.1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, and/or building occupants and pedestrian and vehicular traffic.

.2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

1.19 Hazardous Materials

.1 Report any found or suspected hazardous materials to the Owner.

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 Safety Requirements
.2 Fire Protection
.3 Accident Reporting
.4 Records on Site

1.2 References

.1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations.
.2 Fire Commissioners of Canada, FC 301, Standard for Construction Operations.
.3 National Fire Protection Agency (NFPA)
  .1 NFPA 241 Standard for Safeguarding Construction, Alteration, and Demolition Operations
.4 Occupational Health and Safety Act.
  .1 R.R.O. 1990, Reg. 860: Workplace Hazardous Materials Information System (WHMIS)
  .2 O. Reg. 632/05: Confined Spaces
.5 Ontario Building Code.

1.3 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit to Owner and Consultant copies of the following documents, including updates issued:
  .1 Notice of Project filed with Provincial Ministry of Labour or equivalent for Place of Work
  .2 Site-specific Health and Safety Plan prior to commencement of work on the work site. Plan shall include but not be limited to the following:
    .1 Name and contact info of Contractor's Health and Safety Representative for Work Site; including twenty-four (24) hour emergency contact phone numbers.
    .2 Phone numbers of local fire, police, and ambulance outside of 911 services.
    .3 Location of nearest medical facility and level of injury that each can service.
  .3 Submit to the Owner, Consultant and Municipal Fire Department, for review, a “Fire Safety Plan” conforming to Section 2.14 of the National Fire Code of Canada. Maintain a copy of the “Fire Safety Plan” on site.
  .4 Copies of certification for all employees on site of applicable safety training including, but not limited to:
    .1 WHMIS.
    .2 Fall arrest and protection.
    .3 Suspended Access Equipment.
    .4 Erection of Scaffolding.
    .5 License for powder actuated devices.
  .5 On-site Contingency and Emergency Response Plan addressing:
    .1 Standard procedures to be implemented during emergency situations.
    .2 Preventative planning and protocols to address possible emergency situations.

.3 Guidelines for handling, storing, and disposing of hazardous materials that maybe encountered on site, including measures to prevent damage or injury in case of an accidental spill.

.4 Incident and accident reports, promptly if and upon occurrence
  .1 Reports or directions issued by authorities having jurisdiction, immediately upon issuance from that authority.
  .2 Accident or Incident Reports, within 24 hours of occurrence.

.5 Submit other data, information and documentation upon request by the Consultant as stipulated elsewhere in this section.

1.4 Compliance Requirements

.1 Comply with the latest edition of the Ontario Occupational Health and Safety Act, and the Regulations made pursuant to the Act.

1.5 Constructor

.1 Notify all regulatory bodies required for construction activities, (i.e., Notice of Project, employer notification, etc.). Notifications shall include, but not be limited to, the notification requirements laid out in OHSA Sec 51-53 and the requirements of Ontario Regulation 213/91 for Construction Projects, Sections 5, 6 and 7. For the purpose of this contract the Contractor shall be the "Constructor".

.2 The “Constructor” will be solely responsible for the safety of all persons on the Site.

1.6 Safety Requirements

.1 Observe and enforce all construction safety measures and comply with the latest edition and amending regulations of the following documents and in the event of any differences among those provisions, the most stringent shall apply:
.1 Occupational Health and Safety Act and Regulations for Construction Projects, August 1997, Ontario Regulation 213/91 including amendments.
.2 Hazardous Products Act and Canada Labour Code.
.3 The Workplace Safety and Insurance Board, O. Reg 454.
.4 Ontario Building Code Act, Ontario Regulation 332/12 including amendments.
.5 National Building Code of Canada, Part 8: Safety Measures on Construction and Demolition Sites.
.6 National Fire Code of Canada.
.7 NFPA 241 Standard for Safeguarding Construction, Alteration, and Demolition Operations, 2013 Edition
.8 Environmental Protection Act.
.9 The Power Commission Act.
.10 The Boiler and Pressure Vessels Act.
.11 The Elevators and Lifts Act.
.12 The Operating Engineer's Act.
.13 Municipal statutes.

.2 Obey all Federal, Provincial and Municipal Laws, Acts, Statutes, Regulations, Ordinances and By-laws which could in any way, pertain to the work outlined in the Contract, or to any employees of the Contractor. Satisfy all statutory requirements imposed by the Occupational Health and Safety Act and Regulations made thereunder, on a Contractor, and Constructor and/or Employer with respect to or arising out of the performance of the Contractors obligations under this Contract.

.3 Working at Heights: The supervisor of the project, will be responsible to ensure that his employees and subcontractors/suppliers have current Working at Heights and Fall Protection certification.

.4 The supervisor of the project will be responsible for his employees and subcontractors/suppliers maintaining standard safety practices, as well as the specific safety rules listed below, while working on the Owner’s property.

.5 The Owner reserves the right to order individuals to leave the site if the individual is in violation of any safety requirement or any Act. Any expense incurred will be the responsibility of the Contractor.
.6 Notify the Owner should any hazardous condition become apparent.

.7 Enforce the use of CSA approved hard hats, reflective vests and safety boots for all persons entering or working at the construction site. Refuse admission to those refusing to conform to this requirement.

.8 Provide safeguard and protection against accident, injury or damage to any person on the site, adjacent work areas and adjacent property.

1.7 Confined Space

.1 Confined Space: Where applicable, provide the Consultant and all Regulatory Authorities with a copy of the Contractors' Confined Space Entry Procedure. In the event that defined procedures are not available, abide by the applicable requirements of the Occupational Health and Safety Act and all regulations made thereunder.

.2 Persons intended to work in confined spaces, as defined by the Owner, must have formal training in performing work in confined spaces.

.3 Provide proof of valid certificates of such training for all workers prior to entry of such workers into confined spaces.

.4 Provide all necessary safety equipment for entry into confined spaces.

.5 Where workers are required to enter a confined space, as defined by the OHSA, O. Reg. 632/05 Section 221.2, ensure that workers of the Contractor and all Subcontractors follow the requirements of the above legislation, including but not limited to:
.1 Having a method for recognizing each confined space to which the program applies
.2 Having a method for assessing the hazards to which workers may be exposed
.3 Having a method for the development of confined space entry plans (which include on-site rescue procedures)
.4 Having a method for training workers
.5 Having an entry-permit system.
.6 Supply the necessary tools and equipment to perform the confined space entry. These items include, but are not limited to, required documentation, gas detectors, breathing equipment, fall protection and rescue equipment.

1.8 Safety Meetings

.1 Site toolbox safety meetings will be held weekly for all Contractor employees and all sub trade contractors.

.2 Where a Joint Health and Safety Committee is required on a project, workers and supervisors, selected, as members of the committee must attend.

1.9 Workplace Hazardous Materials Information System (WHMIS)

.1 Be familiar with WHIMIS regulations and be responsible for compliance.

.2 Provide to the Consultant a list of Designated Substances that will be brought to the site prior to

commencing work. Safety Data Sheets (SDS) and the hazardous material inventory for each substance listed must be kept on the Project.

.3 Be responsible for all other requirements of regulations as applicable to Employers.

.4 All controlled products to be properly labelled and stored.

.5 Immediately inform Owner and Consultant if any unforeseen or peculiar safety-related factor, hazard, or condition becomes evident during performance of Work.

1.10 Fire Protection

.1 Provide and maintain safeguard and protection against fire in accordance with current fire codes and regulations.

.2 Provide temporary fire protection throughout the course of construction. Particular attention shall be paid to the elimination of fire hazards.

.3 Comply with the requirements of FCC No. 301 Standards for Construction Operations issued by the Fire Commissioner of Canada and the National Building Code.

.4 Provide and maintain portable fire extinguishers during construction, in accordance with Part 6 of the National Fire Code of Canada 2015 and NFPA 241.

.5 Maintain unobstructed access for firefighting at all areas in accordance with the National Building Code of Canada.

1.11 First Aid

.1 Provide such equipment and medical facility as required by WSI Act to supply first aid services to anyone who may be injured at the place of Work. Report all accidents or injuries to the proper authorities and to the Owner and Consultant.

1.12 Accident Reporting

.1 Investigate and report incidents and accidents as required by Occupational Safety and Health Act, and the Regulations made pursuant to the Act.

1.13 Records on Site

.1 Maintain on site a copy of the safety documentation as specified in this Section and any other safety related reports and documents issued to or received from the authorities having jurisdiction.

.2 Upon request, make copies available to the Consultant.

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 Field Engineering survey services.
.2 Survey services to establish and confirm inverts for Work.
.3 Recording of subsurface conditions found.

1.2 References

.1 Owner's identification of existing survey control points and property limits.

1.3 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit name and address of Surveyor to Consultant.

.3 On request of Consultant, submit documentation to verify accuracy of field engineering work.

.4 Submit certificate signed by surveyor certifying and noting those elevations and locations of completed Work that conform and do not conform to Contract Documents.

1.4 Examination of Work and Site

.1 Examine the site and existing building to be fully informed of their particulars as related to the Work.

.2 Verify dimensions of completed Work in place before fabrication of Work to be incorporated with it. Ensure that all necessary job dimensions are taken for the proper execution of the work. Assume complete responsibility for the accuracy and completeness of such dimensions.

.3 No claims for extra payment will be paid for extra work made necessary or for difficulties encountered due to conditions of the site which were visible or reasonably inferable from an examination of the site at the time prior to tender closing date and furthermore, failure of the Contractor to visit and examine the site shall be deemed a waiver of all claims for extra payment due to any condition of the site existing prior to tender closing date.

.4 As-found damage: Record by photography and submit evidence to Consultant before commencing work, any found damaged surfaces or materials adjacent to new work, and not included under scope of this new work. Remedial work to any damage, not so recorded, shall be the responsibility of the Contractor.

1.5 Qualifications of Surveyor

.1 Qualified registered land surveyor, licensed to practice in Place of Work, acceptable to Consultant.

1.6 Survey Reference Points

.1 Existing control points are designated on drawings.

.2 Locate, confirm and protect control points prior to starting site work. Preserve permanent reference points during construction.

.3 Make no changes or relocations without prior written notice to Consultant.
.4 Report to Consultant when reference point is lost or destroyed or requires relocation because of necessary changes in grades or locations.

.5 Require surveyor to replace control points in accordance with original survey control.

1.7 Survey Requirements

.1 Establish two permanent bench marks on site, referenced to established bench marks by survey control points. Record locations, with horizontal and vertical data in Project Record Documents.

.2 Establish lines and levels, locate and lay out, by instrumentation.

.3 Stake for grading, fill and topsoil placement and landscaping features.

.4 Stake slopes and berms.

.5 Establish pipe invert elevations.

.6 Stake batter boards for foundations.

.7 Establish foundation and floor elevations.

.8 Establish lines and levels for mechanical and electrical work.

1.8 Existing Services

.1 Before commencing work, establish location and extent of service lines in area of Work and notify Consultant of findings. The Contractor is responsible for coordination of all utility locates.

.2 Remove abandoned service lines within 2 m of structures. Cap or otherwise seal lines at cut off points as directed by Consultant.

.3 Where Work involves breaking into or connecting to existing services, carry out work at times directed by authorities having jurisdiction, with minimum of disturbance to building occupants, pedestrian and vehicular traffic.

.4 Where unknown services are encountered, immediately advise Consultant and confirm findings in writing.

.5 Install temporary drain plugs to prevent construction debris from blocking pipes downstream of the work.

.6 All existing concrete floor slabs shall be scanned prior to any cutting or breaking of concrete. Employ a qualified concrete scanning company or inspection and testing agency to scan and map floor slabs for reinforcing, plastic and metal conduit, piping, grounding cables, embedment and the like. Map all slabs and provide copies to the Owner and Consultant.

1.9 Location of Services, Equipment and Fixtures

.1 Location of services, equipment, fixtures and outlets indicated on drawings or specified are to be considered as approximate.

.2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance. Include existing equipment which affects or will be affected by the work.

.3 Inform Consultant of impending installation and obtain approval for actual location.

.4 Location of site services where required, is approximate and is based on information provided by the Owner. Undertake all locates to determine exact locations of existing services and lay out new services to avoid any conflicts with new building elements, including site improvements, building foundations and other new or existing services.

.5 Submit field drawings and interference drawings to indicate relative position of various services and equipment. Refer to requirements for interference drawings specified elsewhere.

.6 Prepare interference and equipment placing drawings to ensure that all components will be properly accommodated within the spaces provided.

.7 Prepare drawings to indicate coordination 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.

.8 Ensure that clearances required by jurisdictional authorities and clearances for proper maintenance and access are indicated and maintained.

.9 Submit interference drawings to Owner and Consultant in accordance with Section 01 33 00.

.10 Unless specifically indicated by the Consultant, interference drawings will be received for information only and will not be reviewed.

1.10 Records

.1 Maintain a complete, accurate log of control and survey work as it progresses.

.2 Record locations of maintained, re-routed and abandoned service lines.

1.11 Subsurface Conditions

.1 Promptly notify Consultant in writing if subsurface conditions at Place of Work differ materially from those indicated in Contract Documents, or a reasonable assumption of probable conditions based thereon.

.2 After prompt investigation, should Consultant determine that conditions do differ materially, instructions will be issued for changes in Work.

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.

1.2 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit written request and obtain Consultant's approval 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

.3 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 Date and time work will be executed.

1.3 Materials

.1 As specified and required for original installation.

.2 Change in Materials: Submit request for substitution in accordance with Section 01 25 00 - Substitution Procedures.

.3 Requests for change in materials shall include documentation indicating conformance to project requirements and intent.

1.4 Definitions

.1 Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

.2 Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

PART 2 PRODUCTS

2.1 Materials

.1 General: Comply with requirements specified in other Sections.

.2 In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

.3 If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Consultant for the visual and functional performance of in-place materials.

PART 3 EXECUTION

3.1 Preparation

.1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.

.2 After uncovering, inspect conditions affecting performance of Work.

.3 Beginning of cutting or patching means acceptance of existing conditions.

.4 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.

.5 Provide protection from elements for areas which may be exposed by uncovering work; maintain excavations free of water.

3.2 General

.1 Carry out all cutting, fitting and patching required for the work of the Contract.

.2 Repair all wall and floor surfaces where items have been removed.

.3 Make good all finishes as required.

.4 Repaint damaged wall surfaces.

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

.6 Uncover Work to install ill-timed Work.

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

.8 Provide cutting and patching of all openings in non-structural elements of Work as necessary to complete installation of mechanical and electrical Work. Include complete removal and replacement of such elements as necessary to provide construction access.

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

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

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

.12 Restore work with new products in accordance with requirements of Contract Documents.
.13 Fit work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

.14 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with “ULC

approved firestopping material, full thickness of the construction element. Include any openings in existing building elements created by removal of existing services or equipment.

.15 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.

3.3 Cutting and Patching

.1 General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

.2 Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

.3 Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

.4 Temporary Support: Provide temporary support of work to be cut.

.5 Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

.6 Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 01 10 00 - Summary of Work.

.7 Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

.8 Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
   .1 In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   .2 Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
   .3 Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
   .4 Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
   .5 Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
   .6 Proceed with patching after construction operations requiring cutting are complete.

.9 Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
   .1 Inspection: Where feasible, test and inspect patched areas after completion to demonstrate

physical integrity of installation.

.2 Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
  .1 Clean piping, conduit, and similar features before applying paint or other finishing materials.
  .2 Restore damaged pipe covering to its original condition.

.3 Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, colour, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform colour and appearance.
  .1 Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

.4 Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.

.5 Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

.10 Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.4 Subfloor Levelling

.1 Where existing flooring is to be removed from floor slabs to remain, including ceramic tile flooring, carefully remove all flooring, grout, adhesives, waterproofing membranes and the like down to the base slab. Clean, patch and repair slab where damaged with concrete or acceptable leveling compound in accordance with new flooring manufacturer's instructions and ASTM F710. Refer to original building drawings and remove and replace existing concrete floor toppings as necessary and where required.

.2 Where new flooring is to be installed on new concrete slab or on framed floors, subfloor shall be levelled in accordance with flooring manufacturer's specifications and tolerances and with ASTM F710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

3.5 Fire Barrier Seals

.1 Ensure fire separations are maintained as indicated on the drawings. patch and firestop all penetrations accordingly.

End of Section

PART 1 GENERAL

1.1 Section Includes

.1 Progressive Cleaning
.2 Final Cleaning

1.2 References

.1 National Fire Protection Association (NFPA)
  .1 NFPA 241-22 Standard for Safeguarding Construction, Alteration, and Demolition Operations.

1.3 Project Cleanliness

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris.

.2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by the Owner. Do not burn waste materials on site.

.3 Clear snow and ice from access to building, bank/pile snow in designated areas only.

.4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.5 Provide on-site containers for collection of waste materials and debris.

.6 Provide and use clearly marked separate bins for recycling.

.7 Clean interior areas prior to start of finishing work and maintain areas free of dust and other contaminants during finishing operations.

.8 Store volatile waste in covered metal containers and remove from premises at end of each working day.

.9 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.

.10 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

PART 2 PRODUCTS

2.1 Products

.1 All cleaning materials and products shall be low VOC type. Submit list of cleaning products including SDS for approval prior to commencement of cleaning operations.

.2 Use only cleaning materials recommended by manufacturer of surface to be cleaned and recommended by cleaning material manufacturer.

PART 3 EXECUTION

3.1 Final Cleaning

.1 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.

.2 Remove waste products and debris other than that caused by others and leave Work clean and suitable for occupancy.

.3 Prior to final review remove surplus products, tools, construction machinery and equipment.

.4 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.

.5 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, floors and ceilings.

.6 Clean lighting reflectors, lenses, and other lighting surfaces. Clean and/or replace lamps, light fixtures, grilles and lenses.

.7 HEPA vacuum clean and dust building interiors, behind grilles, louvres and screens.

.8 Thoroughly vacuum clean interior of electrical equipment.

.9 Wax, seal, shampoo or prepare floor finishes, as recommended by manufacturer.

.10 Clean and seal concrete floor surfaces with non-skid matte sealer.

.11 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.

.12 Clean equipment and fixtures to a sanitary condition; clean or replace filters of mechanical equipment.

.13 Broom clean and wash exterior paved areas, walks, steps and surfaces; rake clean other surfaces of grounds.

.14 Remove dirt and other disfiguration from exterior surfaces.

.15 Clean and sweep roofs. Clear all drains, scuppers, gutters and downspouts.

.16 Remove debris and surplus materials from crawl spaces and other accessible concealed spaces.

.17 Remove snow and ice from access to building.

.18 Under direction of Consultant, aim adjustable luminaires.

3.2 Waste Management and Disposal

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 – Construction Waste Management and Disposal.

End of Section

PART 1 GENERAL

1.1 Section Includes

.1 References.
.2 Submittals.
.3 Definitions.
.4 Waste Management Goals for the Project.
.5 Documents.
.6 Waste Management Plan.
.7 Materials Source Separation Program.
.8 Disposal of Wastes.
.9 Scheduling.
.10 Storage, Handling and Protection.
.11 Application.
.12 Diversion of Materials.

1.2 References

.1 O. Reg. 102/94 Waste Audits and Waste Reduction Work Plans.
.2 O. Reg. 278/05 Occupational Health and Safety Act

1.3 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit a completed Waste Management Plan (WMP) prior to project start-up.

1.4 Definitions

.1 Waste Management Plan (WMP): Contractor's approved overall strategy for waste management including waste reduction workplan and materials source separation program.

.2 Materials Source Separation Program (MSSP): Consists of a series of ongoing activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation.

.3 Separate Condition: Refers to waste sorted into individual types.

1.5 Waste Management Goals for the Project

.1 The Owner has established that this Project shall generate the least amount of waste possible and that processes shall be employed that ensure the generation of as little waste as possible including prevention of damage due to mishandling, improper storage, contamination, inadequate protection or other factors as well as minimizing over packaging and poor quantity estimating.

.2 Of the waste that is generated, the waste materials designated in this specification shall be salvaged for reuse and or recycling. Waste disposal in landfills or incinerators shall be minimized.

1.6 Waste Management Plan

.1 Waste Management Plan: Submit a Waste Management Plan within 10 calendar days after receipt of Notice of Award of Contract, or prior to any waste removal, whichever occurs sooner. The Plan shall contain the following:
  .1 Analysis of the proposed job site waste to be generated, including the types of recyclable and waste materials generated (by volume or weight). In the case of demolition, a list of each item proposed to be salvaged during the course of the project should also be prepared
  .2 Alternatives to Land Filling: Contractor shall designate responsibility for preparing a list of each material proposed to be salvaged, reused, or recycled during the course of the Project.

.2 Post WMP or summary where workers at site are able to review its content.

1.7 Materials Source Separation Program

.1 The Waste Management Plan shall include a Source Separation Program for recyclable waste and shall be in accordance with the established policies currently in place at the local Municipality, and the requirements of O. Reg. 102/94.

.2 Prepare MSSP and have ready for use prior to project start-up.

.3 Implement MSSP for waste generated on project in compliance with approved methods and as approved by Consultant.

.4 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and/or recyclable materials.

.5 Provide containers to deposit reusable and/or recyclable materials.

.6 Locate containers to facilitate deposit of materials without hindering daily operations.

.7 Locate separated materials in areas which minimize material damage.

.8 Collect, handle, store on-site, and transport off-site, salvaged materials in separate condition.

1.8 Disposal of Wastes

.1 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.2 Provide appropriate on-site containers for collection of waste materials and debris. Containers for volatile wastes shall be closed containers and shall be removed from site daily.

.3 Provide and use clearly marked separate bins for recycling.

.4 Remove waste materials from site at regularly scheduled times or dispose of as directed by Consultant. Do not burn waste materials on site.

.5 Remove waste material and debris from site and deposit in waste container at end of each working day.

.6 Do not permit waste to accumulate onsite.

.7 Burying of rubbish and waste materials is prohibited.

.8 Disposal of waste into waterways, storm or sanitary sewers is prohibited.

1.9 Scheduling

.1 Coordinate work with other activities at site to ensure timely and orderly progress of the Work.

1.10 Storage, Handling and Protection

.1 Store, materials to be reused, recycled and salvaged in locations as directed by Owner.

.2 Materials from building demolition to be salvaged or re-used are to be removed and salvaged.

.3 Unless specified otherwise, materials for removal become Contractor's property.

PART 2 PRODUCTS

2.1 Not Used

.1 Not used

PART 3 EXECUTION

3.1 Application

.1 Do work in compliance with Waste Management Plan.

.2 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

.3 Source separate materials to be reused/recycled into specified sort areas.

3.2 Designated Substances

.1 All designated substances abatement, removal and disposal shall be completed in accordance with O. Reg 278/05 and all other applicable legislation.

3.3 Diversion of Materials

.1 Separate materials from general waste stream and stockpile in separate piles or containers, to approval of Owner, and consistent with applicable fire regulations. Mark containers or stockpile areas.

.2 On-site sale of materials is not permitted.

End of Section

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PART 1 GENERAL

1.1 Section Includes

.1 Administrative procedures preceding preliminary and final inspections of Work.

1.2 References

.1 Canadian Construction Documents Committee
  .1 CCDC 2-2020 Stipulated Price Contract including Supplementary Conditions.
.2 OAA/OGCA Document 100 - Recommended Procedures Regarding Substantial Performance of Construction Contracts and Completion Takeover of Projects.
.3 The Construction Act.

1.3 Inspection and Declaration

.1 Contractor's Inspection: The Contractor shall conduct an inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents. Submit duplicate copies of the deficiency list to the Owner and Consultant.
  .1 Notify Consultant in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.
  .2 Request Consultant's review.

.2 Consultant's Review: Consultant and Contractor will perform review of Work to identify obvious defects or deficiencies. Contractor shall correct Work accordingly.

.3 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 Boiler Inspection Branch, Fire Commissioner, Utility companies, TSSA, ESA and other regulatory agencies have been submitted.
  .5 Operation of systems have been demonstrated to Owner's personnel.
  .6 Work is complete and ready for Final Review by the Consultant.

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

.5 Declaration of Substantial Performance: when 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. Refer to CCDC 2, General Conditions Article GC 5.4 - Substantial Performance of Work and Payment of Holdback for specifics to application.

.6 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.

.7 Final Payment: When Consultant considers final deficiencies and defects have been corrected and it appears requirements of Contract have been totally performed, make application for final payment. Refer to CCDC 2, General Conditions Article GC 5.5 – Final Payment for specifics to application.

.8 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, General Conditions Article 5.4 - Substantial Performance of Work and Payment of Holdback.

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 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

1.2 Operating and Maintenance Manuals

.1 Collect reviewed submittals and assemble documents executed by Subcontractors, suppliers, and manufacturers including red-lined as-builts.

.2 Minimum two weeks prior to commencement of scheduled commissioning activities, submit 2 copies of the draft Operating and Maintenance Manuals, for Consultants review and use during the commissioning activities. After the completion of the commissioning activities, the Consultant will return to the Contractor 1 draft copy, with review comments, for revision. Submit 1 copy of the revised Operating and Maintenance for approval prior to the production of final copies. Prior to the Issuance of the Final Certificate of Completion, and within 10 working days after Substantial Performance, submit 2 copies of the final Operating and Maintenance Manuals.

.3 Bind contents in a three ring, hard covered, black plastic jacketed binder, with labelling pocket on spine and with 'D' type rings. Size for 8-1/2" x 11" size paper, enclose title sheet labelled "Operating and Maintenance Data Manual", project name, date and list of contents. Organize contents into applicable sections of work to parallel project specification breakdown. Mark each section by labelled tabs protected with celluloid covers fastened to hard paper dividing sheets.

.4 Include following information as applicable, plus data specified elsewhere:
- .1 operational information on equipment, cleaning and lubrication schedules, filters, overhaul and adjustment schedules and similar maintenance information; copy of building permit.
- .2 copy of final inspection certificate by Electrical Safety Authority.
- .3 Copy of fire alarm verification certificate.
- .4 Copy of sprinkler test verification certificate.
- .5 Copy of certificates issued by other utilities.
- .6 Copies of field tests.
- .7 Copies of all inspection and testing reports.
- .8 Maintenance instructions for finished surface and materials.
- .9 Copy of hardware and paint schedules.
- .10 Description, operation and maintenance instructions for equipment and systems, including complete list of equipment and parts list.
- .11 Indicate nameplate information such as make, size, capacity, serial number.
- .12 Names, addresses and phone numbers of Contractor, Subcontractors and Suppliers, including local source of supplies and replacement parts.
- .13 Manufacturer’s product guarantees and warranties, executed in the name of the Owner, showing name and address of project and guaranty/warranty commencement date and duration of guaranty/warranty, and clear indication of what is being guaranteed and what remedial action will be taken under guaranty/warranty.
  - .1 Separate each warranty or guarantee with index keyed to Table of Contents listing.
  - .2 List subcontractor, supplier, and manufacturer with name, address, and telephone number of responsible principal.
  - .3 Co-execute submittals when required.
- .14 Additional material used in project listed under various sections showing name of manufacturer and source of supply.
- .15 A letter on company letterhead clearly stating and verifying that no materials or products containing more than 0.1 per cent asbestos by dry weight has been applied or installed on the project.

.5 For Mechanical and Electrical include:

.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 troubleshooting; 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. Include maintenance and testing schedule.
.11 Provide Contractor’s co-ordination drawings, with installed colour coded piping diagrams.
.12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
.13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
.14 Include test and balancing reports as specified in Section 01 45 00 - Quality Control.
.15 Additional requirements: as specified in individual specification Sections.

.6 Neatly type lists and notes. Use clear drawings, diagrams or manufacturers' literature.

.7 Manuals shall include complete set of reviewed shop drawings and product data sheets, indicating corrections and changes made during fabrication and installation.

.8 Create electronic copies of manuals, in their entirety in a searchable PDF file format saved to USB flash-drive.

.9 Building will not be deemed ready for use unless the draft copies of the Operating and Maintenance Manuals and the "As-built" Record Documents have been submitted and reviewed by the Consultant.

.10 Building will not be deemed ready for use unless the completed and submitted Operating and Maintenance Manuals and "As-built" Record Documents have been accepted by the Consultant.

1.3 Project Record Documents

.1 After award of Contract, the Contractor will be provided with electronic copies of the Contract Documents. Contractor will use these to maintain current as-built drawings and specifications by recording deviations caused by site conditions and changes ordered by the Consultant and/or the Owner.

.2 Record locations of:
.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 or structure.
.4 Concealed components of mechanical and electrical services;
.5 Field changes of dimension and detail.
.6 Changes made by Change Order, Change Directive or Site Instruction.
.7 Details not on original Contract Drawings.
.8 References to related shop drawings and modifications.

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

.4 Record information on set of drawings, provided by Consultant. Record changes using a different colour of felt tip pen markers for each major system.

.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, Change Order, Change Directive or Site Instruction.

.6 Photos of concealed components must be taken and tagged to their locations labelled on the record drawings. Save photos to a USB flash-drive and submit with Contract close-out package.

.7 Identify all copies of the drawings and specifications as "Project As-built Copy". Maintain in new condition and make available for review on site by Consultant/Owner. At construction completion, neatly and accurately transfer notations to a second set of hard-copy drawings and specifications. Once completed, create electronic copies of both. As-built drawings to be generated in AutoCAD and PDF file formats. As-built specifications to be generated in PDF file format.

.8 Submit following drawings:
.1 Record changes in red. Mark on one set of prints and at completion of project prior to final inspection, produce electronic “as-built” records on disk using latest version of AutoCad. Annotate “AS-BUILT RECORD” in each drawing title block.
.2 All changes shall be shown on a separate drawing layer named "as-built".
.3 At least 2 weeks prior to commencement of scheduled commissioning activities, submit one copy of the draft “As-built” Project Record Documents for Consultants review and use during the commissioning activities. After the completion of the commissioning activities, the Consultant will return to the Contractor the draft copy, with review comments, for revision. Prior to the Issuance of the Final Certificate of Completion, and within 10 working days after Substantial Performance, submit 2 copies of the final “As-built” Project Record Documents and disk of “as-built” record drawings.

.9 Minimum 2 weeks prior to application for final payment, submit one (1) electronic copy of the Project Record Documents to Owner via the Consultant.

1.4 Materials and Finishes

.1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations.

.2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.3 Moisture-Protection and Weather-Exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and

recommended schedule for cleaning and maintenance.

.4 Additional Requirements: as specified in individual specifications Sections.

1.5 Maintenance Materials and Spare Parts

.1 Where supply of maintenance materials and spare parts are specified, deliver to Owner as follows:
- .1 Use unbroken cartons, or if not supplied in cartons, they shall be strongly packaged. Supply maintenance materials and spare parts in quantities specified in individual specification sections.
- .2 Provide only new materials as maintenance materials and spare parts, of the same manufacture, type and quality as incorporated into the Work.
- .3 If applicable, give colour, room number, or area where material used.
- .4 Ensure maintenance materials and spare parts provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work

1.6 Special Tools

.1 Where supply of special tools is specified, deliver to Owner in quantities specified as follows:
- .1 Provide items with tags identifying their associated function and equipment.
- .2 Special tools are to be delivered to the Owner prior to the application for Substantial Performance.
- .3 Receive and catalogue items. Submit inventory listing to Consultant. Include approved listings in Maintenance Manual.
- .4 Ensure spare parts provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.

1.7 Storage, Handling and Protection

.1 Store spare parts, maintenance materials and special tools in manner to prevent damage or deterioration and as follows:.
- .1 Store in original and undamaged condition with manufacturer's seal and labels intact.
- .2 Store components subject to damage from weather in weatherproof enclosures.
- .3 Store paints and freezable materials in a heated and ventilated room.
- .4 Remove and replace damaged products at own expense and to satisfaction of Consultant.
- .5 Clearly mark containers as to content.
- .6 Obtain receipt from Owner upon delivery of materials.

1.8 Final Site Survey Certificate

.1 Provide final site survey certificate in accordance with Section 01 71 00 - Examination and Preparation, certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents.

1.9 Independent Specialty Engineers Sign-Off

.1 Provide paper and electronic copies of signed and stamped engineers review and sign-off letters stating that the work has been built in accordance with their drawings and designs. Conditional or vague letters of sign-off will not be accepted. All specialty design engineers for all sub-contractors and suppliers will be required to review the work in progress at appropriate intervals to ensure compliance with their designs and drawings and shall provide final sign-off letters. Provide copies of all field reports issued by specialty engineers.

1.10 Electronic Documents

.1 Any electronic documentation submitted must be in the formats described above.

.2 Any electronic documentation submitted must be compatible with Consultant's computers or the documentation will be returned for re-submission.

.3 To ensure that the documents are able to be read on a computer different than the Contractor's, enable the "close the disc upon completion" option in the disc authorizing application.

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

.1 Conform to the requirements of Division 1.

1.2 References

.1 The National Building Code of Canada 2020, Part 8-Safety Measures on Construction and Demolition Sites.
.2 CSA Group (CSA)
  .1 CSA S350-M1980 (R2003) Code of Practice for Safety in Demolition of Structures
.3 ASTM International (ASTM)
  .1 ASTM F710-22 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
.4 Ontario Provincial Regulations
  .1 Ontario Regulation 102/94 Waste Audits and Waste Reduction Work Plans.
  .2 Ontario Regulation 103/94 Environmental Protection Act.
  .3 Ontario Regulation 213/07 The Fire Code.
  .4 Ontario Regulation 232/98 Landfilling Sites.
  .5 Ontario Regulation 278/05 Designated Substance - Asbestos on Construction Projects and in Buildings and Repair Operations.
  .6 Ontario Regulation 347 Environmental Protection Act, General — Waste Management.
  .7 Ontario Regulation 332/12 The Building Code.
.5 The Workplace Health and Safety Act, and Regulations for Construction Projects.
.6 The Contractors Health and Safety Policy.
.7 Laws, rules and regulations of other authorities having jurisdiction.

1.3 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit detailed written schedule, methodology and proposed procedures for demolition, including a Safe Work Plan for review prior to commencement of demolition.

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

.4 Drawings for structural elements of the demolition process including shoring, underpinning and installation of new lintels or beams in existing load bearing walls, shall bear signature and stamp of qualified professional engineer registered in the Province of Ontario.

.5 Submit proposed dust-control measures.

.6 Submit proposed noise-control measures.

.7 Submit schedule of demolition activities indicating the following:
  .1 Detailed sequence of demolition and removal work, including start and end dates for each activity.
  .2 Dates for shutoff, capping, and continuation of utility services.
.8 If hazardous materials are encountered and disposed of, landfill records indicating receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

.9 At Project Closeout: Submit record drawings in accordance with Section 01 78 00. Identify and accurately locate capped utilities and other subsurface structural, electrical, or mechanical conditions

1.4 Permits

.1 Obtain and pay for all permits and comply with all laws, rules, ordinances, and regulations relating to Demolition of Building and preservation of Public Health and Safety.

.2 The Consultant will complete General Review during demolition in accordance with the Ontario Building Code. All other engineering required for shoring design and for other structural elements of the demolition work will be completed by the Contractor's own engineer and paid for by the Contractor.

1.5 Waste Management Plan

.1 All work of this section shall be completed in accordance with the contractors approved Waste Management Plan specified in Section 01 74 19.

1.6 Definitions

.1 Chemical Waste: Includes petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals and inorganic wastes.

.2 Demolition Waste: Building materials and solid waste resulting from construction, remodeling, repair, cleanup, or demolition operations that are not hazardous. This term includes, but is not limited to, asphalt concrete, Portland cement concrete, brick, lumber, gypsum wallboard, cardboard and other associated packaging, roofing material, ceramic tile, carpeting, plastic pipe, and steel. The materials may include rock, soil, tree stumps, and other vegetative matter resulting from land clearing and landscaping for construction or land development projects.

.3 Environmental Pollution and Damage: The presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human or animal life; affect other species of importance to humanity; or degrade the utility of the environment for aesthetic, cultural or historical purposes.

.4 Inert Fill: A permitted facility that accepts inert waste such as asphalt and concrete exclusively for the purpose of disposal.

.5 Inert Solids/Inert Waste: Non-liquid solid waste including, but not limited to, soil and concrete that does not contain hazardous substances or soluble pollutants at concentrations in excess of water-quality standards established by a regional water board and does not contain significant quantities of decomposable solid waste.

.6 Landfill: A landfill that accepts non-hazardous materials such as household, commercial, and industrial waste, resulting from construction, remodeling, repair, and demolition operations. A landfill must have a solid waste facilities permit from the Ministry of the Environment and be in conformance to O. Reg 232/98.

.7 Recycling: The process of sorting, cleansing, treating and reconstituting materials for the purpose of using the altered form in the manufacture of a new product. Recycling does not include burning, incinerating or thermally destroying solid waste.

.8 Remove: Remove and legally dispose of items, except those identified for use in recycling, re-use, and salvage programs.

.9 Reuse: The use, in the same or similar form as it was produced, of a material which might otherwise be discarded.

.10 Solid Waste: All putrescible and non-putrescible solid, semisolid, and liquid wastes, including garbage, trash, refuse, paper, demolition and construction wastes, abandoned vehicles and parts thereof, discarded home and industrial appliances, dewatered, treated, or chemically fixed sewage sludge which is not hazardous waste, manure, vegetable or animal solid and semisolid wastes, and other discarded solid and semisolid wastes. "Solid waste" does not include hazardous waste, radioactive waste, or medical waste as defined or regulated by law.

1.7 Quality Assurance

.1 Demolition Firm Qualifications: Demolition contractor shall be an experienced firm that has successfully completed demolition Work similar to that indicated for this Project.

.2 Regulatory Requirements: Comply with governing regulations before starting demolition. Comply with hauling and disposal regulations of authorities having jurisdiction. Obtain and pay for all permits required.

.3 Pre-demolition Conference: Conduct a conference at Project site.
.1 Review the environmental goals of this Project and make a proactive effort to increase awareness of these goals among all labor forces on site.
.2 Review schedule and scheduling procedures.
.3 Review health and safety procedures.
.4 Review of Project conditions including review of record photographs.

1.8 Project Conditions

.1 Construct safety barriers, barricades, fencing and hoarding to separate public from work areas as described in Section 01 56 00.

.2 The Owner assumes no responsibility for the actual condition of the structures to be demolished.

.3 Conditions existing at the time of inspection for bidding purposes will be maintained by the Owner insofar as practicable. Variations within the structures may occur by the Owner's salvage operations prior to start of demolition.

1.9 Designated Substances

.1 Refer to Owner supplied hazardous material report.

.2 Should any other material not identified in the above referenced reports resembling asbestos or other hazardous substances be encountered in course of demolition work, immediately stop work and notify the Owner’s Representative. Refer to Section 01 41 00.

.3 All designated substances abatement, removal and disposal shall conform to the abatement plan prepared by Owner’s consultant.. All work shall be completed in accordance with O. Reg 278/05 and all other applicable legislation. Refer to Specifications included in the Designated Substance Survey for abatement requirements.

PART 2 PRODUCTS

2.1 Materials

.1 Provide all materials necessary for temporary shoring. On completion, remove temporary materials from site.

.2 All building materials removed from the building shall become the property of the Contractor unless specified otherwise and shall be reused in new construction or removed from the Site.

.3 All concrete, masonry, asphalt and similar materials shall be crushed prior to disposal.

2.2 Salvage

.1 All items of salvageable value must be salvaged.

.2 Provide a schedule of items to be salvaged and clearly indicate which items are to be retained by Owner. Clearly identify and tag each salvageable item.

.3 Transport salvaged items from the site as they are removed.

.4 Items of salvageable value to the Contractor may be removed from the structure as the work progresses, if such items are not claimed by the Owner.

2.3 Reuse

.1 Salvage and reuse materials as indicated on the drawings.

2.4 Recycle

.1 All materials from demolition and land clearing which can be recycled through local municipal programs and which is not scheduled for salvage shall be sorted and separated in accordance with Regional, Provincial and Municipal standards and regulations.

.2 Provide recycling receptacles for the duration of construction activities at the building site.

PART 3 EXECUTION

3.1 Examination

.1 Survey existing conditions and correlate with requirements indicated to determine extent of demolition, salvage and recycling required.

.2 Verify that utilities have been disconnected and capped.

.3 Survey condition of the building to determine whether removing any element might result in a structural deficiency or unplanned collapse of any portion of the structure or adjacent structures during demolition.

.4 Retain a licensed and qualified civil or structural engineer to provide analysis, including calculations, necessary to ensure the safe execution of the demolition work.

.5 Perform surveys and tests as the Work progresses to detect hazards resulting from demolition activities.

.6 Preliminary Survey:
.1 The Demolition Plans indicate the general extent of existing conditions based upon drawings provided by the Owner and existing site conditions. Review all areas of work to determine full extent of areas to be demolished, altered or renovated and become familiar with actual conditions and extent of work required.
.2 Before commencing demolition operations, examine Site and provide engineering survey to determine type of construction, condition of structure, and Site conditions. Assess strength and stability of damaged or deteriorated structures.
.3 Assess potential effect of removal of any part or parts on the remainder of structure before such part(s) are removed.
.4 Assess effects of demolition at adjacent structures and consider need for underpinning, shoring and/or bracing.
.5 Investigate for following conditions:
.1 load bearing walls and floors
.2 structure suspended from another
.3 effects of soils, water, lateral pressures on retaining or foundations walls
.4 presence of tanks and other piping systems
.5 presence of designated substances and hazardous materials.

.7 After determining demolition methods, determine area of possible vibration. Carefully inspect beyond those adjacent areas. List potential damage areas and photograph each for record purposes before starting work.

3.2 Preparation

.1 Erect and maintain dustproof and weatherproof partitions as required to prevent spread of dust, fumes and smoke to other parts of building. Maintain fire exits. On completion, remove partitions and make good surfaces to match adjacent surfaces of building.

.2 Provide all shoring and bracing required for the execution of the work.

.3 Ensure all sedimentation controls as required are in place prior to commencement of demolition activities.

.4 Before commencing demolition, verify that existing water, gas, electrical and other services in areas being demolished are cut off, capped diverted or removed as required. Post warning signs on electrical lines and equipment which must remain energized to serve adjacent areas during period of demolition.

.5 Conduct demolition operations and remove materials from demolition to ensure minimum interference with roads, streets, walks, and other adjacent occupied and utilized facilities.

.6 Do not close or obstruct streets, walks, or other adjacent occupied or utilized facilities without permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

3.3 Protection

.1 Erect and maintain temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction. Maintain such areas free of snow, ice, water and debris. Lighting levels shall be equal to that prior to erection.

.2 Provide safe access and egress from working areas using entrances, hallways, stairways or ladder runs, protected to safeguard personnel using them from falling debris.

.3 Do not interfere with use and activities of adjacent buildings and site. Maintain free and safe passage to and from buildings.

.4 Where demolition operations prevent normal access to adjacent properties, provide and maintain suitable alternative access.

.5 Protect existing site improvements, appurtenances, and landscaping that are designated to remain in place.

.6 Ensure that all necessary controls are in place at the beginning of each work period which will prevent the spread of contaminated material beyond the work area limits. Stop work immediately if there exists any possibility of the spread of contaminated materials.

.7 Keep dust from entering existing facilities and areas of building not affected by the Work. Comply with Ministry of Health requirements regarding debris control.

.8 Ensure scaffolds, ladders, equipment and other such equipment are not accessible to public. Protect with adequate fencing or remove and dismantle at end of each day or when no longer required.

.9 Take precautions to guard against movement, settlement or collapse of adjacent structures, services or driveways. Be liable for such movement, settlement or collapse caused by failure to take necessary precautions. Repair promptly such damage when ordered.

.10 If Owner considers additional bracing and shoring necessary to safeguard and prevent such movement or settlement, install bracing or shoring upon Owner's orders.

.11 Particular attention shall be paid to prevention of fire and elimination of fire hazards which would endanger new work or existing premises.

.12 Protect existing adjacent work against damages which might occur from falling debris or other causes due to work of this Section.

.13 At all times protect the structure from overloading.

.14 Provide protection around floor and/or roof openings.

.15 Protect from weather, parts of adjoining structures not previously exposed.

.16 Protect interiors of building parts not to be demolished from exterior elements at all times.

.17 At end of each day's work, leave work in safe condition so that no part is in danger of toppling or falling.

3.4 Temporary Ventilation

.1 Provide all required temporary ventilation for demolition work.

