Elmira District S.S. - Window, Roof, HVAC & Sanitary Upgrades

Tender No. 7119-KP-21

PROJECT MANUAL

Consolidated with all Addenda Notes

For the Window, Roof, HVAC & Sanitary Upgrades at Elmira District Secondary School
4 University Avenue West, Elmira ON

For

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

Contact:
Oliver Wandelt, Project Coordinator

Issued for Construction: April 22, 2021

Prepared by:

LGA Architectural Partners
310 Spadina Avenue, Suite 310
Toronto ON M%T 2E8

Tell 416.203.7600

Project No. 20931

Waterloo Region
District School Board

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Addenda incorporated here where relevant, noted with symbol and Addendum number:
[Refer to Tender Documents for complete addenda]

Addendum #1 Issued 18 March 2021

Addendum #3 Issued 25 March 2021

Addendum #4 Issued 29 March 2021

Addendum #5 Issued 30 March 2021

Addendum #6 Issued 31 March 2021

(MECHANICAL AND ELECTRICAL SPECIFICATIONS UNDER A SEPARATE COVER)

END OF SECTION

1.0 INVITATION TO PROPONENTS

1.1 INTRODUCTION

The Waterloo Region District School Board, herein after referred to as the "Board" would be pleased to receive a bid for: **Elmira District S.S. - Window, Roof, HVAC & Sanitary Upgrades**

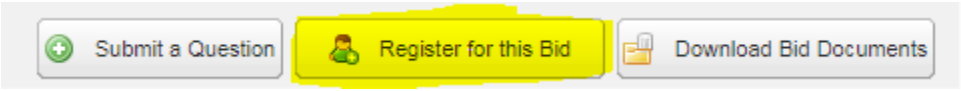
Read the entire package very carefully before preparing a bid.

1.2 ABOUT THE WATERLOO REGION DISTRICT SCHOOL BOARD

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

1.3 DIGITAL PROCUREMENT

All Bidders shall have a Bidding System Vendor account and be registered as a Plan Taker for this Bid opportunity, which will enable the Bidder to download the Bid Call Document, to receive Addenda email notifications, download all documents without the watermark "preview" on them and to submit electronically online.



Additional Contacts on your Bidding System Profile

Your company is strongly urged when creating or updating a Bidding System Vendor account to invite additional contacts to the vendor profile. This will permit these invited contacts that have created their own login to manage (register, submit, edit and withdraw) Bids which your Company is a Registered Plan Taker for. In the event of vacations or illness, these additional contacts may act on your Company's behalf, have the authority to receive addendum notifications from the Bidding System, submit Bids electronically through the Bidding System and/or withdraw and/or edit and/or acknowledge addenda, on your behalf.

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

If you are an invited company contact it is imperative that you create your login from the link contained in the email invitation. Do NOT go directly to the Bidding System website and create a separate vendor account.

1.4 EXAMINATION

Immediately notify to the "submit a question" feature in this bidding system to the attention of: **Klaus Padaric** upon finding design errors, inconsistencies or omissions in the Tender Documents and/or site examination. The Board and/or Consultant will not accept claims for extras from the Proponent, based on the failure to detect and report same found in the Tender Documents, and/or site examination before Tender closing.

1.5 SITE VISIT

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

Due to the nature of this Tender, a NON mandatory site visit has been deemed necessary.
Failure to attend and register at the time and location(s) specified would NOT result in disqualification.
Representatives for the Proponents are requested to sign in at the NON-mandatory site meet.
The Board at its sole discretion may schedule additional non-mandatory site visits
Proponents are to reference 1.8 Time Table for site meet date and time.
The site visit will take place at**: Elmira District Secondary School - 4 University Ave, Elmira, ON N3B 1K2**

The site meet is NON- mandatory for the following**: General Contractors**

Notify via the "submit a question" feature in this bidding system to the attention of: "Site Meet Request", the name of your company and staff that would like to attend a scheduled site meet.
Do not show up without submitting your request to attend the site meet.
The size of the groups at the site meet(s) will be limited as per current Covid-19 protocol.

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

Proponents are to meet in the Main parking lot.

1.6 SUPPLEMENTAL SITE VISITS

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

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

When a supplemental site visit is required, the Proponent or subcontractors may only visit the school after 3:30 P.M., during a scheduled school day. The Proponent or subcontractors shall immediately report to the Main Office, sign in as per the school protocol and ask for the head custodian. The head custodian's role is to ensure that the Proponent or subcontractors are guided to the area of interest regarding this Tender document and to provide access where required.
Proponents or sub-trades may not direct any questions related to this Tender to the head custodian or any other Board staff present. Proponents asking the head custodian or Board staff questions related to the scope or Tender in general will be disqualified.