3.5 Environmental Controls

.1 Comply with provincial and municipal regulations pertaining to water, air, solid waste, recycling, chemical waste, sanitary waste, sediment and noise pollution.

.2 Protection of Natural Resources:
- .1 Preserve the natural resources.
- .2 Confine demolition activities to areas defined by public roads, easements, and work area limits indicated on the drawings.
- .3 Water Resources: Comply with applicable regulations concerning the direct or indirect discharge of pollutants to underground and natural surface waters. Provide sedimentation control where necessary.
- .4 Store and service construction equipment at areas designated for collection of oil wastes.
- .5 Oily Substances: Prevent oily or other hazardous substances from entering the ground, drainage areas, or local bodies of water in such quantities as to affect normal use, aesthetics, or produce a measurable ecological impact on the area.

.3 Dust Control, Air Pollution, and Odour Control: Prevent creation of dust, air pollution and odors.
- .1 Use temporary enclosures and other appropriate methods to limit dust and dirt rising and scattering in air to lowest practical level.
- .2 Store volatile liquids, including fuels and solvents, in closed containers.
- .3 Properly maintain equipment to reduce gaseous pollutant emissions.

.4 Noise Control: Perform demolition operations to minimize noise.
- .1 Provide equipment, sound deadening devices, and take noise abatement measures that are necessary to comply with municipal regulations.

.5 Salvage, Re-Use, and Recycling Procedures:
- .1 Identify re-use, salvage, and recycling facilities.
- .2 Develop and implement procedures to re-use, salvage, and recycle demolition materials.
- .3 Identify materials that are feasible for salvage, determine requirements for site storage, and transportation of materials to a salvage facility.
- .4 Source-separate clean and uncontaminated demolition materials including, but not limited to the following types:
  - .1 Concrete, Concrete Block, Concrete Masonry Units (CMU), Brick.
  - .2 Metal (ferrous and non-ferrous).
  - .3 Wood.
  - .4 Glass.
  - .5 Plastics and Insulation.
  - .6 Gypsum Board.
  - .7 Porcelain Plumbing Fixtures.
  - .8 Fluorescent Light Tubes.
  - .9 Paper: Bond, Newsprint, Cardboard, Paper, Packaging Materials.
  - .10 Other materials as appropriate.

3.6 Performance

.1 Ensure demolition work is supervised by competent foreman at all times.

.2 Demolition shall proceed safely in systematic manner. Work on each floor level shall be complete before commencing work on supporting structure and safety of its supports are impaired. Parts of building which would otherwise collapse prematurely shall be securely shored. Walls and piers shall not be undermined.

.3 Until acceptance, maintain and preserve active utilities traversing premises.

.4 Provide enclosed chutes for disposal of debris from heights more than 1 storey in accordance with CSA S350.

.5 Maintain safety of site by shoring below-grade-structures and excavations resulting from demolition against collapse.

3.7 Demolition

.1 Review demolition procedures to ensure no personnel or equipment are located or working without additional safe working platforms or working surface adequate to support the operations.

.2 Any damage caused to the adjacent buildings or properties by the neglect of the Contractor or any of his forces shall be made good at the expense of the Contractor including all costs and charges which may be claimed by the Owner for damages suffered.

.3 Demolish in a manner to minimize dusting. Keep dusty materials wetted at all times.

.4 Demolition: Use methods required to complete Work within limitations of governing regulations and as follows:
- .1 Locate demolition equipment throughout the building and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
- .2 Demolish concrete and masonry in sizes that will be suitable for acceptance at recycling or disposal facilities.
- .3 Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
- .4 Break up and remove concrete slabs on grade in small sizes, suitable for acceptance at recycling or disposal facilities, unless otherwise shown to remain.
- .5 Remove all disconnected, abandoned utilities.
- .6 Remove all finishes, fixtures, fitments and services as indicated
- .7 Damages: Promptly repair damages to adjacent facilities caused by demolition operations.
- .8 Prevent access to excavations by means of fences or hoardings.

3.8 Selective Demolition

.1 Carefully dismantle and remove all items in as shown and as necessary to complete the work.

.2 Salvage items scheduled for reuse or to be handed over to the Owner.

.3 Particular attention shall be paid to prevention of fire and elimination of fire hazards which would endanger the existing buildings.

.4 Where existing flooring is to be removed from floor slabs to remain, including ceramic tile flooring, carefully remove flooring, grout, adhesives, waterproofing membranes and the like down to the base slab. Patch and repair slab where damaged with concrete or acceptable leveling compound in accordance with new flooring manufacturer’s instructions and ASTM F710. Refer to original building drawings and remove and replace existing concrete floor toppings as necessary and where required.

.5 Return areas to condition existing prior to the start of the work unless indicated otherwise.

.6 At exterior and interior bearing walls to be removed, include breaking out and removal of existing concrete foundations to a minimum of 200 mm below new finished floor level.

3.9 Handling of Demolished Materials

.1 Conform to the approved Waste Management Plan.

.2 Do not allow demolished materials to accumulate or be stored on-site for more than 5 days.

.3 Do not burn, bury or otherwise dispose of rubbish and waste materials on project site.

.4 Pallet and shrink-wrap materials scheduled for re-use and stockpile where directed on site.

.5 Disposal: Transport demolished materials off Owner's property and legally reuse, salvage, recycle, or dispose of materials. Legally transport and dispose of materials that cannot be delivered to a source separated or mixed recycling facility to a transfer station or disposal facility that can legally accept the materials for the purpose of disposal.

.6 Deliver to facilities that can legally accept new construction, excavation and demolition materials for purpose of re-use, recycling, composting, or disposal.

3.10 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 Clean adjacent streets and driveways of dust, dirt and materials caused by demolition operations.

.3 Reinstate areas and existing works outside areas of demolition to conditions that existed prior to commencement of work.

.4 Upon completion of demolition work, remove debris, trim surfaces and leave work site clean.

.5 Video storm and sanitary sewers and jet clean where debris may have accumulated

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 04 22 00 Concrete Unit Masonry

1.3 References

.1 ASTM International (ASTM)
  .1 ASTM A153/A153M-23 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
.2 CSA Group (CSA)
  .1 CSA A23.1:19/A23.2:19 Concrete Materials and Methods of Concrete Construction / Test Methods and Standard Practices for Concrete.
  .2 CSA S304-14 (R2019) Design of Masonry Structures.
  .3 CSA A370-14 (R2018) Connectors for Masonry.
  .4 CAN/CSA A371-14 (R2019) Masonry Construction for Buildings.
  .5 CSA G30.3-M1983 (R1998) Cold-Drawn Steel Wire for Concrete Reinforcement.
  .6 CSA G30.18-09 (R2014) Carbon Steel Bars for Concrete Reinforcement
  .7 CSA W186-M1990 (R2016) Welding of Reinforcing Bars in Reinforced Concrete Construction
.3 American Concrete Institute (ACI)
  .1 Detailing Manual
.4 Reinforcing Steel Institute of Canada (RSIC)
  .1 Reinforcing Steel Manual of Standard Practice

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit the following samples:
  .1 Two of each type of masonry reinforcing and connector specified.

.3 Product Data: Submit manufacturer's printed product literature, specifications and data sheets.

.4 Shop Drawings:
  .1 Submit shop drawings for all masonry reinforcing. Include placing drawings, bar lists and details. Indicate clearly reinforcing bar sizes, spacing, bending details, lap details, dowels to adjacent construction location and quantities of reinforcement and connectors.
  .2 Prepare placing drawings and bar lists in accordance with the American Concrete Institute (ACI) Detailing Manual, and the Reinforcing Steel Institute of Canada (RSIC) Reinforcing Steel Manual of Standard Practice, the typical details included with Contract Documents.
  .3 Prepare placing drawings to minimum scale of 1:50.
  .4 Submit placing drawings and bar lists sufficiently detailed and dimensioned to permit correct placement of reinforcement and accessories without reference to architectural or structural Drawings.
  .5 Show reinforcement, including dowels, in elevation on placing drawings for wall reinforcement.

.6 Show cover to reinforcement
.7 Show location of construction joints.

1.5 Design Criteria

.1 Non-conventional Masonry Connectors
.1 Deflection: maximum 2.0 mm, including free play when acted upon by 0.45 kN lateral load, in all possible positions of adjustment.
.2 Positive restraint at position of maximum adjustment.

.2 Multi-component Ties - Free Play: Maximum 1.2 mm, when assembled in any possible configuration.

1.6 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver, handle and store materials in accordance with manufacturer's printed instructions.

1.7 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

PART 2 PRODUCTS

2.1 Materials

.1 All metal components: hot dipped zinc galvanized to CSA S304 unless otherwise indicated.

.2 Bar Reinforcement: To CSA A371 and CSA G30.18, grade 400R, deformed billet steel bars.

.3 Column Ties: Fero CAT Tie (Column Adjustable Tie), spot weld to columns at 400 mm c/c.

.4 Connectors: to CSA A370 and CSA S304.
.1 Finish: Steel components, hot dip galvanized to CAN/CSA A370.

.2 Strip Ties: Prescriptive corrugated strip tie. 100 mm x 22 mm x 0.91 mm thick corrugated tie conforming to CSA A370.

.5 Wire Reinforcement: To CSA A371 and CSA G30.3.
.1 Interior walls: hot dipped galvanized to CSA S304
.1 4.76 mm wire diameter hot dipped galvanized to CSA S304 for interior bearing walls.
.2 3.66 mm wire diameter bright wire finish, standard duty for interior non-bearing walls and partitions
.3 Truss Type: Blok-Trus BL-30 by Blok-Lok Ltd. for non-vertically reinforced walls
.4 Ladder Type: Blok-Trus BL-10 by Blok-Lok Ltd. for vertically reinforced walls

.6 Equivalent products as manufactured by the following manufacturer's may be used subject to submission and acceptance by the Consultant of technical data:
.1 Hohmann and Barnard Inc.

.7 Epoxy Adhesive: Hilti HIT-HY 2270 Adhesive anchor.

2.2 Fabrication

.1 Fabricate reinforcing in accordance with CSA A23.1 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Ontario.

.2 Obtain Consultant's approval for locations of reinforcement splices other than shown on placing drawings.

.3 Upon approval of Consultant, weld reinforcement in accordance with CSA W186.

.4 Ship reinforcement clearly identified in accordance with drawings.

PART 3 EXECUTION

3.1 Installation

.1 Install masonry reinforcement, connectors and anchors in accordance with CSA A370, CSA A371, CSA A23.1 and CSA S304 unless indicated otherwise.

3.2 Reinforcement

.1 Unless otherwise noted, all masonry walls shall be reinforced with joint reinforcement.

.2 Reinforcement shall be installed in the first and second bed joints, 200 mm apart immediately above lintels and below sill at openings, and in bed joints at 400 mm vertical intervals elsewhere. Reinforcement in the second bed joint above or below openings shall extend 600 mm beyond the jambs. All other reinforcement shall be continuous except that it shall not pass through vertical masonry control joints. Side rods shall be lapped at least 150 mm at splices.

.3 Use prefabricated corner and tee sections for continuous reinforcement at corners and intersecting walls.

.4 Vertical reinforcement shall have a minimum clearance of 13 mm from the masonry and not less than one bar diameter between bars.

.5 All block cores containing vertical reinforcing and/or anchor bolts shall be solidly filled with non-shrink grout.

.6 Place reinforcement and ties in grout spaces prior to grouting.

.7 Cleanouts: Provide cleanouts in the bottom course of masonry for each grout pour when the grout pour height exceeds 1.5 m.

.8 Construct cleanouts so that the space to be grouted can be cleaned and inspected. In solid grouted masonry, space cleanouts horizontally a maximum of 800 mm on center.

.9 Construct cleanouts with an opening of sufficient size to permit removal of debris. The minimum opening dimension shall be 76 mm.

.10 After cleaning, close cleanouts with closures braced to resist grout pressure.

3.3 Bonding and Tying

.1 Bond walls of two or more wythes using seismic connectors and ladder type reinforcement in accordance with CSA S304, CSA A371 and as indicated.

.2 Masonry ties shall be installed as per the requirements of CSA A371 with maximum spacing of 400 mm vertically and 400 mm horizontally.

3.4 Reinforced Lintels and Bond Beams

.1 Reinforce masonry lintels and bond beams as indicated.

.2 Place and grout reinforcement in accordance with CSA S304.

3.5 Metal Anchors

.1 Do metal anchors as indicated.

3.6 Lateral Support and Anchorage

.1 Do lateral support and anchorage in accordance with CSA S304 and as indicated.

.2 Anchor new masonry to existing with steel dowels as indicated. Drill into existing masonry and set reinforcing bars in epoxy adhesive in accordance with manufacturer's instructions.

3.7 Control Joints

.1 Terminate reinforcement 25 mm short of each side of control joints unless otherwise indicated.

.2 Control joints shall be stepped to avoid cutting lintel beams. Under no circumstance shall the control joints be placed to compromise the bearing for the lintel.

3.8 Field Bending

.1 Do not field bend reinforcement and connectors except where indicated or authorized by Consultant.

.2 When field bending is authorized, bend without heat, applying a slow and steady pressure.

.3 Replace bars and connectors which develop cracks or splits.

3.9 Field Touch Up

.1 Touch up damaged and cut ends of galvanized reinforcement steel and connectors with compatible finish to provide continuous coating.

3.10 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 04 05 19 Masonry Anchorage and Reinforcing
.2 Section 06 10 00 Rough Carpentry
.3 Section 07 84 00 Firestopping
.4 Section 07 92 00 Joint Sealants
.5 Section 09 21 16 Gypsum Board
.6 Section 09 91 23 Interior Painting

1.3 References

.1 ASTM International (ASTM)
  .1 ASTM C90-22 Standard Specification for Loadbearing Concrete Masonry Units
  .2 ASTM C129-22 Standard Specification for Nonloadbearing Concrete Masonry Units
  .3 ASTM C150/C150M-22 Standard Specification for Portland Cement
  .4 ASTM C207-18 Standard Specification for Hydrated Lime for Masonry Purposes.
  .5 ASTM D2240-15(2021) Standard Test Method for Rubber Property—Durometer Hardness.
  .6 ASTM D5249-10(2021) Standard Specification for Backer Material for Use with Cold and Hot Applied Joint Sealants in Portland Cement Concrete and Asphalt Joints.
.2 CSA Group (CSA)
  .1 CSA A23.1-14/A23.2:19 Concrete Materials and Methods of Concrete Construction / Test Methods and Standard Practices for Concrete.
  .2 CSA A165 Series-14 (R2019) CSA Standards on Concrete Masonry Units.
  .3 CSA A179-14 (R2019) Mortar and Grout for Unit Masonry
  .4 CSA A370-14 (R2018) Connectors for Masonry.
  .5 CSA A371-14 (R2019) Masonry Construction for Buildings.
  .6 CSA S304-14 (R2019) Design of Masonry Structures.
.3 Canadian Concrete Masonry Producers Association (CCMPA) Quality Assurance Program.

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Data: Submit manufacturer's printed product literature, specifications and data sheets

.3 Submit the following samples:
  .1 Two (2) of each type of concrete masonry units specified.
  .2 Two (2) of each type of masonry accessory specified.

.4 Submit shop drawings for all masonry reinforcing. Include placing drawings, bar lists and details. Indicate clearly reinforcing bar sizes, spacing, bending details, lap details, dowels to adjacent construction location and quantities of reinforcement and connectors.

.5 Submit engineered temporary bracing design drawings for temporary support of masonry walls. Drawings shall be prepared by, and bear the seal of a Professional Engineer, licensed in the Province of Ontario.

.6 Certificates: submit product certificates signed by manufacturer certifying materials comply with

specified performance characteristics and criteria and physical requirements.

.7 Inspection Reports: Inspection and Testing Company shall submit reports of inspections and tests.
  .1 Distribute inspection reports as follows:
    .1 Consultant.
    .2 Structural Engineer
    .3 Contractor.

1.5 Quality Assurance

.1 The masonry sub-contractor shall have a minimum of five years of continuous documented Canadian experience in work of the type and quality shown and specified. Proof of experience shall be submitted when requested by the Consultant and shall be subject to the approval of the Consultant.

.2 Pre-installation meeting: conduct pre-installation meeting to verify project requirements manufacturer's instructions and manufacturer's warranty requirements.

.3 Field Quality Control:
  .1 Inspection and testing will be carried out by Testing Laboratory designated by Owner.
  .2 Payment for specified Work performed by Inspection and Testing Company will be made from Cash Allowance.
  .3 Inspection and Testing Company shall perform sampling, inspection and testing of masonry work at site, in accordance with referenced standards, including but not limited to the following:
    .1 Masonry Placement Inspection
    .2 Reinforcing Steel Placement
    .3 Grout and Mortar Testing
    .4 CMU Testing
  .4 Review provided by Inspection and Testing Company does not relieve Contractor of his sole responsibility for quality control over Work. Performance or non-performance of Inspection and Testing Company shall not limit, reduce, or relieve Contractor of his responsibilities in complying with the requirements of the Specification.
  .5 Provide access to Work for inspectors.

1.6 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver, handle and store materials in accordance with manufacturer’s printed instructions.

.3 Materials shall be kept clean and dry.

.4 Deliver cement, lime and mortar ingredients with manufacturer's seal and labels intact.
.5 Cementitious material and aggregates shall be stored in accordance with the requirements of CSA A23.1.

.6 Exposed units which become stained or chipped, surface marked or scratched, and materials which are affected by inadequate protection shall be replaced, at no additional expense to the Owner.

1.7 Project Conditions

.1 Provide heat enclosures and heat as required.

.2 Work to be undertaken shall be carried out according to CAN3-A371, Clause 5.15.2.

.3 Maintain temperature of mortar between 5 ° C and 50 ° C until batch is used.

.4 Keep masonry dry using secure waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven snow, rain and dirt, until masonry work is completed and protected by flashings or other permanent construction.

.5 Protect masonry and other work from marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.

1.8 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

PART 2 PRODUCTS

2.1 Materials

.1 Masonry Units: Concrete Block: Modular, conforming to CCMPA requirements and CSA A165.1.
- .1 H/20/A/M concrete masonry units to be used at all load bearing masonry walls.
- .2 H/15/A/M concrete, masonry units, at all other locations unless noted otherwise.
- .3 SS/15/A/M semi-solid concrete masonry units to be used at all 2 hour rated fire walls.
- .4 Refer to drawings for Fire Resistance Ratings. Type of concrete and block to conform to Table 5.0, Fire Resistance Rating of Concrete Block in Hours, of the Canadian Concrete Masonry Producers Association Handbook.
- .5 Special shapes: provide special shapes indicated or required including bullnose and corner blocks, base blocks, fillers, and the like as may be required. Provide purpose made shapes for lintels and bond beams.
- .6 Exposed block shall all be made by one manufacturer and shall be uniform in colour, shade and texture.

.2 Bar Reinforcement, wire reinforcement, connectors and ties: as specified in Section 04 05 19 - Masonry Anchorage and Reinforcing.

.3 Control Joint Filler: to ASTM D5249-10, Type 1, Round, flexible, continuous-length, nonabsorbent, nongassing, nonstaining, and nonshrinking. Extruded from a cross-linked polyethylene. Flexibile foam, heat-Resistant Backer Rod. 9.5 mm thick by width of wall.

.4 Pre-manufactured Masonry Control Joint: Pre-manufactured polyvinylchloride control joints may be used in lieu of the specified built-up type of joint.

.5 Mortar: Conforming to CSA A179.
- .1 Use same brand of material and source of aggregate for entire project.
- .2 Aggregate: CSA A179, fine grain aggregates.
- .3 Cement: normal Portland to ASTM C150, Type 10.
- .4 Water shall be clean, potable and free of deleterious amounts of acid, alkalies, or organic materials.
- .5 Hydrated Lime: Type ‘S’ to ASTM C207.
- .6 Type 'S' mortar shall be used for all concrete block masonry work.
- .7 Proprietary Mortar Mixes: conform to mix requirements specified

.8 Mortar colour for concrete unit masonry work shall be grey.
.9 Admixtures of any kind are not allowed.

.6 Grout: to CSA A179, Table 3: Premixed, non-shrink non-metallic grout.

.7 Other materials not specifically described but required for a complete and proper installation of masonry, shall be as selected by the Contractor subject to approval by the Consultant

2.2 Mixes

.1 Mixing: Prepare and mix mortar materials under strict supervision, and in small batches only for immediate use.

.2 Mix proprietary mortars in strict accordance with manufacturer's instructions to produce the specified mortar types in accordance with CSA A179. Do not use re-tempered mortars.

.3 Take representative samples for testing consistency of strength and colour according to CSA A179.

2.3 Damp Course and Flashings

.1 Peel and stick modified SBS bitumen membrane reinforced with proprietary glass screen, minimum thickness of 1.0 mm.

.2 Lap Sealant: recommended by flashing manufacturer.

2.4 Accessories

.1 Mechanical Fasteners: As recommended by manufacturer of material to be fastened, and in accordance with the reference standards, corrosion resistant.

PART 3 EXECUTION

3.1 Examination

.1 Examine work of other trades for defects or discrepancies and report same in writing to Consultant.

.2 Installation of any part of this work shall constitute acceptance of such surfaces as being satisfactory.

3.2 General

.1 Do masonry work in accordance with CSA A371 except where specified otherwise.

.2 A competent masonry foreman shall supervise and direct the work and only skilled masons shall execute the work of this Section.

.3 Coordinate work of this Section with others such as, field welding of anchors to steel work, insulation application, and the like. Prepare all items for built-in as the work proceeds, either supplied and installed by other trades or installed under this Section.

.4 Unless otherwise indicated on the drawings, all interior masonry partitions shall extend from floor

level to the underside of floor or roof structures above.

3.3 Installation

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

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

.3 Lay block with webs to align plumb over each other with thick ends of webs up. The top course of all partitions which do not pass through a ceiling or up to the underside of a roof deck shall have the open cells filled solid.

.4 Cut exposed block with power driven abrasive cutting disc or diamond cutting wheel for flush mounted electrical outlets, grilles, pipes, conduits, leaving 3 mm maximum clearance.

.5 Fill all vertical and bed joints, including plain end faces, through the entire wall thickness solidly with mortar.

.6 Do not break bond of exposed walls where partitions intersect and if bond would show through on exposed face of walls. Bond these partitions to walls they intersect with prefabricated intersection masonry reinforcement in each course.

.7 Bond intersecting block walls in alternate courses.

.8 Terminate non load bearing walls within 20 mm of structure above unless indicated otherwise.

.9 Where walls are pierced by structural members, ducts, pipes, fill voids with mortar to within 20 mm of such members.

.10 Buttering corners of units, throwing mortar droppings into joints, deep or excessive furrowing of bed joints, is not permitted. Do not shift or tap units after mortar has taken initial set. Where adjustment must be made after mortar has started to set, remove mortar and replace with fresh supply.

.11 Do not wet concrete masonry before or during laying in wall.

.12 Bed and vertical joints shall be evenly and solidly filled with mortar.

.13 Provide reinforced bond beams where indicated on structural drawings.

.14 Provide vertical reinforcement as indicated on structural drawings. Fill all reinforced cores solid with grout as indicated. Provide cleanout port at bottom of each grouted core when required by Consultant.

3.4 Exposed Masonry

.1 Do not use chipped, cracked or stained, and otherwise damaged units or unsatisfactory material in exposed and load bearing masonry walls.

.2 Lay all joints 10 mm thick (uniform). All joints shall be full of mortar except where specifically designated to be left open.

.3 All joints shall be slightly concave. Use sufficient force to press mortar tight against masonry units on both sides of joints. Remove excess material or burrs left after jointing by means of a trowel or rubbing with burlap bag.

.4 Provide bullnose block at all exposed masonry corners.

3.5 Tolerances

.1 Tolerances in notes to Clause 5.3 of CSA A371 apply.

3.6 Reinforcement and Connectors

.1 Refer to Section 04 05 19 - Masonry Anchorage and Reinforcing.

3.7 Concrete Masonry Lintels

.1 Refer to Section 04 05 19 - Masonry Anchorage and Reinforcing.

.2 Lintels in non-load-bearing walls shall be constructed with special bond or lintel block units unless shown otherwise on plans. Lintels shall bear 200 mm minimum and bearing shall be isolated with two layers of heavy asphalt coated paper.

.3 Reinforcing steel in lintels shall be 2 x 20 M bars minimum specified under Section 04 05 19 - Masonry Anchorage and Reinforcing, or as noted on drawings.

.4 Concrete fill for lintels shall be 25 MPa or as noted on the drawings. Concrete shall be as specified in Section 03 30 00.

3.8 Loose Steel Lintels

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

.2 Lintels supplied under Section 05 50 00 – Metal Fabrications.

3.9 Control Joints

.1 Provide continuous joints as indicted and at spacing not to exceed 6000 mm c/c unless noted otherwise on drawings.

.2 Break vertical mortar bond with extruded neoprene gasket or building paper.

.3 Prime control joint to prevent drying out of caulking material.

3.10 Support of Loads

.1 Use 25 MPa concrete unless specified otherwise on the Drawings, where concrete fill is used in lieu of solid units.

.2 Use grout to CSA A179 where grout is used in lieu of solid units.

.3 Install building paper below voids to be filled with grout. Keep paper 25 mm back from face of units.

3.11 Lateral Support and Anchorage

.1 Do lateral support and anchorage of masonry in accordance with CSA S304.1 and as indicated.

3.12 Grouting

.1 Grout masonry in accordance with CSA S304.1 and as indicated.

3.13 Temporary Wall Bracing

.1 Design and provide all required temporary engineered wall bracing.

.2 Brace masonry walls to resist wind pressure and other lateral loads during construction period.

.3 Provide temporary bracing of masonry work during and after erection until mortar has cured and permanent lateral support is in place

3.14 Built-ins

.1 Build in items required to be built into masonry and provided by other Sections, including bearing plates, door frames, anchor bolts, sleeves and inserts. Build in items to present a neat, rigid, true and plumb installation. Leave wall openings required for ducts, grilles, pipes and other items.

.2 Prevent displacement of built-in items during construction. Check plumb, location and alignment frequently, as work progresses.

.3 Brace door jambs to maintain plumb. Fill voids between masonry and metal frames with masonry mortar or insulation, as indicated on drawings or as required to provide a neat, finished appearance.

.4 Set wall plates on masonry in non-shrink grout in accordance with manufacturer's instructions.

.5 Do all cutting, fitting, drilling, patching and making good for other trades in masonry work.

3.15 Protection

.1 Protect masonry units from damage resulting from subsequent construction operations.

.2 Use protection materials and methods which will not stain or damage masonry units.

.3 Remove protection materials upon Substantial Performance, or when risk of damage is no longer present.

3.16 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 Allow mortar droppings on unglazed concrete masonry to partially dry then remove by means of trowel, followed by rubbing lightly with small piece of block and finally by brushing.

.3 Remove mortar from concrete floor slabs and leave entire area vacuum clean.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 04 22 00 Concrete Unit Masonry

1.3 References

.1 ASTM International (ASTM)
  .1 ASTM A123/A123M-17 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
  .2 ASTM A653/A653M-23 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealled) by the Hot-Dip Process.
  .3 ASTM D2559 - 12a(2018) Standard Specification for Adhesives for Bonded Structural Wood Products for Use Under Exterior Exposure Conditions
  .4 ASTM F1667-21a Standard Specification for Driven Fasteners: Nails, Spikes, and Staples
.2 CSA Group (CSA)
  .1 CSA A247- M86 (R1996) Insulating Fiberboard.
  .2 CSA B111-1974(R2003) Wire Nails, Spikes and Staples.
  .3 CSA G164-18 Hot Dip Galvanizing of Irregularly Shaped Articles.
  .4 CSA O80 SERIES-15 Wood Preservation
  .5 CSA O86-14 Engineering Design in Wood
  .6 CSA O121-17 Douglas Fir Plywood.
  .7 CSA O141:23 Canadian Standard Lumber.
  .8 CSA O151-17 Canadian Softwood Plywood
  .9 CSA O437 Series-93 (R2011) Standards on OSB and Waferboard
  .10 CSA Z809-08 Sustainable Forest Management
.3 Underwriters Laboratories Canada (ULC)
  .1 ULC 102-2018 Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
.4 National Lumber Grading Authority (NGLA)
  .1 Standard Grading Rules for Canadian Lumber, Latest Edition.
.5 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.

1.4 Quality Assurance

.1 Sawn lumber shall be identified by the grade stamp of an association or independent grading agency certified by the Canadian Lumber Standards Accreditation Board.

1.5 Shipping, Handling and Storage

.1 Protect materials, under cover, both in transit and on the site.

.2 Store materials to prevent deterioration or the loss or impairment of their structural and other essential properties. Do not store materials in areas subject to high humidity and areas where masonry and concrete work are not completely dried out.

.3 Store sheathing materials level and flat, in a dry location. Protect panel edges from moisture at all times.

1.6 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

PART 2 PRODUCTS

2.1 Materials

.1 Timber Material shall be 'Grade Stamped'.

.2 CSA Z809 or FSC Certified.

.3 Construction Lumber: To CSA O141 Softwood Lumber graded to NLGA Standard Grading Rules for Canadian Lumber, published by the National Lumber Grades Authority. All lumber shall bear grade stamps. Moisture content of softwood lumber not to exceed 19% at time of installation.
.1 Framing lumber, plates, furring, blocking, No. 1 SPF.
.2 Nailing strips, furring and strapping: No. 4 S-P-F.
.3 Fitment framing: No. 1 S-P-F.

.4 Canadian Softwood Plywood: to CSA O151-M, standard construction, good one or both sides as required, thickness as shown or specified.
.1 Douglas Fir Plywood: To CSA O121-M, standard construction, good one side, thickness as shown on the drawings.
.2 Plywood used for exposed interior work shall have select grade veneer, one or both faces where exposed, with fire retardant finish. Fire retardant shall be in accordance with CAN/CSA-080.1, and all treated materials shall bear a ULC approval stamp.
.3 Poplar Plywood: to CSA 0153, standard construction.
.4 Mat formed structural panel board (oriented strand board): to CSA O437, square edge, 12.7 mm thickness.

.5 Nails, Spikes and Staples: To ASTM F1667.

.6 Bolts: 12.5 mm diameter, galvanized, complete with nuts and washers.

.7 Proprietary Fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, recommended for purpose by manufacturer.

.8 Wood Preservative to CSA O80 SERIES.

.9 Adhesive: Contractors gun grade cartridge loaded wood adhesive, general purpose, to ASTM D2559.

.10 Galvanizing: to CSA-G164. Use galvanized fasteners, and hardware for exterior work, preservative treated lumber, and materials in contact with concrete or masonry.

.11 Fire Retardant Treatment

.1 Arch Wood Protection, Inc., "Dricon FRT" or equal by Chemical Specialties, Inc., D-Blaze", Hoover Treated Wood Products "Pyro-Guard" or Osmose Wood Preserving Co., Inc. "FirePRO" interior Type A fire-retardant wood treatment.

.2 Pressure impregnate lumber and plywood with fire-retardant chemicals to comply with AWPA C20 (lumber) and C27 (Plywood), respectively, for treatment type indicated; identify "fire-retardant-treated wood" with appropriate classification marking of Underwriters Laboratories, Inc., or other testing and inspecting agency acceptable to authorities having jurisdiction.

.1 Treated materials shall meet FR-S ratings of not more than 25 for flame spread, smoke developed and fuel contributed when tested in accordance with UL 723 or ASTM E84, with no increase in flame spread and evidence of significant progressive combustion upon continuation of test for additional 30 minutes.

.2 No increase in above ratings when subjected to standard ASTM D2898 rain test.

.3 For interior locations use fire-retardant chemical formulation that produces "Interior Type A" treated lumber and plywood with the following properties under conditions present after installation:

.1 No reduction takes place in bending strength, stiffness and fastener holding capacities below values published by manufacturer of chemical formulation that are based on tests by a qualified independent testing laboratory of treated wood products identical to those indicated for this Project under elevated temperature and humidity conditions simulating installed conditions.

.2 No other form of degradation occurs due to acid hydrolysis or other causes related to manufacture and treatment.

.3 No corrosion of metal fasteners results from their contact with treated wood.

.4 Inspect each piece of treated lumber or plywood after drying and discard damaged or defective pieces.

.5 Kiln-dry all lumber and plywood materials after treatment to maximum 15% moisture content.

PART 3 EXECUTION

3.1 Installation

.1 Workmanship

.1 Execute work using skilled mechanics according to best practice, as specified here.

.2 Lay out work carefully and to accommodate work of other trades. Accurately cut and fit; erect in proper position true to dimensions; align, level, square, plumb, adequately brace, and secure permanently in place. Join work only over solid backing.

.2 Rough Hardware: Include rough hardware such as nails, bolts, nuts, washers, screws, clips, hangers, connectors, strap iron, and operating hardware for temporary enclosures.

.3 Erection of Framing Members

.1 Install members true to line, levels and elevations. Space framing members and frame all openings as detailed on the drawings.

.2 Construct continuous members from pieces of longest practical length.

.3 Install spanning members with crown edge up.

.4 Anchor wood framing to supporting walls with galvanized metal strap ties.

.4 Provide treated wood nailers, blocking, cants, grounds, furring and similar members where shown and where required for screeding or attachment of other work and surface applied items. Attach to substrate as required to support applied loading.

.5 Electrical Equipment Backboard: provide backboards for mounting electrical equipment as indicated. Use 19 mm thick fir face veneer fire retardant softwood plywood on 19 x 38 mm furring around perimeter and at maximum of 305 mm intermediate spacing.
.1 Install plywood backboards with countersunk screws.

.6 Blocking: Provide solid wood backing to support millwork, cabinetwork, equipment, fixtures, railings and accessories and the like, as required. Coordinate with work of other Sections and install all required backing. Any such equipment mounted on gypsum wallboard assemblies or similar assemblies shall be adequately supported.
.1 Provide solid wood blocking in all partitions where wall stops are specified in the hardware schedule.

3.1 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 06 10 00 Rough Carpentry
.2 Section 07 92 00 Joint Sealants
.3 Section 09 21 16 Gypsum Board
.4 Section 09 91 23 Interior Painting

1.3 References

.1 ASTM International (ASTM)
  .1 ASTM F1667/F1667M-21a Standard Specification for Driven Fasteners: Nails, Spikes, and Staples
.2 Architectural Woodwork Manufacturer's Association of Canada (AWMAC)
  .1 Architectural Woodwork Standards Manual
.3 American National Standards Institute (ANSI)
  .1 ANSI A208.1-2009 Particleboard
  .2 ANSI/NPA A208.2-2009 Medium Density Fibreboard (MDF)
  .3 ANSI/NEMA LD 3-2005 High-Pressure Decorative Laminates (HPDL)
  .4 ANSI/HPVA HP-1-2009 Standard for Hardwood and Decorative Plywood
.4 CSA Group (CSA)
  .1 CSA O112 SERIES-M1977 (R2006) Wood Adhesives
  .2 CSA O121-08 (R2013) Douglas Fir Plywood
  .3 CSA O151-17 (R2022) Canadian Softwood Plywood
  .4 CSA O153:19 Poplar Plywood
  .5 CSA Z809-08 Sustainable Forest Management
.5 Canadian General Services Board (CGSB)
  .1 CAN/CGSB-11.3-M, Hardboard
.6 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.

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit shop drawings conforming to AWMAC's STANDARDS (NAAWS).
  .1 Show proposed assembly, connections, anchorage, materials, dimensions, thickness, and finishes.
  .2 On casework and countertop elevations show location of backing required for attachment within walls.

.3 Samples:
  .1 Submit duplicate, 300 mm long samples of each type of solid wood and 300 x 300 mm samples of each type of plywood used in exposed work and scheduled to receive stained or natural finish, complete with specified finish, prior to fabrication of cabinetwork.
  .2 Veneer samples minimum 304 mm x 304 mm. Each sample set of three to represent range of colour and grain expected.

.3 Submit full range of manufacturer's standard plastic laminates for selection by the Consultant.
.4 Submit sample of each type of cabinet hardware component used.

1.5 Quality Assurance

.1 Unless otherwise specified, carry out finish carpentry work in accordance with the requirements of "Millwork Standards" (latest issue) of Architectural Woodwork Manufacturers' Association of Canada (AWMAC), Custom Grade.

.2 Woodwork Manufacturer Qualifications:
.1 Minimum 5 years of production experience similar to this project, whose qualifications indicate ability to comply with requirements of this Section.

.3 Preinstallation Conference:
.1 Before framing completed hold a meeting with the contractor, casework manufacturer, casework installer, and framing sub-contractor.
.2 Review locations of backing required for casework installation as shown on casework shop drawings.
.3 Review method of attachment for backing to wall system as shown on architectural drawings.

1.6 Definition

.1 "Exposed" when referred to in this Section, shall mean all parts which can be viewed and shall include interiors of cabinets, backs of doors, shelving and gables.

1.7 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver, handle and store materials in accordance with manufacturer's printed instructions.

.3 Protect against damage, including damage by excessive changes in moisture content, during delivery and storage. Maintain minimum storage temperature of 16 ° C, and relative humidity of 25% to 55%.

.4 Cover plastic laminate faces at shop with heavy Kraft paper.

.5 Do not deliver finish carpentry components to site before all wet trades are completed, the building is closed in and humidity conditions on site are acceptable. Do not deliver during rain or damp weather

.6 Store materials on site in such a way as to prevent deterioration or loss or impairment of essential properties. Prevent excessive moisture gain of materials.

1.8 Protection

.1 Provide coverings as necessary to protect finish carpentry components from damage of any kind during storage and after installation.

1.9 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

1.10 Warranty

.1 Warrant the work of this Section against defects of workmanship and material, for a period of two years from the date of Substantial Performance and agree to make good promptly any defects which occur or become apparent within the warranty period.

PART 2 PRODUCTS

2.1 Materials

.1 All materials CSA Z809 or FSC Certified.

.2 Solid Wood:
- .1 Unless otherwise indicated, provide AWMAC Custom Grade.
- .2 All wood materials shall be new, straight and clean, free of sap, knots, pitch, and other defects, except as permitted by applicable grading rules.
- .3 All wood shall be kiln dried to a maximum moisture content of 7%.
- .4 Softwood: to CSA O141, dressed all sides used in concealed locations.

.3 Veneers: As required by AWMAC's STANDARDS (NAAWS) for its use and Grade specified. Flat sliced maple veneers from architectural grade flitches to provide uniform grain pattern and colour throughout, free of dark streaks and blemishes. Sharp variation of grain patterns and colour between adjacent jointed pieces is not acceptable.

.4 Plywood:
- .1 Veneer core plywood: hardwood with a non-telegraphing grain manufactured with exterior glue. To ANSI/HPVA HP-1-09, minimum five (5) plies.
- .2 Soft Plywood: to CSA O151-M Standard Grade, solid two sides. Use in concealed locations only, except as indicated.
- .3 To ANSI/HPVA HP-1-09, Grade A face, book matched, flat cut maple face and No. 3 edge.

.5 Particleboard: Meeting requirements of AWMAC’s STANDARDS (NAAWS). To ANSI A208.1 , minimum density of 720kg/m3 Grade "R".

.6 MDF: Medium Density Fiberboard meeting requirements of AWMAC’s STANDARDS (NAAWS).

.7 Edgeband
- .1 For wood veneer casework: Veneer of same species and cut as exposed surfaces.
- .2 For plastic laminate casework: High Pressure Decorative Laminate (HPDL).

.8 Hardboard: To CGSB 11-GP-3M, Type 2, 6 mm thick or as indicated.

.9 Stainless Steel: Type 316 with AISI No. 4 finish, 1.80 mm thick.

.10 Melamine Overlaid Panels:
- .1 Melamine overlay, heat and pressure laminated with phenolic resin to 12.7 mm thick particle board.
- .2 Overlay bonded to both faces where exposed two sides, and when panel material require surface on one side only, reverse side to be overlaid with a plain balancing sheet.
- .3 Furniture finish: solid colour as selected by the Consultant.
- .4 Edge Finishing: matching melamine and polyester overlay edge strip with self-adhesive.

.11 Fasteners and Adhesive:
- .1 Nails and staples: ASTM F1667, galvanized, spiral head nails.

.2 Screws: Zinc, cadmium or chrome plated steel.
.3 Splines: wood or metal, to suit application.
.4 Adhesive: Type 1 waterproof. To CSA O112-M, type as appropriate for the intended application. Complying with ANSI/WDMA I.S-1 series. Contact bond not acceptable.
.5 Avoid the use of adhesives, preservatives, synthesizing agents and finish coatings that contain formaldehyde and high V.O.C. content.

.12 Cabinet Hardware: Products listed are a standard of acceptance. Products by other manufacturers, of equal quality and similar appearance may also be accepted subject to review and approval by Consultant. Provide cabinet locks at all millwork casework units that have doors as part of the unit.
.1 Recessed Shelf Standard:
.1 Knape & Vogt KV 255, Zinc, finish.
.2 Knape & Vogt KV 256AL Series Aluminum Shelf Support Clip
.2 Hinges: Blum concealed hinges, 125° clip and 125° opening with self-closing spring. Soft close. Full or half overlay. Nickel plated steel.
.3 Cabinet Pulls: Richelieu D-Pull No: 30134-170, 96 mm c.c. brushed stainless steel.
.4 Cabinet Locks: CCL 0737 pin tumbler MK & KA by room.
.5 Catches: Type optional with manufacturer.
.6 Drawer Slides: Knape & Vogt 8450FM Soft-Close Full-Extension Drawer Slide
.7 Door and Drawer Bumpers: “Quietex” bumpers.
.8 Provide other hardware and hardware accessories as detailed or required.
.9 All exposed hardware to have Platinum (Mica) finish by Teknion or equivalent unless noted otherwise.

2.2 Fabrication

.1 Materials and methods of construction to meet requirements of AWMAC's STANDARDS (NAAWS) for grade or grades specified.
.1 If there is conflict between plans and/or specifications and AWMAC's STANDARDS (NAAWS), plans and specifications shall govern.

.2 Wood Casework: AWMAC Standard Custom Grade.

.3 Construction Type: Frameless

.4 Cabinet and door interface: Flush overlay.

.5 Exposed joints and edges:
.1 Uniformly space exposed joints unless otherwise indicated.
.2 No edge grain shall be visible; mitre external corners, house internal fasteners. Glue mitred corners.
.3 All exposed edges of plywood and particle board shall have solid wood edging, pressure glued. AWMAC No. 3 edge.
.4 Ease edges of solid lumber components to 1.6 mm radius.

.6 Mechanical Fasteners:
.1 Inconspicuously locate mechanical fasteners. Wherever possible, conceal fastenings.
.2 Countersink nail heads.
.3 Where exposed to view, countersink screw and bolt heads and fill holes with matching wood plugs.
.4 Cutting and fitting: make cut-outs in work of this Section as required to accommodate work of other Sections.
.5 Make provisions in cabinetwork to accept built-in appliances, provided by others.

2.3 Wood Casework

.1 Materials and methods of construction to meet requirements of AWMAC's STANDARDS (NAAWS) for grade or grades specified.

.2 If there is conflict between plans and/or specifications and AWMAC's STANDARDS (NAAWS), plans and specifications shall govern.

.3 Wood Casework:
.1 Grade: AWMAC's STANDARDS (NAAWS) Custom Grade

.4 Exposed Surfaces grade A maple, flat cut, book matched material suitable for clear finish meeting requirements of AWMAC's STANDARDS (NAAWS) for Grade specified.

.5 Exposed interior surfaces: Veneer of same species and cut [and grade] as exposed exterior surfaces.

.6 Semi-exposed surfaces: veneer of same species as exposed faces.

2.4 Drawers

.1 Sides: Particle board with melamine surfaces.

.2 Bottoms: MDF or hardboard with melamine surfaces

.3 Joinery: Meeting requirements of AWMAC's STANDARDS (NAAWS) for Grade specified.

2.5 Stainless Steel Countertops

.1 Stainless Steel Countertops: Fabricate stainless steel counters with stainless steel sheeting bonded under pressure to exterior grade high density overlaid DFP plywood, 19 mm thick. Provide all returns and radii to present a clean neat finish. All counter front and side edges to be Marine Edge finish. Provide backsplashes as indicated on drawings at adjacent walls. Continuously weld all seams and grind smooth.

2.6 Finishes

.1 All exposed counters and backsplash surfaces: stainless steel as indicated..

.2 Wood Finish: 3 coats clear polyurethane finish on all sides as specified in Section 09 91 23. Factory finish wherever practical.

.3 All exposed interior surfaces: melamine unless indicated otherwise.

.4 Cabinet and case backs unexposed to view shall be back primed with one coat of moisture repellent sealer.

.5 Apply finishes in accordance with the AWMAC Manual.

.6 Stainless Steel: Type 316 stainless steel, brushed finish.

2.7 Factory Finishing

.1 Grade: AWMAC's STANDARDS (NAAWS) Match grade of product to be finished.

PART 3 EXECUTION

3.1 Examination

.1 Verify mechanical, electrical, plumbing, HVAC and other building components, affecting work in this Section are in place and ready.

.2 Verify HVAC controls and systems are operating properly.

.3 Verify adequacy of backing and support framing. Advise Contractor of areas and surfaces requiring further modifications for plumb, level, even or square fitting.

3.2 Installation

.1 Install work in accordance with AWMAC Installation Manual, Custom grade.

.2 Secure all work in place, square, plumb, and level.

.3 Accurately scribe and closely fit components to irregularities of adjacent surfaces.

.4 Accurately fit joints in true plane, locate joints over bearing or supporting surfaces.

.5 Countersink mechanical fasteners used at exposed and semi-exposed surfaces, excluding installation attachment screws and those securing cabinets end to end.

.6 Where permitted, nail with small headed finishing nails. Countersink nail heads with nail setter.

.7 Install plastic laminate components using concealed fastening devices.

.8 Where components are fastened with screws or bolts, countersink screw and bolt heads and provide wood plugs matching surrounding wood.

.9 Where cabinetwork abuts other building elements, provide wood trim matching cabinetwork except where otherwise detailed.

.2 Cut equipment cutouts shown on plans using templates provided.
- .1 Radius internal corners at least 3 mm and chamfer edges.
- .2 Where core edge is to remain exposed, cover with plastic laminate edging.
- .3 Where core edge is to be concealed, seal with sealer.

.10 Where access is required to valves and other mechanical and electrical components, located behind cabinetwork, provide removable plywood access panels of size required and secure with four brass screws.

.11 Provide for wiring and cable management systems wiring grommets as indicated on the drawings.

.12 Apply mildew resistant silicone sealant to perimeter of all countertops as specified in Section 07 92 00.

3.3 Adjustment

.1 Adjust all moving and operating parts to function smoothly and correctly.

.2 Fill and retouch all nicks, chips and scratches. Replace all un-repairable damaged items.

.3 Replace damaged components which, in the opinion of the Consultant, cannot be satisfactorily repaired.

3.4 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 Upon completion of installation, clean installed items of pencil and ink marks and broom clean the area of operation.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 04 22 00 Concrete Unit Masonry
.2 Section 07 92 00 Joint Sealants
.3 Section 09 21 16 Gypsum Board

1.3 References

.1 ASTM International (ASTM)
  .1 ASTM E84-24 Standard Test Method for Surface Burning Characteristics of Building Materials
  .2 ASTM E119-20 Standard Test Methods for Fire Tests of Building Construction and Materials
  .3 ASTM E136-19a Standard Test Method for Behavior of Material in a Vertical Tube Furnace at 750° C
  .4 ASTM E814-13a (2017) Standard Test Method for Fire Tests of Penetration Firestop Systems
  .5 ASTM E1966-15(2019) Standard Test Method for Fire-Resistive Joint Systems
  .6 ASTM E2307-20 Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus
.2 Underwriter's Laboratories of Canada (ULC)
  .1 ULC 101-2014 Standard Methods of Fire Endurance Tests of Building Construction and Materials
  .2 ULC 102.2-2018 Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies
  .3 ULC 115-2018 Standard Method of Fire Tests of Firestop Systems
.3 National Fire Protection Association (NFPA)
  .1 NFPA 252 Standard Methods of Fire Test and Door Assemblies
.4 South Coast Air Quality Management District (SCAQMD) California State
  .1 SCAQMD Rule 1168-03: Adhesives and Sealants.
.5 Ontario Building Code

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product Data: Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Quality Assurance Submittals: submit following in accordance with Section 01 45 00 - Quality Control.
  .1 Test reports: in accordance with ULC 101 for fire endurance and ULC 102 for surface burning characteristics.
  .2 Submit certified test reports from approved independent testing laboratories, indicating compliance of applied fire stopping with specifications for specified performance characteristics and physical properties
  .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  .4 Manufacturer's Instructions: submit manufacturer's installation instructions and special

handling criteria, installation sequence, cleaning procedures.

1.5 Definitions

.1 Fire Stop Material: device intended to close off opening or penetration during fire or materials that fill openings in wall or floor assembly where penetration is by cables, cable trays, conduits, ducts and pipes and poke-through termination devices, including electrical outlet boxes along with their means of support through wall or floor openings.

.2 Single Component Fire Stop System: fire stop material that has Listed Systems Design and is used individually without use of high temperature insulation or other materials to create fire stop system.

.3 Multiple Component Fire Stop System: exact group of fire stop materials that are identified within Listed Systems Design to create on site fire stop system.

1.6 Quality Assurance

.1 One installer shall install all firestopping on the project. Each trade shall not firestop their own service penetrations. Installer shall be certified by fire stopping manufacturer.

.2 Qualifications:
.1 Qualified Installer: specializing in fire stopping installations with 5 years documented experience approved and trained by manufacturer.

1.7 Sustainable Requirements

.1 Materials shall be Low VOC type conforming to SCAQMD Rule 1168-03. Maximum VOC level of firestopping materials shall be 250 g/l.

1.8 Project Conditions

.1 Environmental Conditions: Do not install fire-stopping when ambient or substrate temperatures are outside limits permitted by fire-stopping manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

.2 Ventilation: Ventilate fire-stopping per fire-stopping manufacturers' instructions by natural means or, where this is inadequate, forced air circulation.

1.9 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver, handle and store materials in accordance with manufacturer’s printed instructions.

.3 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer, ULC markings.

.4 Storage and Protection:
.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Replace defective or damaged materials with new.

1.10 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

PART 2 PRODUCTS

2.1 Materials

.1 All fire stopping shall consist of ULC listed firestop system.

.2 Applications: Provide fire-stopping systems composed of materials specified in this Section that comply with system performance and other requirements.

.3 General: Provide fire-stopping systems that are produced and installed to resist the spread of fire, according to requirements indicated, and the passage of smoke and other gases.

.4 All firestopping material shall be:
.1 From one manufacturer;
.2 Intumescent where an appropriate system exists.

.5 Fire stopping and smoke seal systems: ULC listed in accordance with ULC 115.
.1 Asbestos-free materials and systems capable of maintaining effective barrier against flame, smoke and gases in compliance with requirements of ULC 115 and not to exceed opening sizes for which they are intended.

.6 Service penetration assemblies: ULC listed systems tested to ULC 115.

.7 Service penetration fire stop components: ULC listed and certified by test laboratory to ULC 115.

.8 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.

.9 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.

.10 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.

.11 Primers: to manufacturer's recommendation for specific material, substrate, and end use.

.12 Water: potable, clean and free from injurious amounts of deleterious substances.

.13 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.

.14 F-Rated Through-Penetration Fire-stop Systems: Provide through-penetration fire-stop systems with F ratings indicated, but not less than that equaling or exceeding the fire-resistance rating of the constructions penetrated.

.15 T-Rated Through-Penetration Fire-stop Systems: Provide through-penetration fire-stop systems with T ratings, in addition to F ratings, where indicated and where systems protect penetrating items exposed to contact with adjacent materials in occupy-able floor areas. T-rated assemblies are required where the following conditions exist:
.1 Where fire-stop systems protect penetrations located outside of wall cavities.
.2 Where fire-stop systems protect penetrations located outside fire-resistive shaft enclosures.

.3 Where fire-stop systems protect penetrations located in construction containing doors required to have a temperature-rise rating.
.4 Where fire-stop systems protect penetrating items larger than a 100 mm diameter nominal pipe or 10,000 mm² in overall cross-sectional area.

.16 Fire-Resistive Joint Sealants: Provide joint sealants with fire-resistance ratings indicated, but not less than that equaling or exceeding the fire-resistance rating of the construction in which the joint occurs. Sealants for vertical joints: non-sagging.

.17 For fire-stopping exposed to view, traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions.
.1 For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration fire-stop systems.
.2 For floor penetrations with annular spaces exceeding 100 mm or more in width and exposed to possible loading and traffic, provide fire-stop systems capable of supporting the floor loads involved either by installing floor plates or by other means.
.3 For penetrations involving insulated piping, provide through-penetration fire-stop systems not requiring removal of insulation.

.18 For firestopping exposed to view, provide products with flame-spread values of less than 25 and smoke-developed values of less than 450.

.19 Compatibility: Provide fire-stopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by fire-stopping manufacturer based on testing and field experience.

.20 Accessories: Provide components for each fire-stopping system that are needed to install fill materials and to comply with "System Performance Requirements". Use only components specified by the fire-stopping manufacturer and approved by the qualified testing and inspecting agency for the designated fire resistance-rated systems. Accessories include but are not limited to the following items:
.1 Permanent forming/damming/backing materials including the following:
.1 Semi-refractory fibre (mineral wool) insulation.
.2 Ceramic fibre.
.3 Sealants used in combination with other forming/damming materials to prevent leakage of fill materials in liquid state.
.4 Fire-rated formboard.
.5 Joint fillers for joint sealants.
.2 Temporary forming materials.
.3 Substrate primers.
.4 Collars.
.5 Steel sleeves.

PART 3 EXECUTION

3.1 Manufacturer’s Instructions

.1 Compliance: comply with manufacturer's written recommendations or specifications.

3.2 Preparation

.1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation

of materials.

.2 Ensure that substrates and surfaces are clean, dry and frost free.

.3 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.

.4 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour retarder.

.5 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.3 Installation

.1 Install fire stopping and smoke seal material and components in accordance with manufacturer's certified tested system listing and as necessary to maintain fire resistance ratings of floor and wall assemblies.

.2 Provide fire stopping for all disciplines.

.3 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.

.4 Fill spaces between openings, ducts, pipes and unused sleeves passing through fire separations with firestop material and install firestopping systems in accordance with the appropriate ULC system number for the products and type of penetration.

.5 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.

.6 Tool or trowel exposed surfaces to neat finish.

.7 Remove excess compound promptly as work progresses and upon completion.

3.4 Sequences of Operation

.1 Proceed only when submittals have been reviewed by Consultant.

.2 Mechanical pipe insulation: certified fire stop system component.
.1 Ensure pipe insulation installation precedes fire stopping.

3.5 Field Quality Control

.1 Inspections: notify Consultant when ready for inspection and prior to concealing or enclosing fire stopping materials and service penetration assemblies.

.2 Employ a ULC accredited Designated Responsible Individual (DRI) to inspect and label all fire stop applications on site.

.3 Manufacturer's Field Services:
.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as

described in Article 1.4 - Submittals.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, as directed in Article 1.6 - Quality Assurance.

3.6 Schedule

.1 Fire stop and smoke seal at:
- .1 Penetrations through fire-resistance rated partitions and walls.
- .2 Perimeter of fire-resistance rated partitions.
- .3 Intersection of fire-resistance rated partitions.
- .4 Control and sway joints in fire-resistance rated partitions and walls.
- .5 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.
- .6 Around mechanical and electrical assemblies penetrating fire separations.
- .7 Rigid ducts: greater than 129 cm²: fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.
- .8 All electrical boxes installed in fire rated gypsum board assemblies.
- .9 All locations required by the Ontario Building Code.
- .10 Any other locations indicated.

3.7 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

.3 Remove temporary dams after initial set of fire stopping and smoke seal materials.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 06 10 00 Rough Carpentry
.2 Section 06 40 00 Architectural Woodwork
.3 Section 07 84 00 Firestopping
.4 Section 08 44 13 Glazed Aluminum Curtain Walls

1.3 References

.1 ASTM International (ASTM)
  .1 ASTM C510-16(2022) Standard Test Method for Staining and Color Change of Single- or Multicomponent Joint Sealants
  .2 ASTM C661-15(2022) Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer
  .3 ASTM C679-15(2022) Standard Test Method for Tack-Free Time of Elastomeric Sealants
  .4 ASTM C719-22 Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle)
  .5 ASTM C794-18(2022) Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants
  .6 ASTM C834-17 Standard Specification for Latex Sealants
  .7 ASTM C919-22 Standard Practice for Use of Sealants in Acoustical Applications
  .8 ASTM C920-18 Standard Specification for Elastomeric Joint Sealants
  .9 ASTM C1183/C1183M-13(2018) Standard Test Method for Extrusion Rate of Elastomeric Sealants
  .10 ASTM C1193-16 Standard Guide for Use of Joint Sealants
  .11 ASTM C1246-17(2022) Standard Test Method for Effects of Heat Aging on Weight Loss, Cracking, and Chalking of Elastomeric Sealants After Cure
  .12 ASTM C1247-20 Standard Test Method for Durability of Sealants Exposed to Continuous Immersion in Liquids
  .13 ASTM C1248-22 Standard Test Method for Staining of Porous Substrate by Joint Sealants
  .14 ASTM C1311-22 Standard Specification for Solvent Release Sealants
  .15 ASTM C1330-23 Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants.
  .16 ASTM D412-16(2021) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension
  .17 ASTM D2203-01(2023) Standard Test Method for Staining from Sealants
  .18 ASTM E84-24 Standard Test Method for Surface Burning Characteristics of Building Materials
  .19 ASTM E90-09(2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
.2 Department of Justice Canada (Jus)
  .1 Canadian Environmental Protection Act, 1999 (CEPA).
.3 U. S. Environmental Protection Agency (EPA)
  .1 EPA 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings.
.4 U.S. Food and Drug Administration (FDA)
  .1 FDA 21 CFR 177.2600 - Title 21 Part 177 Indirect Food Additives: Polymers.

.5 South Coast Air Quality Management District (SCAQMD) California State
.1 SCAQMD Rule 1168-03: Adhesives and Sealants.

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit product data for all sealant materials and accessories including:
.1 Preparation instructions and recommendations.
.2 Standard drawings illustrating manufacturer's recommended sealant joint profiles and dimensions applicable to Project.

.3 Joint Sealant Schedule: Indicate joint sealant location, joint sealant type, manufacturer and product name, and colour, for each application. Utilize joint sealant designations included in this Section.

.4 Greenguard Certificates: For each sealant and accessory product specified to meet volatile organic emissions standards of the Greenguard Children and Schools Certification.

1.5 Quality Assurance

.1 Installer Qualifications: Company with minimum of three years of experience specializing in work of this section, employing applicators trained for application of joint sealants required for this project, with record of successful completion of projects of similar scope, and approved by manufacturer.

.2 Single Source Responsibility: Provide joint sealants by a single manufacturer responsible for testing of Project substrates to verify compatibility and adhesion of joint sealants.

.3 Caulking work shall be carried out in strict accordance with manufacturer's printed directions.

.4 Preconstruction Manufacturer Laboratory Compatibility, Staining, and Adhesion Testing: Submit samples of each substrate or adjacent material that will be in contact with or affect joint sealants. Current manufacturer test data of products on matching substrates will be acceptable
.

.5 Adhesion: Use ASTM C719 and ASTM C794 to determine requirements for joint preparation, including cleaning and priming.

.6 Compatibility: Use ASTM C1087 to determine materials forming joints and adjacent materials do not adversely affect sealant materials and do not affect sealant colour

.7 Stain Testing: Use ASTM C510, ASTM C1248, or ASTM D2203 to verify non-staining characteristics of proposed sealants on specified substrates.

.8 Pre-construction manufacturer laboratory testing is not required when sealant manufacturer can furnish data acceptable to Consultant based on previous testing for materials matching those of the Work.

1.6 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver, handle and store materials in accordance with manufacturer's printed instructions.

1.7 Project Conditions

.1 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

.2 Ventilate area of work by use of approved portable supply and exhaust fans

1.8 Scheduling

.1 Schedule work so waterproofing, water repellents and preservative finishes are installed after sealants, unless sealant manufacturer approves otherwise in writing.

.2 Ensure sealants are cured before covering with other materials.

1.9 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

PART 2 PRODUCTS

2.1 Manufacturer

.1 Basis-of-Design Products: Provide joint sealant products manufactured by Tremco, Inc., Commercial Sealants and Waterproofing, 220 Wicksteed Avenue, Toronto, www.tremcosealants.com, or comparable products of other manufacturer approved by Consultant.

2.2 Materials – General

.1 VOC Content for Interior Applications: Provide sealants and sealant primers complying with the following VOC content limits per 40 CFR 59, Subpart D (EPA Method 24):
  .1 Architectural Sealants: 250 g/L.
  .2 Sealant Primers for Nonporous Substrates: 250 g/L.
  .3 Sealant Primers for Porous Substrates: 775 g/L.

.2 Low-Emitting Sealants for Interior Applications: Provide sealants and sealant primers complying with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

.3 Compatibility: Provide joint sealants and accessory materials that are compatible with one another, and with adjacent materials, as demonstrated by sealant manufacturer using ASTM C1087 testing and related experience.

.4 Joint Sealant Standard: Comply with ASTM C920 and other specified requirements for each joint sealant.

.5 Stain Test Characteristics: Where sealants are required to be non-staining, provide sealants tested per ASTM C1248 as non-staining on porous joint substrates specified.

.6 Food Contact Suitability: Where sealants are required to be suitable for contact with food provide sealants complying with 21 CFR 177.2600.

2.3 Silicone Joint Sealants

.1 SJS#1: Single-Component, Nonsag, Non-Staining, Moisture-Curing Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 100/50, Use NT; SWRI validated.
- .1 Basis of Design Product: Tremco Spectrem 1.
- .2 Volatile Organic Compound (VOC) Content: 1 g/L maximum.
- .3 Volatile Organic Emissions (VOE): Not greater than Greenguard Children & Schools Certification emissions levels.
- .4 Staining, ASTM C1248: None on concrete, marble, granite, limestone, and brick.
- .5 Colour: As selected by Consultant from manufacturer's standard line.

.2 SJS#2: Single-Component, Nonsag, Non-Staining, Neutral-Curing Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 50, Use NT; SWRI validated.
- .1 Basis of Design Product: Tremco Spectrem 2.
- .2 Volatile Organic Compound (VOC) Content: 50 g/L maximum.
- .3 Volatile Organic Emissions (VOE): Not greater than Greenguard Children & Schools Certification emissions levels.
- .4 Staining, ASTM C1248: None on concrete, marble, granite, limestone, and brick.
- .5 Colour: As selected by Consultant from manufacturer's standard line.

.3 SJS#3: Single-Component, Nonsag, Non-Staining, Neutral-Curing Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 50, Use NT.
- .1 Basis of Design Product: Tremco Spectrem 3.
- .2 Volatile Organic Compound (VOC) Content: 20 g/L maximum.
- .3 Volatile Organic Emissions (VOE): Not greater than Greenguard Children & Schools Certification emissions levels.
- .4 Staining, ASTM C1248: None on concrete, marble, granite, limestone, and brick.
- .5 Colour: As selected by Consultant from manufacturer's standard line.

.4 SJS#4: Multi-Component, Nonsag, Non-Staining, Field-Tintable Neutral-Curing Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 50, Use NT.
- .1 Basis of Design Product: Tremco Spectrem 4-TS.
- .2 Volatile Organic Compound (VOC) Content: 20 g/L maximum.
- .3 Volatile Organic Emissions (VOE): Not greater than Greenguard Children & Schools Certification emissions levels.
- .4 Staining, ASTM C1248: None on concrete, marble, granite, limestone, and brick.
- .5 Colour: As selected by Consultant from manufacturer's standard line.

.5 SJS#5: Mildew-Resistant, Single-Component, Acid-Curing Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 25, Use NT.
- .1 Basis of Design Product: Tremco Tremsil 200 Sanitary.
- .2 Volatile Organic Compound (VOC) Content: 1 g/L maximum.
- .3 Volatile Organic Emissions (VOE): Not greater than Greenguard Children & Schools Certification emissions levels.
- .4 Colour: White and Clear.

2.4 Urethane Joint Sealants

.1 UJS#1: Single-Component, Nonsag, Moisture-Cure, Polyurethane Joint Sealant: ASTM C920, Type S, Grade NS, Class 50, Use NT; Greenguard certified.

.1 Basis of Design Product: Tremco Dymonic 100.
.2 Volatile Organic Compound (VOC) Content: 40 g/L maximum.
.3 Volatile Organic Emissions (VOE): Not greater than Greenguard Children & Schools Certification emissions levels.
.4 Tensile Strength ASTM D412: 350 to 450 psi
.5 Percent Elongation ASTM D412: 800 to 900%
.6 Modulus at 100% ASTM D412: 75 to 85 psi
.7 Tear Strength ASTM D412: 65 to 75 psi
.8 Smoke Development ASTM E84: 5
.9 Colour: As selected by Consultant from manufacturer's standard line.

.2 UJS#2: Single-Component, Nonsag, Moisture-Cure, Polyurethane Hybrid Joint Sealant: ASTM C920, Type S, Grade NS, Class 35, Use NT; Greenguard certified.
.1 Basis of Design Product: Tremco Dymonic FC.
.2 Extrusion Rate ASTM C1183: 93.1 mL/min
.3 Weight Loss ASTM C1246: Pass
.4 Tack Free Time ASTM C679: 3 to 4 hours.
.5 Volatile Organic Compound (VOC) Content: 10 g/L maximum.
.6 Volatile Organic Emissions (VOE): Not greater than Greenguard Children & Schools Certification emissions levels.
.7 Colour: As selected by Consultant from manufacturer's standard line.

.3 UJS#3: Single-Component, Nonsag, Polyurethane Joint Sealant: ASTM C920, Type S, Grade NS, Class 25, Use NT.
.1 Basis of Design Product: Tremco Vulkem 116.
.2 Volatile Organic Compound (VOC) Content: 60 g/L maximum.
.3 Colour: As selected by Consultant from manufacturer's standard line.

.4 UJS#4: Immersible, Single-Component, Pourable, Traffic Grade Polyurethane Joint Sealant: ASTM C920, Type S, Grade P, Class 50, Use T and I.
.1 Basis of Design Product: Tremco Vulkem 45 SSL.
.2 Volatile Organic Compound (VOC) Content: 110 g/L maximum.
.3 Volatile Organic Emissions (VOE): Not greater than Greenguard Children & Schools Certification emissions levels.
.4 Colour: As selected by Consultant from manufacturer's standard line.

.5 UJS#5: Immersible, Multi-Component, Pourable, Traffic-Grade Polyurethane Joint Sealant: ASTM C920, Type M, Grade P, Class 35, Use T, O, and I.
.1 Basis of Design Product: Tremco Vulkem 445SSL.
.2 Tensile Strength, ASTM D412: 1.7 MPa, at 100 percent elongation.
.3 Tear Strength, ASTM D412: 6.1 kN/m.
.4 Adhesion to Concrete, After Water, ASTM C794: 4.4 kN/m
.5 Hardness, ASTM C661: 40 durometer Shore A, minimum.
.6 Accelerated Weathering, ASTM C793: Pass.
.7 Volatile Organic Compound (VOC) Content: 106 g/L maximum.
.8 Colour: As selected by Consultant from manufacturer's standard line.

.6 UJS#6: Multi-Component, Non-sag, Polyurethane Joint Sealant: ASTM C920, Type M, Grade NS, Class 50, Use I.
.1 Basis of Design Product: Tremco Dymeric 240 FC.
.2 Volatile Organic Compound (VOC) Content: 0 g/L maximum.
.3 Volatile Organic Emissions (VOE): Not greater than Greenguard Children & Schools Certification emissions levels.

.4 Colour: As selected by Consultant from manufacturer's standard line.

2.5 Latex Joint Sealants

.1 LJS#1: Latex Joint Sealant: Siliconized acrylic latex, ASTM C834, Type OP, Grade NF.
.1 Basis of Design Product: Tremco Tremflex 834.
.2 Volatile Organic Compound (VOC) Content: 35 g/L maximum.
.3 Volatile Organic Emissions (VOE): Not greater than Greenguard Children & Schools Certification emissions levels.
.4 Colour: White, paintable.

2.6 Solvent Release-Curing Sealants

.1 BJS#1: Butyl-Rubber-Based Joint Sealant: ASTM C1311.
.1 Basis of Design Product: Tremco Tremco Butyl Sealant.
.2 Volatile Organic Compound (VOC) Content: 250 g/L maximum.
.3 Colour: As selected by Consultant from manufacturer's standard colours.

2.7 Joint Sealant Accessories

.1 Cylindrical Sealant Backing: ASTM C1330, Type B non-absorbent, bi-cellular material with surface skin, or Type O open-cell polyurethane, as recommended by sealant manufacturer for application.

.2 Bond Breaker Tape: Polymer tape compatible with joint sealant and adjacent materials and recommended by sealant manufacturer.

.3 Joint Substrate Primers: Substrate primer recommended by sealant manufacturer for application.

.4 Cleaners: Chemical cleaners acceptable to joint sealant manufacturer.

.5 Masking tape: Non-staining, non-absorbent tape product compatible with joint sealants and adjacent joint surfaces.

PART 3 EXECUTION

3.1 Examination

.1 Examine joint profiles and surfaces to determine if work is ready to receive joint sealants. Verify joint dimensions are adequate for development of sealant movement capability. Verify joint surfaces are clean, dry, and adequately cured. Proceed with joint sealant work once conditions meet sealant manufacturer's written recommendations.

3.2 Preparation

.1 Joint Surface Cleaning: Clean joints prior to installing joint sealants using materials and methods recommended by sealant manufacturer. Comply with ASTM C1193.
.1 Remove curing compounds, laitance, form-release agents, dust, and other contaminants.
.2 Clean nonporous and porous surfaces utilizing chemical cleaners acceptable to sealant manufacturer.
.3 Protect elements surrounding the Work of this section from damage or disfiguration. Apply masking tape to adjacent surfaces when required to prevent damage to finishes from sealant installation.

3.3 Application

.1 Sealant and Primer Installation Standard: Comply with ASTM C1193 and manufacturer's written instructions.

.2 Joint Backing: Select joint backing materials recommended by sealant manufacturer as compatible with sealant and adjacent materials. Install backing material at depth required to produce profile of joint sealant allowing optimal sealant movement.
- .1 Install joint backing to maintain the following joint ratios:
  - .1 Joints up to 13 mm wide: 1:1 width to depth ratio.
  - .2 Joints greater than 13 mm wide: 2:1 width to depth ratio; maximum 13 mm joint depth.
- .2 Install bond breaker tape over substrates when sealant backings are not used.

.3 Masking: Mask adjacent surfaces to prevent staining or damage by contact with sealant or primer.

.4 Joint Priming: Prime joint substrates when recommended by sealant manufacturer or when indicated by preconstruction testing or experience. Apply recommended primer using sealant manufacturer's recommended application techniques.

.5 Liquid Sealant Application: Install sealants using methods recommended by sealant manufacturer, in depths recommended for application. Apply in continuous operation from bottom to top of joint vertically and horizontally in a single direction. Apply using adequate pressure to fill and seal joint width.
- .1 Tool sealants immediately with appropriately shaped tool to force sealants against joint backing and joint substrates, eliminating voids and ensuring full contact.
- .2 Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- .3 Tool exposed joint surface concave using tooling agents approved by sealant manufacturer for application.

.6 Installation of Acoustical Sealant: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations on both sides of assemblies with a continuous bead of acoustical sealant. Comply with ASTM C919 and with manufacturer's written recommendations.

3.4 Field Quality Control

.1 Field-Adhesion Testing: Perform adhesion tests in accordance with manufacturer's instructions and with ASTM C1193, Method A. .1 Perform 5 tests for the first 300 m of joint length for each kind of sealant and joint substrate, and one test for each 300 m of joint length thereafter or 1 test per each floor per building elevation, minimum.
- .1 For sealant applied between dissimilar materials, test both sides of joint.

.2 Remove sealants failing adhesion test, clean substrates, reapply sealants, and re-test. Test adjacent sealants to failed sealants.

.3 Submit report of field adhesion testing to Consultant indicating tests, locations, dates, results, and remedial actions taken.

3.5 Interior Joint Sealant Schedule

.1 Interior vertical movement joints in interior concrete and unit masonry.

.1 UJS#1, UJS#2: Single-component non-sag urethane sealant.

.2 Interior movement joints in interior unit masonry.
.1 UJS#1, UJS#2: Single-component non-sag urethane sealant.

.3 Interior perimeter joints of exterior aluminum frames.
.1 UJS#1: Single-component non-sag urethane sealant.

.4 Interior perimeter joints of interior frames.
.1 UJS#2: Single-component non-sag urethane sealant.
.2 LJS#1: Siliconized acrylic latex

.5 Interior sanitary joints between plumbing fixtures, food preparation fixtures and casework and adjacent walls, floors, and counters.
.1 SJS#5: Mildew-Resistant, Single-Component, nonsag, acid-curing silicone joint sealant.

.6 Interior traffic joints in floor and between floor and wall construction.
.1 UJS# 4, UJS#5: Single-component pourable urethane sealant.

.7 Interior non-moving joints between interior painted surfaces and adjacent materials.
.1 LJS#1: Siliconized acrylic latex
.2 Joint-Sealant Colour: Paintable.

.8 Interior concealed sealants at thresholds and sills.
.1 BJS#1: Butyl-rubber-based joint sealant.

.9 Interior exposed and non-exposed acoustical applications.
.1 AJS#1: Acoustical joint sealant.

3.6 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 Cleaning: Remove excess sealant using materials and methods approved by sealant manufacturer that will not damage joint substrate materials.
.1 Remove masking tape immediately after tooling joint without disturbing seal.
.2 Remove excess sealant from surfaces while still uncured.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 07 92 00 Joint Sealants

1.3 References

.1 ASTM International (ASTM)
  .1 ASTM A1008/A1008M-20 Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
  .2 ASTM A1011/A1011M-18a Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
  .3 ASTM C612-14 (2019) Standard Specification for Mineral Fiber Block and Board Thermal Insulation
  .4 ASTM C864-05(2019) Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers
  .5 ASTM C920-18 Standard Specification for Elastomeric Joint Sealants
  .6 ASTM E283/E283M-19 Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
  .7 ASTM E331-00(2009) Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
.2 The Aluminum Association, Inc (AA)
  .1 DAF-45 Designation System for Aluminum Finishes.
.3 American Architectural Manufacturers Association (AAMA)
  .1 AAMA 501 Methods of Test for Exterior Walls
  .2 AAMA 609 & 610.2 Cleaning and Maintenance Guide for Architecturally Finished Aluminum.
  .3 AAMA 2603 Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels
  .4 AAMA 2604 Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels
.4 Canadian Standards Association (CSA)
  .1 CSA S157-05/S157.1-05 (R2010) Strength Design in Aluminum.
  .2 CSA W59.2-M1991 (R2008) Welded Aluminum Construction.
.5 Ontario Ministry of Municipal Affairs and Housing (MMAH)
  .1 Ontario Building Code
  .2 MMAH Supplementary Standard SB-10, Energy Efficiency Requirements.

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Samples: Submit duplicate 300 mm long sample sections of all component parts of aluminum extrusions, finished in specified colours.

.3 Shop Drawings:
  .1 Indicate materials and profiles and provide full-size, scaled details for components.

.2 Indicate: Type and location of exposed finishes, method of anchorage, number of anchors, supports, reinforcement, accessories and caulking materials. Indicate location of caulking.
.3 Indicate assembly details and dimensions of fabrication.
.4 Indicate installation details and sequencing, method of glass installation, and location and method of sealing air and vapour barrier to curtain wall frame components.
.5 Indicate system dimensions, framed opening requirements and tolerances, adjacent construction, anticipated deflection under load, affected related work, weep drainage network, expansion and contraction joint location and details, and field welding required.

.4 Submit test reports from approved independent testing laboratories, certifying compliance with specified performance characteristics and physical properties, for:
.1 Energy efficiency (MMAH SB-10 compliance for complete assembly including glass units)
.2 Wind load resistance.
.3 Thermal resistance.
.4 Air infiltration.
.5 Water tightness
.6 Anodized finish, weathering characteristics.
.7 Design and components not complying with above requirements will not be accepted.

.5 Certificates: submit product certificates signed by manufacturer certifying materials and assemblies comply with specified performance characteristics and criteria and physical requirements.

.6 Operations and Maintenance Data: At completion of the project submit three copies of manufacturer's maintenance, cleaning and maintenance instructions for curtain walls for inclusion into Operation and Maintenance Manuals specified in Section 01 78 00.

1.5 Quality Assurance

.1 The installers executing the work of this Section shall have had at least ten years continuous Canadian experience in the successful manufacture and installation of work of the type and quality shown and specified and shall be approved by the systems manufacturer.

.2 Perform work in accordance with AAMA CW-DG-1.

.3 Perform welding work in accordance with CSA W59.2.

1.6 Performance Requirements

.1 Design system as thermally broken, pressure-equalized vented and drained assembly.

.2 Insulating glass units in combination with curtain wall framing shall be designed by the supplier to comply with ASTM E1300.

.3 Insulating glass units in combination with curtain wall framing shall be designed by the supplier to comply with energy efficient requirements specified in MMAH Supplementary Standard SB-10. Submit engineered shop drawings, calculations and certificates certifying compliance with that standard.

.4 Air infiltration shall not exceed 0.0003 $m^3/s.m^2$ when tested in accordance with ASTM E283 at a pressure differential of 298.77 Pa.

.5 Water penetration: To ASTM E331: None, with static pressure of 718.2 Pa.

.6 Drain water entering joints, condensation occurring in glazing channels or migrating moisture occurring within system, to exterior by weep drainage network.

.7 Provide continuous air barrier and vapour retarder throughout assembly, primarily in line with inside pane of glass and heel bead of glazing compound. Position thermal insulation on exterior surface of air and vapour barrier.

1.7 Protection

.1 Protect the work of this trade from damage. Protect work of other trades resulting from the work of this Section.

.2 Provide at the factory, strippable coatings on all exposed surfaces of aluminum. This coating and protective wrappings shall remain on the surfaces through the period that other trades' works proceed on the building and shall be removed on completion of the building.

.3 Make good all damaged work caused by failure to provide adequate protection. Remove unsatisfactory work and replace at no expense to the Owner.

1.8 Sequencing

.1 Co-ordinate work of this Section with air barrier placement, flashing placement, and other related components or materials.

1.9 Project Conditions

.1 Do not install sealants when ambient and surface temperature is less than 5 °C. Maintain this minimum temperature during and after installation of sealants.

1.10 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions. Handle work of this section in accordance with AAMA CW-10.

.3 Store materials indoors in dry location. Ensure materials do not come in contact with ground or other damp substrates.

.4 Cover exposed pre-finished surfaces with pressure-sensitive, heavy protection paper or apply strippable plastic coating before shipping to job site. Leave protective covering in place until final cleaning of building. Provide instructions for removal of protective covering.

1.11 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

1.12 Warranty

.1 Warrant the work of this Section against defects of workmanship and material, for a period of five years from the date of Substantial Performance and agree to make good promptly any defects which occur or become apparent within the warranty period.

.2 Provide a warranty stating that the anodized finish will be non-fading, nonconvertible, and permanently a part of the metal surface for a period of five years after acceptance of the building. The warranty shall state that any item showing failure during the warranty period will be replaced or refinished to the original condition, at no cost to the Owner.

PART 2 PRODUCTS

2.1 Manufacturers

.1 Manufacture: Aluminum sections and products manufactured by Alumicor form the basis of the drawings and specifications. The following manufacturers are considered as acceptable alternates subject to approval by the Consultant, of supporting technical literature, samples, drawings, engineering data and performance data:

.1 Windspec

.2 It is a mandatory requirement that all curtain walls and aluminum doors, frames, windows and screens specified in Section 08 50 00 be supplied by the same manufacturer.

2.2 Materials

.1 System Description: Existing vertical, glazed, pre-finished aluminum curtain wall system including thermally broken tubular steel reinforced aluminum sections. New insulated spandrel panels as indicated on drawings. Related flashings, anchorage and attachment devices.

.2 Assembled system to permit re-glazing of individual glass and infill panel units without requiring removal of structural mullion sections.

.3 Extruded aluminum: To ASTM B221, AA 6063-T54 or 6063-T6 alloy and temper.

.4 Flashings: Pre-finished aluminum where exposed to view. Finish: To match curtain wall sections. Secured with concealed fasteners.

.5 Fasteners: Where exposed shall be stainless steel, to ASTM A276, 300 series or 400 series stainless steel cadmium plated of sufficient size and quantity to suit their intended purpose.

.6 Thermal Barrier: Thermal separator shall be extruded of a silicone compatible elastomer that provides for silicone adhesion. Thermal Break shall be designed in accordance with AAMA TIR-A8 and tested in accordance with AAMA 505.

.7 Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements, containing no asbestos, formulated for 0.762 mm thickness per coat

.8 Sealant: Single-Component, Nonsag, Moisture-Cure, Polyurethane Joint Sealant: ASTM C920, Type S, Grade NS, Class 50, Use NT as specified in Section 07 92 00 – Joint Sealants.

.9 Adhesives: as recommended by manufacturer of materials to be bonded.

.10 Spandrel Panel Insulation: To ULC 702 Type 1 or ASTM C612 Type IVB, semi rigid stone wool insulation board, unfaced, square edged. Density 56 kg/$m^{3.}$ Thickness as indicated.
.1 Curtainrock. by Roxul
.2 MinWool Curtainwall by Johns Manville

.3 Fasteners and adhesive
.1 Adhesive types as recommended by insulation manufacturer for application.
.2 Insulating clips to be adhesive bonded pin and disc type.

2.3 Curtain Wall System

.1 Spandrel Panels at Concealed Locations: 0.84 mm galvanized sheet steel exterior panel, stone wool insulation with 0.84 mm galvanized sheet steel metal back-up as indicated on the drawings.

2.4 Fabrication

.1 Fabricate in accordance with manufacturer's written instructions.

.2 Take field measurements prior to fabrication.

.3 Framing joints to be accurately machined, fit, assembled, secured and sealed to provide tight, hairline, flush, neat weathertight joints and corners.

.4 Prepare components to receive anchor devices. Install anchors.

.5 Arrange fasteners and attachments to ensure concealment from view.

.6 Provide thermal break to maintain the interior surface of frames and glass free from condensation and frosting under conditions of minimum -12° C outside temperature with 24° C inside temperature at 35% relative humidity. All frame members to have extruded silicone compatible elastomeric thermal break integrated with the inner and outer aluminum extrusions by a roll-crimping process to form a rigidly interconnected assembly without the use of fasteners or other thermal bridging elements.

.7 Provide adequate, shielded drainage and pressure equalization where required.

.8 Form continuous flashings with intermediate clips, anchorages and reinforcing and as much as possible, be shop assembled. Provide all filler and closure pieces as required.

2.5 Aluminum Finishes

.1 Finish exposed surfaces of aluminum components in accordance with Aluminum Association Designation System for Aluminum Finishes.

.2 Clear anodic finish: designation AA- AA M10C22A41, not less than 18 micrometre thick, Architectural Class I designation.

2.6 Isolation Coating

.1 Apply one coat of bituminous paint to concealed aluminum and steel surfaces in contact with cementitious or dissimilar materials to provide isolation coating. Isolate aluminum from following:
.1 Dissimilar metals, except stainless steel, zinc, or white bronze of small area.
.2 Concrete, mortar, masonry and other alkaline materials.

.2 Coating material shall be low VOC type conforming to SCAQMD Rule 1113-96.

PART 3 EXECUTION

3.1 Examination

.1 Verify dimensions, tolerances and method of attachment with other work on site.

.2 Verify that wall openings and adjoining air barrier materials are prepared and ready to receive work of this Section and match reviewed shop drawings.

.3 Commence installation only when variations or discrepancies on the Site which will prevent satisfactory installation of this Section's work are corrected.

3.2 Installation

.1 Install curtain wall system in accordance with manufacturer's written instructions and reviewed shop drawings and AAMA MCWM-1 Metal Curtain Wall Manual. Install in accordance with manufacturer’s written instructions to achieve vented and drained, pressure-equalized rain screen assembly.

.2 Provide all fastenings or anchors to be built in under other Sections. Coordinate location and connection details for intermediate support framing with Section 05 12 23.

3.3 Caulking

.1 Refer to Section 07 92 00 – Joint Sealants. Install perimeter sealant to method required to achieve performance criteria.

3.4 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 Remove protective material from pre-finished aluminum surfaces.

.3 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.

.4 Perform cleaning of aluminum components in accordance with AAMA 609 & 610.2.

.5 Remove excess sealant by moderate use of solvent acceptable to sealant manufacturer.

.6 Visible manufacturer's identification labels are not permitted.

3.5 Protection

.1 Protect finished work from damage.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 06 10 00 Rough Carpentry
.2 Section 07 84 00 Firestopping
.3 Section 07 92 00 Joint Sealants
.4 Section 09 22 16 Non-Structural Metal Framing
.5 Section 09 91 23 Interior Painting

1.3 References

.1 ASTM International (ASTM)
  .1 ASTM C514-04(2020) Standard Specification for Nails for the Application of Gypsum Board
  .2 ASTM C840-20 Standard Specification for Application and Finishing of Gypsum Board
  .3 ASTM C954-22 Standard 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
  .4 ASTM C1002-22 Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
  .5 ASTM C1047-19 Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base
  .6 ASTM C1178/C1178M-18 Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel
  .7 ASTM C1278/C1278M-17 Standard Specification for Fiber-Reinforced Gypsum Panel
  .8 ASTM C1288-17 Standard Specification for Fiber-Cement Interior Substrate Sheets
  .9 ASTM C1325-22 Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units
  .10 ASTM C1396/C1396M - 17 Standard Specification for Gypsum Board
  .11 ASTM C1629/C1629M-19 Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels
  .12 ASTM E90-09(2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
  .13 ASTM E814-13a(2017) Standard Test Method for Fire Tests of Penetration Firestop Systems
  .14 ASTM E1966-15(2019) Standard Test Method for Fire-Resistive Joint Systems
.2 Canadian General Standards Board (CGSB)
  .1 CAN/CGSB-51.34 Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
  .2 CAN/CGSB 19-GP-21M Sealing and Bedding Compound for Acoustical Purposes
.3 Underwriters Laboratories of Canada (ULC)
  .1 ULC 102-2018 Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
  .2 ULC 114-2018 Standard Method of Test for Determination of Non-Combustibility in Building Materials
  .3 ULC 129- 2015 Standard Method of Test for Smoulder Resistance of Insulation (Basket Method)
  .4 ULC List of Equipment and Material, Volume III, Fire Resistance Ratings.
.4 Gypsum Association (GA)
  .1 GA-214-2022 Recommended Levels of Gypsum Board Finish.
  .2 GA-216-2021 Application and Finishing of Gypsum Board.
  .3 GA-253-2021 Application of Gypsum Sheathing

.5 Wall and Ceiling Bureau (WCB)
.1 Technical Bulletin Control Joint Placement in Gypsum Board Assemblies

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for gypsum board assemblies and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Samples:
.1 Submit for review and acceptance of each unit.
.2 Samples will be returned for inclusion into work.

1.5 Quality Assurance

.1 Dry wall installers: minimum 5 years proven experience.

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

1.6 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver, handle and store materials in accordance with manufacturer’s printed instructions.

.3 Protect gypsum board materials before, during and after installation and to protect the installed work and materials of other trades affected by this work. Store materials in a dry area inside the building. Do not remove wrapping until ready for use. Prevent damage to all edges and surfaces.

1.7 Project Conditions

.1 Maintain temperature minimum 10 ° C, maximum 21 ° 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.

1.8 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

PART 2 PRODUCTS

2.1 Gypsum Board

.1 To ASTM C1396/C1396M. Standard for non-rated applications, Type X for rated applications, 1220 mm wide x maximum practical length, ends square cut, edges tapered with round edge,

12.7 mm thick or to thickness indicated on drawings. All fire rated board shall be minimum 16 mm thickness.

.2 Water and Moisture Resistant Board: to ASTM C1396, 12.7 mm thick, 1220 mm wide with tapered edges.

.3 Abuse Resistant Gypsum Board: CGC Fibrerock abuse resistant fibre/gypsum panels, 16 mm thickness.