1.7 COMMUNICATION

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

Board contact: Klaus Padaric

Responses will be via addenda.

1.7.1 From Issue Date to Deadline for Questions/Queries

Proponents, subcontractors, and third party suppliers of goods or services shall forward questions; report any errors, omissions or ambiguities to the submit a question feature in this bidding system.

1.7.3 Blackout Period: From Deadline for Questions/Queries to Bid Results Notification

All communication from the Proponent to the Board or any consultants are prohibited during the blackout period, unless initiated by the Board's contact.

1.7.4 After the release of the Bid Results Notification

Proponents submitting a bid are entitled to a debriefing. Proponents have 60 days from the issue date of the bid results notification to request a debriefing. Proponents are to forward a written request for debriefing to the Board Contact.

1.7.5 Consequences of not following the Proponent Contact Protocol

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

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

1.8 TIME TABLE

Issue Date of Tender	**March 16, 2021.**
Non Mandatory Site Meet	**March 23, 2021, 2:00 P.M.**
Deadline for Questions/Queries	3 **March 30, 2021, 2:00 P.M.**
Deadline for Issuing Addenda	3 **March 31, 2021.**
Closing Deadline	3 **April 6, 2021, 2:00:00 P.M.**
Blackout Period	**Deadline for Questions/Queries to Bid Award Notification**
Anticipated Start Date	**April 12, 2021 (abatement); June 1, 2021.**
Substantial Completion Date	**September 6, 2021.**
Deemed Complete Date	4 **October 29, 2021.**

1.8 WARRANTY AND MAINTENANCE

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

2.0 BOARD PURCHASE ORDER

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

Bidder(s). The Purchase Order number must appear on all invoices in order to ensure prompt payment.

3.0 CONSULTANT

The Board has hired the following consultant to assist in the preparation of this Tender**: LGA Architectural Partners**

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

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

In addition to the above, the consultant will be responsible for the contract administration of the project after the purchase order has been issued or the contract has been signed by the Board.

END OF SECTION

1.0 SCOPE OF WORK

The project involves7 principal phases of work, and one optional phase:

1. Re-roofing of the existing high roof and the west portion of the gymnasium block.
2. Replacement of southwest wing windows and entrance door.
3. Re-routing of existing sanitary line from under the gymnasium, with associated site work.
4. Provision of new RTU to serve the gymnasium.
5. Provision of new RTUs for air conditioning to the cafeteria.
6. Locker refurbishment.
7. Decommissioning of existing boiler and relocation of services to a new ground floor pump room.

   Optional phase: removal of basement boiler and curbs.

END OF SECTION

1.0 VENDOR OF RECORD

1.1 VENDOR REGISTRATION PROCESS

This tender document is open to those who are currently registered under the Board's Vendor Registration System.

The Waterloo Region District School Board, in an effort to build an improved supplier base and to obtain exceptional long term value, has undertaken a project to register vendors

To become a Vendor of Record for this Tender or any future business opportunities go to the Board's public website at www.wrdsb.ca and refer to About, Procurement Services, Vendor Registration, and submit the completed application, as per instructions on the website.

2.0 GENERAL CONTRACTORS

All bid submission from bidders other than Vendor of Record contractors listed below or identified by Addendum will have their Bid ruled informal.

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

Name	Phone Number	Email
1568796 Ontario Inc. o/a RENOKREW	(416) 604-7042	info@renokrew.com
Bestco Construction (2005) Ltd	(905) 304-4597	estimating@bestcoconstruction.com
Collaborative Structures Limited	(519) 658-2750	jblackler@collaborativestructures.com
Complete Building Systems Inc.	(519) 576-5800	estimating@completebuildinsystems.ca
CRD Construction	(519) 822-1801	sbock@crdconstruction.on.ca
D. Grant Construction Limited	(519) 652-2949	swillis@dgrantconstruction.com
Dakon Construction	(519) 746-0920	james@dakon.ca
Elgin Contracting and Restoration Ltd.	(519) 633-9969	info@elgincontracting.com
Gateman-Milloy Inc.	(519) 748-6500	info@gatemanmilloy.com
K&L Construction (Ontario) Ltd	(519) 472-7164	todd.hodgins@kandlconstruction.com
Melloul Blamey Construction	(519) 886-8850	joel.melloul@melloul.com
Nith Valley Construction Ltd	(519) 662-1324	mail@nithvalley.com
PM Contracting Ltd	(519) 576-8327	sarahziegler@pm.on.ca
PRE-ENG CONTRACTING LTD.	(905) 738-6866	info@pre-eng.com
Ritestart Limited	(905) 876-0505	jduncan@ritestart.ca
Reid & Deleye Contractors Ltd	(519) 688-2600	gregd@reid-deleye.com
SG Cunningham Ltd	(519) 886-2730	allan@cunningham.on.ca
Sierra Construction	(519) 421-7413	info@sierraconstruction.ca
SPEC Construction Inc.	(519) 650-4030	info@spec-build.com
STM Construction Ltd	(519) 756-7030	robertbox@stmconstruction.com
Tambro Construction	(519) 766-1234	btami@tambro.com
TRP Construction	(905) 336-1041	info@trpconstruction.ca
Van Horne Construction Ltd	(905) 677-5150	otekin@vanhorne.ca
Zehr Levesque Inc.	(519) 576-2233	estimating@zehrgroup.ca
Golden Gate contracting	(905) 844-1122	lubna@ggcontracting.ca