2.2 Fastening and Adhesives

.1 Drywall Screws: To ASTM C954 or ASTM C1002 self-drilling, self-tapping, case hardened, length to suit board thickness and provide minimum 12 mm penetration into support.

.2 Joint Tape: To ASTM C475, 50 mm perforated with preformed seam, mould and mildew resistant.
.1 Joint tape for abuse resistant gypsum board: CGC Mould Resistant Fiberglass Drywall Tape.

.3 Joint Filler and Topping: To ASTM C475 vinyl or latex base, slow setting.

.4 Laminating Compound: as recommended by manufacturer, asbestos-free.

.5 Surface burning characteristics to ULC 102:
.1 Flame spread: 15
.2 Smoke developed: 5
.3 Smoulder resistance: to ULC 129.
.4 Non-combustible: to ULC 114

.6 Thickness to suit depth of wall framing and as indicated.

.7 Acoustic sealant: as specified in Section 07 92 00 - Joint Sealants.

2.3 Accessories

.1 Casing beads, corner beads, control joints and edge trim: to ASTM C1047, zinc-coated by hot-dip process 0.5 mm base thickness, perforated flanges, one piece length per location.

.2 Insulating Strip: Rubberized, moisture resistant, 3.0 mm thick, 12 mm wide closed cell neoprene strip, with self-sticking permanent adhesive on one face; lengths as required.

.3 Control Joints: Bailey D-ZNCJ 7/16 x 10' Drywall or Veneer Plaster Control Joint.

.4 Sealants: as specified in Section 07 92 00 - Joint Sealants.

PART 3 EXECUTION

3.1 General

.1 Prior to installation of gypsum wallboard, ensure that all required vapour barriers, air seals, gaskets and the like installed under another Section have been inspected and accepted by Municipal authorities and the Consultant. Failure to do so will result in removal of all gypsum board installed prior to approval and replacement, at no additional cost to the Owner.

.2 Unless otherwise indicated on the drawings, all gypsum board partitions shall extend from floor level to the underside of floor or roof structures above.

3.2 Gypsum Board Application

.1 Do application and finishing of gypsum board in accordance with ASTM C840 and/or GA-216 except where specified otherwise.

.2 Do not apply gypsum board until bucks, anchors, blocking, electrical, and mechanical work are approved.

.3 Apply gypsum board at right angles to framing members or furring using screw fasteners. Maximum spacing of screws 300 mm o.c.

.4 Apply water or moisture resistant gypsum wallboard where indicated. Apply water resistant sealant to edges, ends and cut outs which expose gypsum core.

.5 Carry gypsum board from floor to underside of floor or roof structure above. Furr out and carry gypsum board around any structural members as may be required. Neatly cope gypsum board to fill deck flutes where gypsum board abuts floor or roof deck.

3.3 Accessories

.1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges.

.2 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated.

.3 Install insulating strips continuously at edges of gypsum board or casing beads abutting exterior door or window frames, to provide thermal break.

.4 Install continuous bead of acoustic sealant at all penetrations through sound control partitions.

.5 Provide control joints in gypsum board facing. Construct control joints in accordance with ASTM C840 and as described in Wall and Ceiling Bureau Technical Bulletin “Control Joint Placement in Gypsum Board Assemblies”. Place control joints consistent with lines of building spaces as indicated. Where not indicated install as directed at maximum 6.0 m spacing. Control joints shall be supported with metal studs or furring channels on both sides of the joint Construct joints using back-to-back casing beads filled with a low modulus sealant capable of flexible joint movement. Maintain fire-resistance rating of wall assemblies. Control joints shall be provided:
   .1 At abutting structural elements, steel columns.
   .2 At expansion or control joints in the substrate.
   .3 At each door jamb.

3.4 Access Doors

.1 Install access doors to electrical and mechanical fixtures specified in respective Sections.

.2 Rigidly secure frames to furring or framing systems, to satisfy fire rating requirements.

3.5 Taping and Filling

.1 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. Finish to GA-214 Level 5.

.2 Finish corner beads, control joints and trims as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.

.3 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after painting is completed.

.4 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.

.5 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for painting.

3.6 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 06 10 00 Rough Carpentry
.2 Section 09 21 16 Gypsum Board

1.3 References

.1 ASTM International (ASTM)
  .1 ASTM A653/A653M-23 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  .2 ASTM C645-18 Standard Specification for Nonstructural Steel Framing Members
  .3 ASTM C754-20 Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
  .4 ASTM C841-03(2018) Standard Specification for Installation of Interior Lathing and Furring.
  .5 ASTM C1002-22 Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
  .6 ASTM E90-09(2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
  .7 ASTM E814-13a(2017) Standard Test Method for Fire Tests of Penetration Firestop Systems
  .8 ASTM E1966-15(2019) Standard Test Method for Fire-Resistive Joint Systems
.2 Canadian General Services Board (CGSB)
  .1 CAN/CGSB-1.40-97 Primer, Structural Steel, Oil Alkyd Type.
.3 Underwriters Laboratories of Canada (ULC)
  .1 ULC List of Equipment and Material, Volume III, Fire Resistance Ratings.
.4 CSSBI Lightweight Steel Framing Manual

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product Data:
  .1 Submit manufacturer's instructions, printed product literature and data sheets for metal framing and include product characteristics, performance criteria, physical size, finish and limitations.

1.5 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.

1.6 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver, handle and store materials in accordance with manufacturer's printed instructions.

1.7 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

PART 2 PRODUCTS

2.1 Metal Stud Framing Systems

.1 Non-load bearing channel stud framing: to ASTM C645, stud size as indicated, roll formed from 0.53 mm thickness hot dipped galvanized steel sheet, for screw attachment of gypsum board. Knock-out service holes at 460 mm centres.
  .1 Thickness of materials to conform to referenced standards unless noted otherwise.
  .2 Thickness of materials shall be selected from manufacturer's standard span tables to suit total height requirements.

.2 Floor and ceiling tracks: to ASTM C645, in widths to suit stud sizes, 32 mm flange height.

.3 Metal channel stiffener: 1.4 mm thick cold rolled steel, coated with rust inhibitive coating.

.4 Tie Wire: 0.90 mm, galvanized, soft annealed, steel wire or clip as recommended by the manufacturer of furring channels.

.5 Wind bearing light weight steel stud framing for exterior wall applications is specified in Section 05 41 00.

2.2 Metal Furring and Suspension Systems

.1 Channel framing: to ASTM C645, stud size as indicated, roll formed from 0.53 mm thickness hot dipped galvanized steel sheet, for screw attachment of gypsum board.
  .1 Thickness of materials to conform to referenced standards unless noted otherwise.

.1 Metal Furring Runners, Hangers, Tie Wires, Inserts, Anchors: to ASTM C645 , electro-zinc coated steel.

.2 Runner Channels: 38 x 19 x 0.59 mm and 38 x 9.5 x 0.45 mm, hot dip or electro-galvanized sheet steel. Use of various sizes governed by applied loads and applicable spans.

.3 Drywall Furring Channel: Channel shaped furring member for screw attachment of drywall with knurled face. For interior use. Furring masonry or concrete surfaces. Cross furring under steel joist or suspended metal channels in suspended ceiling systems: 70 x 22 x 0.9 mm with knurled face, hot dip or electro-galvanized sheet steel. Bailey D-1001.

.4 Deflection Track: Bailey Multi-Slot Track MST 250, size to suit studs, and top deflection clips TDC 350 and TDC 587.

.5 Horizontal Flange attachment: Bailey Horizontal Flange Attachment Clip (HFA Clip)

.6 Hangers: minimum 4.1 mm diameter (or as required by ULC fire rating design requirements) mild steel rods.

2.2 Fasteners

.1 Powder activated fasteners: to suit structural conditions and fastening requirements and in accordance with manufacturer's recommendations: Ramset; Hilti; or approved equivalent.

.2 Sheet Metal Screws: To ASTM C1002, self-drilling, self-tapping, case hardened, length to suit board thickness and provide minimum 12 mm penetration into support.

2.3 Accessories

.1 Acoustic sealant: As specified in Section 07 92 00.

.2 Insulating strip: rubberized, moisture resistant 3 mm thick foam strip, 12 mm wide, with self-sticking adhesive on one face, lengths as required.

.3 Zinc Rich Paint: to CGSB 1-GP-181M. Low VOC type.

PART 3 EXECUTION

3.1 Examination

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for non-structural metal framing application in accordance with manufacturer's written instructions.
  .1 Visually inspect substrate in presence of Consultant.
  .2 Inform Consultant of unacceptable conditions immediately upon discovery.
  .3 Proceed with installation only after unacceptable conditions have been remedied [and after receipt of written approval to proceed from Consultant.

3.2 Erection

.1 Comply with ASTM C754.

.2 All gypsum board shall be supported with steel framing whether indicated or not.

.3 Unless otherwise indicated on the drawings, all gypsum board partitions shall extend from floor level to the underside of floor or roof structures above.

.4 Align partition tracks at floor and ceiling and secure at 600 mm on centre maximum. Provide top deflection tracks where indicated or as required to permit structural deflection. Install top deflection clips as necessary to increase load capacity.

.5 Install damp proof course under stud shoe tracks of partitions on slabs on grade.

.6 Place studs vertically at 400 mm on centre unless noted otherwise 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.

.7 Erect metal studding to tolerance of 1:1000.

.8 Attach studs to bottom and ceiling track using screws.

.9 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs

ensure web openings are aligned.

.10 Co-ordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other Sections.

.11 Provide two studs extending from floor to ceiling at each side of openings wider than stud centres specified. Secure studs together, 50 mm apart using column clips or other approved means of fastening placed alongside frame anchor clips.

.12 Install heavy thickness single jamb studs at openings.

.13 Erect track at head of door/window openings and sills of window openings to accommodate intermediate studs. Secure track to studs at each end, in accordance with manufacturer's instructions. Install intermediate studs above and below openings in same manner and spacing as wall studs.

.14 Frame openings and around built-in equipment, cabinets, access panels, on four sides. Extend framing into reveals. Check clearances with equipment suppliers.

.15 Provide 40 mm stud or furring channel secured between studs for attachment of fixtures behind lavatory basins, toilet and bathroom accessories, and other fixtures including grab bars and towel rails, attached to steel stud partitions.

.16 Install steel studs or furring channel between studs for attaching electrical and other boxes.

.17 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs. Use 50 mm leg ceiling tracks.

.18 Install continuous insulating strips to isolate studs from un-insulated surfaces.

.19 Install two continuous beads of acoustical sealant under studs and tracks around perimeter of sound control partitions.

3.3 Wall Furring

.1 Install wall furring for gypsum board wall finishes in accordance ASTM C754 and ASTM C841 except where specified otherwise and indicated on drawings.

.2 Frame openings and around built-in equipment, cabinets, access panels, etc., on four sides. Extend furring into reveals. Check clearances with equipment suppliers.

.3 Furr duct shafts, beams, columns, pipes and exposed services where indicated.

3.4 Suspended and Furred Ceilings and Bulkheads

.1 Erect hanger and runner channels for suspended gypsum board ceilings and bulkheads in accordance with ASTM C754 and ASTM C841 except where specified otherwise and indicated on drawings.

.2 Securely anchor hanger to structural supports 1220 mm o.c. maximum along runner channels and not more than 150 mm from ends. Under no circumstances shall hanger wires be secured to or supported from mechanical or electrical materials or equipment or penetrate mechanical ductwork.

.3 Space runner or furring channels as shown on drawings and not more than 610 mm o.c.

maximum nor 150 mm from walls. Run channels in long direction of board. Bend hanger sharply under bottom flange of runner and securely wire in place with a saddle tie. Provide channels below mechanical or electrical equipment and mechanical ductwork to maintain maximum spacing.

.4 Install furring channels transversely across runner channels in short direction of wallboard at 610 mm o.c. maximum or 150 mm from walls and interruptions in ceiling continuity. Secure channels to support with furring clips or wire. Where splicing is necessary lap minimum 200 mm and wire tie each end with double loops of 0.90 mm galvanized tie wire, 25 mm from each end of overlap.

.5 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 610 mm around perimeter of fixture. Coordinate with Electrical.

.6 Install work level to tolerance of 1:1200.

.7 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, grilles, etc.

.8 Install furring channels parallel to, and at exact locations of steel stud partition header track.

.9 Furr for gypsum board faced vertical bulkheads within or at termination of ceilings.

3.5 Gypsum Board

.1 Installation of gypsum board is specified in Section 09 21 16

3.6 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

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

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 07 92 00 Joint Sealants
.2 Section 09 21 16 Gypsum Board
.3 Section 09 65 16.23 Vinyl Sheet Flooring

1.3 References

.1 ASTM International (ASTM)
  .1 ASTM D2047-17 Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine
  .2 ASTM E648-19ae1 Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
  .3 ASTM E662-21ae1 Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
  .4 ASTM F710-22 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
  .5 ASTM F970-22 Standard Test Method for Measuring Recovery Properties of Floor Coverings after Static Loading
  .6 ASTM F1303-04(2021) Standard Specification for Sheet Vinyl Floor Covering with Backing
  .7 ASTM F1869-23 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
  .8 ASTM F1913-19 Standard Specification for Vinyl Sheet Floor Covering Without Backing
  .9 ASTM F2170-19a Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
.2 Resilient Floor Covering Institute (RFCI)
  .1 RFCI Standard Slab Moisture Test Method (Calcium Chloride Method) as a supplementary test method to ASTM F2170
.3 Underwriters Laboratories of Canada (ULC)
  .1 ULC 102.2-2018 Method of Test for Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials and Assemblies
.4 DIN 51130 Slip Resistance Test
.5 ACI 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product data: Submit manufacturer’s current printed product literature, specifications and installation instructions.

.3 Submit shop drawings, seaming plan, coving details, and manufacturer's technical data, installation and maintenance instructions for flooring and accessories.
  .1 Submit a cut diagram indicating seam locations and roll direction. Use mitered seam layouts for corners when changing directions 180 degrees (e.g. when running material down corridors which bisect at a right angle), unless approved otherwise.

.4 Samples for Verification: For each type of product indicated, in manufacturer's standard-size samples of each resilient product colour, texture, and pattern required.

1.5 Quality Assurance

.1 Installer shall be competent in the installation of resilient sheet flooring using heat-welded seams.

.2 Provide types of flooring and accessories supplied by one manufacturer, including leveling and patching compounds, and adhesives.

.3 Provide flooring material to meet the following fire test performance criteria as tested by a recognized independent testing laboratory:
.1 ASTM E648 Critical Radiant Flux of 0.45 watts per sq. cm. or greater, Class I.
.2 ASTM E662 (Smoke Generation) Maximum Specific Optical Density of 450 or less.

1.6 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver, handle and store materials in accordance with manufacturer’s printed instructions.

.3 Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 13 °C or more than 29 °C.

1.7 Project Conditions

.1 Install flooring and accessories after the other finishing operations, including painting, have been completed. Close spaces to traffic during the installation of the flooring. Do not install flooring over concrete slabs until they are sufficiently dry to achieve a bond with the adhesive, in accordance with the manufacturer's recommended bond and moisture tests.

.2 Maintain ambient temperatures within range recommended by manufacturer, but not less than 18 °C or more than 27 °C in spaces to receive resilient products during the following time periods:
.1 48 hours before installation.
.2 During installation.
.3 48 hours after installation.

.3 Maintain the ambient relative humidity between 40% and 60% during installation.

.4 Until Substantial Performance, maintain ambient temperatures within range recommended by manufacturer, but not less than 18 °C or more than 27 °C.

1.8 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

1.9 Warranty

.1 Warrant the work of this Section against defects of workmanship and material, for a period of ten years from the date of Substantial Performance and agree to make good promptly any defects which occur or become apparent within the warranty period.

PART 2 PRODUCTS

2.1 Manufacturer

.1 Polyflor Canada Inc. 3209 Orlando Drive, Mississauga Ontario. Phone: (905) 364-3000. Email sales@polyflor.ca.

2.2 Resilient Sheet Flooring

.1 The Resilient Sheet Flooring shall be Polysafe Verona PUR Original as supplied by Polyflor Canada Inc of Mississauga, Ontario Canada. Polysafe Verona PUR Original is recommended for heavy traffic areas that require a hard-wearing flooring which is attractive and easy to maintain. The Flooring shall be 0.080” (2.00mm) thickness in a roll width of 6’ 6” (2m); and comply with ASTM F1303 Standard Specification for Vinyl Sheet Covering with a backing; and ISO 13845 & ISO 10874. The Flooring shall incorporate a polyurethane reinforcement (PUR) to enable a polish-free maintenance program. The Flooring shall be suitable for use with Underfloor Heating, where a maximum temperature of 81°F (27°C) is recognized as the upper limit.

.2 Colours: To be selected by Consultant from full range of manufacturer’s standards.

2.3 Accessories

.1 Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic-cement-based formulation.

.2 Adhesives: As recommended by manufacturer to meet site conditions.

2.4 Accessories

.1 Installation Qualification: Contractors for floor covering installation should be professional installers, experienced in managing commercial flooring projects and qualified to install the various flooring materials specified.

PART 3 EXECUTION

3.1 Manufacturer’s Instructions

.1 Comply with manufacturer's written instructions for installing resilient sheet flooring

3.2 Examination

.1 Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the work.

.2 Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

.3 Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 Preparation

.1 Prepare substrates according to manufacturer's written instructions to ensure adhesion of Resilient Sheet Flooring.
  .1 Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
  .2 Remove substrate paint, coatings and other substances that are incompatible with adhesives or contain soap, wax, oil, solvents, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
  .3 Mechanically remove contamination on the substrate that may cause damage to the resilient flooring material. Permanent and non-permanent markers, pens, crayons, paint, etc., must not be used to write on the back of the flooring material or used to mark the substrate as they could bleed through and stain the flooring material.
  .4 Prepare Substrates according to ASTM F710 including the following:
    .1 Moisture Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
      .1 Perform anhydrous calcium chloride test, ASTM F1869. Results must not exceed 5 lbs. Moisture Vapor Emission Rate per 1,000 sq. ft. in 24 hours.

–or –

      .2 Perform relative humidity test using in situ probes, ASTM F2170. Must not exceed 80%.
    .2 A pH test for alkalinity must be conducted. Results should range between 7 and 9. If the test results are not within the acceptable range of 7 to 9, the installation must not proceed until the problem has been corrected.
    .3 Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.

.2 Fill cracks, holes, depressions and irregularities in the substrate with good quality Portland cement based underlayment leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

.3 Floor covering shall not be installed over expansion joints.

.4 Do not install resilient products until they are same temperature as the space where they are to be installed.
  .1 Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

.5 Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.4 Installation

.1 Resilient Sheet Flooring:
  .1 Install with adhesive specified for the site conditions and follow adhesive label for proper use.
  .2 Install rolls in sequential order following roll numbers on the labels.
  .3 Reverse sheets unless instructed otherwise in manufacturer's installation instructions.
  .4 Roll the flooring in both directions using a 100 pound three-section roller.
  .5 Vinyl sheet flooring must be welded.

Note: It is recommended to heat weld seams to provide a more sterile and water tight seam.

3.5 Protection

.1 Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
  .1 No traffic for 24 hours after installation.

.2 No heavy traffic, rolling loads, or furniture placement for 72 hours after installation.

3.6 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 Wait 72 hours after installation before performing initial cleaning.

.3 Comply with manufacturer's written instructions for cleaning and protection of resilient products.

.4 Perform the following operations immediately after completing resilient product installation:
.1 Remove adhesive and other blemishes from exposed surfaces.
.2 Sweep and vacuum surfaces thoroughly.
.3 Damp-mop surfaces to remove marks and soil.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 03 30 00 Cast-in-Place Concrete
.2 Section 06 40 00 Architectural Woodwork
.3 Section 09 21 16 Gypsum Board

1.3 References

.1 ASTM International (ASTM)
  .1 ASTM E84-23d Standard Test Method for Surface Burning Characteristics of Building Materials
  .2 ASTM F710-21 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
  .3 ASTM F1066-04(2018) Standard Specification for Vinyl Composition Floor Tile
  .4 ASTM F1344-21a Standard Specification for Rubber Floor Tile
  .5 ASTM F1861-21 Standard Specification for Resilient Wall Base
.2 Underwriters Laboratories of Canada (ULC)
  .1 ULC 102.2-2018 Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies
.3 South Coast Air Quality Management District (SCAQMD), California State
  .1 SCAQMD Rule 1168-03, Adhesives and Sealants Applications.

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit duplicate samples of manufacturer’s full range of colours for specified products for selection of colours by the Consultant.

.3 Submit a complete list of all materials proposed to be furnished and installed under this portion of the Work, stating manufacturer's name and catalogue number for each item, and product samples in colours specified.
  .1 Submit two copies of the manufacturer's current recommended method of installation for each item.

.4 Provide maintenance data for resilient flooring for incorporation into Operation and Maintenance Manual specified in Section 01 78 00 – Closeout Submittals.

1.5 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver, handle and store materials in accordance with manufacturer’s printed instructions.

.3 Use all means necessary to protect resilient flooring materials before, during and after installation and to protect the installed work and materials of all other trades.

1.6 Maintenance Materials

.1 Provide extra stock materials of resilient flooring, base and adhesives in accordance with Section 01 78 00 – Closeout Submittals.
  .1 Provide one carton of each colour, pattern and type flooring material required for this project for maintenance use.
  .2 Provide one container of adhesive.
  .3 Clearly identify each container of floor tile and each container of adhesive.

.2 Extra materials to be from same production run as installed materials.

1.7 Environmental Requirements

.1 Maintain air temperature and structural base temperature at floor installation area above 20° C for 48 hours before, during and after installation.

1.8 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

1.9 Warranty

.1 Warrant the work of this Section against defects of workmanship and material, for a period of ten years from the date of Substantial Performance and agree to make good promptly any defects which occur or become apparent within the warranty period.

PART 2 PRODUCTS

2.1 Materials

.1 Resilient Base: To ASTM F1861, 100 mm high thermoplastic rubber, not less than 3.0 mm thickness with preformed internal and external corners. Base at resilient tile shall have standard toe.
  .1 Johnsonite DuraCove DC Rubber Wall Base.
  .2 Roppe Pinnacle Rubber Base.
  .3 Amtico Marathon.
  .4 Burke Mercer BurkeBase.

.2 Primers, Adhesives and Caulking: non-flammable, solvent free, waterproof, recommended by flooring manufacturer for specific material on applicable substrate, above, at or below grade.

PART 3 EXECUTION

3.1 Surface Conditions

.1 Conform to requirements of ASTM F710.

.2 Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

.3 Confirm that base may be installed in accordance with the original design and the manufacturer's recommendations.

.4 In the event of discrepancy, immediately notify the Consultant. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 Base Application

.1 Lay out base to keep number of joints to a minimum. Locate joints at maximum available spacing or at internal or pre moulded corners.

.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 a 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 pre-moulded end pieces at flush door frames.

.7 Cope internal corners. Use pre moulded corner units for right angle external corners. Use formed straight base materials for external corners of other angles, minimum 300 mm each leg.

.8 Provide rubber base at all locations specified, regardless of floor finish.

3.3 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 Remove excess adhesive from resilient floor coverings, base and adjacent finished surfaces as the work progresses.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 04 22 00 Concrete Unit Masonry
.2 Section 09 21 16 Gypsum Board

1.3 References

.1 ASTM International (ASTM)
  .1 ASTM A780/A780M-20 Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
.2 Environmental Protection Agency (EPA)
  .1 Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings).
.3 Master Painters Institute (MPI)
  .1 MPI Architectural Painting Specifications Manual, 2018
  .2 MPI Standard GPS-1-12 and GPS-2-12 MPI Green Performance Standard for Painting and Coatings.
.4 Society for Protective Coatings (SSPC)
  .1 Systems and Specifications, SSPC Painting Manual 2009
.5 Underwriters Laboratories of Canada (ULC)
  .1 ULC 102-18 Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
.6 South Coast Air Quality Management District, California State (SCAQMD)
  .1 SCAQMD Rule 1113-96, Architectural Coatings.
.7 Green Seal GS-11 Green Seal Environmental Standard for Paints and Coatings, January 1997.
.8 National Fire Code of Canada

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product Data:
  .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Samples:
  .1 Submit duplicate 200 x 300 mm sample panels of each paint, stain, clear coating and special finish with specified paint or coating in colours, gloss/sheen and textures required to MPI Architectural Painting Specification Manual standards.
  .2 Retain reviewed samples on-site to demonstrate acceptable standard of quality for appropriate on-site surface.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties and SCAQMD Rule 1113-96.

.5 Provide maintenance data for paint products for incorporation into Operating and Maintenance Manuals specified in Section 01 78 00- Closeout Submittals. Include following:
  .1 Product name, number, type and use.

.2 Colour numbers.
.3 MPI Environmentally Friendly classification system rating.

1.5 Quality Assurance

.1 Qualifications:
.1 Contractor: to have a minimum of five years proven satisfactory experience.
.2 Qualified journeypersons as defined by local jurisdiction to be engaged in painting work.
.3 Apprentices: may be employed provided they work under direct supervision of qualified journeyperson in accordance with trade regulations.

.2 Conform to latest MPI requirements for painting work including preparation and priming.

.3 Materials: in accordance with MPI Painting Specification Manual "Approved Product" listing and from a single manufacturer for each system used.

.4 Paint materials to be highest quality product of an approved manufacturer listed in MPI Painting Specification Manual and to be compatible with other coating materials as required.

.5 Retain purchase orders, invoices and documents to prove conformance with noted MPI requirements when requested by Consultant.

.6 Provide mock-up in accordance with Section 01 45 00 - Quality Control.
.1 Prepare and paint designated surface, area, room or item (in each colour scheme) to specified requirements, with specified paint or coating showing selected colours, gloss/sheen and textures. Locate where directed.
.2 Mock-up will be used to judge workmanship, substrate preparation, operation of equipment and material application and workmanship to MPI Architectural Painting Specification Manual standards.
.3 Allow 24 hours for inspection of mock-up before proceeding with work.
.4 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Approved mock-up may remain as part of finished work.

1.6 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver and store materials in original containers, sealed, with labels intact. Labels to indicate:
.1 Manufacturer's name and address.
.2 Type of paint or coating.
.3 Compliance with applicable standard.
.4 Colour number in accordance with established colour schedule.

.3 Provide and maintain dry, temperature controlled, secure storage. Store materials and equipment in well-ventilated area with temperature range 7 ° C to 30 ° C. Store materials and supplies away from heat generating devices.

.4 Observe manufacturer's recommendations for storage and handling.

.5 Keep areas used for storage, cleaning and preparation, clean and orderly. After completion of operations, return areas to clean condition.

.6 Remove paint materials from storage only in quantities required for same day use.

.7 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.

.8 Remove damaged, opened and rejected materials from site.

1.7 Fire Safety Requirements

.1 Provide one 9 kg Type ABC dry chemical fire extinguisher adjacent to storage area.

.2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

.3 Handle, store, use and dispose of flammable and combustible materials in accordance with National Fire Code of Canada requirements.

1.8 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

.2 Place materials defined as hazardous or toxic in designated containers. Handle and dispose of hazardous materials in accordance with Municipal regulations.

.3 Unused materials must be disposed of at official hazardous material collections site.

.4 Paint and related materials are regarded as hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from the Ministry of the Environment.

.5 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.

.6 Place materials defined as hazardous or toxic waste in containers or areas designated for hazardous waste.

1.9 Maintenance

.1 Extra Materials:
- .1 Submit maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Quantity: provide one four litre can of each type and colour of finish coating. Identify colour and paint type in relation to established colour schedule and finish system.
- .3 Deliver to Owner and store where directed.

1.10 Ambient Conditions

.1 Heating, Ventilation and Lighting:
- .1 Ventilate enclosed spaces in accordance with Section 01 51 00 – Temporary Utilities.
- .2 Provide heating facilities to maintain ambient air and substrate temperatures above 10 ° C for 24 hours before, during and after paint application until paint has cured sufficiently.
- .3 Provide continuous ventilation for seven days after completion of application of paint.
- .4 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.
- .5 Provide minimum lighting level of 323 Lux on surfaces to be painted.

.2 Temperature, Humidity and Substrate Moisture Content Levels:

.1 Unless pre-approved in writing by Consultant and product manufacturer, perform no painting when:
  .1 Ambient air and substrate temperatures are below 10 ° C.
  .2 Substrate temperature is above 32 ° C unless paint is specifically formulated for application at high temperatures.
  .3 Substrate and ambient air temperatures are not expected to fall within MPI or paint manufacturer's prescribed limits.
  .4 The relative humidity is under 85% or when the dew point is more than 3 ° C variance between the air/surface temperature. Paint should not be applied if the dew point is less than 3 ° C below the ambient or surface temperature. Use sling psychrometer to establish the relative humidity before beginning paint work.
.2 Ensure that conditions are within specified limits during drying or curing process, until newly applied coating can itself withstand 'normal' adverse environmental factors.
.3 Perform painting work when maximum moisture content of the substrate is below:
  .1 Allow new concrete to cure minimum of 28 days.
  .2 15% for wood.
  .3 12% for plaster and gypsum board.
.4 Test for moisture using calibrated electronic Moisture Meter. Test concrete floors for moisture using "cover patch test".
.5 Test concrete and plaster surfaces for alkalinity as required.

.3 Surface and Environmental Conditions:
  .1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.
  .2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits.
  .3 Apply paint when previous coat of paint is dry or adequately cured.

PART 2 PRODUCTS

2.1 Materials

.1 Provide paint materials for paint systems from single manufacturer.

.2 Products to meet requirements of GS-11 or SCAQMD Rule 1113-96

.3 Paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.

.4 Only qualified products with E2 or E3 "Environmentally Friendly" rating are acceptable for use.

.5 Linseed oil, shellac, and turpentine: highest quality product from approved manufacturer listed in MPI Architectural Painting Specification Manual, compatible with other coating materials as required.

.6 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids:
  .1 Non-flammable, biodegradable.
  .2 Manufactured without compounds which contribute to ozone depletion in the upper atmosphere.
  .3 Manufactured without compounds which contribute to smog in the lower atmosphere.
  .4 Do not contain methylene chloride, chlorinated hydrocarbons or toxic metal pigments.
  .5 Recycled content of 15% post-consumer and ½ post-industrial waste.

.7 Formulate and manufacture water-borne surface coatings with no aromatic solvents,

formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.

.8 Flash point: 61 °C or greater for water-borne surface coatings and recycled water-borne surface coatings.

2.2 Colours

.1 Consultant will provide Colour Schedule.

.2 Colour schedule will be based upon selection of four base colours and three deep tint accent colours.

.3 Selection of colours will be from manufacturer's full range of colours.

.4 Where specific products are available in restricted range of colours, selection will be based on limited range.

.5 Second coat in three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 Mixing and Tinting

.1 Perform colour tinting operations prior to delivery of paint to site.

.2 Use and add thinner in accordance with paint manufacturer's recommendations. Do not use kerosene or similar organic solvents to thin water-based paints.

.3 Thin paint for spraying in accordance with paint manufacturer's instructions.

.4 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 Gloss/Sheen Ratings

.1 Paint gloss: defined as sheen rating of applied paint, in accordance with following values:

Gloss Level Category/	Units @ 60 Degrees	Units @ 85 Degrees
G1 – matte finish	0 to 5	Max. 10
G2 – velvet finish	0 to 10	10 to 35
G3 – eggshell finish	10 to 25	10 to 35
G4 – satin finish	20 to 35	Min. 35
G5 – semi-gloss finish	35 to 70	
G6 – gloss finish	70 to 85	
G7 – high gloss finish	> 85	

.2 Gloss level ratings of painted surfaces as specified and as noted on Finish Schedule.

2.5 Interior Painting Systems

.1 Structural Steel:
.1 INT 5.1X Latex G5 semi-gloss finish (over quick dry shop primer).

.2 Metal Fabrications:
.1 INT 5.3A Latex G5 semi-gloss finish

.3 Galvanized Metal: interior doors, frames, railings, misc. steel, pipes, and ducts.
.1 INT 5.3A Latex G5 semi-gloss finish

.4 Concrete Masonry:
.1 INT 4.2D High performance architectural latex G5 semi-gloss finish.

.5 Concrete masonry units at wet areas such as kitchens and change rooms:
.1 INT 4.2G Epoxy (tile-like) finish.

.6 Wood Clear Polyurethane Finish:
.1 INT 6.3K Polyurethane varnish G6 gloss finish.

.7 Electrical Equipment Backboards:
.1 INT 6.4P Fire retardant, pigmented coating. Low odour/low VOC. Semi-gloss (UL/ULC rated).

.8 Gypsum Board: Walls and Bulkheads.
.1 INT 9.2A Latex G3 eggshell finish over latex sealer.

.9 Gypsum Board: Ceilings and Bulkheads:
.1 INT 9.2A Latex G2 velvet finish over latex sealer.

.10 All other surfaces not noted above: high performance finish suitable for commercial and institutional environment and in accordance with MPI painting manual.

.11 Concrete Vertical Surfaces (including horizontal soffits)
.1 INT 3.1A Latex G4 (over w.b. alkali-resistant primer)

PART 3 EXECUTION

3.1 General

.1 Perform preparation and operations for interior painting in accordance with MPI Architectural Painting Specifications Manual except where specified otherwise.

.2 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and application instructions, and data sheets.

3.2 Examination

.1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report damages, defects, unsatisfactory or unfavourable conditions to Consultant before proceeding with work.

3.3 Preparation

.1 Protection:
.1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking and in accordance with paint manufacturers and MPI recommendations. If damaged, clean and restore surfaces as directed by Consultant.
.2 Protect items that are permanently attached such as Fire Labels on doors and frames.

.3 Protect factory finished products and equipment.

.2 Surface Preparation:
.1 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.
.2 Place "WET PAINT" signs in occupied areas as painting operations progress.

.3 Clean and prepare surfaces in accordance with MPI Architectural Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:
.1 Remove dust, dirt, and other surface debris by vacuuming, wiping with dry, clean cloths, or compressed air.
.2 Wash surfaces with a biodegradable detergent and bleach where applicable and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.
.3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
.4 Allow surfaces to drain completely and allow to dry thoroughly.
.5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.
.6 Use trigger operated spray nozzles for water hoses.
.7 Many water-based paints cannot be removed with water once dried. Minimize use of mineral spirits or organic solvents to clean up water-based paints.

.4 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.

.5 Where possible, prime non-exposed surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.
.1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.
.2 Apply wood filler to nail holes and cracks.
.3 Tint filler to match stains for stained woodwork.

.6 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements and SSPC-SP 6. Remove traces of blast products from surfaces, pockets and corners to be painted by brushing with clean brushes blowing with clean dry compressed air or vacuum cleaning.

.7 Touch up of shop primers with primer as specified.

.8 Do not apply paint until prepared surfaces have been accepted by Consultant.

3.4 Application

.1 Apply paint materials in accordance with paint manufacturer's written application instructions.

.2 Brush and Roller Application:
.1 Apply paint in uniform layer using brush and/or roller type 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 free of roller tracking and heavy stipple.
.5 Remove runs, sags and brush marks from finished work and repaint.

.3 Spray application:
  .1 Provide and maintain equipment that is suitable for intended purpose, capable of 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 uniform layer, overlapping at edges of spray pattern. Back roll first coat application.
  .4 Brush out immediately all runs and sags.
  .5 Use brushes and rollers to work paint into cracks, crevices and places which are not adequately painted by spray.

.4 Apply coats of paint continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.5 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.6 Sand and dust between coats to remove visible defects.

.7 Finish surfaces both above and below sight lines as specified for surrounding surfaces.

.8 Finish alcoves as specified for adjoining rooms.

.9 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.5 Mechanical/Electrical Equipment

.1 Paint finished area exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces.

.2 Mechanical and electrical rooms: paint exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment.

.3 Other unfinished areas: leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.

.4 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

.5 Do not paint over nameplates.

.6 Keep sprinkler heads free of paint.

.7 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.

.8 Paint fire protection piping red.

.9 Paint natural gas piping yellow.

.10 Paint both sides and edges of backboards for telephone and electrical equipment before installation. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

.11 Do not paint interior transformers and substation equipment.

3.6 Field Quality Control

.1 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.

.2 Standard of Acceptance:
.1 Walls: no defects visible from a distance of 1000 mm at 90 degrees to surface.
.2 Ceilings: no defects visible from floor at 45 degrees to surface when viewed using final lighting source.
.3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

3.7 Cleaning and Restoration

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 Remove protective coverings and warning signs as soon as practical after operations cease.

.3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.

.4 Protect freshly completed surfaces from paint droppings and dust to approval of Consultant. Avoid scuffing newly applied paint.

.5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Consultant.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 09 21 16 Gypsum Board

1.3 References

.1 Underwriters Laboratories of Canada (ULC)
  .1 ULC 102-18 Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit shop drawings.
  .1 Show dimensions, layout and details for fabrication and installation of whiteboards, tackboards, aluminum trim and anchorage.

.3 Provide maintenance data for whiteboards and tackboards for incorporation into Operating and Maintenance Manuals specified in Section 01 78 00- Closeout Submittals.

1.5 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver, handle and store materials in accordance with manufacturer's printed instructions.

.3 Use all means necessary to protect whiteboards, tackboards, aluminum trim, during and after installation and to protect the installed work and materials of all other trades.

.4 In the event of damage, immediately make all repairs and replacements necessary to the approval of the Consultant and at no additional cost to the Owner.

1.6 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

1.7 Requirements of Regulatory Agencies

.1 Surface burning characteristics of materials: to ULC S102.

PART 2 PRODUCTS

2.1 General

.1 The following manufacturers have been approved for the work of this Section:
  .1 Architectural School Products Ltd.

.2 Broome Porcelain Company
.3 Egan Visual
.4 Global School Products
.5 Martack Specialties
.6 Steelcase Inc.
.7 Ghent
.8 Epson
.9 Best Rite

.2 Whiteboards and tackboards shall be supplied by one manufacturer. Projection White Board can be supplied by different manufacturer.

2.2 Whiteboards

.1 Basis of Design: Series 9800 writing boards, white porcelain enamel on steel, factory pre-framed in clear anodized aluminum trim with chalk rail by Architectural School Products Ltd. or equivalent.
.1 Sizes as indicated.

.2 Provide one package of companion writing pens (3 each red, blue, green and black) for each whiteboard.

2.3 Tackboards

.1 Tackboards shall be 13 mm factory pre-laminated consisting of 6.4 mm thick fine grained natural cork laminated to 6.4 mm particle board or masonite substrate under mechanical pressure in maximum panel sizes of 1220 x 2440 mm. Bonding of materials by a waterproof adhesive that will not delaminate or rupture at the contact surfaces.

.2 Basis of design: Deluxe Series 4000, fine grain natural cork, light textured, brown with satin finished anodized aluminum frame and concealed fasteners, as manufactured by Architectural School Products Ltd. or equivalent.

.3 Sizes as indicated.

.4 All tackboards shall meet the minimum requirements of the applicable building code and shall have a flame spread rating of less than 150 when tested in accordance with ULC 102.

2.4 Trim

.1 Aluminum trim and chalk trays shall be 6063 T5 aluminum alloy with satin finish clear etched and anodized .05 mm satin finish free from extruding draw marks and surface scratches.
.1 Perimeter: No. 205 trim - 19 mm exposed face and weight of approximately 0.372 kg/m.
.2 Divider Bar No. 207 trim for adjacent panels of elevations greater than 2440 mm - 13 mm exposed face and weight of approximately 0.372 kg/m.
.3 Maprail: No. 206 trim for whiteboard elevation only complete with integral natural fine grained cork insert, end stops and two (2) combination roller maphooks per 1.2 lineal metre or portion thereof, - 50 mm exposed face and weight of approximately 0.520 kg/m.
.4 Tray No. 212 triangular box section for whiteboard elevations only complete with contour fitting and castings - 100 mm projection from wall and weight of approximately 1.42 kg/m.

PART 3 EXECUTION

3.1 Coordination

.1 Co-ordinate with all other trades as required to ensure proper and adequate provision in framing and wall finish for the installation of whiteboards and tackboards in the locations required.

.2 Prior to installation, inspect locations of all whiteboards and tackboards and verify that all necessary provisions have been made. In the event of discrepancy, immediately notify the Consultant.

.3 Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 Installation

.1 Install all whiteboards and tackboards where indicated on the drawings and in full accordance with the manufacturer's recommendations, anchoring all components firmly in place for long life under hard use.

.2 Erection of materials shall be carried out to ensure a rigid, straight, square, plumb and horizontal installation.

.3 All aluminum trim to be attached in such a manner that all fastenings shall be concealed. All corners are to be mitred.

3.3 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 All whiteboards, tackboards, and aluminum trim are to be cleaned prior to Substantial Performance.

End of Section

Division 22 Plumbing

Contract Requirements for Plumbing

22 02 51 Plumbing General Requirements
22 02 61 Plumbing Occupancy Requirements

Common Work Results for Plumbing

22 05 11 Plumbing Work Requirements
22 05 19 Thermometers and Pressure Gauges
22 05 21 Plumbing Demolition and Renovation
22 05 34 Plumbing Bases, Hangers, and Supports (Indoor)
22 05 53 Identification of Plumbing Services

Commissioning for Plumbing

22 05 65 Plumbing Contractor Commissioning Requirements

Plumbing Insulation

22 07 19 Plumbing Piping Insulation

Facility Water Distribution

22 11 16 Domestic Water Piping – Copper
22 11 19 Domestic Water Piping – Polyethylene
22 11 20 Backflow and Cross Connection Measures
22 11 31 Potable Water Auxiliary Equipment
22 36 13 Plumbing Auxiliary Equipment

Facility Sanitary Sewerage

22 13 13 Sanitary Drains
22 13 16 Sanitary Waste and Vent Piping – Cast Iron and Copper
22 13 17 Sanitary Waste and Vent Piping – Plastic
22 13 23 Sanitary Interceptors

Fire Extinguishers

22 37 13 Portable Fire Extinguishers

Plumbing Fixtures Combined With Drawing Schedule

22 44 13 Plumbing Fixtures Combined With Drawing Schedule

Division 23 Heating, Ventilating, and Air Conditioning (HVAC)

Common Contract Requirements for HVAC

23 02 51 HVAC General Requirements
23 02 61 HVAC Occupancy Requirements

Common Work for HVAC

23 05 11 General HVAC Work Requirements
23 05 21 HVAC Demolition and Renovation
23 05 31 HVAC Expansion Joints, Anchors, and Guides
23 05 34 Bases, Hangers and Supports (Indoor)
23 05 35 Bases, Hangers, and Supports (Outdoor)
23 05 49 HVAC Vibration and Noise Control Measures
23 05 53 Identification of HVAC Services

Testing, Adjusting, and Balancing
23 07 11 Testing, Adjusting, and Balancing (TAB) of HVAC Systems
Commissioning for HVAC
23 08 11 HVAC Contractor Commissioning Requirements
HVAC Insulation
23 10 13 Duct Insulation
Facility Fuel Piping
23 11 13 Site Services – Natural Gas & Propane Piping
23 11 23 Facility Natural-Gas & Propane Piping
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 14 Volume-Control Dampers
23 33 16 Fire Dampers
23 33 17 Smoke Control Dampers
23 33 18 Operating Dampers
23 33 53 Duct Liners
HVAC Fans
23 34 23 Packaged Exhausters
Air Outlets and Inlets
23 37 13 Diffusers, Registers, and Grilles
23 37 23 Louvres, Intakes, and Exhaust
Ventilation Hoods
23 38 13 Commercial-Kitchen Hoods
Packaged Outdoor HVAC Equipment
23 74 45 Packaged Air Source Rooftop HVAC Units with Back-Up Gas Heat
Custom Outdoor HVAC Equipment
23 75 24 Custom Outdoor, Indirect Fired Make-up Air Unit (Heat Only)
General Requirements for Integrated Automation
25 02 05 Integrated Automation General Requirements
Building Automation System
25 20 12 Building Automation System

END OF SECTION

Part 1 General

1.1 GENERAL PROVISIONS

.1 This section covers items common to all sections of Plumbing 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.

.5 The term “Mechanical Contractor” shall remain active and shall mean a “single contractor” performing plumbing, drainage, heating, cooling, ventilation, and control services.

.6 When quoting as a subcontractor this contractor shall explicitly state the services they are providing i.e. Mechanical (all services), Plumbing (water and drainage systems) or HVAC (including hydronic and air systems).

.7 Contractors shall be explicit to identify whether Fire Protection is included or omitted from the mechanical scope.

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 plumbing 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 AND 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.

.5 No bonding required for this contractor.

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.

1.5 DRAWINGS

.1 The drawings and this specification have been assembled together as a responsibility of the consultant. The same is true for the other consultants, i.e. architect, structural engineer, civil engineer, fire protection engineer, electrical engineer, etc.

.2 The drawings and specifications are not assembled together for responsibility/division between subcontractors. The division of work between subcontractors remains the responsibility of the buildings' contractor (also known as the prime contractor or general contractor).

.3 All subcontractors are encouraged to perform work amicably utilizing all of the drawings and specifications published by all of the consultants.

.4 Plumbing and 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.

.5 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 fittments.

.6 Plumbing and 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.

.7 Install piping and ductwork to clear structural members and any fireproofing. Locate plumbing 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.

.8 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.

.9 Locate all plumbing, mechanical, and electrical equipment in such a manner as to facilitate easy and safe access to and maintenance and replacement of any part.

.10 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.

.11 Relocate equipment and/or material installed but not co-ordinated with work of other Sections and/or installed incorrectly as directed, without extra charge.

.12 Where drawings are done in metric and product not available in metric, the corresponding imperial trade size shall be utilized.

1.6 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 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, plumbing, 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 file version AutoCAD 2013) 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 plumbing 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 Plumbing and Mechanical Division are lists of “Alternate Equipment” manufacturers acceptable to Consultant if their product meets characteristics of specified described equipment. Submitted Bids shall be based on the supply of named articles and or products as specified in the Bid Documents.

.2 Each bidder may elect to use “Alternate Equipment” from lists of Alternates where listed. Include for any additional costs including all costs for revisions to electrical contract to suit Alternate used. Prices are not required in Tender for Alternates listed except where specifically noted as “Separate Price”. Complete the Supplementary Tender Form.

.3 When two or more suppliers/manufacturers are named in the Bid Documents, only one supplier/manufacturer of the products named will be acceptable; however, it is the responsibility of this Division to ensure “Alternate Equipment” fits space allocated and gives performance specified. If an “Alternate Equipment” nor “equal” specified product unit is proposed and does not fit space allotted in Consultant’s opinion, supply of specified described equipment will be required without change in Contract amount. Should electrical characteristics for “alternate” or “equal” equipment differ from equipment specified it shall be the responsibility of the equipment manufacturer to pay all costs associated with the revisions to the electrical contract. Only manufacturers listed will be accepted for their product listing. All other manufacturers shall be quoted as substitution stating conditions and credit amount.

.4 If item of material specified is unobtainable, state in Tender proposed substitute and amount added or deducted for its use. Extra monies will not be paid for substitutions after Contract has been awarded.

.5 If pipe or item, of size or weight indicated, is unobtainable, supply next larger size or heavier weight without additional charge.

1.9 EXAMINATION

.1 Site 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 Plumbing and 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 plumbing 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 Plumbing 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 Plumbing 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 Plumbing 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 affect 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 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 an 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

1.12 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.

.1 Mobilization and shop drawings (max. $2,000.00)
.2 Demolition
.3 Inside buried plumbing and drainage
.4 Above grade rough-in plumbing and drainage
.5 Grease Interceptors

.6 Plumbing fixtures

.7 Piping insulation

.8 Firestopping

.9 Plumbing contractor closeout requirements (min. of 3% for the first $500,000.00, 1% from $500,000.00 to $5,000.000.00, and 0.5% beyond. Shall not be 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.

.6 Mobilization amount may only be drawn when all required shop drawings have been reviewed by the consultant.

1.13 COMMISSIONING CONTRACT BREAKDOWN

.1 This contractor shall work with the plumbing and HVAC system commissioning contractor as specified elsewhere.

1.14 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 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 their Engineer shall not supersede Contract Documents.

.9 Review comments of Consultant shall not relieve this Division from responsibility for deviations from Contract Documents unless Consultant's attention has been called to such deviations in writing at time of submission, nor shall they relieve this Division from responsibility for errors in items submitted.

.10 Check work described by catalog data with Contract Documents for deviations and errors.

.11 Shop drawings and product data shall show:

.1 Mounting arrangements.

.2 Operating and maintenance clearances. e.g., access door swing spaces.

.12 Shop drawings and product data shall be accompanied by:

.1 Detailed drawings of bases, supports, and anchor bolts.

.2 Acoustical sound power data, where applicable.

.3 Points of operation on performance curves.

.4 Manufacturer to certify as to current model production.

.5 Certification of compliance to applicable codes.

.13 State sizes, capacities, brand names, motor HP, accessories, materials, gauges, dimensions, and other pertinent information. List on catalog covers page numbers of submitted items. Underline applicable data.

.14 Shop drawings shall be submitted electronically as per the following directions:

.1 Electronic Submissions:

.1 Electronically submitted shop drawings shall be prepared as follows:

.1 Use latest software to generate PDF files of submission sheets.

.2 Scanned legible PDF sheets are acceptable. Image files are not acceptable.

.3 PDF format shall be of sufficient resolution to clearly show the finest detail.

.4 PDF page size shall be standardized for printing to letter size (8.5"x11"), portrait with no additional formatting required by the consultant. Submissions requiring larger detail sheets shall not exceed 11"x17".

.5 Submissions shall contain multiple files according to section names as they appear in Specification.

.6 File names shall include consultant project number and description of shop drawing section submitted.

.7 Each submission shall contain an index sheet listing the products submitted, indexed in the same order as they appear in the Specification. Include associated PDF file name for each section.

.8 On the shop drawing use an “electronic mark” to indicate what is being provided.

.9 **Each file shall bear an electronic representation of the “company stamp” of the contractor. If not stamped the file submission will not be reviewed.**

.2 Email submissions shall include subject line to clearly identify the consultants project number and the description of the shop drawings submitted.

.3 Electronic attachments via email shall not exceed 10MB. For submissions larger than 10MB, multiple email messages shall be used. Denote related email messages by indicating “1 of 2” and “2 of 2” in email subject line for the case of two messages.

.4 Electronic attachments via web links (URL) shall directly reference PDF files. Provide necessary access credentials within link or as username/password clearly identified within body of email message.

.5 On site, provide one (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 EQUIPMENT NAMEPLATE DATA

.1 Between the manufactures design published literature, the shop drawing submission literature, and the nameplate data on the equipment, they can all read differently.

.2 Most of the confusion and differences are coming out of the electrical power installation.

.3 The contractors installing and connecting the equipment are responsible for the coordination of this data through the construction period.

.4 The contractors shall share and/or request this information through out the project and monitor/make adjustments, provide recommendations accordingly based on any discrepancies.

.5 The contractors are responsible for any cost associated with the changing data.

.6 The final installation must meet the “Nameplate Data” on the equipment on site.

1.16 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 Submit one (1) copy of Operation and Maintenance Manual to Consultant for approval. Submission of individual data will not be accepted unless 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.

.4 Make changes as required and re-submit as directed by Consultant.

.5 Operation data to include:

.1 Control schematics for each system including environmental controls.

.2 Description of each system and its controls.

.3 Operation instruction for each system and each component.

.4 Description of actions to be taken in event of equipment failure.

.5 Valves schedule and flow diagram.

.6 Colour coding chart.

.7 Spare parts equipment list.

.8 Manufacturers standard or extended warranty information.

.6 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.

.7 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.

.5 Copy of all substantial performance final certificates.

.8 Miscellaneous data to include:

.1 Letter of contractor’s 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.

.9 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.

1.17 AS-BUILT DRAWINGS

.1 Site records:

.1 Contractor shall provide two (2) sets of reproducible plumbing 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 plumbing systems, control systems, and low voltage control wiring.

.2 On a weekly basis, transfer information to reproducibles, revising reproducibles to show all work as actually installed.

.3 Use different colour waterproof ink for each service.

.4 Make available for reference purposes and inspection at all times.

.2 As-built drawings submittal for TAB and review:

.1 Prior to start of Testing, Adjusting, and Balancing (TAB), finalize production of as-built drawings.

.2 Identify **each drawing** in lower right-hand corner in letters at least 3 mm (1/8") high as follows: - "AS-BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW PLUMBING SYSTEMS AS INSTALLED" (Company Name) (Signature of Contractor) (date).

.3 TAB to be performed using as-built drawings.

.4 Submit copy to Consultant for review and approval. When returned, make corrections 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.

1.18 WARRANTIES

.1 In addition to guarantee specified in General Conditions, guarantee 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 plumbing 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 plumbing sub-contractor approved by Consultant. Include copy of service/warranty agreement in warranty section of Operation & Maintenance Manual.

Warranty period shall start from date of ready for takeover. Warranty start date based on shipment date, start up date, substantial completion date, etc. are not applicable.

.4 Warranty Duration:

.1 One (1) year warranty period applies unless otherwise noted.

.5 Warranty Coverage:

.1 Applies to parts and labour.

1.19 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 TAB Reports

.5 Plumbing Systems Commissioning

.6 Instructions to Owners

1.20 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.

1.21 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 environmental damages but have readily accessible for inspection. Store items subject to moisture damage (such as controls) in dry, heated space.

.3 Remove all damaged materials from site.

1.22 ENERGY EFFICIENCY

.1 The 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 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 Potable Water Test (Refer to domestic water piping – Copper section – Part 3)

.2 Backflow Test Certificate (for all testable devices)

Part 2 Products

2.1 Not Used

Part 3 Execution

3.1 Not Used

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 Test drainage, waste and vent piping to Ontario Building Code and authorities having jurisdiction.

.3 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 Equipment: test as specified in relevant sections.

1.2 SYSTEM START UP

.1 Provide adjusting testing and start up of all equipment prior to testing and balancing (TAB) specified elsewhere.

.2 Provide consultant with written notice verifying all equipment operation and installation is complete.

.3 Start up shall be in presence of the following: owner or representative, contractor, building automation systems (BAS) contractor, and manufacturer's representative. Each person shall witness and sign off each piece of equipment. Consultant's attendance will be determined by consultant.

.4 Simulate system start up and shut down and verify operation of each piece of equipment.

.5 Arrange with all parties and provide 72 hours notice for start up procedure.

.6 Arrange with building automation systems contractor to sequence all components and ensure system operation.

1.3 COMMISSIONING

.1 Co-ordinate and direct each step of the commissioning process and recommend acceptance or non-acceptance to the Owner/Owner's Representative.

.2 Prepare, in writing, documentation of any deficiencies discovered during the commissioning process. Submit to consultant and Owner/Owner's Representative.

.3 The Commissioning Process is detailed in *ASHRAE Guideline 1-1996 HVAC Commissioning Process.* The commissioning plan may be modified to reflect the actual construction schedule and design.

.4 Provide a pre-functional test of all plumbing 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 plumbing/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 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.

.6 Plumbing 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.

.7 The verification testing procedures shall address all operating characteristics of all plumbing equipment and systems.

1.4 DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTION

.1 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.2 Plumbing 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 this Division, qualified manufacturers' representatives who are knowledgeable about the project to provide demonstrations and instructions.

.4 Use operation and maintenance manual, as-built drawings, audio visual aids, etc. as part of instruction materials.

.5 Instruction duration time requirements as specified in appropriate sections.

.6 Where deemed necessary, Consultants may record these demonstrations on video tape for future reference.

1.5 TRIAL USAGE

.1 Consultant or owner may use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 Trial usage to apply to following equipment and systems:

.1 Domestic water

.2 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 plumbing equipment at following heights unless indicated otherwise.

.1	Barrier-free wall hung lavatory	840 (33") max to top of rim 737 (29") min underside of rim front 685 (27") clear at 400 (8") from basin front 350 (14") min clear under waste trap
.2	Backflow preventors	900 – 1200 (3'– 4') to centerline of unit

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 plumbing responsibility is indicated in Equipment Schedule on plumbing/mechanical and/or electrical drawings.

.2 Power wiring and conduit is specified in Electrical Division except for conduit, wiring and connections below 50 V which are related to control systems. Follow Electrical Division for quality of materials and workmanship.

.3 Electrically operated equipment shall be C.S.A. approved label. Special Inspection Label of Provincial Authority having jurisdiction will be accepted in lieu of C.S.A. approval. Each motor shall have an approved starter. Starter will be supplied and installed by Electrical Division unless otherwise indicated.

1.12 CONTROL WIRING

.1 Furnish and install all components, devices, and control wiring for all plumbing, fire protection, HVAC equipment, HVAC systems, lighting, and other electrical loads to make all equipment operable to satisfaction of owner and consultant and to manufacturer’s requirements and recommendations.

.2 All electrical wiring and installations shall comply with local and national electrical 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 service rooms.

.6 Free-run plenum rated cable shall be run in cable hangers where provided by Electrical Division or tied neatly to pipe and duct hangers in the ceiling. Avoid wiring that droops. Follow building lines and do not run wiring “as the crow flies”.

1.13 PIPING AND EQUIPMENT SUPPORTS

.1 Fabricate from structural grade steel meeting requirements of - Structural Steel Section. Submit structural calculations with shop drawings.

.2 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.

.3 Where housekeeping pads incorporate existing pads provide 10 mm dowels into existing pads. New pad height shall match existing.

1.14 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.

1.15 FIRE STOPPING

.1 This contractor shall work with all other contractors on the project in providing one common method of fire stopping all penetrations made in fire rated assemblies.

.2 Approved fire stopping and smoke seal material in all fire separations and fire ratings within annular space between pipes, ducts, insulation and adjacent fire separation and/or fire rating.

.3 Do not use cementitious or rigid seals around penetrations for pipe(s) or other equipment at all wall, floor, or ceiling penetrations.

.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 Alternate Manufacturers to approval of local authority:

.1 Minnesota Mining and Manufacturing
.2 Fryesleeve Industries Inc.
.3 General Electric Pensil Firestop Systems
.4 International Protective Coatings Corp.
.5 Rectorseal Corporation (Metacaulk)
.6 Proset Systems
.7 3M
.8 AD Systems
.9 Hilti

.16 Ensure firestop manufacturer representative performs onsite inspections and certifies installation. Submit inspection reports/certification at time of substantial completion.

1.16 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.

1.17 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 service room(s). Base colour as specified in Pipe 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.

1.18 ACCESS DOORS

.1 Provide access doors to concealed plumbing 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 Manufacturers:

.1 Le Hage

.2 Zurn

.3 Acudor

.4 Nailor Industries Inc.

1.19 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.

1.20 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 vacuum air breaker and chain with cap.

.3 Drain valves on potable water systems shall be complete with vacuum breaker.

1.21 REPAIRS, CUTTING, AND RESTORATION

.1 Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown. Surface finishes shall exactly match existing finishes of same materials.

.2 Each Section of this Division shall bear expense of cutting, patching, and repairing to install their work and/or replacing of work of other Sections required because of its fault, error, tardiness, or because of damage done by it.

.3 Cutting, patching, repairing, and replacing pavements, sidewalks, roads, and curbs to permit installation of work of this Division is responsibility of Section installing work.

.4 All patching, painting and making good of the existing walls, floors, ceilings, partitions and roof will be at the expense of this Contractor, but performed by the Contractor specializing in the type of work involved unless otherwise noted.

1.22 EXISTING SYSTEMS

.1 Connections into existing systems to be made at time approved by Consultant. Request written approval of time when connections can be made.

.2 Be responsible for damage to existing plant by this work.

1.23 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.

1.24 DISCONNECTION AND REMOVAL

.1 Disconnect and/or remove equipment, piping, etc. as indicated.

.2 Cap and conceal all redundant and obsolete connections.

.3 Provide a list of equipment to be removed to the owner, for his acceptance of same. Remove all equipment from site, which the owner does not retain.

.4 Store equipment to be retained by owner on site where directed by consultant.

1.25 OWNER SUPPLIED EQUIPMENT

.1 Connect to equipment supplied by the owner and make operable.

1.26 DEMOLITION

.1 The general requirements are indicated on the drawings and on the outline specification in Division 1.

.2 The general execution of the demolition is to be carried out in a clean and efficient manner.

.3 Demolition of existing ceiling, walls etc., to facilitate removal of existing services or equipment or installation of new to be kept to a minimum and then restored to match existing.

.4 All openings or holes created by removal of existing plumbing systems which are not being reused are to be patched with the same material surrounding surfaces.

.5 All new holes and openings to facilitate plumbing systems are to be patched to match surrounding surfaces.

.6 Protect all existing furnishings materials and equipment. Any damage occurring as a result of the work of this Division shall be repaired or replaced at the expense of this Division.

.7 Where work involves breaking into or connecting to existing services, carry out work at times directed by the Owners in an expedient manner with minimum disruption to the facility and systems downtime.

.8 Where unknown services are encountered, immediately advise Consultant and confirm findings in writing.

.9 Where the location of any services has been shown on the plans, such information is not guaranteed. It is this Division's responsibility to verify locations, invert elevations, etc., immediately after moving on site. Should for any reason the information obtained necessitates changes in procedure or design, advise the Consultant at once. If verification of existing conditions is not done at the outset and any problems arise, the responsibility for same is entirely this Divisions.

1.27 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 USB.

.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 1 copy of USB.

.4 Identify video routing on As-built drawings.

1.28 LOCATION OF EXISTING UNDERGROUND SERVICES

.1 This contractor shall locate existing services prior to starting any work in the affected area.

.2 This contractor shall use a video camera for the existing storm and/or sanitary drainage at the indicated connection point to confirm location, size and invert of the existing piping.

1.29 EXISTING CONCRETE SLAB X-RAY/SCANNING

.1 This contractor shall retain the services of a qualified company to provide and X-ray and/or scan of the existing buried services in wall and/or floors prior to starting any work in the affected area.

.2 Failure to locate existing piping, conduit rebar etc., shall not relieve this contractor of repair of same prior to installing his service.

.3 This contractor shall be responsible for all repairs and/or replacement of existing services caused by cutting the existing concrete slabs and/or walls.

1.30 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 Plumbing Contractor as specified under Division 2. Where backfilling outside the building is not specified under Division 2 the plumbing 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 plumbing 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.

1.31 EXISTING SYSTEM DRAINAGE

.1 Drain all existing piping and drainage systems including all related equipment as required to facilitate system renovations.

.2 Disposal of existing system shall be to the requirements of the local and/or provincial regulations.

1.32 COOPERATION WITH OTHER TRADES

.1 Give full cooperation to other trades and furnish in writing to other trades, with copies to the engineer, any information necessary to permit the work of all trades to be installed satisfactorily and with the least possible interference or delay.

.2 Where plumbing work will be installed in close proximity to, or will interfere with work of other trades, assist in working out space conditions to make a satisfactory adjustment. Prepare composite working drawings and sections at a suitable scale, not less than ¼ inches = 1-foot – 0-inches, clearly showing how the plumbing work is to be installed in relation to the work of other trades. If work is installed before coordinating with other trades, or if it causes any interference with work of other trades, make the necessary changes in the work to correct the conditions and bear all costs.

.3 Furnish to other trades necessary templates, patterns, setting drawings, and shop details for the proper installation of work and for coordinating adjacent work.

1.33 WATERPROOFING SEAL MATERIALS

.1 Modular, expanding mechanical seal assemblies consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and pipe sleeve or wall opening, assembled with stainless steel bolts and pressure plates and designed so when bolts are tightened the links expand to seal the opening watertight. Select seal assemblies to suit pipe size and sleeve size or wall opening size.

.2 Standard of quality assurance manufacturers are:

.1 Thunderline Corp. (Power Plant Supply Co.) “Link Seal” Model S-316

.2 The Metraflex Co. “MetraSeal” type ES

.3 Or approved equivalent.

1.34 SLEEVE, CUT, AND FORMED OPENING LOCATION DRAWINGS

.1 Prepare and submit for review, drawings indicating size and location of required sleeves, recesses, and formed openings in poured or precast concrete work.

.2 Such drawings are to be completely and accurately dimensioned and relate sleeve, recesses, and formed openings to suitable grid lines and elevation datum, and are to take into account structural items such as grade beams, column caps, and column drop slabs.

.3 Begin to prepare such drawings immediately upon notification of acceptance of bid and award of Contract.

1.35 SUSTAINABLE CONSTRUCTION

.1 Construction Waste Management:

.1 Recycle all waste materials to avoid land fill sites where possible.

.2 All metal contents shall be recycled.

.3 All cardboard and paper shall be recycled.

.4 All plastic packaging shall be recycled.

.5 All wood shall be directed to the appropriate recycled wood section at the landfill site.

.2 This contractor is responsible for their own waste management system and cost associated with the disposal. This can be their own on site system, daily removal, back to shop, or a communal system shared with other contractors on site.

.3 In all cases the cost to remove materials on site are the cost of this contractor.

1.36 FREEZE PROTECTION

.1 Do not run lines in outside walls, or locations where freezing may occur. Piping next to outside walls shall be in furred spaces with insulation between the piping and the outside wall. Insulation of piping shall not be considered freeze protection.

1.37 SCAFFOLDING, RIGGING, AND HOISTING

.1 Provide all scaffolding, rigging, hoisting, and services necessary for erection and delivery into the premises of any equipment and apparatus furnished; remove same from premises when no longer required. Conform to OSHA requirements and standards.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ANSI/ASME B40.100, Pressure Gauges and Gauge Attachments.

.3 CAN/CGSB-14.4, Thermometers, Liquid-in-Glass, Self Indicating, Commercial/Industrial Type.

.4 CAN/CGSB-14.5, Thermometers, Bimetallic, Self-Indicating, Commercial/Industrial Type.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with general requirements.

.2 Submit manufacturer's product data for following items:

.1 Thermometers.

.2 Pressure gauges.

.3 Stop cocks.

.4 Siphons.

.5 Wells.

Part 2 Products

2.1 GENERAL

.1 Design point to be at mid point of scale or range.

.2 Ranges: suitable for application.

2.2 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 Manufacturers:

.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 PRESSURE GAUGES

.1 Install in following locations:

.1 Upstream and downstream of PRV's.

.2 Upstream and downstream of control valves.

.3 Inlet and outlet of backflow preventors.

.4 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.

3.3 NAMEPLATES

.1 Install engraved lamacoid nameplates as specified elsewhere identifying medium.

END OF SECTION

Part 1 General

1.1 GENERAL PROVISIONS

.1 Conform to the General Provisions of General Requirements Section.

.2 This project is one of a retrofit nature in part, and which will require some demolition.

.3 Allow for all remedial work in areas indicated on the drawings and as generally defined in the relevant sections of the specifications.

1.2 RELATED WORK SPECIFIED ELSEWHERE

.1 Electrical Division.

1.3 SCOPE OF WORK

.1 The scope of work is essentially the selected disconnection and/or removal of services and/or equipment, piping, ductwork, etc. as indicated or required to complete the work.

Part 2 Products

2.1 GENERAL

.1 This Division is to liaise with the Owners or Consultant for equipment being removed that may be suitable for reuse to that specified or handed over to the Owner.

.2 This Division is to take full responsibility for any special tools or equipment required to disassemble or remove material from building.

Part 3 Execution

3.1 GENERAL

.1 The general requirements are indicated on the drawings and on the outline specification in Division 1.

.2 The general execution of the demolition is to be carried out in a clean and efficient manner.

.3 Demolition of existing ceilings, walls, etc., to facilitate removal of existing services or equipment or installation of new to be kept to a minimum and then restored to match existing.

.4 All openings or holes created by removal of existing plumbing systems which are not being reused are to be patched with the same material surrounding surfaces.

.5 All new holes and openings to facilitate plumbing systems are to be patched to match surrounding surfaces.

.6 Protect all existing furnishings, materials, and equipment. Any damage occurring as a result of the work of this Division shall be repaired or replaced at the expense of this Division.

.7 Where work involves breaking into or connecting to existing services, carry out work at times directed by the Owners in an expedient manner with minimum disruption to the facility and systems downtime.

.8 Where unknown services are encountered, immediately advise Consultant and confirm findings in writing.

.9 Where the location of any services has been shown on the plans, such information is not guaranteed. It is this Division's responsibility to verify locations, invert elevations, etc., immediately after moving on site. Should for any reason the information obtained necessitate changes in procedure or design, advise the Consultant at once. If verification of existing conditions is not done at the outset and any problems arise, the responsibility for same is entirely this Division's.

.10 Disconnect and/or remove equipment, piping, ductwork, etc. as indicated.

.11 Cap and conceal all redundant and obsolete connections.

.12 Provide a list of equipment to be removed to the Owner, for their acceptance of same. Remove all equipment from site which the Owner does not retain.

.13 Maintain equipment to be retained by Owner on site where directed by Consultant.

.14 Demolition of all parts of the work must be completed within the confines of the work area and in such a way as the dust produced and risk to injury of will not adversely affect the building users.

.15 Demolished areas of the existing building will remain in their current use in some cases. Demolition in these areas must be kept to the minimum required to complete the work.

.16 Demolition shall take place within areas isolated from all other areas with appropriate hoarding, scaffolding, netting, fencing or other means of security between building users and the work.

.17 Co-ordinate making safe electrical devices, capping plumbing and removal of fixtures prior to commencement of demolition.

.18 All piping and equipment to be removed and/or abandoned shall be drained prior to capping and/or abandoning. Disposal of all liquids shall be to the approval of authority of having jurisdiction and/or provincial regulations.

3.2 EXISTING SYSTEM DRAINAGE

.1 Drain all existing piping systems including all related equipment as required to facilitate system renovations.

.2 Disposal of existing system shall be to the requirements of the local and/or provincial regulations.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 American National Standards Institute/ American Society of Mechanical Engineers (ANSI/ASME)

.1 ANSI/ASME B31.1, Power Piping, (SI Edition).

.3 American Society for Testing and Materials (ASTM)

.1 ASTM A 125, Specification for Steel Springs, Helical, Heat-Treated.

.2 ASTM A 307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.3 ASTM A 563, Specification for Carbon and Alloy Steel Nuts.

.4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)

.1 MSS SP-58, Pipe Hangers and Supports - Materials, Design, Manufacture Selection, Application, and Installation.

1.2 DESIGN REQUIREMENTS

.1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.

.2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP-58.

.3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.

.4 Design hangers and supports to support systems under all conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.

.5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment to be in accordance with MSS SP-58.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with general requirements.

.2 Submit shop drawings and product data for following items:

.1 All bases, hangers and supports.

.2 Connections to equipment and structure.

.3 Structural assemblies.

1.4 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

Part 2 Products

2.1 GENERAL

.1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS-SP-58.

.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.2 PIPE HANGERS

.1 Finishes:

.1 Pipe hangers and supports: to ANSI & ULC requirements

.2 Ensure steel hangers in contact with copper piping are copper plated.

.2 Upper attachment structural: Suspension from upper flange of I-Beam or joist.

.1 Cold piping NPS 50 mm (2") maximum: Ductile iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.

.1 Rod: 10 mm (3/8") UL listed

.2 Cold piping NPS 65 mm (2 1/2") or greater, all hot piping: Malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed & FM approved.

.3 Upper attachment structural: Suspension from upper flange of I-Beam.

.1 Cold piping NPS 50 mm (2") maximum: Ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed.

.2 Cold piping NPS 65 mm (2 1/2") or greater, all hot piping: Malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nuts.

.4 Upper attachment to concrete.

.1 Ceiling: Carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm (1/4") minimum greater than rod diameter.

.2 Concrete inserts: wedge shaped body with knockout protector plate ULC listed. Note: Rapidex and Siporex are <u>not</u> considered concrete. Should one of these systems be encountered, piping/ductwork and/or equipment shall be supported from adjacent walls or from supplemental steel provided by this contractor attached to the adjacent walls/structure.

.5 Shop and field-fabricated assemblies.

.1 Trapeze hanger assemblies: ASME B31.1.

.2 Steel brackets: ASME B31.1.

.6 Hanger rods: threaded rod material to MSS SP-58.

.1 Ensure that hanger rods are subject to tensile loading only.

.2 Provide linkages where lateral or axial movement of pipework is anticipated.

.7 Pipe attachments: material to MSS SP-58.

.1 Attachments for steel piping: carbon steel.

.2 Attachments for copper piping: copper plated black steel.

.3 Use insulation shields for all piping.

.4 Oversize pipe hangers and supports to accommodate thermal insulation. Provide 1.5 mm (16 gauge) saddles.

.8 Adjustable clevis: material to MSS SP-58 UL listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.

.1 Ensure "U" has hole in bottom for rivetting to insulation shields.

2.3 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 centre plate for pipe sizes NPS 300 mm (12") and over, carbon steel to comply with MSS SP-58.

2.4 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.

2.5 OTHER EQUIPMENT SUPPORTS

.1 From structural grade steel meeting requirements of structural steel section specified herein.

.2 Submit structural calculations with shop drawings.

2.6 MANUFACTURER

.1 Acceptable Manufacturers:

.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 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.

.3 Clevis plates:

.1 Attach to concrete with 4 minimum concrete inserts at each corner.

.4 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 Copper piping: up to NPS 15 mm (1/2"): every 1.5 m (5').

.3 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')	

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 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 lamacoid 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 Black letters, white background (except where required otherwise by applicable codes).

.2 Construction:

.1 3 mm (1/8") thick laminated plastic, matte finish, with square corners, letters accurately aligned and machine engraved into core.

.3 Sizes:

.1 Conform to following table:

Size	No. of 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.

.4 Locations:

.1 Equipment in Mechanical Rooms: Use size #9.

.2 Equipment above ceiling: use size #1 riveted to ceiling suspension system.

2.3 EXISTING IDENTIFICATION SYSTEMS

.1 Apply existing identification system to new work.

.2 Where existing identification system does not cover for new work, use identification system specified this section.

2.4 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
Domestic hot water supply	Green	DOM. HW SUPPLY
Dom. HW recirculation	Green	DOM. HW CIRC
Domestic cold water supply	Green	DOM. CWS
Domestic tempered supply	Green	DOM. TEMPERED
Trap Primer	Green	TRAP PRIMER
Sanitary	Green	SAN
Plumbing vent	Green	SAN. VENT

2.5 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.

2.6 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 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 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, 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 SHOP DRAWINGS AND AS-BUILT DRAWINGS

.1 Conform to General Requirements Section for shop drawings and as-built drawings requirements.

1.2 INSTALLATION INSPECTION AND EQUIPMENT VERIFICATION

.1 The Plumbing Contractor shall co-ordinate with the Consultant who will inspect the plumbing installation.

.2 The Plumbing 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
- Electrical - volts, amps, fuse size, overload size
- Any other special characteristics.

1.3 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.

1.4 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.

1.5 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 plumbing contractor and shall report to the Commissioning Consultant.

1.6 CLOSEOUT SCHEDULE

.1 The Plumbing 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 plumbing systems shall be directed to the Consultant with copies to the Owner and Consultant.

.3 The forms and reports to be issued shall include:

.1 Shop drawings, issued and accepted

.2 Equipment verification forms

.3 Testing forms

.4 Reports resulting from tests

.5 Testing schedule

.6 Equipment Start-up Forms

1.7 OPERATION AND MAINTENANCE MANUAL

.1 Conform to General Requirements section for the Operating and Maintenance Manual requirements.

1.8 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 Consultant before training commences. Provide course documentation for up to eight people.

.5 The training sessions shall be scheduled and co-ordinated by the Plumbing Contractor.

.6 Training shall be provided for the following systems:

System	Minimum Training Times
Water Sewer Treatment Systems	2 hours

1.9 PLUMBING 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.

1.10 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.

1.11 CLOSEOUT PROCESS ALLOCATION

.1 The mechanical contractor closeout process shall be as follows:

.1 3% for the first $500,000 of contract value.

.2 1% of the contract value for value between $500,000 to $5,000,000.

.3 0.5% of contract value for the value in excess of $5,000,000.

.4 Minimum Allocation for Close Out Documents is $5,000.

.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 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 C547, Type I and IV, Standard Specifications for Mineral Fibre Pipe Insulation.

.2 ASTM C 335, Test Method for Steady State Heat Transfer Properties of Pipe Insulation.

.3 ASTM C177, Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Proprieties by Means of the Guarded Hot-Plate Apparatus.

.4 ASTM C518, Standard Test Method for Steady-State Thermal Transmission Proprieties by Means of the Heat Flow Meter Apparatus.

.5 ASTM C 921, Practice for Determining the Properties Jacketing Materials for Thermal Insulation.

.6 ASTM C1695, Standard Specification for Fabrication of Flexible, Removable, and Reusable Blanket Insulation for Hot Service.

.7 ASTM C1729 Standard Specification for Aluminium Jacketing for 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), North American Commercial and Industrial 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.

.3 Submit properly completed detail plates from the North American Commercial and Industrial Insulation Standards manual, applicable to installation types required by this specific section.

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 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.

1.5 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.

.3 "ASJ+" – All Service Jacket – vapor retarder laminate of aluminium foil inner layer, reinforced with fiberglass scrim, bonded to a bleached kraft paper, with outer poly film leaving no paper exposed.

.4 "ASJ" – All Service Jacket (no outer film) – vapor retarder laminate of aluminium foil inner layer, reinforced with fiberglass scrim, bonded to a bleached kraft paper outer layer.

Part 2 Products

2.1 MATERIAL LIMITATIONS

.1 Products 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 C335, ASTM C177 or ASTM C518.

.3 Type A-1: Rigid moulded or wound mineral fibre with factory applied vapour retarder jacket.

.1 Mineral fibre: to ASTM C547 Type I and IV.

.2 Jacket: to ASTM C1136, Type I, II, III, IV, X.

.3 Maximum "k" factor: to ASTM C547.

.4 Type A-5: Fiberglass 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°@100°F (38°C) is 0.26BTU x IN/H FT^2 x °F

.4 Jacket: specified in 'Factory-Applied Jackets' Article

.5 Materials:

.1 All materials must be supplied by the same manufacturer.

.2 Acceptable Manufacturers:

.1 Johns Manville

.2 Knauf

.3 Manson

.4 Owens Corning

2.4 INSULATION SECUREMENT

.1 Tape: Self-adhesive, aluminum, reinforced, 50 mm (2") wide minimum.

.2 Contact adhesive: Quick setting.

.3 Canvas adhesive: Washable.

2.5 CEMENT

.1 Thermal insulating and finishing cement:

.1 Hydraulic setting or Air drying on mineral wool, to ASTM C 449M.

2.6 VAPOUR RETARDER LAP ADHESIVE

.1 Water based, fire retardant type, compatible with insulation.

2.7 INDOOR VAPOUR RETARDER FINISH

.1 Compatible with insulation.

2.8 JACKETS

.1 Polyvinyl Chloride (PVC):

.1 Minimum thickness: 20 mm (0.020")

.2 One-piece moulded type [and sheet] to CAN/CGSB-51.53 with pre-formed shapes as required.

.3 Colours: white.

.4 Minimum service temperatures: -29°C (-20°F).

.5 Maximum service temperature: 65°C (150°F).

.6 Moisture vapour transmission: 0.05 perm.

.7 Fastenings:

.1 Use solvent weld adhesive compatible with insulation to seal laps and joints.

.2 Tacks are not to be used below ambient temperature (cold) operating systems.

.3 Pressure sensitive vinyl tape of matching colour.

2.9 CAULKING FOR JACKETS

.1 Caulking: Silicone clear caulking.

Part 3 Execution

3.1 PRE-INSTALLATION REQUIREMENT

.1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed, and certified.

.2 Surfaces to be clean, dry, free from foreign material.

3.2 INSTALLATION

.1 Install in accordance with TIAC, North American Commercial and Industrial Insulation 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.

.5 Below ambient/chilled water installation:

.1 All pipes, valves, strainers, flanges, unions, and other pipe system components and spec must be properly insulated with correctly completed vapor retarder 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 0.02 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 specialties.

.5 All fitting insulation must be of the same type, thickness, and density of the pipe insulation, be premoulded insulation covers or fabricate from the same material as the pipe insulation. Full thickness must be maintained over all fitting surfaces. Blanket insulation with a 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 of the 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 to 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.

3.3 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

.1 Application: At expansion joints, valves, primary flow measuring elements, flanges, and unions at equipment.

.2 Flexible removable blanket insulation covers are not acceptable for below-ambient (cold) operation piping systems. Rigid removable insulation jackets that are vapor retarder exterior material, that can be vapor sealed at the seams, are acceptable on below-ambient (cold) operation piping systems.

.3 Design: To permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.

.4 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")
Horizontal Cast Iron Sanitary Piping	A-1/A-5	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/ASME B16.15, Cast Copper Alloy Threaded Fittings, Classes 125 and 250.

.3 ANSI B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.

.4 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

.5 ANSI B16.24, Cast Copper Alloy, Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500, and 2500.

.6 ASTM B88M, Specification for Seamless Copper Water Tube (Metric).

.7 MSS-SP-70, Cast Iron Gate Valves, Flanged and Threaded Ends.

.8 MSS-SP-71, Cast Iron Swing Check Valves, Flanged and Threaded Ends.

.9 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.

1.2 SHOP DRAWINGS

.1 Submit shop drawing data in accordance with general requirements.

1.3 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

Part 2 Products

2.1 PIPING

.1 Domestic hot, cold and recirculation systems, within building.

.1 Above ground: copper tube, hard drawn, type L: to ASTM B88M.

2.2 FITTINGS

.1 Bronze pipe flanges and flanged fittings, Class 150 and 300: to ANSI B16.24.

.2 Cast bronze threaded fittings, Class 125 and 250: to ANSI/ASME B16.15.

.3 Cast copper, solder type: to ANSI B16.18.

.4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.

.5 Tee drill NPS 25 mm (1") and larger.

2.3 JOINTS

.1 Solder: 95/5.

.2 Teflon tape: for threaded joints.

.3 Dielectric connections between dissimilar metals: dielectric fitting to ASTM F1545, complete with thermoplastic liner.

.4 Tee drill fittings shall be brazed with silver solder, 45% Ag - 15% Cu or copper phosphorous, 95% Cu, 5% P and non-corrosive flux.

2.4 VALVES

.1 All valves shall be of commercial grade and of same manufacturer, Lead-Free.

.2 Acceptable Manufacturers:

.1 Milwaukee

.2 Crane

.3 Kitz

.4 Apollo

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 BALANCING VALVES

.1 Provide brass balancing valves suitable for potable water.

.2 Brass body, EDPM O-Ring, Polytetrafluoroethylene slip washer and stainless steel spring.

.3 Connect with dielectric connections.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with Provincial Plumbing Code and local authority having jurisdiction.

.2 Cut square, ream and clean tubing and tube ends, clean recesses of fittings and assemble without binding.

.3 Assemble all piping using fittings manufactured to ANSI standards.

.4 Install tubing close to building structure to minimize furring, conserve headroom and space. Group exposed piping and run parallel to walls.

.5 Install CWS piping below and away from HWS and HWC and all other hot piping so as to maintain temperature of cold water as low as possible.

.6 Connect to fixtures and equipment in accordance with manufacturers instructions unless otherwise indicated.

.7 Bent tubing is not acceptable.

3.2 VALVES

.1 Isolate equipment, fixtures and branches with ball valves.

.2 Balance recirculation system using lockshield globe valves. Mark settings and record on as-built drawings on completion.

3.3 PRESSURE TESTS

.1 Conform to requirements of general requirements.

.2 Test pressure: greater of 1½ times maximum system operating pressure or 860 kPa (125 psi).

3.4 FLUSHING AND DISINFECTING

.1 Maintain testable RP backflow preventor between municipal water and new plumbing system.

.2 Ensure a minimum of 90% of plumbing fixtures are installed.

.3 Flush water mains through available outlets with a sufficient flow of potable water to produce a velocity of 1.5 m/s, within pipe for 10 min, or until foreign materials have been removed and flushed water is clear with backflow protection.

.4 Provide connections and pumps for flushing as required.

.5 Open and close valves, and operate fixtures to ensure thorough flushing.

.6 When flushing has been complete to satisfaction of Consultant introduce a strong solution of Chlorine into water system and ensure that it is distributed throughout entire system.

.7 Rate of chlorine application to be proportional to rate of water entering pipe.

.8 Chlorine injection to be close to point of filling water main or at building water service and to occur simultaneously.

.9 Confirm adequate chlorine residual not less than 50 ppm has been obtained, leave system charged with chlorine solution for 24 h. After 24 h, further samples shall be taken to ensure that there is still not less than 10 ppm of chlorine residual remaining throughout system.

.10 Upon 10 ppm confirmation and 24 hr elapsed time flush line to remove chlorine solution.

.11 Measure chlorine residuals at extreme end of pipe-line 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 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 Fittings: Classes 150, 300, 600, 900, 1500, and 2500.

.6 CSA B137.1 Polyethylene (PE) Pipe, Tubing, and Fittings for Cold-Water Pressure Services.

.7 CSA B137.5, cross linked polyethylene (PEX) tubing systems for pressure applications.

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 Buried domestic cold water systems

.1 1100 kPa (160 psi) polyethylene.

.2 Acceptable Manufacturers:

.1 Ipex Gold Stripe

2.2 FITTINGS

.1 Brass compression fittings.

2.3 PIPE SIZE

.1 Pipe shall be made to Copper Tube Size (CTS) outside diameter and shall have the following minimum inside diameters:

Nominal Size (in.)	Minimum Inside Diameter (in.)
¾"	0.785
1"	1.025
1¼"	1.265
1½"	1.505
2"	1.985

2½"	2.465
3"	2.945

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 Buried piping:

.1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.

3.2 PRESSURE TESTS

.1 Conform to requirements of general requirements.

.2 Test pressure: greater of 1 1/2 times maximum system operating pressure or 860 kPa (125 psi).

3.3 DISINFECTION

.1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction.

.2 Upon completion, provide laboratory test reports on water quality for Consultant approval. Water testing results to include ecoli count and total coliform count.

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 Manufacturers:
Watts
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 BACKFLOW PREVENTORS

.1 General Requirements:

.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.

.2 Reduced Pressure Principle:

.1 Up to 50 mm (2"):

.1 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.

.2 Acceptable Manufacturers:

.1 Watts 009 ½" - 2"

.2 Wilkins 975 XL ½" - 2"

.3 Conbraco 40-200 Series

2.2 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 Manufacturers:

.1 Watts BD series

.2 Emco

.3 Chicago

.4 Zurn

2.3 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 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.

3.3 HOSE BIBBS AND SEDIMENT FAUCETS

.1 Install at bottom of all risers, at low points to drain systems, and as 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 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.

.2 Hose bibbs, sediment faucets:

.1 Verify operation.

.5 Commissioning reports:

.1 Record all results on approved report forms.

.2 Include signature of tester and supervisor.

.3 To be countersigned by Consultant.

.6 Verification:

.1 Notify Consultant 48 h before commencing tests.

.2 All tests and procedures to be witnessed by Consultant.

.3 All reported results subject to verification by consultant.

.7 Training:

.1 Train O&M personnel in start-up, operation, monitoring, servicing, maintenance and shut-down procedures.

.8 Demonstrations:

.1 Demonstrate full compliance with Design Criteria.

.2 Demonstrations also to show completeness of O&M personnel training.

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.

.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 A126, Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.

.3 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.

.4 CAN/CSA-B79, Commercial and Residential Drains and Cleanouts.

1.2 SUBMITTALS

.1 Submit shop drawings and product data in accordance with general requirements.

.2 For shop drawings, indicate dimensions, construction details and materials.

.3 For product data, indicate dimensions, construction details and materials for all items specified herein.

1.3 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

.2 Data to include:

.1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year, and capacity.

.2 Details of operation, servicing, and maintenance.

.3 Recommended spare parts list.

Part 2 Products

2.1 FLOOR DRAINS

.1 Floor drains and trench drains: to CAN/CSA-B79.

.2 Refer to schedule for types and acceptable manufacturer.

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 Manufacturers:

.1 Zurn ZSS-1469

.2 Mifab C1400-RD

.3 Watts CO-480-RD-3

.4 Jay R. Smith 4710

.2 Cover for terrazzo finish: round polished nickel bronze with recessed cover for filling with terrazzo, vandal-proof locking screws.

.1 Acceptable Manufacturers:

.1 Zurn ZN-1400-Z

.2 Mifab C1100-UR-6

.3 Watts CO-200-U-1-6

.4 Jay R. Smith SQ-4-1753-NBRT-SP-U

.3 Cover for VCT tile and linoleum floors: square polished nickel bronze with 15 mm (1/2") thick flush mounted heavy duty nickel bronze cover, complete with vandal-proof locking screws.

.1 Acceptable Manufacturers:

.1 Zurn ZN-1400-T – HD

.2 Mifab C1100-TS-6

.3 Watts CO-200-TS-1-6

.4 Jay R. Smith 4200-U

.4 Cover for ceramic tile floors: 15 mm (½") thick heavy duty nickel bronze square, cover complete with gasket, vandal-proof screws, for flush finish.

.1 Acceptable Manufacturers:

.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 SQ-4-1753-NBCO-SP-U-Y

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 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.

3.4 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 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 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.

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.

.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 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 and below 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.Execution

2.4 APPLICATION

.1 Install copper or cast iron drainage on first 10'-0" (3.0m) of all fixtures discharging waste above 110°F.

2.5 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 Venting shall be 7.5 m (25'-0") from any outdoor air intakes.
- .4 Provide copper vent piping through roof as per detail.

.6 Use torque wrench to obtain proper tension in cinch bands when using hubless cast iron pipe. Butt ends of pipe against centering flange of coupling.

.7 Flash pipes passing through roof with 453 g (16 oz) sheet copper flashing fitted snugly around pipes and caulk between flashing and pipe with flexible waterproof compound.

- .1 Flashing base shall be at least 600 mm (24") square.
- .2 Flashing may be a 24 kg/m^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.

.8 Before piping is covered, conduct tests in presence of Consultant and correct leaks or defective work. Conduct test prior to placing floor slab but after backfill is placed.

- .1 Do not caulk threaded work.
- .2 Fill waste and vent system to roof level [a minimum of 3,100 mm - (10')] with water and show no leaks for 2 hours.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASTM D2235, Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.

.3 ASTM D2564, Specification for Solvent Cements for Poly(Vinyl-Chloride) (PVC) Plastic Piping Systems.

.4 CAN/CSA-B181.1, ABS Drain, Waste and Vent Pipe and Pipe Fittings.

.5 CAN/CSA-B181.2, PVC and CPVC Drain, Waste and Vent Pipe and Pipe Fittings.

.6 CAN/CSA-B182.1, Plastic Drain and Sewer Pipe and Pipe Fittings.

Part 2 Products

2.1 PIPING AND FITTINGS

.1 Buried sanitary, and vent piping to:

.1 80 mm (3") and smaller: ABS drain waste and vent pipe to CAN/CSA-B181.1.

.2 100 mm (4") and larger: SDR-35 PVC drain waste and vent pipe to CAN/CSA-B181.2.

.3 Vent piping: any size, PVC-DWV plastic drain and sewer pipe and fittings CAN/CSA-B181.2.

.2 Above grade sanitary and vent piping:

.1 80 mm (3") and smaller: IPEX: PVC-XFR drain waste and vent pipe to CAN/CSA-B181.2.

.2 100 mm (4") and larger: IPEX: PVC-XFR drain waste and vent pipe to CAN/CSA-B181.2.

.3 Vent piping: any size, IPEX: PVC-XFR plastic drain and sewer pipe and fittings CAN/CSA-B181.2.

.3 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') 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') 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 be 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 Thaler insulated Stack Jack flashing.

.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.

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 ENZYMATIC GREASE INTERCEPTORS (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:

.1 Refer to Schedules.

.3 Supply one (1) case of four 1 kg (2.2 lbs) cans of enzyme activator with interceptors.

.4 Provide extensions as required to suit finished floor elevation and installed depth.

.5 Provide secondary flow control devices for all interceptors that serve fixtures installed more than one storey above unit.

.6 Acceptable Manufacturers:

.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 HYDROMECHANICAL GREASE INTERCEPTORS (PLASTIC)

.1 Hydromechanical type interceptor, tested and rated in accordance with the Environmental Protection Act (EPA), complete with fire resistant polypropylene construction for mounting flush with floor with aluminum non-skid covers on floor complete with flow control fitting suitably vented, and extension.

.2 Capacity:

.1 Refer to Schedules.

.3 The unit shall be able to treat effluent to less than 100 mg/litre of oil and grease.

.4 Provide extensions as required to suit finished floor elevation and installed depth.

.5 Provide secondary flow control devices for all interceptors that serve fixtures installed more than one storey above unit.

.6 Acceptable Manufacturers:

.1 Canplas Endura

.2 MIFAB (with confirmation of CSA Compliance)

.3 JRC Plastic Interupters and Pit Boxes (Tel: 1-416-453-2364) (with confirmation of CSA compliance)

.4 Jonespec (with confirmation of CSA compliance)

.5 Contour (with confirmation of CSA compliance)

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.

.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 CIRCULATING PUMPS

.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.

.4 Supports: provide as recommended by manufacturer.

.5 Acceptable Manufacturers:

.1 Bell & Gossett

.2 Armstrong

.3 Taco

2.2 THERMOSTATIC WATER CONTROLLER (Built-in Recirc)

.1 Thermostatic High-Low Mixing Valves (Two required)

.1 Thermostatic mixing valve shall consist of a liquid filled thermal motor and piston control mechanism with positive shut-off of hot water when cold water supply is lost. Valve allows a restricted cold water flow in the event of loss or interruption of the hot water supply. All flow is shut off in the event of thermostatic failure.

.2 Construction: Bronze body and cap with replaceable corrosion resistant components, including stainless steel piston and liner.

.3 Valve shall come equipped with integral check stops, thermometer, removable strainers.

.4 Valve shall control temperature within ± 3°F.

.5 Thermostatic mixing valve shall be ASSE 1017, UPC and CSA certified.

.6 Acceptable Manufacturers:

.1 Bradley HL130

.2 Symmons

.3 Powers

.4 Leonard

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 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.

3.3 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 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 Acceptable Manufacturers:

.1 Wilson & Cousins

.2 National

2.2 IDENTIFICATION

.1 Identify extinguishers in accordance with recommendations of NFPA 10.

.2 Attach tag or label to extinguishers indicating month and year of installation and provide space for the addition of recording service dates.

2.3 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 Acceptable Manufacturers:

.1 National FB 4040 blanket, FB 6078 MC cabinet

.2 Wilson & Cousins

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 Manufacturers:

.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:

.1 Chrome plated flexible supply pipes each with screwdriver stop, reducers, escutcheon and chrome plated nipple.

.2 Acceptable Manufacturers:

.1 Delta 47T900 Series

.2 McGuire

.2 Waste:

.1 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.

.2 Acceptable Manufacturers:

.1 Delta 33T200 Series

.2 McGuire

.3 ‘P’ Traps:

.1 Cast brass P trap with cleanout on each fixture not having integral trap.

.2 Chrome plated in all exposed places.

.3 Acceptable Manufacturers:

.1 Delta 33T300 Series

.2 McGuire

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 Aerators: operation, cleanliness.

.2 Vacuum breakers, backflow preventors: operation under all conditions.

.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.

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.

END OF SECTION

Part 1 General

1.1 GENERAL PROVISIONS

.1 This section covers items common to all sections of Heating, Ventilation, and Air Conditioning (HVAC) 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.

.5 The term “Mechanical Contractor” shall remain active and shall mean a “single contractor” performing plumbing, drainage, heating, cooling, ventilation, and control services.

.6 When quoting as a subcontractor this building contractor shall explicitly state the services they are providing i.e. Mechanical (all services), Plumbing (water and drainage systems) or HVAC (including hydronic and air systems).

.7 Contractors shall be explicit to identify whether Fire Protection is included or omitted from the mechanical scope.

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 HVAC 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 AND 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.

1.5 DRAWINGS

.1 The drawings and this specification have been assembled together as a responsibility of the consultant. The same is true for the other consultants, i.e. architect, structural engineer, civil engineer, fire protection engineer, electrical engineer, etc.

.2 The drawings and specifications are not assembled together for responsibility/division between subcontractors. The division of work between subcontractors remains the responsibility of the buildings' contractor (also known as the prime contractor or general contractor).

.3 All subcontractors are encouraged to perform work amicably utilizing all of the drawings and specifications published by all of the consultants.

.4 Plumbing and HVAC Drawings do not show structural and related details. Take information involving accurate measurements 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.

.5 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.

.6 Plumbing and HVAC 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.

.7 Install piping and ductwork to clear structural members and any fireproofing. Locate HVAC 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.

.8 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.

.9 Locate all HVAC and electrical equipment in such a manner as to facilitate easy and safe access to and maintenance and replacement of any part.

.10 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.

.11 Relocate equipment and/or material installed but not co-ordinated with work of other Sections and/or installed incorrectly as directed, without extra charge.

.12 Where drawings are done in metric and product not available in metric, the corresponding imperial trade size shall be utilized.

1.6 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 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, plumbing, HVAC, 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 file version AutoCAD 2013) 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 HVAC 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 HVAC 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 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 Plumbing and HVAC 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, HVAC, 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 HVAC 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 HVAC 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 HVAC 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 HVAC 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 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 an 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

1.12 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.

.1 Mobilization and shop drawings (max. $2,000.00)
.2 Demolition
.3 Gas Piping
.4 HVAC
.5 MUA Unit
.6 NFPA Hoods

.7 Piping insulation

.8 Ductwork

.9 Duct insulation

.10 Grilles and diffusers

.11 Fire stopping

.12 Fans

.13 HVAC system commissioning

.14 Building automation systems

.15 Testing, adjusting, and balancing

.16 HVAC contractor closeout requirements (min. of 3% for the first $500,000.00, 1% from $500,000.00 to $5,000.000.00, and 0.5% beyond. Shall not be 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.

.6 Mobilization amount may only be drawn when all required shop drawings have been reviewed by the consultant.

1.13 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.

1.14 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 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 their Engineer shall not supersede Contract Documents.

.9 Review comments of Consultant shall not relieve this Division from responsibility for deviations from Contract Documents unless Consultant's attention has been called to such deviations in writing at time of submission, nor shall they relieve this Division from responsibility for errors in items submitted.

.10 Check work described by catalog data with Contract Documents for deviations and errors.

.11 Shop drawings and product data shall show:

.1 Mounting arrangements.

.2 Operating and maintenance clearances. e.g., access door swing spaces.

.12 Shop drawings and product data shall be accompanied by:

.1 Detailed drawings of bases, supports, and anchor bolts.

.2 Acoustical sound power data, where applicable.

.3 Points of operation on performance curves.

.4 Manufacturer to certify as to current model production.

.5 Certification of compliance to applicable codes.

.13 State sizes, capacities, brand names, motor HP, accessories, materials, gauges, dimensions, and other pertinent information. List on catalog covers page numbers of submitted items. Underline applicable data.

.14 Shop drawings shall be submitted electronically as per the following directions:

.1 Electronic Submissions:

.1 Electronically submitted shop drawings shall be prepared as follows:

.1 Use latest software to generate PDF files of submission sheets.

.2 Scanned legible PDF sheets are acceptable. Image files are not acceptable.

.3 PDF format shall be of sufficient resolution to clearly show the finest detail.

.4 PDF page size shall be standardized for printing to letter size (8.5"x11"), portrait with no additional formatting required by the consultant. Submissions requiring larger detail sheets shall not exceed 11"x17".

.5 Submissions shall contain multiple files according to section names as they appear in Specification.

.6 File names shall include consultant project number and description of shop drawing section submitted.

.7 Each submission shall contain an index sheet listing the products submitted, indexed in the same order as they appear in the Specification. Include associated PDF file name for each section.

.8 On the shop drawing use an “electronic mark” to indicate what is being provided.

.9 **Each file shall bear an electronic representation of the “company stamp” of the contractor. If not stamped the file submission will not be reviewed.**

.2 Email submissions shall include subject line to clearly identify the consultant’s 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 EQUIPMENT NAMEPLATE DATA

.1 Between the manufactures design published literature, the shop drawing submission literature, and the nameplate data on the equipment, they can all read differently.

.2 Most of the confusion and differences are coming out of the electrical power installation.

.3 The contractors installing and connecting the equipment are responsible for the coordination of this data through the construction period.

.4 The contractors shall share and/or request this information through out the project and monitor/make adjustments, provide recommendations accordingly based on any discrepancies.

.5 The contractors are responsible for any cost associated with the changing data.

.6 The final installation must meet the “Nameplate Data” on the equipment on site.

1.16 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 Submit one (1) copy of Operation and Maintenance Manual to Consultant for review and approval. Submission of individual data will not be accepted unless 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.

.4 Make changes as required and re-submit as directed by Consultant.

.5 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.

.6 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.

.7 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.

.5 Copy of all substantial performance final certificates.

.8 Miscellaneous data to include:

.1 Letter of contractor's 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.

.9 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.

1.17 AS-BUILT DRAWINGS

.1 Site records:

.1 Contractor shall provide two (2) sets of reproducible HVAC 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 HVAC systems, control systems, and low voltage control wiring.

.2 On a weekly basis, transfer information to reproducibles, revising reproducibles to show all work as actually installed.

.3 Use different colour waterproof ink for each service.

.4 Make available for reference purposes and inspection at all times.

.2 As-built drawings submittal for TAB and review:

.1 Prior to start of Testing, Adjusting, and Balancing (TAB), finalize production of as-built drawings.

.2 Identify **each drawing** in lower right-hand corner in letters at least 3 mm (1/8") high as follows: - "AS-BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW HVAC SYSTEMS AS INSTALLED" (Company Name) (Signature of Contractor) (date).

.3 TAB to be performed using as-built drawings.

.4 Submit copy to Consultant for review and approval. When returned, make corrections 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.

1.18 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 and Maintenance Manual.

.3 If HVAC 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 HVAC sub-contractor approved by Consultant. Include copy of service/warranty agreement in warranty section of Operation and 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 ready for takeover.

.5 Warranty period shall start from date of ready for takeover. Warranty period shall start from date of ready for takeover. Warranty start date based on shipment date, start up date, substantial completion date, etc. are not applicable.

.5 Warranty Duration:

.1 One (1) year warranty period applies unless otherwise noted.

.6 Warranty Coverage:

.1 Applies to parts and labour.

1.19 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 TAB Reports
.5 HVAC System Commissioning
.6 Instructions to Owners

1.20 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.

1.21 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 environmental damaging conditions but have readily accessible for inspection. Store items subject to moisture damage (such as controls) in dry, heated space.

.3 Remove any damaged materials from the site.

1.22 DESIGNATED SUBSTANCES AND HAZARDOUS MATERIALS

.1 If designated substances and/or hazardous materials are suspected or identified cease all work in the immediate area in accordance with OHSA and notify consultant.

.2 Each contractor and on site employee of the contractor shall have "asbestos awareness training".

.3 The Contractor shall ensure that employees who may come into contact with designated substances and/or hazardous materials due to the nature of the work that they perform, have received training that enables them to recognize designated substances and/or hazardous materials and that enables them to react in accordance with the Occupational Health and Safety Act and regulations thereto should contact with designated substances and/or hazardous materials occur during the course of their work.

.4 It is the responsibility of the contractor to review the designated substances and/or hazardous materials book in the building prior to starting any work.

.5 Existing occupied buildings (depending upon their age) may contain designated substances and/or hazardous materials in thermal insulating materials and some manufactured products, such as vinyl asbestos floor tile. Any insulating materials, on pipes, fittings, boilers, tanks, ductwork, etc. may contain designated substances and/or hazardous materials and shall not be disturbed.

.6 A survey of each building documenting the location and condition of designated substances and/or hazardous materials -containing materials is available for your mandatory review prior to commencing any work on premises.

1.23 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.

1.24 ENERGY EFFICIENCY

.1 The HVAC 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 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 Mandatory TSSA Gas Pressure Test (CSA B149.1)

.2 NFPA-96 Kitchen Hood Fire Suppression System Test

Part 2 Product

2.1 Not Used.

Part 3 Execution

3.1 Not Used.

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.

.6 Equipment: Test as specified in relevant sections.

.7 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures or test medium.

1.2 SYSTEM START UP

.1 Provide adjusting testing and start up of all equipment prior to testing and balancing (TAB) specified elsewhere.

.2 Provide Consultant with written notice verifying all equipment operation and installation is complete.

.3 Start up shall be in presence of the following: Owner or Representative, Contractor, Building Automation Systems (BAS) Contractor, and Manufacturer's Representative. Each person shall witness and sign off each piece of equipment. Consultant's attendance will be determined by Consultant.

.4 Simulate system start up and shut down and verify operation of each piece of equipment.

.5 Arrange with all parties and provide 72 hours' notice for start up procedure.

.6 Arrange with building automation systems contractor to sequence all components and ensure system operation.

1.3 COMMISSIONING

.1 Co-ordinate and direct each step of the commissioning process and recommend acceptance or non-acceptance to the Owner/Owner's Representative.

.2 Prepare, in writing, documentation of any deficiencies discovered during the commissioning process. Submit to Consultant and Owner/Owner's Representative.

.3 The Commissioning Process is detailed in *ASHRAE Guideline 1-1996 HVAC Commissioning Process.* The commissioning plan may be modified to reflect the actual construction schedule and design.

.4 Provide a pre-functional test of all HVAC 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 HVAC/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 HVAC 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 HVAC equipment and systems, including:

Equipment Checklist
Rooftop Heating/Cooling Unit(s)
Exhaust Fans
Air Handling Unit(s)
Controllers/Valves/Dampers
Relays/Sensors/Transducers

System Checklist
Air Handling Units

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 HVAC 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 HVAC Division, qualified manufacturers' representatives who are knowledgeable about the project to provide demonstrations and instructions.

.4 Use operation and maintenance manual, as-built drawings, audio visual aids, etc. as part of instruction materials.

.5 Instruction duration time requirements as specified in appropriate sections.

.6 Where deemed necessary, Consultants may record these demonstrations on video tape for future reference.

1.5 TRIAL USAGE

.1 Consultant or Owner may use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 Trial usage to apply to following equipment and systems:

.1 HVAC

.2 Exhaust air

.3 Control systems

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 ANCHOR BOLTS AND TEMPLATES

.1 Supply anchor bolts and templates for installation by other divisions.

1.9 PROTECTION OF OPENINGS

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

1.10 ELECTRICAL

.1 Electrical work to conform to Electrical Division including the following:

.1 Supplier and installer responsibility and related HVAC responsibility is indicated in Equipment Schedule on HVAC and/or electrical drawings,

.2 Power wiring and conduit is specified in Electrical Division except for conduit, wiring and connections below 50 V which are related to control systems specified in HVAC Division. Follow Electrical Division for quality of materials and workmanship.

.3 Electrically operated equipment shall be C.S.A. approved label. Special Inspection Label of Provincial Authority having jurisdiction will be accepted in lieu of C.S.A. approval. Each motor shall have an approved starter. Starter will be supplied and installed by Electrical Division unless otherwise indicated.

1.11 CONTROL WIRING

.1 Furnish and install all components, devices, and control wiring for all 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, HVAC wiring and installations shall comply with local and national electrical and HVAC 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 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".

1.12 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 equipment at following heights unless indicated otherwise.

.1	Thermostats (Operable, Barrier Free)	1200 mm (47.2")
.2	Thermostats (Non Barrier Free)	1500 mm (59")

.4 Also follow direction of architectural drawings and where discrepancies occur clarify prior to rough-in.

1.13 MOTORS

.1 Provide high efficiency motors for HVAC 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

- .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 HVAC 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 cementitious or rigid seals around penetrations for pipe or ductwork where penetrating through walls, floors, ceilings, etc.

.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 Alternate Manufacturers to approval of local authority:

- .1 Minnesota Mining and Manufacturing
- .2 Fryesleeve Industries Inc.
- .3 General Electric Pensil Firestop Systems
- .4 International Protective Coatings Corp.
- .5 Rectorseal Corporation (Metacaulk)
- .6 Proset Systems
- .7 3M
- .8 AD Systems
- .9 Hilti

.16 Ensure firestop manufacturer representative performs onsite inspections and certifies installation. Submit inspection reports/certification at time of substantial completion.

1.19 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.

1.20 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 service room, base colour as specified in HVAC 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.

1.21 SPARE PARTS

.1 Furnish spare parts in accordance with general requirements and as follows:

.1 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.

1.22 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.

1.23 ACCESS DOORS

.1 Provide access doors to concealed HVAC 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 Manufacturers:

.1 Le Hage

.2 Zurn

.3 Acudor

.4 Nailor Industries Inc.

1.24 REPAIRS, CUTTING, AND RESTORATION

.1 Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown. Surface finishes shall exactly match existing finishes of same materials.

.2 Each Section of this Division shall bear expense of cutting, patching, and repairing to install their work and/or replacing of work of other Sections required because of its fault, error, tardiness, or because of damage done by it.

.3 Cutting, patching, repairing, and replacing pavements, sidewalks, roads, and curbs to permit installation of work of this Division is responsibility of Section installing work.

.4 All patching, painting and making good of the existing walls, floors, ceilings, partitions and roof will be at the expense of this Contractor, but performed by the Contractor specializing in the type of work involved unless otherwise noted.

1.25 EXISTING SYSTEMS

.1 Connections into existing systems to be made at time approved by Consultant. Request written approval of time when connections can be made.

.2 Be responsible for damage to existing plant by this work.

1.26 CLEANING

.1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units prior to turn over to owner.

.2 In preparation for final acceptance, clean and refurbish all equipment and leave in operating condition including replacement of all filters in all air and piping systems.

1.27 DISCONNECTION AND REMOVAL

.1 Disconnect and/or remove equipment, piping, ductwork, etc. as indicated.

.2 Cap and conceal all redundant and obsolete connections.

.3 Provide a list of equipment to be removed to the owner, for his acceptance of same. Remove all equipment from site, which the owner does not retain.

.4 Store equipment to be retained by owner on site where directed by consultant.

1.28 OWNER SUPPLIED EQUIPMENT

.1 Connect to equipment supplied by the owner and make operable.

1.29 DEMOLITION

.1 The general requirements are indicated on the drawings and on the outline specification in Division 1.

.2 The general execution of the demolition is to be carried out in a clean and efficient manner.

.3 Demolition of existing ceiling, walls etc., to facilitate removal of existing services or equipment or installation of new to be kept to a minimum and then restored to match existing.

.4 All openings or holes created by removal of existing HVAC systems which are not being reused are to be patched with the same material surrounding surfaces.

.5 All new holes and openings to facilitate HVAC systems are to be patched to match surrounding surfaces.

.6 Protect all existing furnishings, materials, and equipment. Any damage occurring as a result of the work of this Division shall be repaired or replaced at the expense of this Division.

.7 Where work involves breaking into or connecting to existing services, carry out work at times directed by the Owners in an expedient manner with minimum disruption to the facility and systems downtime.

.8 Where unknown services are encountered, immediately advise Consultant and confirm findings in writing.

.9 Where the location of any services has been shown on the plans, such information is not guaranteed. It is this Division's responsibility to verify locations, invert elevations, etc., immediately after moving on site. Should for any reason the information obtained necessitate changes in procedure or design, advise the Consultant at once. If verification of existing conditions is not done at the outset and any problems arise, the responsibility for same is entirely this Division's.

1.30 EXISTING CONCRETE SLAB X-RAY/SCANNING

.1 This Contractor shall retain the services of a qualified company to provide an X-ray and/or scan of the existing buried services in wall and/or floors prior to starting any work in the affected area.

.2 Failure to locate existing piping, conduit, rebar, etc. shall not relieve this Contractor of repair of same prior to installing his service.

.3 This Contractor shall be responsible for all repairs and/or replacement of existing services caused by cutting the existing concrete slabs and/or walls.

1.31 EXCAVATING AND BACKFILLING

.1 Provide all excavating and backfilling inside and outside the building for any buried services. 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 or ductwork. Backfilling outside building over and above the 450 mm (18") backfill as previously specified herein shall be by the HVAC Contractor as specified under Division 2. Where backfilling outside the building is not specified under Division 2 the HVAC 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 HVAC Contractor shall provide all labour and material, including all equipment required for dewatering the excavation. After the water has been removed, this Contractor shall install a 300 mm (12") base of compacted 50 mm (2") clear stone covered with filter cloth before installing backfill as detailed and/or as specified.

.5 Be responsible for all weather protection required to install piping and/or equipment to the satisfaction of the Consultant.

.6 Be responsible for providing all clear stone or granular 'A' material suitable for application to replace existing soil not suitable for backfilling above the 450 mm (18") bedding material.

1.1 TSSA INSPECTION

.1 Prior to final completion of the project, this contractor shall make application, arrange, and pay for a TSSA inspection of all piping systems and equipment installations, including, but not limited to medical gasses, refrigeration, fuel piping, compressed air, heating plant, cooling plant, and associated equipment installed under the contract.

.2 Provide a copy of the TSSA report in the maintenance manuals for each system.

1.2 INTEGRATED LIFE SAFETY SYSTEMS TESTING

.1 HVAC systems in this building, including but not limited to smoke control dampers, smoke control fans, high speed low velocity ceiling fans, makeup air units, and heat tracing for fire protection systems may be subject to Integrated Life Safety Systems testing.

.2 The HVAC Contractor shall co-ordinate with the Integrated Life Safety Systems Testing Agent as follows:

.1 Confirm which HVAC systems are to be included as part of the testing process.

.2 Verify in writing to the Integrated Life Safety Systems Testing Agent that HVAC 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.

.4 Refer to Division 1/Division 26 Integrated Life Safety Systems Testing specifications for additional information/requirements.

1.3 REFRIGERANT CONTAINING EQUIPMENT

.1 A2L refrigerants are classified as mildly flammable. CSA B52-2023 has specific safety clauses related to the use of refrigerants with this classification within buildings.

.2 This Contractor shall be responsible to ensure that the installation requirements of CSA B52-2023 are met.

.3 Throughout this specification various pieces of equipment have been specified with refrigerant leak detection systems. Field wiring of the alarm status of this system to various downstream system components is required under Annex P of the standard and is the responsibility of this Contractor. These devices include the following:

.1 Open all zone dampers connected to the affected system.

.2 Disable electric reheat coils within the affected system.

.3 Activate field installed safety shut off valves on the affected refrigeration systems.

.4 De energize any potential sources of ignition with the ductwork system of the affected system.

.5 Energize fans within the ductwork system.

.6 Activate any designated refrigeration leak ventilation systems.

1.4 FREEZE PROTECTION

.1 Do not run lines in outside walls, or locations where freezing may occur. Piping next to outside walls shall be in furred spaces with insulation between the piping and the outside wall. Insulation of piping shall not be considered freeze protection.

1.5 SCAFFOLDING, RIGGING, AND HOISTING

.1 Provide all scaffolding, rigging, hoisting, and services necessary for erection and delivery into the premises of any equipment and apparatus furnished; remove same from premises when no longer required. Conform to OSHA requirements and standards.

1.6 COOPERATION WITH OTHER TRADES

.1 Give full cooperation to other trades and furnish in writing to other trades, with copies to the engineer, any information necessary to permit the work of all trades to be installed satisfactorily and with the least possible interference or delay.

.2 Where plumbing work will be installed in close proximity to, or will interfere with work of other trades, assist in working out space conditions to make a satisfactory adjustment. Prepare composite working drawings and sections at a suitable scale, not less than ¼ inches = 1-foot – 0-inches, clearly showing how the HVAC work is to be installed in relation to the work of other trades. If work is installed before coordinating with other trades, or if it causes any interference with work of other trades, make the necessary changes in the work to correct the conditions and bear all costs.

.3 Furnish to other trades necessary templates, patterns, setting drawings, and shop details for the proper installation of work and for coordinating adjacent work.

1.7 WATERPROOFING SEAL MATERIALS

.1 Modular, compressed seal assemblies consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and pipe sleeve or wall opening, assembled with stainless steel bolts and pressure plates and designed so when bolts are tightened the links expand to seal the opening watertight. Select seal assemblies to suit pipe size and sleeve size or wall opening size.

.2 Standard of quality assurance manufacturers are:

.1 Thunderline Corp. (Power Plant Supply Co.) “Link Seal” Model S-316

.2 The Metraflex Co. “MetraSeal” type ES

.3 Or approved equivalent.

1.8 SLEEVE, CUT, AND FORMED OPENING LOCATION DRAWINGS

.1 Prepare and submit for review, drawings indicating size and location of required sleeves, recesses, and formed openings in poured or precast concrete work.

.2 Such drawings are to be completely and accurately dimensioned and relate sleeve, recesses, and formed openings to suitable grid lines and elevation datum, and are to take into account structural items such as grade beams, column caps, and column drop slabs.

.3 Begin to prepare such drawings immediately upon notification of acceptance of bid and award of Contract.

1.9 SUSTAINABLE CONSTRUCTION

.1 Construction Waste Management:

.1 Recycle all waste materials to avoid land fill sites where possible.

.2 All metal contents shall be recycled.

.3 All cardboard and paper shall be recycled.

.4 All plastic packaging shall be recycled.

.5 All wood shall be directed to the appropriate recycled wood section at the landfill site.

.2 This Contractor is responsible for their own waste management system and cost associated with the disposal. This can be their own on site system, daily removal, back to shop, or a communal system shared with other contractors on site.

.3 In all cases the cost to remove materials on site are the cost of this Contractor.

END OF SECTION

Part 1 General

1.1 GENERAL PROVISIONS

.1 Conform to the General Provisions of General Requirements Section.

.2 This project is one of a retrofit nature in part, and which will require some demolition.

.3 Allow for all remedial work in areas indicated on the drawings and as generally defined in the relevant sections of the specifications.

1.2 RELATED WORK SPECIFIED ELSEWHERE

.1 Electrical Division.

1.3 SCOPE OF WORK

.1 The scope of work is essentially the selected disconnection and/or removal of services and/or equipment, piping, ductwork, etc. as indicated or required to complete the work.

Part 2 Products

2.1 GENERAL

.1 This Division is to liaise with the Owners or Consultant for equipment being removed that may be suitable for reuse to that specified or handed over to the Owner.

.2 This Division is to take full responsibility for any special tools or equipment required to disassemble or remove material from building.

Part 3 Execution

3.1 GENERAL

.1 The general requirements are indicated on the drawings and on the outline specification in Division 1.

.2 The general execution of the demolition is to be carried out in a clean and efficient manner.

.3 Demolition of existing ceilings, walls, etc., to facilitate removal of existing services or equipment or installation of new to be kept to a minimum and then restored to match existing.

.4 All openings or holes created by removal of existing HVAC systems which are not being reused are to be patched with the same material surrounding surfaces.

.5 All new holes and openings to facilitate HVAC systems are to be patched to match surrounding surfaces.

.6 Protect all existing furnishings, materials, and equipment. Any damage occurring as a result of the work of this Division shall be repaired or replaced at the expense of this Division.

.7 Where work involves breaking into or connecting to existing services, carry out work at times directed by the Owners in an expedient manner with minimum disruption to the facility and systems downtime.

.8 Where unknown services are encountered, immediately advise Consultant and confirm findings in writing.

.9 Where the location of any services has been shown on the plans, such information is not guaranteed. It is this Division's responsibility to verify locations, invert elevations, etc., immediately after moving on site. Should for any reason the information obtained necessitate changes in procedure or design, advise the Consultant at once. If verification of existing conditions is not done at the outset and any problems arise, the responsibility for same is entirely this Division's.

.10 Disconnect and/or remove equipment, piping, ductwork, etc. as indicated.

.11 Cap and conceal all redundant and obsolete connections.

.12 Provide a list of equipment to be removed to the Owner, for his acceptance of same. Remove all equipment from site which the Owner does not retain.

.13 Maintain equipment to be retained by Owner on site where directed by Consultant.

.14 Demolition of all parts of the work must be completed within the confines of the work area and in such a way as the dust produced and risk to injury of will not adversely affect the building users.

.15 Demolished areas of the existing building will remain in their current use in some cases. Demolition in these areas must be kept to the minimum required to complete the work.

.16 Demolition shall take place within areas isolated from all other areas with appropriate hoarding, scaffolding, netting, fencing or other means of security between building users and the work.

.17 Co-ordinate making safe electrical devices, capping plumbing and removal of fixtures prior to commencement of demolition.

.18 All piping and equipment to be removed and/or abandoned shall be drained prior to capping and/or abandoning. Disposal of all liquids shall be to the approval of authority of having jurisdiction and/or provincial regulations.

3.2 EXISTING SYSTEM DRAINAGE

.1 Drain all existing piping systems including all related equipment as required to facilitate system renovations.

.2 Disposal of existing system shall be to the requirements of the local and/or provincial regulations.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 American Society for Testing and Materials

.1 ASTM A53/A53M, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 ASTM A105/A105M, Specification for Carbon Steel Forgings for Piping Applications.

.3 MSS SP 58 (Manufacturers Standardization Society of the Valve and Fitting Industry – Pipe Hangers and Supports, Materials, Design and Manufacture).

1.2 DELEGATED ENGINEERING DESIGN AND PRODUCT SUBMITTAL

.1 Provide a delegated engineering design for all hydronic and domestic water risers to good engineering practice.

.1 Design Limitation: No more than 1,800 lbs shall be point loaded per core slab plank per floor.

.2 The design shall include analysis documentation signed and sealed by a licensed Professional Engineer with a minimum of five (5) years of experience in the design of piping risers and associated support systems.

.3 Submittal Requirements:

.1 Submit detailed calculations addressing thermal expansion, and where applicable to project location, seismic restraint requirements for the piping systems.

.2 Submit schematic drawing of the installed Riser system indicating components used and locations.

.3 Submit maximum anchor reaction loads for review and approval by the Structural Engineer of Record.

.4 Provide detailed drawings for each anchor, including dimensions and attachment method to the building structure.

.5 Provide detailed drawings and specifications for field assembly and structural attachment of pipe alignment guides.

.6 Provide product submittals for each required guide, anchor and expansion device.

.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 Submit sign off letter from Professional Engineer who completed the expansion compensation design.

.3 Data to include:

.1 Servicing requirements, including any special requirements, stuffing box packing, lubrication and recommended procedures.

Part 2 Products

2.1 ACCEPTABLE MATERIALS

.1 All materials furnished under this section shall be from a single supplier, designed and engineered as a complete system:

.1 Mason Industries

.2 Kinetics Noise Control Inc.

.3 Flex Pression Ltd.

2.2 ANCHORS AND GUIDES

.1 Anchors:

.1 Provide as indicated in expansion compensation design drawings.

.2 Alignment guides:

.1 Provide as indicated in expansion compensation design drawings.

.2 To accommodate specified thickness of insulation.

.3 Vapour barriers, jackets to remain uninterrupted.

2.3 ALIGNMENT GUIDES

.1 Wall Mounted:

.1 Spider type, designed to maintain axial alignment of piping.

.2 Guides shall not carry dead weight loads.

.3 Guides shall allow for movement of insulation with pipe.

2.4 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. One-piece body construction.

.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, P7FE (teflon) or graphite impregnated non-asbestos fiber.

.9 Thermal plastic packing: P7FE (teflon) or graphite impregnated non-asbestos fiber 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.

.15 Lubricant fittings, plunger, gun not required for low friction self lubricating packing.

2.5 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.

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 SITE REVIEW

.1 The Professional Engineer who stamps the submitted expansion compensation shop drawings shall be responsible to conduct periodic site reviews of the installed systems.

.2 The Professional Engineer shall provide written confirmation that the systems are installed to manufacturer recommendations and their design prior to project closeout.

3.3 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.

3.4 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 American National Standards Institute/ American Society of Mechanical Engineers (ANSI/ASME)

.1 ANSI/ASME B31.1, Power Piping, (SI Edition).

.3 American Society for Testing and Materials (ASTM)

.1 ASTM A 125, Specification for Steel Springs, Helical, Heat-Treated.

.2 ASTM A 307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.3 ASTM A 563, Specification for Carbon and Alloy Steel Nuts.

.4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)

.1 MSS SP-58, Pipe Hangers and Supports - Materials, Design, Manufacture Selection, Application, and Installation.

1.2 DESIGN REQUIREMENTS

.1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.

.2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP-58.

.3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.

.4 Design hangers and supports to support systems under all conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.

.5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment to be in accordance with MSS SP-58.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with general requirements.

.2 Submit shop drawings and product data for following items:

.1 All bases, hangers and supports.

.2 Connections to equipment and structure.

.3 Structural assemblies.

1.4 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

Part 2 Products

2.1 GENERAL

.1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS-SP-58.

.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.2 PIPE HANGERS

.1 Finishes:

.1 Pipe hangers and supports: to ANSI & ULC requirements

.2 Ensure steel hangers in contact with copper piping are copper plated.

.2 Upper attachment structural: Suspension from upper flange of I-Beam or joist.

.1 Cold piping NPS 50 mm (2") maximum: Ductile iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.

.1 Rod: 10 mm (3/8") UL listed

.2 Cold piping NPS 65 mm (2 1/2") or greater, all hot piping: Malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed & FM approved.

.3 Upper attachment structural: Suspension from upper flange of I-Beam.

.1 Cold piping NPS 50 mm (2") maximum: Ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed.

.2 Cold piping NPS 65 mm (2 1/2") or greater, all hot piping: Malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nuts.

.4 Upper attachment to concrete.

.1 Ceiling: Carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm (1/4") minimum greater than rod diameter.

.2 Concrete inserts: wedge shaped body with knockout protector plate ULC listed. Note: Rapidex and Siporex are <u>not</u> considered concrete. Should one of these systems be encountered, piping/ductwork and/or equipment shall be supported from adjacent walls or from supplemental steel provided by this contractor attached to the adjacent walls/structure.

.5 Shop and field-fabricated assemblies.

.1 Trapeze hanger assemblies: ASME B31.1.

.2 Steel brackets: ASME B31.1.

.6 Hanger rods: threaded rod material to MSS SP-58.

.1 Ensure that hanger rods are subject to tensile loading only.

.2 Provide linkages where lateral or axial movement of pipework is anticipated.

.7 Pipe attachments: material to MSS SP-58.

.1 Attachments for steel piping: carbon steel.

.2 Attachments for copper piping: copper plated black steel.

.3 Use insulation shields for all piping.

.4 Oversize pipe hangers and supports to accommodate thermal insulation. Provide 1.5 mm (16 gauge) saddles.

.8 Adjustable clevis: material to MSS SP-58 UL listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.

.1 Ensure "U" has hole in bottom for rivetting to insulation shields.

2.3 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 centre plate for pipe sizes NPS 300 mm (12") and over, carbon steel to comply with MSS SP-58.

2.4 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.

2.5 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

.1 Provide templates to ensure accurate location of anchor bolts.

2.6 OTHER EQUIPMENT SUPPORTS

.1 From structural grade steel meeting requirements of structural steel section specified herein.

.2 Submit structural calculations with shop drawings.

2.7 MANUFACTURER

.1 Acceptable Manufacturers:

.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 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.

.5 CSA B272-93 – Prefabricated Self-Sealing Roof Vent Flashings

.6 CRCA (Canadian Roofing Contractor’s Association)

.7 SPRI (Single Ply Roofing Institute)

.8 CUFCA (Canadian Urethane Foam Contractor’s Association) and CGSB-51-GP-46MP, Manual for “Installers of Spray Polyurethane Foam Thermal Insulation”

.9 CSA G40.21-M1987, M350W, and M300W (Structural Quality Steels)

.10 CSA W47.1-1983 (Certificate of Companies for Fusion Welding of Structural Steel)

.11 CSA W59-M1989 (Welded Steel Construction – Metal Arc Welding)

.12 CSA G164-M1981 (Hot Dip Galvanizing of Irregularly Shaped Articles)

1.2 DESIGN REQUIREMENTS

.1 Construct support systems 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 Design 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.

.4 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.

.3 Manufacturer's installation instruction.

1.4 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in general requirements.

1.5 QUALITY ASSURANCE

.1 Roof accessories manufactures to have minimum five (5) years documented experience in the design and fabrication of roofing specialties and accessories.

1.6 SPECIAL WARRANTY

.1 Warrant products installed under this section of work to be free of leaks, condensation, and defects in materials and/or manufacture for a period of twenty (20) years when installed in accordance with the manufacturer's written instructions.

Part 2 Products

2.1 PIPE/SUPPORT

.1 Pipe/Support:

.1 Adjustable height 6061-T6, hollow aluminum with mill finish, urethane insulated supports, 2" (51 mm) diameter.

.2 Stack Jack Flashing:

.1 Height to suit application.

.2 Fully urethane insulated.

.3 Aluminum construction.

.4 Complete with EPDM triple pressure grommet seal and EPDM base seal and other accessories as required to suit roof type.

.3 Provide appropriate stainless steel mounting hardware to suit supported pipe/equipment.

.4 Provide appropriate system support as specified in this section to suit application.

.1 Single Plain Pipe: Type 304 stainless steel pipe roller assembly to suite actual 0.D pipe.

.2 Double Plain Pipe: Type 304 stainless steel pipe roller assemblies sized to suit actual 0.D pipe.

.3 Single Insulated Pipe: Type 304 stainless steel pipe cradle assembly sized to suit actual 0.D of insulated pipe.

.4 Double insulated Pipe: Type 304 stainless steel pipe cradle assemblies sized to suit actual 0.D of insulated pipe.

.5 Acceptable Manufacturers:

.1 Thaler MERS 600 series.

.2 Acceptable equals if submitted and approved during tender period.

2.2 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

.1 Provide templates to ensure accurate location of anchor bolts.

2.3 ROOF CURB MOUNTED EQUIPMENT

.1 Install as per manufacturer's 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.

2.4 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 Manufacturers:

.1 Quick Block

.2 Erico

2.5 PIPING THROUGH ROOF

.1 Provide Thaler MEF-9 or equal gas piping flashing where pipe and/or relief vent penetrates roof.

2.6 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 Manufacturers:

.1 Portable pipe hanger

.2 Bigfoot systems

.3 Miro rooftop supports

.4 Walravin BIS Yeti

.5 Ecofoot

Part 3 Execution

3.1 INSTALLATION

.1 Roof support install in accordance with:

.1 Manufacturer's instructions and recommendations.

.2 Provide protection against deterioration due to contact of dissimilar metals.

.2 Flashing Installation:

.1 Install roof support flashing in accordance with manufacturer’s printed instructions.

.3 Vibration Control Devices:

.1 Install as indicated and at all roof mounted equipment that is not internally isolated.

.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 PIPE SUPPORT SPACING

.1 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')	

.2 Pipework greater than NPS 300 mm (12"): to MSS SP-69.

.3 Gas and fuel oil piping: every 1.8 m (6').

3.3 EXAMINATION

.1 Report to the contractor in writing, defects of work prepared by other trades and other unsatisfactory site conditions. Verify site dimensions. Commencement of work will imply acceptance of prepared work.

3.4 ADJUSTING

.1 Verify that all manufactured units have been installed in accordance with specifications and details and will function as intended. Adjust any items where necessary to ensure proper operation.

3.5 CLEANING

.1 Clean manufactured units using materials and methods approved by manufacturer. Do not use cleaning techniques which could impair performance of the roofing system.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 ASHRAE Handbook (2013) – Noise and Vibration Control chapter.

1.2 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.

.3 Provide detailed engineered shop drawings, outlining the manufacturer's recommended product for each piece of mechanical equipment. Submission shall be specific to the reviewed and returned shop drawings for equipment on the project.

1.3 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for incorporation into manual specified in general requirements.

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 Kinetics Noise Control

.2 Korfund

.3 Mason Industries

2.2 BASE TYPES

.1 Provide Base Type as indicated in Table under section 2.4 of this specification.

.1 Curb-Mounted Spring Rail:

.1 Full-perimeter rail type isolator, spring components shall be **1"/25 mm deflection**, free-standing, un-housed, laterally stable steel springs. Springs shall have a lateral stiffness greater than 1.0 times the rated vertical stiffness and shall be designed for 50% overload to solid.

.2 Vibration Restrained Curb-Mounted Spring Rail:

.1 All rooftop air-handling units shall be supported by vibration isolation curbs. The vibration isolation curbs shall be complete assemblies designed to resiliently support the equipment at the specified elevation and shall constitute a fully enclosed air- and weather-tight system.

.3 Spring Isolation Roof Curb:

.1 Curb type isolator with integral spring isolators, designed to provide a complete roof curb installation. All rooftop air handling units shall be supported by vibration isolation curbs. The vibration isolation curbs shall be complete assemblies designed to resiliently support equipment at the specified elevation and shall constitute a fully enclosed air- and weather-tight system. The isolation curb shall consist of an upper support rail with supply and return duct supports on which the equipment and duct openings rest and a lower support curb which is attached to the roof structure, separated by free-standing, un-housed, laterally stable steel springs.

.2 Minimum 3" static deflection from spring isolators.

2.3 ROOF CURB ACOUSTIC LINING

.1 Design Basis: Kinetics RT-7

.2 Factory laminated acoustic panel. Panels to be sectional and modular, designed for easy and accurate field assembly.

.3 Panels to be minimum 7 – ¼" thick and comprised of alternating fiberglass absorption media and acoustically dampened sheet rock. Integrate additional layers as required to meet required STC rating.

.4 Provide on all HVAC equipment over 4,000 cfm capacity.

.5 Required STC Rating: 60.

Part 3 Execution

3.1 INSTALLATION

.1 Install vibration isolation equipment in accordance with manufacturers instructions and adjust mountings to level equipment.

.2 Provide Roof Curb acoustic lining on all HVAC equipment above 4,000 cfm / 10 tonnes capacity.

.3 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.

.4 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").

.5 Where isolation is bolted to floor use vibration isolation rubber washers.

.6 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.

.7 Rooftop Units and Central Air Handling Units

.1 Packaged rooftop units shall be provided with standard curb mounted spring rails.

.2 Central air handling units (10,000 cfm or greater) shall be provided with spring isolation roof curbs.

.8 Spring isolators shall not be used in series to ensure no harmonics issues. This contractor shall review internally isolated equipment against method of spring isolation and ensure no overlap.

3.2 SITE VISIT

.1 Manufacturer to visit site and provide written certification that installation is in accordance with manufacturer's instructions and submit report to Consultant.

.2 Provide Consultant with notice 24 h in advance of visit.

.3 Make adjustments and corrections in accordance with written report.

3.3 TESTING

.1 Experienced and competent sound and vibration testing professional engineer to take vibration measurement for HVAC systems after start up and TAB of systems to Testing Adjusting and Balancing Section.

.2 Vibration measurements shall be taken for equipment-listed below:

.3 Provide Consultant with notice 48 h in advance of commencement of tests.

.4 Establish adequacy of equipment isolation and acceptability of noise levels in occupied areas and where appropriate, remedial recommendations including sound curves.

.5 Submit complete report of test results including sound curves.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-1.60, Interior Alkyd Gloss Enamel.

.2 CAN/CGSB-24.3, Identification of Piping Systems.

.3 Canadian Standards Association (CSA).

.1 Natural Gas and Propane Installation Code CSA B149.1.

.4 National Fire Protection Association

.1 NFPA 13, Installation of Sprinkler Systems.

.2 NFPA 14, Standpipe and Systems.

1.2 PRODUCT DATA

.1 Submit product data in accordance with General Requirements.

.2 Product data to include paint colour chips, all other products specified in this section.

1.3 PRODUCT LITERATURE

.1 Submit product literature in accordance with General Requirements.

.2 Product literature to include nameplates, labels, tags, lists of proposed legends.

Part 2 Products

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

.1 Metal or plastic lamicoid nameplate mechanically fastened to each piece of equipment by manufacturer.

.2 Lettering and numbers to be raised or recessed.

.3 Information to include, as appropriate:

.1 Equipment: Manufacturer's name, model, size, serial number, capacity.

.2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM NAMEPLATES

.1 Colours:

.1 Hazardous: red letters, white background.

.2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).

.2 Construction:

.1 3 mm (1/8") thick laminated plastic, matte finish, with square corners, letters accurately aligned, and machine engraved into core.

.3 Sizes:

.1 Conform to following table:

Size	No. of 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.

.4 Locations:

.1 Terminal cabinets, control panels: Use size #5.

.2 Equipment in Mechanical Rooms: Use size #9.

.3 Roof top equipment: use size #9.

.4 Equipment above ceiling: use size #1 riveted to ceiling suspension system.

2.3 EXISTING IDENTIFICATION SYSTEMS

.1 Apply existing identification system to new work.

.2 Where existing identification system does not cover for new work, use identification system specified this section.

.3 Before starting work, obtain written approval of identification system from Consultant.

.4 Upon completion of this project all references to room names and numbering shall be to the Owner's requirements which may or may 'NOT' be the numbering system used on the drawings. Each contractor shall verify the proper numbering scheme to be used prior to project completion.

.5 All equipment shall be identified in sequence from the existing equipment and "NOT" duplicate numbering of equipment.

2.4 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
Hot water heating supply	Yellow	HEATING SUPPLY
Hot water heating return	Yellow	HEATING RETURN
Natural gas	Yellow	NATURAL GAS
Gas regulator vents		to Codes
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.

.2 This contractor must co-ordinate their work with that of the TAB contractor.

1.2 QUALIFICATIONS OF TAB AGENCIES

.1 Names of all personnel it is proposed to perform TAB to be submitted to and approved by Consultant within 30 days of start of work.

.2 Provide documentation confirming qualifications, successful experience.

.3 Only the following NEBB (National Environmental Balancing Bureau) TAB contractors may quote:

GROUP A – STANDARD NEBB

.1 Air Audit Inc.
110 Turnbull Court, Unit 11
Cambridge, ON N1T 1K6
(519) 740-0871

.2 Air Velocities Control Ltd.
206 Lawlor Avenue
Toronto, ON M4E 3M1
(905) 279-4433

.3 Flowset Balancing Ltd.
431 Willis Drive .
Oakville, ON L6L 4V6
(416) 410-9793

.4 Air Adjustments & Balancing Inc.
P.O. Box 176,
Schomberg, ON L0G 1T0
(416) 254-3004

.5 Clark Balancing Ltd.
8094 Esquesing Line
Milton, ON L9T 2X9
(905) 693-1518

.6 VPG Associates
2062 King Road
King City, ON L7B 1K9
(905) 833-4334

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.

1.10 APPLICATION TOLERANCES

.1 Do TAB to following tolerances of design values:

.1 HVAC systems: plus 10%, minus 5%.

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 The following additional information shall be provided for all air systems:

.1 Minimum damper position (MAD/Economizer) and the corresponding BAS signal and the voltage to the actuator to meet the full ASHRAE occupied ventilation requirements.

.2 Minimum damper position (MAD/Economizer) and the corresponding BAS signal and the voltage to the actuator to meet the full ASHRAE unoccupied ventilation requirements.

.3 Static pressure reading for each HVAC/AHU unit with VAV/VVT boxes open to 80% of design airflow and bypass damper closed to 0%. Provide reading at normal MAD/economizer damper position, dampers fully closed and dampers fully open.

.3 TAB report to show all results in SI or imperial units as indicated on plans and to include:

.1 Project as-built drawings.

.2 System schematics.

1.16 VERIFICATION

.1 All reported results subject to verification by Consultant.

.2 Provide manpower and instrumentation to verify up to 30% of all reported results.

.3 Number and location of verified results to be at discretion of Consultant.

.4 Bear costs to repeat TAB as required to satisfaction of Consultant.

1.17 SETTINGS

.1 After TAB is completed to satisfaction of Consultant, replace drive guards, close all access doors, lock all devices in set positions, ensure sensors are at required settings. Replace all ceiling tile etc.

.2 Permanently mark all settings to allow restoration at any time during life of facility. Markings not to be eradicated or covered in any way.

1.18 COMPLETION OF TAB

.1 TAB to be considered complete only when final TAB Report received and approved by Consultant.

1.19 AIR SYSTEMS

.1 Standard: TAB to be to most stringent of TAB standards of NEBB, AABC, SMACNA, ASHRAE.

.2 Do TAB of all systems, equipment, components, controls specified in the Mechanical Division including but not limited to following:

.1 Air handling systems and equipment

.2 Duct testing to SMACNA standards.

.3 Qualifications: personnel performing TAB to be current member in good standing of NEBB.

.4 Quality assurance: Perform TAB under direction of qualified supervisor.

.5 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.

.6 Locations of equipment measurements: To include, but not be limited to, following as appropriate:

.1 Inlet and outlet of each damper, filter, coil, humidifier, fan, and other equipment causing changes in conditions.

.2 At each controller, controlled device.

.7 Locations of systems measurements to include, but not be limited to, following as appropriate: Each main duct, main branch, sub-branch, grille, register or diffuser.

1.20 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.

1.21 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 Zone pressure differences:

.1 Adjust HVAC systems, equipment, controls to establish air pressure differentials, with all systems in all possible combinations of normal operating modes.

.4 Smoke management systems:

.1 Test for proper operation of all smoke and fire dampers installed as component parts of air systems specified.

.5 Provide duct testing as specified.

.6 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:

- .1 Shop Drawings and As-built Drawings
- .2 Installation inspection and equipment verification
- .3 Plumbing and drainage system testing
- .4 Testing of piping systems
- .5 Independent contractor balancing of water systems
- .6 Testing of air systems
- .7 Independent contractor balancing of air systems
- .8 Testing of equipment and systems
- .9 BAS Commissioning
- .10 Verification of refrigeration leak detection systems
- .11 Commissioning Consultant performance testing
- .12 Commissioning meetings
- .13 Operating and maintenance manuals
- .14 Training
- .15 Systems Demonstration and turnover
- .16 Testing forms
- .17 Warranties
- .18 Contractor to provide list of equipment maintenance including schedule of maintenance parts, quantities, and model fixtures, etc.

3.2 SHOP DRAWINGS AND AS-BUILT DRAWINGS

.1 Conform to General Requirements Section for shop drawings and as-built 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:

.1 Manufacturers name, address and telephone number

.2 Distributors name, address and telephone number

.3 Make, model number and serial number

.4 Pumps - RPM, impeller sizes, rated flow

.5 Fans - belt type and size, shive type and size

.6 Electrical - volts, amps, fuse size, overload size

.7 Any other special characteristics.

3.4 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.

3.5 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.

3.6 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.

3.7 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.

3.8 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:

.1 Air Handling Units

.2 Cooling Tower

.3 Life Safety and Fire Protection Systems

.4 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 Verification of Refrigeration Leak Detection System Operation:

.1 The commissioning process shall include the verification of the refrigeration leak detection system.

.2 All interlocks between leak detection systems installed and system components, as well as 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. 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 all refrigerant leak system specific ventilation systems.

.6 De-energize any other potential sources of ignition within the affected system.

3.9 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:

.1 Shop drawings, issued and accepted

.2 Equipment verification forms

.3 Testing forms

.4 Reports resulting from tests

.5 Testing schedule

.6 Equipment Start-up Forms

3.10 OPERATION AND MAINTENANCE MANUAL

.1 Conform to General Requirements section for the Operating and Maintenance Manual requirements.

3.11 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

.1 Operating procedures

.2 Maintenance procedures

.3 Trouble-shooting procedures

.4 Spare parts required

.5 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
Air Handling Units	2 hours
Life Safety & Fire Protection Systems	2 hours
The Mechanical System	8 hours

.7 The minimum training for the BAS shall be 16 hours. The training shall include:

.1 A walk through of the installation for the Building Owner to review the installation and equipment

.2 Operation of the central computer

.3 Operation of portable terminals

.4 Control sequences

.5 Report set-up and generation

.6 Managing the system

.7 Maintenance requirements

.8 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:

.1 Identify equipment

.2 Identify starters associated with equipment

.3 Identify valves and balancing dampers

.4 Identify access doors

.5 Review general maintenance of equipment

.6 Review drain points in pipework systems

.7 Identify maintenance items

.9 When each training session has been completed The Owner shall sign the associated form to verify completion.

3.12 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:

.1 The installation is complete

.2 The acceptance test conducted by the Mechanical Consultant has been completed successfully

.3 The Commissioning Consultant system performance testing has been completed successfully

.4 Training has been completed

.5 Operating and Maintenance Manuals have been accepted

.6 Shop-drawings have been updated

.7 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.

3.13 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.

3.14 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.

3.15 CLOSEOUT PROCESS ALLOCATION

.1 The mechanical contractor closeout process shall be as follows:

.1 3% for the first $500,000 of contract value.

.2 1% of the contract value for value between $500,000 to $5,000,000.

.3 0.5% of contract value for the value in excess of $5,000,000.

.4 Minimum Allocation for Close Out Documents is $5,000.

.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 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 Canadian General Standards Board (CGSB)

.1 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 C177 Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Proprieties by Mean of the Guarded Hot-Plate Apparatus.

.2 ASTM C518 Standard Test Method for Steady-State Thermal Transmission Proprieties by Means of the Heat Flow Meter Apparatus.

.3 ASTM C 449M, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.4 ASTM C1729 Standard Specification for Aluminum Jacketing for Insulation.

.5 ASTM C1290 Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.

.6 ASTM C1393 Standard Specification for Perpendicularly Oriented Mineral Fiber Roll and Sheet Thermal Insulation for Pipes And Tanks.

.7 ASTM C553, Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.8 ASTM C612, Mineral Fiber Block and Board 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 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.

.3 Submit completed detail plates from the North American Commercial and Industrial Insulation Standards manual, applicable to installation types required by this specification section.

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 have successfully completed apprenticeship program.

.2 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.

.3 "ASJ+" – All Service Jacket – vapor retarder laminate of aluminium foil inner layer, reinforced with fiberglass scrim, bonded to a bleached kraft paper, with outer poly film leaving no paper exposed.

.4 "ASJ" – All Service Jacket (no outer film) – vapor retarder laminate of aluminium foil inner layer, reinforced with fiberglass scrim, bonded to a bleached kraft paper outer layer.

.5 “FSK” – Foil Scrim Kraft – vapor retarder laminate of aluminium foil outer layer, reinforced with fiberglass scrim, bonded to a natural kraft paper inner layer.

.2 Insulation systems - insulation material, fasteners, jackets, and other accessories.

1.7 QUALITY ASSURANCE

.1 Products shall not contain formaldehyde, asbestos, lead, mercury or mercury compounds or PBDE fire retardants.

Part 2 Products

2.1 LIMITATION ON MATERIALS

.1 Products 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 to ASTM C612, with factory applied vapour retarder jacket meeting the requirement of ASTM C1136 Type II and IV (FSK):

.1 Jacket: to ASTM C1136 Type II and IV (FSK)

.2 Maximum "k" value: .033 W/M•°C (.23 BTU•IN/HR•FT^2•°F)

.4 Type C-2: Mineral fibre blanket to ASTM C553 Type I, II, and III, ASTM C1136 Type II and IV, and ASTM C1290 Type III:

.1 Jacket: to ASTM C1136, Type II and IV.

.2 Maximum "k" value: 0.042 W/M•°C (.29 BTU•IN/HR•FT^2•°F)

.5 Manufacturers:

.1 All materials must be supplied by the same manufacturer.

.2 Acceptable Manufacturers:

.1 Johns Manville

.2 Knauf

.3 Manson

2.4 JACKETS

.1 Canvas:

.1 220 g/m^2 (6 oz/sq.yd.) cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C 921.

.2 Lagging adhesive: Compatible with insulation.

2.5 ACCESSORIES

.1 Vapour retarder lap adhesive:

.1 Water based, fire retardant type, compatible with insulation.

.2 Indoor Vapour Retarder Finish:

.1 Compatible with insulation.

.3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C 449.

.4 ULC Listed Canvas Jacket:

.1 220 g/m^2 (6oz/yd^2) 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 Childers CP-82 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 North American Commercial and Industrial Insulation 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 fan exhaust ducts exposed (visible) in space being served	None	
Interior acoustically lined ducts	None	
Breeching	**C-3**	**50 mm (2")**
Last 1.5m of exhaust duct	C-1	25 mm (1")
Exterior ductwork	C-1	80 mm (3")

.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
Outdoor, exposed to precipitation	Aluminum	Aluminum

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 CSA B149.1, Natural Gas and Propane Installation Code.

.3 ASTM D2513, Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing and Fittings.

.4 ASTM D2683, Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing.

.5 ASTM D3261, Standard Specification for Butt Heat Fusion Polyethylene Plastics Fittings Polyethylene Pipe and Tubing.

.6 ASTM D3350, Standard Specification for Polyethylene Plastics Pipe and Fittings materials.

.7 ASTM F1055, Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethlyene (PEX) Pipe and Tubing.

.8 NSF / ANSI 14, Plastics Piping System Components and Related Materials.

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.

1.4 QUALIFICATIONS OF INSTALLING CONTRACTOR

.1 The installing contractor shall be regularly engaged by utility companies for the installation of buried gas piping and gas meter assemblies.

.2 Minimum of 3 years experience with the installation of similar systems shall be demonstrated prior to beginning work.

Part 2 Products

2.1 FEE FOR GAS SERVICE AND GAS METER ASSEMBLY

.1 Mechanical contractor is responsible for all fees and charges requested by the local utility to provide the gas service and meter.

2.2 PROTECTION OF GAS SERVICE PIPING AND GAS METER STATIONS

.1 Provide fencings and/or bollards as required by the utility.

.2 Provide housekeeping pad to utility standards for gas meter assembly.

2.3 GAS SERVICE

.1 Mechanical contractor shall arrange with the local utility to have the gas service provided from the street to the gas meter where indicated.

.2 Co-ordinate layout of gas main from street to utility meter with the utility to match the location indicated on drawings.

.3 Co-ordinate buried gas piping with other site services. Layout shall miss all other services on site unless there is no other possible route.

.4 Ensure gas piping route is accurately captured on as-built drawings.

.5 Submit all plans as requested by the local utility.

.6 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).

.7 Provide approved pulse gas meter in all locations where indicated on the drawings.

2.4 PIPE

.1 Buried pipe:

- .1 CGA approved polyethylene gas pipe.
- .2 Material Properties
- .3 Cell Classification: 234373E, tested to ASTM D3350
- .4 Density (g/cc): 0.925-0.940, tested to ASTM D1505
- .5 Hydrostatic Design Basis (psi at 73°F): 1,250, tested to ASTM D2837
- .6 Flexural Modulus (psi at 73°F); 80k-110k, tested to ASTM D790
- .7 Coefficient of thermal expansion (in/in/°F ($x10^{-5}$)): 9.0
- .8 Melt Index (g/10 min (190°D / 2.16 kg)): 0.4-0.15, tested to ASTM D1238
- .9 Maximum Operating Temperature: 140°F
- .10 Rated Pressure
  - .1 SDR 11: 100 PSI for sizes 20 mm to 100 mm diameter.
  - .2 SDR 10: 111 PSI for sizes 25 mm to 32 mm diameter.
  - .3 SDR 9.3: 120 PSI for 15 mm diameter.

.2 Acceptable Materials: IPEX Yellow 2708

2.5 JOINTING MATERIAL/METHODOLOGY

.1 Butt heat fusion or electrofusion type for all buried pipe / tubing.

.2 Socket type weld acceptable for above grade piping.

2.6 FITTINGS

.1 Suitable for use with heat fusion or electrofusion type joining.

2.7 PIPE BEDDING AND SURROUND MATERIAL

.1 Granular material to aggregates:

.1 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.

2.8 BACKFILL MATERIAL

.1 As indicated.

.2 Type 3, in accordance with Excavating, Trenching, and Backfilling.

2.9 BALL VALVES

.1 Refer to Facility and Natural Gas Piping section.

2.10 LUBRICATED PLUG VALVES

.1 Refer to Facility and Natural Gas Piping section

2.11 GAS REGULATOR

.1 Refer to Facility and Natural Gas Piping section.

2.12 EMERGENCY GENERATOR SUPERVISORY VALVE

.1 Refer to Facility and Natural Gas Piping section.

Part 3 Execution

3.1 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.

3.2 GRANULAR BEDDING AND BACKFILL

.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") below pipe.

.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 Backfilling / beddings shall not be installed in a wetted trench.

.7 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.

.8 Hand place surround material in uniform layers not exceeding 150 mm (6") compacted thickness as indicated. Provide surround to 300 mm (12") above top of pipe. Do not dump material within 1.0 m (40") of pipe.

.9 Place layers uniformly and simultaneously on each side of pipe.

.10 Compact each layer from pipe invert to mid height of pipe to at least 95% maximum density to ASTM D698.

.11 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.

.12 When field test results are acceptable to Consultant, place surround material at pipe joints.

3.3 PIPING INSTALLATION

.1 Install in accordance with applicable Provincial/Territorial Codes.

.2 Install in accordance with manufacturer's installation manual.

.3 Minimum Bend Radius: Ensure all bends respect manufacturer literature regarding minimum allowable bend radius.

.4 Install to minimize the use of buried fittings and joints. Where possible provide continuous roll of piping from factory to eliminate all field installed fittings and joints.

.5 Provide tracer wire and marker tape for all buried gas piping.

.6 Install in accordance with CAN/CSA B149.

.7 Assemble piping using fittings manufactured to ANSI standards.

.8 Ream pipes, clean scale and dirt, inside and out.

.9 Degrease and cut square all piping prior to welding / joining sections.

3.4 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.

3.5 PURGING

.1 Purge after pressure test in accordance with CAN/CSA B149.

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, and A106, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded ERW 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 Fees and charges requested by the local utility to provide the gas service and meter.

.2 Submit all plans as requested by the local utility.

.3 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.

.4 Provide approved pulse gas meter in all locations where indicated on the drawings.

2.2 PIPE

.1 Steel pipe: to ASTM A106, 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: nonmetallic 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/A106.

.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 Manufacturers:

.1 Newman Hattersley

.2 Crane

.3 Jenkins

.4 Milwaukee

.5 Toya

2.7 GAS REGULATOR

.1 Reduce pressure from 34.5 kPa (5 psi) to 1.74 kPa (7" WC) capacity as indicated.

.1 Acceptable Manufacturers:

.1 Singer

.2 Schlumberger

.2 Vent interior relief valve to outdoors with gooseneck and stainless steel insect screen. Vent piping shall be sized as per manufacturers' requirements and recommendations.

.3 Isolate with lubricated plug valve and union connection.

2.8 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 Manufacturers:

.1 Quick Block

.2 Erico

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 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.

3.5 PURGING

.1 Purge after pressure test in accordance with CAN/CSA B149.

3.6 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.

3.7 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 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
Residential Suite Ductwork:			
Square and Rectangular			
Up to 300 mm (12”) *	26	26	26
Round and Oval Snap Lock *			
Up to 200mm (8”) *	30	30	30

*****Following SMACNA for low pressure ductwork.

.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 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 Manufacturers:

.1 Ductmate Canada Ltd.

.4 Foil tape all transverse and longitudinal joints.

.3 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.

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 Manufacturers:

.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 Manufacturers:

.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	Acceptable Leakage Classification (Rectangular)	Acceptable Leakage Classification (Round)
2500 (10")	A	4	2
1500 (6")	A	4	2
1000 (4")	A	4	2
750 (3")	A	8	4
500 (2")	B	16	8
250 (1")	B	16	8
125 (0.5")	C	16	8

.2 Seal classification:

.1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.

.2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant.

.3 Class C: transverse joints and connections made air tight with gaskets, or sealant or combination thereof. Longitudinal seams sealed with foil tape or sealant.

2.5 SEALANT

.1 Sealant: oil resistant, polymer type flame resistant duct sealant. Temperature range of -30°C (-22°F) to plus 93°C (199°F).

.2 Flame-spread rating not more than 25.

.3 Smoke developed classification not more than 50.

.4 Acceptable Manufacturers:

.1 Duro Dyne S-2

.2 Foster

2.6 TAPE

.1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm (2") wide.

.1 Acceptable Manufacturers:

.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 WATERTIGHT DUCT

.1 Provide watertight duct for:

.1 Fresh air intake.

.2 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.

2.11 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 Manufacturers:

.1 Myatt fig. 485

.2 For steel joist: manufactured joist clamp or steel plate washer.

.1 Acceptable Manufacturers:

.1 Grinnell fig. 61 or 60

.3 For steel beams: manufactured beam clamps:

.1 Acceptable Manufacturers:

.1 Grinnell Fig. 60

Part 3 Execution

3.1 GENERAL

.1 The following systems shall conform to these requirements:

System	Pressure	Class	Material
General Exhaust	+	A	Galvanized Steel/Aluminum
Individual Exhaust	+	A	Galvanized Steel/Aluminum
Dryer Exhaust	+	A	Aluminum
HVAC Supply and Return	+/-	B	Galvanized steel
Commercial 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 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.

3.4 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.

3.5 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.

3.6 LEAKAGE TESTS

.1 Co-ordinate leakage testing with TAB contractor. TAB contractor will be responsible for all duct testing.

.2 Duct to be tested in accordance with SMACNA HVAC Duct Leakage Test Manual.

.3 Leakage tests to be done in sections.

.4 Trial leakage tests to be performed as instructed to demonstrate workmanship.

.5 Install no additional ductwork until trial test has been passed.

.6 Test section to be minimum of 15 m (50'-0") long with not less then 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. **The extent of the cleaning shall be limited to the area immediately surrounding the new connection point.**

.5 Ensure all systems are clean prior to start up.

3.8 ROOF MOUNTED DUCT SUPPORT

.1 Provide zero penetration duct support on roof where indicated.

.2 Base shall be made of high density polypropylene with UV protection.

.3 Frames shall be galvanized. All fastenings, rods, nuts, washers, etc. shall be stainless steel.

.4 Provide shop drawings as specified. Install to manufacturers recommendations.

.5 Acceptable Manufacturers:

.1 Portable pipe hanger

.2 Bigfoot systems

.3 Trikon Systems

3.9 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 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 Manufacturers:

.1 BVA Systems

.2 Vibron

.3 VAW Systems

.4 IAC Acoustics

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.

.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 fibre insulation.

.3 Gaskets: neoprene

.4 Hardware:

.1 Up to 300 mm (12"): 2 sash locks

.2 301 mm to 450 mm (13" to 18"): 4 sash locks Complete with safety chain.

.3 451 mm to 1000 mm (19" to 40"): piano hinge and minimum 2 sash locks.

.4 Doors over 1000 mm (40"): piano hinge and 2 handles operable from both sides.

.5 Hold open devices.

.5 Acceptable Manufacturers:

.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 Manufacturers:

.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 Manufacturers:

.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 Manufacturers:

.1 Greenheck GPR – 600 mm (24") high

.2 Penn

2.7 SPIN-IN COLLAR

.1 Construction: galvanized straight or conical spin-in collar complete with spin-in bead and crimped collar connection.

.2 Provide balancing damper where indicated.

.3 Acceptable Manufacturers:

.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 Manufacturers:

.1 Duro Dyne

.2 E.H. Price

.3 Nailor
.4 T.A. Morrison
.5 Tamco
.6 Ruskin
.7 Ventex/Alumavent
.8 United Enertech

2.4 LOCKING QUADRANTS

.1 6 mm (1/4") dial regulator with square bearing shaft.

.1 18 gauge oval frame, cadmium plated, clearly shows damper position.
.2 18 gauge formed handle for easy adjustment.
.3 Bolt and wing nut lock damper securely.
.4 Offset mounting holes avoid interference with damper movement and mechanical fastening to duct.

.2 9 mm (3/8") and larger: clamp quadrant with square bearing shaft.

.1 Accommodates and securely locks square rod, bearing fitting and adaptor pins.
.2 Heavily ribbed 16 gauge steel frame, 3 mm (1/8") thick formed steel handle, cadmium-plated.
.3 By tightening nut, bearing is securely locked in handle, preventing slippage and rattle.
.4 Neoprene and steel washer assembly seals bearing opening to eliminate air-leakage.
.5 Screw holes for mechanically fastening to ductwork.

.3 High pressure system locking quadrant:

.1 Airtight, rattle-proof regulator, designed for ZERO leakage at high pressure. Use for applications up to 500°F constant temperature.
.2 Handle design for easy recognition of damper position.
.3 Heavy-gauge, zinc-plated steel, 2 high temperature rubber seals and washers, end bearing support, and 2 end bearings. Pressure loss and damper rattle in ductwork has been a constant annoyance for as long as HVAC ductwork has been installed. Now, a truly air-tight, rattle-proof regulator is available. The SPEC-SEAL regulator utilizes a special high-temperature rubber seal to eliminate leakage and rattle even at many times the pressure found in high pressure.
.4 Soft, comfortable grip handle with a highly-visible, plastic cover which indicates the damper position.
.5 Handle to accommodate 9 mm (3/8") or 12 mm (1/2") to match damper shaft size, square and round bearing shafts.

.4 Acceptable Manufacturers:

.1 Duro Dyne
.2 Ductmate
.3 Pottorff

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 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 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 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 Manufacturers:

.1 Ruskin
.2 Nailor
.3 E.H. Price
.4 T.A. Morrison
.5 Tamco
.6 Ventex/Alumavent
.7 United Enertech
.8 Safeair-Dowco (stainless steel)
.9 Greenheck
.10 Pottorff

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 Manufacturers:

.1 Ruskin
.2 Nailor
.3 E.H. Price
.4 T.A. Morrison
.5 Tamco

.6 Greenheck

.7 Ventex/Alumavent

.8 Pottorff

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 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

2.2 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.

2.3 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.

2.4 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.

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 BACK DRAFT DAMPERS

.1 Automatic gravity operated, multi leaf, aluminum construction with nylon bearings, centre pivoted or counterweighted, as indicated.

.2 Acceptable Manufacturers:

.1 T.A. Morrison
.2 Tamco Series 7000
.3 Ruskin
.4 Nailor
.5 E.H. Price
.6 Henderson Industrial
.7 Ventex/Alumavent
.8 Pottorff

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 SMACNA HVAC Duct Construction Standards, Metal and Flexible.

.3 ASTM C1071 Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).

.4 ASTM C916 Standard Specification for Adhesive for Duct Thermal Insulation.

.5 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.

.6 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 RECTANGULAR/SQUARE DUCT LINER

.1 General:

.1 Acoustical duct liner to be fibreglass duct liner meeting or exceeding requirements of ASTM C1071, Type I, Flexible or Type II, Rigid, and NFPA 90A/90B.

.2 Bonded with formaldehyde free bio-based binder

.3 Mat faced airstream surface

.4 Factory applied edge coating

.5 Shall not contain formaldehyde, PBDE's, asbestos, mercury, mercury compounds, lead, contain 50% or greater recycled glass content.

.6 Thermal conductivity, ASTM C177/C518/C1114 .24BTU (sf•hr•°F) @ 75°F mean temp).

.7 Noise Reduction Coefficient (NRC) 1.5 PCF 1" = .70, 1 ½ " = .80, 2" =.95
ASTM C423, Type A mounting.

.8 Noise Reduction Coefficient (NRC) 2.0 PCF 1/2" = .50, 1" = .70, 1 ½ " = .85
ASTM C423, Type A mounting

.9 Corrosiveness/corrosion, ASTM C665/C1617. Does not accelerate/pass.

.10 Mold and mildew growth/fungi resistance, ASTM C1338, ASTM G21/G22, UL2824. Pass/resistant to mold.

.11 Maximum service temperature, ASTM C411, 250°F (121°C).

.12 Maximum rate air velocity, ASTM C1071, 6,000 ft./min. (30.5 m/sec.)

.13 Water vapor sorption, ASTM C1104, less than 3%.

.14 Surface burning characteristics, ASTM E84, UL 273, CAN/ULC S102, 20/50 flame spread/smoke development.

.15 Acceptable Manufacturers:

.1 Knauf Atmosphere Duct Liner

.2 Manson

.3 Johns Manville

.4 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: 96 kg/m^3 (6 lb/ft^3).

2.2 ADHESIVE

.1 Meet requirements of ASTM C916.

.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 Manufacturers:

.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 Manufacturers:

.1 Duro Dyne

.2 Ductmate

2.4 JOINT TAPE

.1 Poly-Vinyl treated open weave fiberglass membrane 50 mm (2") wide.

.2 Acceptable Manufacturers:

.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 Manufacturers:

.1 Duro Dyne 1A-94

.2 Ductmate

Part 3 Execution

3.1 GENERAL

.1 Do work in accordance with recommendations of MAIMA Fibrous Glass Duct Liner Standards (FGDLS) or SMACNA duct liner standards.

.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 Provide vibration isolation hangers/pads for all fans.

.7 Electrical components and motors within the airstream shall be classified for use in a Class I, Zone 2 system (as defined by the Electrical Safety Code) when connected to ductwork systems served by refrigerant containing air handling systems.

.8 Provide factory mounted speed control for all direct drive motors.

.9 Acceptable Manufacturers:

.1 Greenheck
.2 Penn-Barry
.3 Cook
.4 Jenco (S & P)/Jenn
.5 Carnes
.6 Acme
.7 Zonex
.8 Twin-City
.9 Reversomatic
.10 Fantech
.11 Aerovent

2.2 ROOF EXHAUSTERS – UTILITY SET

.1 Centrifugal V belt or direct driven as indicated.

.1 Housing: Galvanized steel [coated steel] housing with motor enclosure.
.2 Impeller: Centrifugal backward inclined aluminum wheel.
.3 Adjustable motor sheave (for belt drive). Provide with speed controller (for direct drive).
.4 15 mm (1/2") mesh 2.0 mm (79 mil) diameter aluminum birdscreen.
.5 Automatic gasketted aluminum backdraft dampers.
.6 Disconnect switch within fan housing.
.7 Continuous curb gaskets, cadium plated securing bolts and screw, and sound insulating.

.2 Roof curbs: of same manufacturer as fan. Built to suit duct penetration of roof. Roof curbs for NFPA 96 duct penetrations are to be vented.

.3 Sleepers: Built-up sleepers, height as required (not less than 150 mm above finished roof), properly flashed and roofed into roofing system.

.4 Vibration isolators: Suitably sized for weight of fan.

.5 Size, type, and capacity: As indicated.

.6 To NFPA 96 requirements where indicated.

.7 Provide vibration isolators, inertia base, and flexible connection on downstream side of indoor mounted utility set fans.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Provide flexible duct connection for all fans.

.3 Provide backdraft damper at building exterior penetration.

.4 Provide and install vibration isolation.

.5 Provide and install roof curb for all roof mounted fans.

.6 Provide and install sleepers for utility set style roof mounted fans; provide roof curb for duct 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 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 them 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 Manufacturers:

.1 E.H. Price

.2 Nailor

.3 Krueger
.4 Titus
.5 Carnes
.6 Seiho
.7 Metalaire
.8 Tuttle and Bailey

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 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 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 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 Manufacturers:

.1 Reversomatic

.2 Broan

.3 Ventex

.4 AirVent

.5 Shop fabricated (submit sample for approval).

Part 3 Execution

3.1 INSTALLATION

.1 In accordance with manufacturers and SMACNA recommendations.

.2 Reinforce and brace air vents, intakes and goosenecks as indicated.

.3 Anchor securely into opening.

.4 Seal with caulking all around to ensure weather tightness.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All codes, standards, etc. as referenced shall be the latest edition.

.2 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 between 1981 mm (6' - 6") and 2200mm (7'-3") 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 Max hood flow: Refer to schedule.

.2 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.

.3 The ventilator extractor shall include a full length inlet slot, a centrifugal vortex chamber, and a variable flow baffle. The vortex chamber shall provide a full 270° centrifugal spin around the vortex baffle for maximum grease extraction. The vortex chamber, the baffles, and the fire damper blades, bushings and edge seals shall be fully accessible through the front removable doors within the hood canopy.

.4 The filter rack shall include a full length stainless steel grease gutter and grease cup.

.5 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.

.6 The hood shall have incandescent lights evenly spaced along the length of the hood.

.7 Controller

.1 Provide controller capable of the following:

.1 Start/stop of exhaust fan.

.2 Start/stop of make-up air unit.

.3 Thermal start option.

.4 Interlock to fire suppression system.

.8 Accessories:

.1 Stainless steel No. 4 finish fascia panel.

.2 Spacer from wall.

.9 Acceptable Manufacturers:

.1 Spring Air

.2 Garland

.3 Halton

2.2 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 sign-off for the operation.

.9 Gas solenoid valve and trim.

.10 Acceptable Manufacturers:

.1 Spring Air

.2 Garland

.3 Pyro-Chem

.4 Halton

2.3 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 Acceptable Manufacturers:

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 Hood height shall be as indicated on architectural kitchen elevations. Contractor shall review manufacturer's installation guide to ensure that the elevation of the hood is within the specified allowable mounting heights prior to installation. Advise consultant prior to installation of any discrepancies.

3.2 EXHAUST SYSTEM TESTING

.1 Test exhaust and ductwork system in accordance with local authority requirements. Note that NFPA 96 requires light, air, ballon and other tests at the discretion of the local authority. 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 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.

3.6 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/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 Lennox

.2 Trane

.3 Carrier

.4 Johnson/York

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 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.

.5 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 HEATING SECTION

.1 Gas Heat

.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.

2.9 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.

2.10 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.

2.11 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.

2.12 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.

2.13 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 Cooling status/capacity.

.16 Unit status.

.17 All time schedules.

.18 Active alarms with time and date.

.19 Previous alarms with time and date.

.20 Optimal start.

.21 Supply fan speed.

.22 System operating hours.

.1 Fan

.2 Cooling

.3 Individual compressor

.4 Heating

.5 Economizer

.6 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

2.14 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.

2.15 CAPACITY

.1 As indicated.

2.16 ACCESSORIES

.1 600 mm (24") high roof curb.

.2 Vibration rail.

.3 Opposed blade economizer dampers.

.4 Condenser coil hail guard.

.5 Stainless steel vertical extension on flue gas discharge.

.6 Stainless steel heat exchanger.

.7 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 CGSB CAN/CGSB 1.181, Ready Mixed Organic Zinc, Rich Coating.

.3 ANSI/NFPA-90A, Installation of Air Conditioning and Ventilating Systems.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section general requirements.

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.

1.5 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.

1.6 MANUFACTURED ITEMS

.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 in force.

.2 The air handling units and major components shall be products of manufacturers regularly engaged in the production of such equipment and with a minimum of fifteen continuous years of proven production experience.

.3 Manufacturer shall have a fully implemented and auditable quality assurance program, equal to the ISO-9002 Quality Standard.

Part 2 Products

2.1 GENERAL

.1 Field Factory assembled components to form units supplying air at design conditions as indicated and specified.

.1 Acceptable Manufacturers:

.1 Spring Air

.2 Engineered Air

.3 ICE Western

2.2 UNIT CONSTRUCTION

.1 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.

.2 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.

.3 Units shall be provided with gasketed access doors to the following components: fans and motors; filters; dampers and operators; and access plenums. Access doors shall be large enough for easy access. Provide hinged access doors, fully lined, with a minimum of two (2) Levelock handles (one locking) operable from both sides.

.4 Casings shall be supported on formed galvanized steel channel or structural channel supports, designed and welded for low deflections. Integral lifting lugs shall be provided for hoisting.

.5 All units shall be internally insulated with 25 mm (1") thick 24 kg/m³ (1.5 lb./ft³) density, neoprene coated fibre glass thermal insulation.

24 kg/m³ (1.5 lb/ft³) insulation shall be secured to metal panels with a fire retardant adhesive and welded steel pins at 400 mm (16") o/c. All longitudinal insulation joints and butt ends shall be covered by a sheet metal break to prevent erosion of exposed edges. Drain pans and all floor areas shall be insulated on the underside.

.6 Air handling units shall be weatherproofed and equipped for installation outdoors. This shall include generally 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; rain gutters over all access doors; all joints caulked with a water resistant sealant; roof joints turned up 50 mm (2") with three break interlocking design; outer wall panels extend a minimum of 6 mm (1/4") below the floor panel; drain trap(s) for field installation.

.7 Provide full perimeter roof mounting curb of heavy gauge sheet metal, minimum of 300 mm (12") 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. External insulation of the roof mounting curb shall be provided by the Roofing Subcontractor.

2.3 FANS

.1 Centrifugal fans shall be rated in accordance with AMCA Standard Test Code, Bulletin 210. Fan manufacturer shall be a member of AMCA. All fans and fan assemblies shall be dynamically balanced during factory test run. Fan shafts shall be selected for stable operation at least 20% below the first critical RPM. Fan shafts shall be provided with a rust inhibiting coating.

.2 Drives shall be adjustable on fans with motors 3.73 kW (5 hp) or smaller. On fans with larger motors, fixed drives shall be provided. All drives shall be provided with a rust inhibiting coating. The air balancer shall provide for drive changes (if required) during the air balance procedure.

.3 All single phase belt drive motor applications shall include rubber isolation for motors. 19kw (1/4 hp) through 1.1kW (1½ hp). Provide internal spring isolation for single phase motors over 1.1kW (1½ hp).

.4 Fan motors shall be ODP high efficiency.

2.4 GAS HEAT SECTION, INDIRECT FIRED

.1 General

.1 Heating units shall have an indirect natural gas fired heating section that is ETL, C-ETL, approved for both sea level and high altitude areas. The entire assembly shall be approved and labeled by a nationally recognized certification agency.

.2 Operating natural gas pressure at units manifold shall be 1750 Pa (7" w.c.).

.3 Gas fired units shall be approved for operation in -40°C/-40°F locations.

.2 Heat Exchanger

.1 Heat exchanger shall be a primary drum and multi-tube secondary assembly constructed of titanium stainless steel with multi-plane metal tubulators, and shall be of a floating stress relieved design. Heat exchanger shall be provided with condensate drain connection. The heat exchanger casing shall have 25mm (1") of insulation between the outer cabinet and inner liner. Blower assemblies close coupled to duct furnace type heat exchangers are not acceptable.

.3 Gas Burner

.1 The burner assembly shall be a blow through positive pressure type with a combustion air damper interlocked with main gas valve to provide optimum air/fuel ratios at all inputs with 80% or higher efficiency throughout its operating range. Flame surveillance shall be with a solid-state programmed flame relay utilizing a flame rod for gas operation. The burner and gas train shall be in a cabinet enclosure. Insulation in the burner section shall be a heat reflective galvanized steel liner. Burners to be manufactured by Maxon, Ovenpak or Engineered Air. Atmospheric burners or burners requiring power assisted venting are not acceptable.

.2 Modulating burners shall have a 10:1 turndown providing that the minimum input is at least 100 MJ.

.3 Controls: An integral control panel shall be completely pre-wired with motor contractors, overloads, control transformer, high limit, combustion air flow switch, terminal block and all necessary relays. The control of the unit shall be provided with electronic control using modulating discharge air sensor.

.4 Provide warm weather bypass control for all units utilizing modulating discharge air controls, to allow the supply fan to continue operating during the purge cycle whenever ambient temperature is above the burner ambient set point.

.5 All operating controls and functions shall be factory tested prior to shipment.

.6 Operating natural gas pressure shall be 7" (1750 Pa) W.C.

2.5 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 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.

.3 50 mm (2") Pleated Panel Disposable Filters: Non-woven re-inforced cotton/poly fabric media with a metal support grid and heavy duty beverage board enclosing frame. The filter media shall have an average efficiency of 30-35%+ on ASHRAE Standard 52.1.

2.6 DAMPERS

.1 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.

.2 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.

.3 Two position inlet dampers shall be parallel blade type complete with actuator.

2.7 CONTROLS

.1 Controls and gas manifolds shall be contained in a control panel that provides easy access to contained components.

.2 Provide electronic ignition of pilot through a spark rod and electronically programmed flame supervision controller.

.3 Safety devices shall include:

.1 Flame proving sensor

.2 High air velocity sensor

.3 Low air velocity sensor

.4 High temperature limit

.4 Unit shall start from exhaust system interlock (by others) wired to unit control terminal strip as indicated on field wiring diagram.

.5 Unit discharge air temperature shall be maintained constant by a discharge air sensor which shall modulate the main flow ratio gas valve.

.6 Electronic sensor shall modulate the gas valve through a controller. An electronic temperature selector (remote mounted) shall be capable of adjusting the discharge air temperature set point.

2.8 COMPONENTS

.1 Incorporate the following components to provide a complete system.

.1 Outdoor air intake hood.

.2 Filter section.

.3 Indirect fired heat exchanger and burner.

.4 Supply air blower.

.5 Air proving switch.

2.9 ACCESSORIES

.1 Internal wiring to terminal strip in Nema 1 enclosure with space for DDC controller.

.2 Dead front disconnect.

.3 600mm (24”) high roof curb.

.4 Indoor control panel OFF/ON/AUTO and temperature dial.

.5 Discharge air controller/sensor (for installation duct).

2.10 CAPACITY

.1 Provide unit capacity indicated.

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 manufacture 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 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 Conform to the General Mechanical requirements of Mechanical Division.

.2 Conform to the General Electrical requirements of Electrical Division.

1.2 WORK INCLUDED

.1 Provide an extension of the existing building controls system, Hamilton Smith (EMCS) system using Reliable Controls.

.2 Provide all labour, materials, products, equipment and services to supply, install and commission the electronic control and monitoring system with electronic or pneumatic actuation as specified in this Section of the Specification.

.3 Provide all computer hardware and software, operator input/output communication devices, communication units, communication interface to digital system controllers, field sensors and controls as required to meet the specified performance.

.4 Provide all wiring, conduit in accordance with Electrical Division, labour, including calibration, commissioning, software programming and data base generation, generation of colour graphics and additional work necessary to provide a complete and fully operating system.

.5 Provide 120 Volt, 20 amp circuits to field panels and other devices requiring a main supply from circuits supplied by Electrical Division.

.6 Surge transient protection shall be incorporated in design of system to protect electrical components.

.7 Obtain Hydro permit and inspection.

1.3 GENERAL SYSTEM REQUIREMENTS

.1 Provide a single architecture common data base microprocessor based electronic control and monitoring BAS system for heating and other specified systems employing distributed processing and direct digital control (DDC) with electronic sensing and electronic actuation to conform with the specification requirements. The BAS shall consist of the following:

.1 Stand-Alone DDC Controllers

.2 Application Specific Controllers

.2 The system shall be modular in nature and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, DDC Controllers, Application Specific Controllers and operator devices.

.3 System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution. Each DDC Controller shall operate independently by performing its own specified control, alarm management, operator I/O and data collection. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.

.4 DDC Controllers shall be able to access any data from, or send control commands and alarm reports directly to, any other DDC Controller or combination of controllers on the network without dependence upon a central processing device. DDC Controllers shall also be able to send alarm reports to multiple operator workstations without dependence upon a central processing device.

.5 Provide English language operator interface using readily understood English language abbreviations and mnemonics. It is intended that the interface be user friendly, as to promote the acceptance of the BAS by the building operators.

1.4 A2L REFRIGERANT CONTAINING EQUIPMENT

.1 A2L refrigerants are classified as mildly flammable. CSA B52-2023 has specific safety clauses related to the use of refrigerants with this classification within buildings.

.2 This contractor shall be responsible to ensure that the installation requirements of CSA B52-2023 are met.

.3 Throughout this specification various pieces of equipment have been specified with refrigerant leak detection systems. Field wiring of the alarm status of this system to various downstream system components is required under Annex P of the standard and is the responsibility of this contractor. These devices include the following:

.1 Open all zone dampers connected to the affected system.

.2 Disable electric reheat coils within the affected system.

.3 Activate field installed safety shut off valves on the affected refrigeration systems

.4 De-energize any potential sources of ignition with the ductwork system of the affected system.

.5 Energize fans within the ductwork system.

.6 Activate any designated refrigeration leak ventilation systems.

1.5 VERIFICATION OF REFRIGERATION LEAK DETECTION SYSTEM OPERATION

.1 The commissioning process shall include the verification of the refrigeration leak detection system.

.2 All interlocks between leak detection systems installed and system components, as well as 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. 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.

1.6 EXISTING BUILDING

.1 The existing building currently has Hamilton Smith (EMCS) system using Reliable Controls.

.2 The successful contractor shall locate the communication line and identify its entire length with yellow caution tape. The successful contractor shall maintain it during construction and verify proper operation after construction. Educate other trades and repair all damages that may have occurred.

.3 Relocate controls and wiring to accommodate new services being installed i.e. ductwork, piping, etc.

.4 Non compatible manufacturers shall provide their own communication loop in the building for their new services. Wherever possible both communication loops shall be beside each other.

.5 Non compatible manufacturers (i.e. Siemens and Tour Anderson) shall be in addition to providing graphics. Provide for a monolithic programming so the operator does not have to alter between software programs. All systems shall be graphically shown on the same floor plan of the building.

1.7 QUALITY ASSURANCE

.1 Materials and equipment shall be the catalogue products of a single manufacturer regularly engaged in production and Installation of automatic temperature control systems and shall be manufacturer's latest standard design that complies with the specification requirements.

.2 Install system using competent workmen who are fully trained in the installation of temperature control equipment. Single source responsibility of the supplier shall be the complete installation and proper operation of the DDC control system and BAS shall include debugging and proper calibration of each component in the entire system.

1.8 RELATED WORK

.1 Provide interfacing of all controls to new BAS under this contract as described in this Specification.

.2 Provide hardware interfacing to all controls instrumentation provided as specified in this Section.

.3 The BAS shall provide the following for installation by the Mechanical Division Contractor as required.

.1 Wells for temperature sensors.

.2 Control dampers not supplied by packaged equipment suppliers.

1.9 SHOP DRAWINGS

.1 Furnish six (6) copies of all Shop Drawings, diagrams, schedules and equipment and software data sheets as may be deemed necessary by the Consultant in order to ensure the intention of the Specification and schedule of work are being met.

.2 Submit shop drawings for the following:

.1 All building automation and other control components.

.2 Identified schematic control diagrams for all systems, each diagram indicating control components, component catalogue numbers, operation sequence, and interlocking.

.3 Riser diagram showing the physical location of building control system equipment and the system architecture. DDC Controller trunk conductors shall also be shown.

.4 List of connected data points, including DDC Controller's to which they are connected and input/output devices (sensors, transducers, etc.).

.5 Drawings of each HVAC system showing all connected (connected and calculated) point addresses and operator notations.

.6 Complete sequences of operation of the DDC systems in both flow chart and program format.

.7 BAS central system configuration complete with all peripheral devices, batteries, power supplies, modems etc. with interconnection diagrams.

.8 Technical specification data sheets of each system component and software module.

.9 Descriptive data and sequence of operation of all operating, user, and application software including a complete Operators Manual and Programmers Manual tailored to the job.

1.10 REFERENCE STANDARDS

.1 Provide electrical material and installation in accordance with the appropriate sections of the current edition of the applicable local codes for signaling systems. Install wiring in conduit or approved totally enclosed raceways. Do not use cable raceways or troughs.

.2 Provide materials and equipment which are standard components regularly manufactured and guaranteed to be available as regular inventory as replacement parts.

.3 Provide electrical and electronic equipment which is CSA or Ontario Hydro approved where such approvals are required by the regulatory authorities.

.4 Provide ASCII American Standard for Communication and Information Interchange code input/output devices with standard EIA Electronic Industry Association interface.

1.11 DOCUMENTATION – GENERAL

.1 Provide documentation for the BAS before the commencement of acceptance testing.

.2 Provide two sets of operator and programmer manuals to serve the diverse needs of personnel concerned with the operation, and maintenance of the facility.

.3 Provide prior to project completion 3 sets of maintenance documentation of a standard which would enable the Owner to undertake planned maintenance, repair, calibration and other adjustments as may be necessary from time to time, on any component provided under this Contract without additional documentation being required and without assistance from others.

Part 2 Products

2.1 ACCEPTABLE MANUFACTURER

.1 Siemens Building Technologies shall be carried by the Mechanical Division Contractor.

.2 This is an extension of a existing system and only Siemens Building Technologies will be accepted.

.3 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).

2.2 AUTOMATION CONTROL VALVES AND OPERATORS

.1 All characteristics of control valves shall be suitable for the required operation. Provide operators sized to assure smooth, positive operation over the entire operating range, without chatter or slamming, and to give tight shutoff at end positions against the system pressures to be encountered.

.2 Straight through water valves shall be single seated with equal percentage flow characteristics.

.3 All valves shall have stainless steel stems and spring loaded Teflon cone packing.

.4 Valves 50 mm (2") and smaller shall have screwed 1034 kPa (150 psi) bronze bodies. Valves 65 mm (2½") and larger shall have flanged 860 kPa (125 psi) cast iron bodies.

.5 All characteristics of control valves shall be suitable for the required operation. Operators are to be 24 Vac, receiving 0 to 10 Vdc proportional control signals. Valve operators for terminal equipment controllers to be 24 Vac with maintenance-free synchronous motors and magnetic hysteresis couplings protecting against overload.

2.3 PRESSURE ELECTRIC SWITCHES

.1 Switch shall be SPDT snap acting and rated for 16 amperes at 120V.

.2 The pressure range shall be 0 to 130 kPa (0 to 19 psi).

.3 The set point shall be adjustable from 20.6 and 130 kPa (3 and 19 psi) and the differential adjustable between 13.7 and 41.1 kPa (2 and 6 psi). The pressure switch shall be CSA approved.

2.4 TEMPERATURE SENSORS

.1 All liquid immersed sensors shall be RTD or thermistor type temperature detectors. Each sensor shall be provided with a well, suitable for the working temperature and pressure of the fluid. The accuracy of the sensor shall be ± 0.3°C (± 0.5°F) over a range of 18°C to 49°C (65°F to 120°F).

.2 Outdoor air sensor shall be the RTD type with a 4-20mA transmitter mounted at the sensor. The RTD shall be mounted in a weather proof enclosure, the 4-20mA transmitter shall be mounted inside the building within an electrical box. The accuracy of the sensor shall be ± 0.3°C (± 0.5°F) over a range of 18°C to 49°C 65°F to 120°F).

2.5 DIFFERENTIAL PRESSURE SENSORS

.1 Differential pressure sensors shall be provided for water differential pressure air and static pressure applications. The differential pressure range shall be selected to match the application. Select materials suitable for the measured variable, i.e. water and air, and to withstand a minimum of twice the normal pressure.

.2 Each sensor shall be provided with an industry standard 4-20mA transmitter, mounted at the sensor. The transmitter and sensor shall have a combined accuracy of <+/- 1.0% full scale. Setra C-264 or equivalent is acceptable.

2.6 CURRENT SWITCHES

.1 Provide solid state current DC switches with LED which operate when the level sensed by an internal current transformer exceeds the threshold value set by a four-turn adjustment.

.2 The switch shall be capable of open-collector transistor outputs, capable of 150 mA dc continuous, 500 mA momentary. Maximum permissible voltage between output and common in off state is 30 VDC. Maximum voltage drop at 150 mA is 0.8 volts.

2.7 PANELS

.1 Control panels shall be fully enclosed cabinets with all steel constructions. Cabinets shall have hinged door with locking latch or bolt on cover plate. All cabinet locks shall be common keyed.

.2 Panels shall be wall mounted or free standing and shall be as located on the mechanical drawings.

.3 All relays, transducers etc., shall be located within the control panels.

.4 Each DDC Controller enclosure shall have a standard duplex AC power receptacle located within the enclosure to provide power for test equipment, operation communication devices.

2.8 NAMEPLATES

.1 Duct and pipe mounted sensors and panels shall be provided with minimum size 80 mm x 25 mm x 3 mm (3" x 1" x 1/8") lamicoid nameplates, clearly identifying the equipment and functions with letter and number designation. Nameplates shall be mechanically secured and listed in the Operating and Maintenance manual.

2.9 NETWORKING COMMUNICATIONS

.1 The design of the BAS shall network operator workstations and stand-alone DDC Controllers. The network architecture shall be capable of consisting of three levels, a management Ethernet level network based on TCP/IP protocol, a high performance peer-to-peer building level network and DDC Controller floor level local area networks with access being totally transparent to the user when accessing data or developing control programs.

.2 The design of BAS shall allow the co-existence of new DDC Controllers with existing DDC Controllers in the same network without the use of gateways or protocol converters.

.3 Peer-to-Peer Building Level Network:

.1 All operator devices either network resident or connected via dial-up modems shall have the ability to access all point status and application report data or execute control functions for any and all other devices via the peer-to-peer network. No hardware or software limits shall be imposed on the number of devices with global access to the network data at any time.

.2 The network shall support a minimum of 100 DDC controllers and PC workstations.

.3 Each PC workstation shall support a minimum of 4 peer-to-peer networks hardwired or dial up.

.4 The system shall support integration of third party systems (fire alarm, security, lighting, PCL, chiller, boiler) via panel mounted open protocol processor. This processor shall exchange data between the two systems for inter-process control. All exchange points shall have full system functionality as specified herein for hardwired points.

2.10 DDC CONTROLLER FLOOR LEVEL NETWORK

.1 This level communication shall support a family of application specific controllers and shall communicate with the peer-to-peer network through DDC Controllers for transmission of global data.

.2 Telecommunication Capability:

.1 Auto-dial/auto-answer communications shall be provided to allow DDC Controllers to communicate with remote operator stations and/or remote terminals via telephone lines, as indicated in the sequence of operations.

.2 Auto-dial DDC Controllers shall automatically place calls to workstations to report alarms or other significant events. The auto-dial program shall include provisions for handling busy signals, “no answers” and incomplete data transfers.

.3 Operators at dial-up workstations shall be able to perform all control functions, all report functions and all database generation and modification functions as described for workstations connected via the network. Routines shall be provided to automatically answer calls from remote DDC Controllers. The fact that communications are taking place with remote DDC Controllers over the telephone lines shall be completely transparent to an operator.

2.11 DDC CONTROLLER

.1 DDC Controllers shall be 16-bit stand-alone, multi-tasking, multi-user, real-time digital control processors consisting of modular hardware with plug-in enclosed processors, communication controllers, power supplies and input/output point modules. Controller size shall be sufficient to fully meet the requirements of this specification and the attached point I/O schedule. Each controller shall support a minimum of two (2) Floor Level LAN Device Networks.

.2 Each DDC Controller shall have sufficient memory to support its own operating system and databases, including:

.1 Control processes.

.2 Energy management applications.

.3 Alarm management applications including custom alarm messages for each level alarm for each point in the system.

.4 Historical/trend data for points specified.

.5 Maintenance support applications.

.6 Custom processes.

.7 Operation I/O.

.8 Dial-up communications.

.9 Manual override monitoring.

.3 Each DDC Controller shall support firmware upgrades without the need to replace hardware.

.4 Provide all processors, power supplies and communication controllers so that the implementation of a point only requires the addition of the appropriate point input/output termination module and wiring.

.5 DDC Controllers shall provide a minimum two RS-232C serial data communication ports for operation of operator I/O devices such as industry standard printers, operator terminals, modems and portable laptop operator's terminals. DDC Controllers shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems, printers or terminals.

.6 As indicated in the point I/O schedule, the operator shall have the ability to manually override automatic or centrally executed commands at the DDC Controller via local, point discrete, on-board hand/off/auto operator override switches for digital control type points and gradual switches for analog control type points.

.1 Switches shall be mounted either within the DDC Controllers key-accessed enclosure, or externally mounted with each switch keyed to prevent unauthorized overrides.

.2 DDC Controllers shall monitor the status of all overrides and inform the operator that automatic control has been inhibited. DDC Controllers shall also collect override activity information for reports.

.7 DDC Controllers shall provide local LED status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device. Graduated intensity LED's or analog indication of value shall also be provided for each analog output. Status indication shall be visible without opening the panel door.

.8 Each DDC Controller shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all panel components. The DDC Controller shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication.

.9 Isolation shall be provided at all peer-to-peer network terminations, as well as all field point terminations to suppress induced voltage transients consistent with IEEE Standards 587.

.10 In the event of the loss of normal power, there shall be an orderly shutdown of all DDC Controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.

.1 Upon restoration of normal power, the DDC Controller shall automatically resume full operation without manual intervention. Should DDC Controller memory be lost for any reason, the user shall have the capability of reloading the DDC Controller via the local RS-232C port, via telephone line dial-in or from a network workstation PC.

Part 3 Execution

3.1 INSTALLATION

.1 Install all equipment, accessories, conduit and interconnecting wiring in a neat and protected manner by skilled and qualified work persons using the latest standard practices of the industry.

.2 Meet Owner's requirements.

.3 Install piping in apparatus rooms exposed, securely anchored to structure or equipment and run parallel or at right angles to structure.

.4 Upon completion of the work, all thermostats, control valves damper operators and dampers and other devices shall be calibrated and adjusted as required to place the system in complete and satisfactory operating condition.

.5 Cooperate with the air and water balance technicians during the balancing of the system.

.6 Trip test high and low temperature protection devices to ensure satisfactory operation, in the presence of the Owner.

.7 Conceal piping, serving equipment outside the apparatus rooms wherever possible, and install so that it does not interfere with other trades.

.8 Provide adequate drip runs at low points with petcocks installed in such a manner that the runs are accessible for periodic drainage.

.9 Carry out a pressure test prior to mounting of control instruments to ensure that piping network is leak free. Pressurize system to 413 kPa (60 psig) air for a period of 24 hours at end of which time pressure loss shall not exceed 68 kPa (10 psig). Test shall also conform to the requirements of authorities having jurisdiction.

.10 Unless otherwise specified, meet manufacturer's latest printed instructions for materials, planned maintenance and installation methods.

.11 Notify Consultant in writing of any conflict between these Specifications and manufacturer's instructions.

.12 Retain, at no additional cost to the Owner, original equipment suppliers to provide contacts that are required on the Point Schedules and in the software and sequence specified. Provide the necessary relays, auxiliary contacts and transformers required to interconnect equipment.

.13 All equipment installed shall be mechanically stable and, as necessary, fixed to wall or floor. Anti vibration mounts to be provided, if required, for the proper isolation of equipment.

.14 Install equipment so as to allow for easy maintenance access and such that it does not interfere in any way with access to adjacent equipment and personnel traffic in the surrounding space.

.15 Install equipment in locations providing adequate ambient conditions for its specified functioning, allowing for adequate ventilation and with no condensation traps.

.16 Shield and ground communication trunk wiring at a single end.

.17 Do not splice trunk line.

.18 Provide complete installation, testing, debugging and interfacing of specified software.

.19 Provide new pilot positioners where none are existing now on all dampers and control valves to be connected to BAS output when necessary.

3.2 CONTROL WIRES

.1 Supply and install wiring as required for the automatic control system. Install wiring in EMT conduit. Comply with all requirements of Electrical Division.

.2 All wiring concealed in walls and chases and all exposed wiring shall be run in conduit.

3.3 ACCEPTANCE TESTING

.1 Upon completion of the system control contractor will request, in writing, to the Engineer and Owner that the acceptance procedures can commence.

.2 After installation forward submittal data relevant to point index, functions, limits, sequences, interlocks, software routines and associated parameters and other pertinent information for the operating system and data base to the Owners authorized representative. Enter software into the central computer and debug.

.3 Prior to on-line operation perform a complete demonstration and readout of the computer real-time responsibilities of surveillance and command in the presence of the Owner’s authorized representative.

.4 Adjust all devices and components to ensure that the operations are performed correctly and that all analog values are displays to the accuracy specified. Check all alarms, start/stop and status conditions to ensure proper operation.

.5 Upon successful completion of on-line operation provide the Owner’s authorized representative with written confirmation, inspection and approval of the satisfactory operation of the building automation system.

.6 Complete all outstanding deficiencies as determined by the Owner’s representative in his inspection report, after which a resubmission of formal acceptance shall be made. Repeat this procedure, if necessary, until acceptable performance has been established.

3.4 TRAINING

.1 The Contractor shall provide during normal working hours, a competent instructor to give full instruction to designated personnel in the adjustment, operation and maintenance of the system installed, rather than a general training course.

.2 Provide 20 hours of training for Owner's operating personnel. Training shall include:

.1 Explanation of drawings, operations and maintenance manuals

.2 Walk-through of the job to locate control components

.3 DDC Controller

Explanation of adjustment, calibration and replacement procedures

.3 Since the Owner may require personnel to have more comprehensive understanding of the hardware and software, additional training must be available from the Contractor. If such training is required by the Owner, it will be contracted at a later date. Provide description of available local and factory customer training.

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 Warrant in writing, all provided equipment, accessories, installations, software and firmware against defects in workmanship and materials for a period of one (1) year commencing from the date of Ready for Takeover.

.2 Maintain the affected parts operational during repair of defective equipment covered by the warranty.

.3 Provide warranty service at no cost to the owner for the guarantee period, this shall include, but not limited to the following:

.1 Emergency repair service on regular working hour basis during warranty.

.2 Replacing defective parts and components as required.

.3 Servicing by factory trained and employed service representatives of system manufacture.

.4 System software support.

.4 Supplier shall have an in-place support facility within 32 km (20 miles) of the site with technical staff, spare parts inventory and all necessary test and diagnostic equipment.

.3 Warranty Coverage:

.1 Applies to parts and labour.

3.6 CONTROL STRATEGIES

.1 Provide all hardware and software necessary to achieve specified control. The sequence of events required for each control loop is described for each system in the control sequence. Also refer to summary for required temperature and status monitoring.

Part 4 SEQUENCE OF OPERATIONS

4.1 PACKAGED HVAC (CONSTANT VOLUME)

.1 General

.1 The constant volume air handling units consists of a mixed air section with outdoor air and return air dampers, pre-filter, DX cooling coil, multiple-stage gas heat, and supply fan. The unit is DDC controlled using electric actuation.

.2 Limits and Safeties

.1 Unit shall be equipped with a freeze stat.

.2 Mechanical cooling low temperature protection: If the outdoor air temperature falls below its Mechanical Cooling Lockout setpoint, it will prevent the mechanical cooling stages from being energized.

.3 Monitor units' refrigeration leak detection system. Upon signal from 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 Unit Start/Stop

.1 Occupied Mode: unit fan runs continuously.

.2 Unoccupied Mode: unit fan is off unless there is requirement for space heating and cooling.

.4 Control Strategy

.1 Space Temperature Control

.1 Room Temperature Control: The gas heat and DX cooling stage(s) will be activated appropriately to maintain the supply air temperature at its setpoint.

.2 Unoccupied Mode: When the room temperature falls below the unoccupied low limit setpoint, then the HVAC unit will start and continue to run until the room temperature rises by 3C°. If the room temperature rises above the unoccupied high limit setpoint, then the unit will start and continue to run until the room temperature falls by 3C°. Unit shall operate at full heat or cooling to bring space to setpoint as quickly as possible. Provide minimum run times as per Occupied mode. If supplemental heat is available, it shall be first stage heat.

.3 Morning Warm-up: When the HVAC unit starts-up after the unoccupied period and the return air temperature is below the warm-up mode setpoint, 20°C (adj.), the warm-up mode is in effect. The outdoor air damper will close fully and the gas valve will open until the return air temperature exceeds warm-up mode setpoint. Cooling stages will be locked-out during the warm-up mode.

.2 Supply Fan Shutdown Delay: If the fan system is shut down while heating or cooling stages are energized, the stages will immediately de-energize and the fan will continue to run for 60 sec. (heating mode, adj.) or 30 sec. (cooling mode, adj.) more, then shut down.

.3 Manual Override Timer: The supply fan will also be started if the manual override timer switch is activated. The fan will then run until the switch times out.

.4 Ventilation Control

.1 The ERV shall be enabled during all occupied hours and warm up periods to provide minimum ventilation rate. The ERV shall utilize free cooling when conditions are suitable.

.2 Provide CO_2 controls connected to the unit to override OA damper controls to allow more outside air to enter. Maintain CO_2 at 1000 ppm (adj). Limit outside air in order to prevent MAT falling below 13 degrees C.

.3 Outside air damper shall be open to minimum position during occupied mode and closed in unoccupied mode.

.5 Economizer:

.1 An economizer cycle shall be employed to return the outside air dampers to minimum position should the outside air temperature exceed the return air temperature.

.5 Alarms

.1 Fan System Failure Alarm: An alarm is generated whenever the supply fan fails to respond to start-stop commands.

.2 Unit not cooling when commanded, as indicated by SAT (5 minute delay)

.3 Unit not heating when commanded, as indicated by SAT (5 minute delay)

.4 Supply air temperature above 35°C (5 minute delay)

.5 Unit is running and return air CO_2 levels are above 800 ppm (1 hour delay)

.6 Points List

.1 **Where available, points may be integrated via BACNet. Any points not available via BACNet shall be provided by this contractor.**

Name	AI	AO	DI	DO
Space Temperature	X			
Space Temperature Adjustment	X			
Fan Command				X
Fan Status	X			
Gas Heat Stage 1				X
Gas Heat Stage 2				X
Cooling Stage 1				X
Cooling Stage 2				X
Mixed/OA damper Command		X		
Occupied/Unoccupied Command				X
Mix Air Temperature	X			
Supply Air Temperature	X			
Return Air CO_2	X			
Return Air Temperature	X			
Unit Alarm			X	

4.2 KITCHEN MAKE UP AIR AND EXHAUST FAN SYSTEMS (HOOD CONTROL PANEL)

.1 General

.1 The NFPA hood is being provided with a control panel that will control all exhaust fan and make up air commands. Commands shall include on/off of fans, as well as speed control for hoods with demand control systems.

.2 The BAS contractor shall be responsible for all wiring between the hood and the controlled devices. Provide protocol gateways between VFDs and hood control system signal as required.

.3 The BAS shall be responsible to set the MUA units discharge air temperature.

.4 The BAS shall monitor all equipment status'.

.5 The BAS shall monitor the control panels on/off command status as well as it's alarm status.

.2 Safeties and Limits

.1 Unit control panel shall utilize internal safeties.

.2 BAS shall monitor units' refrigeration leak detection system. Upon signal from 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 Start/Stop

.1 The NFPA hood control panel shall be utilized to turn the unit on and off. The Control panel shall have a manual switch, as well as thermal detection system as per NFPA 96 requirements.

.4 Control Strategy

.1 The unit controls gas heating and integral cooling to maintain the SAT to setpoint.

.2 The SAT setpoint is adjusted to meet the load in the space based on the room temperature sensor.

.3 Gas heating will be disabled when the outdoor air temperature is above 18° C (adj).

.4 Mechanical cooling will be locked out when outdoor air temperature is below 18° C.

.5 Alarms

.1 The following alarms shall be provided

.1 Supply Air temperature is below 6° C, or above 45° C (5 minute delay).

.2 Unit not heating when commanded, as indicated by SAT (5 minute delay).

.3 Fan status not received when unit commanded on (5 minute delay).

.4 Provide alarm if kitchen exhaust fan is left on for more than 2 hours during unoccupied hours.

.6 Points List

.1 **Where available, points may be integrated via BACNet. Any points not available via BACNet shall be provided by this contractor.**

Name	AI	AO	DI	DO
Supply Fan Status	X			
Exhaust Fan Status	X			
Discharge Air Set Point / Heating/Cooling stages as required		X		X
Heating Lockout				X
Gas Burner Status	X			
Cooling Lockout				
DX Cooling Status	X			
Supply Air Temperature	X			
MUA Unit Alarm			X	
Control Panel Alarm			X	
Control Panel Fan/MUA Command			X	

4.3 EXHAUST FANS (GENERAL)

.1 Start/stop exhaust fans on time of day schedule.

.2 The DDC system uses a current switch to confirm fan operation. Provide a dual voltage relay adjacent to the BAS panel. DDC system generates an alarm if status deviates from DDC start/stop control.

.3 Points List

Name	AI	AO	DI	DO
Exhaust Fan Command				X
Exhaust Fan Status	X			

4.4 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

Division 26 Common Requirements for Electrical

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Common Contract Requirements for Electrical

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Common Work Results for Electrical

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Division 28 Electronic Safety and Security

Fire Detection and Alarm

28 31 25 Fire Alarm System (Addressable)

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 Submit tender based on specified described equipment or Alternates listed.

.2 State in Tender, names of all Subcontractors proposed for work under this Division.

1.4 LIABILITY INSURANCE

.1 This contractor must maintain and produce at the request of the consultant proof of proper insurance to fully protect the owner, the consultant and the contractor from any and all claims due to accidents, misfortunes, acts of God, etc.

1.5 ELECTRICAL SAFETY AUTHORITY

.1 The contractor is to determine general inspection fees with Electrical Safety Authority and include as part of tender.

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 CO-ORDINATION DRAWINGS

.1 Prepare interference and equipment placing drawings to ensure that all components will be properly accommodated within the constructed spaces provided.

.2 Prepare drawings to indicate co-ordination and methods of installation of a system with other systems where their relationship is critical. Ensure that all details of equipment apparatus, and connections are co-ordinated.

.3 Ensure that clearances required by jurisdictional authorities and clearances for proper maintenance are indicated on drawings.

.4 Upon consultant’s request submit copies of interference drawings to 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.

.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 Demolition

.4 Panelboards and miscellaneous distribution equipment

.5 Branch conduits

.6 Branch wiring

.7 Lighting fixtures (interior)

.8 Emergency lighting

.9 Fire alarm system

.10 Starters, contactors, and control devices

.11 Wiring for mechanical equipment

.12 Wiring for owner's equipment

.13 Integrated Life Safety System Testing

.14 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 Panelboards

.2 Fire alarm system

.3 Luminaires and drivers

.4 Emergency battery units and fixtures

.5 Starters, contactors, and control devices

.6 Firestopping materials

.7 Wiring devices

.8 Disconnect switches and fuses

.9 Roof cone

.10 Co-ordination study

.11 Integrated Life Safety System Testing Plan (ITP)

.2 Submissions shall be submitted electronically as per the following directions:

.1 Electronic Submissions:

.1 Electronically submitted shop drawings shall be prepared as follows:

.1 Use latest software to generate PDF files of submission sheets.

.2 Scanned legible PDF sheets are acceptable. Image files are not acceptable.

.3 PDF format shall be of sufficient resolution to clearly show the finest detail.

.4 PDF page size shall be standardized for printing to letter size (8.5"x11"), portrait with no additional formatting required by the consultant. Submissions requiring larger detail sheets shall not exceed 11"x17".

.5 Submissions shall contain multiple files according to section names as they appear in Specification.

.6 File names shall include consultant project number and description of shop drawing section submitted.

.7 Each submission shall contain an index sheet listing the products submitted, indexed in the same order as they appear in the Specification. Include associated PDF file name for each section.

.8 On the shop drawing use an “electronic mark” to indicate what is being provided.

.9 **Each file shall bear an electronic representation of the “company stamp” of the contractor. If not stamped the file submission will not be reviewed.**

.2 Email submissions shall include subject line to clearly identify the consultants’ project number and the description of the shop drawings submitted.

.3 Electronic attachments via email shall not exceed 10MB. For submissions larger than 10MB, multiple email messages shall be used. Denote related email messages by indicating “1 of 2” and “2 of 2” in email subject line for the case of two messages.

.4 Electronic attachments via web links (URL) shall directly reference PDF files. Provide necessary access credentials within link or as username/password clearly identified within body of email message.

.5 On site, provide one (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 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.

.2 Reproduce drawings and specifications required by Electrical Safety Authority at no cost.

.3 Notify consultant of changes required by Electrical Safety Authority prior to making changes.

.4 Furnish Certificates of Acceptance to consultant from Electrical Safety Authority and other authorities having jurisdiction upon completion of work.

.5 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 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 Lamacoid 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 disconnects, starters and contactors must indicate equipment being controlled and voltage.

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
Fire alarm	red
Emergency lighting	pink
Emergency up to 208V	yellow/red/yellow (striped)

.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.

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 Wall receptacles:

.1 General: 400 mm (16").

.2 Above top of counters or counter splash backs: 100 mm (4").

.2 Panelboards: as required by Code or 1400 mm (56").

.3 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.

.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 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 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings as indicated on drawings or as determined from co-ordination study.

.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).

.4 Final Submittals:

.1 Upon acceptance of Operation and Maintenance Manual by the consultant, provide the following:

.1 Provide one (1) copy of final Operation and Maintenance Manual, 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 Coordination Study / Arc Flash Hazard (including photos of each breaker)

.6 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.

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 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 Fill voids around pipes:

.1 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.

.2 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 The firestopping materials are not to shrink, slump or sag and be free of asbestos, halogens and volatile solvents.

.6 Firestopping materials are to consist of a component sealant applied with a conventional caulking gun and trowel.

.7 Firestop materials are to be capable of receiving finish materials in those areas, which are exposed and scheduled to receive finishes.

.8 Firestopping shall be inspected and approved by local authority prior to concealment or enclosure.

.9 Install material and components in accordance with ULC certification, manufacturers instructions and local authority.

.10 Submit product literature and installation material on firestopping in shop drawing and product data manual.

.11 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 & 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 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 EXISTING SYSTEMS

.1 Connections into existing systems to be made at time approved by consultant. Request written approval of time when connections can be made.

.2 Be responsible for damage to existing plant by this work.

1.52 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.

1.53 ASBESTOS

.1 If asbestos is suspected or identified cease all work in the immediate area in accordance with OHSA and notify consultant.

.2 Each contractor and on site employee of the contractor shall have “asbestos awareness training”.

.3 The contractor shall ensure that employees who may come into contact with asbestos due to the nature of the work that they perform, have received training that enables them to recognize asbestos and that enables them to react in accordance with the Occupational Health and Safety Act and regulations thereto should contact with asbestos occur during the course of their work.

.4 It is the responsibility of the contractor to review the asbestos book in the building prior to starting any work.

.5 Existing occupied buildings (depending upon their age) may contain asbestos in thermal insulating materials and some manufactured products, such as vinyl asbestos floor tile. Any insulating materials, on pipes, fittings, boilers, tanks, ductwork, etc. may contain asbestos and shall not be disturbed.

.6 **A survey of each building documenting the location and condition of asbestos-containing materials is available for your mandatory review prior to commencing any work on premises.**

1.54 DISCONNECTION AND REMOVAL

.1 Disconnect and/or remove equipment as indicated.

.2 Cap and conceal all redundant and obsolete connections.

.3 Provide a list of equipment to be removed to the owner, for his acceptance of same. Remove all equipment from site, which the owner does not retain.

.4 Store equipment to be retained by owner on site where directed by consultant.

1.55 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.

1.56 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.

1.57 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.

1.58 EXISTING CONCRETE SLAB X-RAY/SCANNING

.1 This contractor shall retain the services of a qualified company to provide and X-ray and/or scan of the existing buried services in walls and/or floors prior to starting any work in the affected area.

.2 Failure to locate existing piping, conduit, rebar etc., shall not relieve this contractor of repair of same prior to installing his service.

.3 This contractor shall be responsible for all repairs and/or replacement of existing services caused by cutting the existing concrete slabs and/or walls.

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 22 11 – CLEAN AGENT FIRE SUPPRESSION SYSTEM and DIVISION 1

.3 Section 23 02 52 – HVAC GENERAL REQUIREMENTS and DIVISION 1

.4 Section 23 33 17 – SMOKE CONTROL DAMPERS

.5 Section 26 01 16 – ELECTRICAL GENERAL REQUIREMENTS and DIVISION 1

.6 Section 26 51 13 – LIGHTING EQUIPMENT

.7 Section 28 31 25 – FIRE ALARM SYSTEM (ADDRESSABLE)

.8 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 92, Standard for Smoke Control Systems

.9 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 Kitchen Fire Suppression Systems
- .3 Smoke Damper Assemblies
- .4 Emergency Lighting
- .5 HVAC Shutdown and ON/OFF/Auto Controls

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. 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 Testing of Integrated Fire Protection and Life Safety Systems Report.

.4 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 CSA C22.2 No. 123 (latest edition), Metal Sheathed Cables.

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 ARMOURED CABLES

.1 Conductors: insulated, copper minimum size as indicated above.

.2 Type: AC90 (minimum size 12 AWG).

.3 Armour: interlocking type fabricated from aluminum strip.

.4 Connectors must be suitable for installed environment and approved for use with armoured cable.

Part 3 Execution

3.1 INSTALLATION OF BUILDING WIRES

.1 Install wiring from source to load through raceways as specified.

.2 Provide separate neutral conductors for all lighting circuits and circuits originating from surge protected panels. Size raceways accordingly.

3.2 INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible.

.2 Terminate cables in accordance with Wire and Box Connectors - 0 - 1000 V Section.

.3 These cables are to be installed in concealed locations only. These concealed locations are considered to be stud walls and “drops” to stud walls, lighting fixtures, and ceiling mounted devices.

.4 These “drops” shall not be permitted to exceed 2.4 m (8'-0"). To limit these “drops” to lengths noted above provide additional branch wiring in conduit.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data for cabinets in accordance with Electrical General Requirements Section.

Part 2 Products

2.1 MATERIALS

.1 Junction and pull boxes must conform to CSA C22.2 No. 40 (latest edition)

2.2 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 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.

3.2 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 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 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.**

2.4 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 Insulated grounding conductors: green with insulation type that matches specified phase conductors. Gauge shall be in conformance with the latest edition of the Electrical Safety Code to suit required installation conditions.

.2 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:

- .1 Grounding and bonding bushings.
- .2 Protective type clamps.
- .3 Bolted type conductor connectors.
- .4 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 bonding connection to gas piping from electrical service ground at each location it enters a building, including multiple entries.

.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.

3.2 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Electrical Service equipment, electrically conductive metal gas piping, frames of motors, starters, building steel work and distribution panels.

3.3 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.

3.4 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Electrical General Requirements Section.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CAN/CSA C22.2 No.18-92, Outlet Boxes, Conduit Boxes, and Fittings.

.2 CSA C22.2 No.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.

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.

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.

.3 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. Coordinate surface installations with Consultant prior to rough-in, unless otherwise noted.

.4 Use electrical metallic tubing (EMT) for all branch circuits unless specified otherwise.

.5 Use rigid aluminum threaded conduit where specified and up to 2.1 m (7'-0") above finish floor where exposed to mechanical injury.

.6 Use rigid PVC conduit underground and in kitchen areas.

.7 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.

.8 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.

.9 Conduits terminating at electrical equipment in sprinklered areas are to be provided rain-tight insulated compression style connectors.

.10 **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").

.11 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.12 Mechanically bend steel conduit over 27 mm (1") diameter.

.13 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.14 Install fish cord in empty conduits.

.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 CONDUITS UNDERGROUND

.1 Slope conduits to provide drainage.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 This analysis is to be performed by an independent, third party firm.

.2 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.

.3 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.

.4 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.

.5 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 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.

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 digital image of each breaker indicating final settings and placement of labels

3.3 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.**

3.4 ACCEPTABLE TESTING FIRMS

.1 MVA Engineering (519) 668-4698

.2 GT Wood Company Ltd. (905) 272-1696

.3 Brosz & Associates (905) 472-6660

.4 K-Tek Electro-services Ltd. (905) 640-2002

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 10000A (symmetrical) interrupting capacity or as indicated.

.6 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

.7 Panelboard mains, number of circuits, and number and size of branch circuit breakers as indicated.

.8 Two keys for each panelboard and key panelboards alike.

.9 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

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.

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.

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 lamacoid labels for series rating breakers. Lamacoid label to state “Series Rating Breaker.” Lamacoid 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 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 Standard Devices
  - .1 Standard duplex receptacle: Hubbell Cat # HBL5252CN
  - .2 T-slot receptacles: Hubbell Cat. #HBL5352
  - .3 Tamper resistant receptacle: Hubbell Cat # BR15TR
  - .4 Tamper resistant T-slot receptacle: Hubbell Cat. #BR20TR
- .2 Above 20A
  - .1 Dryer receptacle: Hubbell Cat # HBL9430A
  - .2 Range receptacle: Hubbell Cat # HBL9450A
- .3 Tamper resistant
  - .1 Tamper resistant ground fault protected T-slot receptacle: Hubbell Cat. #GFTR20

.6 Acceptable alternate manufacturers include:

- .1 Pass & Seymour
- .2 Leviton

2.2 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 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 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.

.2 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.

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 Motor Protection:

1-600 A: Mersen Type AJT

.2 Other acceptable manufacturers:

.1 GEC

.2 Little Fuse

Part 3 Execution

3.1 INSTALLATION

.1 Install fuses in mounting devices immediately before energizing circuit.

.2 Ensure correct fuses fitted to physically matched mounting devices.

.1 Install Class R rejection clips for HRCI-R fuses.

.3 Ensure correct fuses fitted to assigned electrical circuit.

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

.1 Submit product data in accordance with Electrical General Requirements Section.

Part 2 Products

2.1 DISCONNECT SWITCHES

.1 Enclosed manual air break switches must conform to CSA C22.1 No.4 (latest edition).

.2 Fuseholder assemblies must conform to CSA C22.2 No.39 (latest edition).

.3 Fusible, and/or non-fusible, horsepower rated disconnect switches, size as indicated.

.4 Provision for padlocking in off switch position by three locks.

.5 Mechanically interlocked door to prevent opening when handle in ON position.

.6 Fuses: size as indicated, to Fuses - Low Voltage Section.

.7 Fuseholders: relocatable and suitable without adaptors, for type and size of fuse indicated.

.8 Quick-make, quick-break action.

.9 ON-OFF switch position indication on switch enclosure cover.

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 Disconnect switches mounted on mechanical rooftop equipment shall be installed minimum 750 mm (30") above finished roof to be protected against damage and weather (snow build up).

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 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 fixtures, and driver: 5 years.

.2 The labour required to replace these drivers must be included in the above guarantee, however only for the extent of the contract guarantee and warranty period as noted in Electrical General Requirements.

Part 2 Products

2.1 FIXTURE CONSTRUCTION

.1 Fixtures must be constructed of 20 gauge (minimum) cold rolled steel. All metal edges require smooth finish.

.2 Light leaks must be prevented by providing gasketting, stops, and barriers.

.3 Fixtures must be finished in high reflective baked white enamel. This surface must have a reflectance of not less than 85%.

2.2 FIXTURE LENS

.1 Unless otherwise noted fixture lenses shall be as follows:

.1 Lens thickness: 3.2 mm (1/8")

.2 Material: injection moulded clear prismatic virgin acrylic

.3 Frame: hinged, latched, steel.

2.3 LED FIXTURES

.1 Fixture 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 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.

2.5 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.

2.6 ACCEPTABLE LIGHTING MANUFACTURERS

.1 Refer to the light fixture schedule as indicated on drawings.

Part 3 Execution

3.1 INSTALLATION

.1 Locate and install luminaires as indicated. Luminaires are not to be supported from the roof deck. Provide additional unistrut support channel and/or support from structure. Co-ordinate with consultant on site.

.2 Ball align hangers must be provided for rod suspended fixtures.

.3 Install emergency lighting units and associated remote mounted fixtures as indicated.

.4 Direct “heads” on units and remote mounted fixtures to illuminate path(s) of exit.

.5 Install emergency lighting units and remote fixtures at 300 mm (12") below finished ceiling, unless indicated otherwise.

.6 Provide a 15 A 120 V duplex receptacle (connected to circuit indicated) adjacent to unit. **This receptacle connection is to be no lower than 8'-0" (2400 mm) AFF.**

.7 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.

.8 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.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CAN/ULC-S524 (latest edition), Installation of Fire Alarm Systems.

.2 CAN/ULC-S536 (latest edition), Inspection and Testing of Fire Alarm Systems.

.3 CAN/ULC-S537 (latest edition), Verification of Fire Alarm Systems.

.4 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 End-of-line devices.

.3 Annunciators.

.4 Ancillary devices.

.5 Interface and zone modules.

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 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.**

1.7 SYSTEM OPERATION

.1 The existing system is configured for single stage operation.

1.8 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.

1.9 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 existing fire alarm system is an addressable, single stage zoned, non-coded, indicating, fully integrated fire alarm.

2.2 FIRE ALARM CONTROL PANEL

.1 The existing fire alarm control panel is by Mircom.

2.3 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.

2.4 REMOTE ANNUNCIATOR PANELS

.1 Each remote panel shall be updated.

2.5 GRAPHIC DISPLAY (PASSIVE)

.1 Existing passive graphic layout to be updated to suit scope of work.

2.6 ANCILLARY DEVICES

.1 Relay unit to initiate fan shutdown on MUA-1.

2.7 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.

2.8 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.

2.9 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.

2.10 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.

2.11 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.**

2.12 APPROVED EQUIPMENT

DEVICE	**MIRCOM**
Control Panel	
	Existing
Intelligent Devices	
Monitor Module	MIX-M500MA
Control Module	MIX-M500RA
Isolator Module	M500XA

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 Connect alarm circuits to main control panel.

.3 Install end-of-line devices at end of applicable alarm and signalling circuits.

.4 Install remote annunciator panels and connect to annunciator circuit wiring.

.5 Locate and install remote relay units to control fan shut down.

.6 Connect fire suppression systems to control panel.

.7 **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.**

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 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.

3.9 ADDITIONAL INSTALLED FIRE ALARM SYSTEM COMPONENTS

.1 The electrical contractor is to include in their bid the cost to add two (2) additional fire smoke damper connections and 120V loss of power trouble signal with associated module and including four (4) additional isolation modules to be installed and verified as directed by the consultant.

END OF SECTION