2.1 PROJECT TRADES

If the trade classifications listed are required for this tender project, the general contractor is to select from the vendor of record listing below for each trade category. The general contractor is to perform due diligence when selecting all subcontractors and manage them accordingly.

The Board at its discretion may request the names of the trades carried and including all projects trades, not just those listed below (if any). This request may be prior to the tender award or after the award of the tender. The prime/general contractor shall provide this list within two business days of the request.

The following are vendors of record and are invited to submit bids for this tender

ABATEMENT

Name	Phone Number	Email
Azbest Environmental	(226) 751-5059	hank@azbest.ca
Biggs & Narciso Construction	(905) 470-8788	james@biggsandnarciso.com
Caliber Environmental Construction	(905) 884-5500	jimball@caliberenv.com
Enviro-cor Enterprises	(519) 753-0993	kelly@enviro-cor.ca
FPR Environmental Inc	(519) 568-8222	frank@asbestosmouldexperts.com
GB Environmental Services	(905) 984-3455	gflett@gbenvironmental.net
I&I Construction Services Ltd	(905) 884-1290	tbarron@iandi.ca
Jobi Construction Ltd.	(519) 227-1181	bparsons@jobiconstruction.com
McGowan Insulations Ltd.	(905) 549-1844	info@mcgowan.on.ca
Power Environmental Power Vac	(905) 318-0622	info@powervachamilton.ca
Puroclean Property Restoration	(519) 653-8030	jreis@puroclean.com
Reitzel Bros. Environmental	(519) 648-2237	ddeleon@ags-environmental.com
Schouten Environmental Inc	(519) 577-8989	brant@schouten.ca
Zero Environmental	(519) 772-5500	randyb@zeroenvironmental.com

EXCAVATING

Name	Phone Number	Email
A&A Paving	(519) 744-3005	aandapaving@bellnet.ca
Brantco Construction	(519) 622-1600	tdemartin@brantco.ca
Capital Paving	(519) 822-4511	cdowne@capitalpaving.on.ca
Encora Enterprises Ltd. o/a EX-L Excavating and Site Services	(519) 821-3123	pfinamore@encora.ca
Forwell Landscape and Excavating	(519) 465-1144	flx5@live.com
G. Melo Excavating Ltd.	(519) 623-3572	srands@gmeloex.com
Gateman-Milloy Inc.	(519) 748-6500	info@gatemanmilloy.com
KIESWETTER EXCAVATING INC.	(519) 699-4445	lee@kieswetter.com
Moser Landscape Group	(519) 886-9231	troy.s@moserlandscapegroup.ca
2545224 Ontario Limited O/A T. Musselman Excavating	(519) 634-1113	aghent@musselmanexcavating.com
Schouten Environmental Inc	(519) 577-8989	brant@schouten.ca

PAVING

Name	Phone Number	Email
5 Star Paving Cambridge Inc	(519) 624-1712	derek@5starpaving.com
A&A Paving	(519) 744-3005	aandapaving@bellnet.ca
Alex Paving Ltd	(519) 743-5332	chris@alexpaving.com
Brantco Construction	(519) 622-1600	tdemartin@brantco.ca
Capital Paving	(519) 822-4511	cdowne@capitalpaving.on.ca
G. Melo Excavating Ltd.	(519) 623-3572	srands@gmeloex.com
Gateman-Milloy Inc.	(519) 748-6500	info@gatemanmilloy.com
KW Cornerstone Paving Ltd	(519) 743-6411	matt.sawatzky@kwcornerstone.com
Melrose Paving Co. Ltd.	(416) 697-8410	selim@melrosepaving.com
Quality Paving 1994 Ltd	(519) 743-8338	dtittley@qualitypaving.ca
Steed and Evans	(519) 744-7315	gens@steedevans.on.ca
T Weber Co Ltd	(519) 742-2051	robin@tweber.ca

MASONRY

Name	Phone Number	Email
Advanced Masonry Inc	(519) 846-2121	dkocher@advancedmasonry.ca
Brownstone Masonry	(905) 856-3115	brownstonemason@bellnet.ca
Core Tec. Contracting	(519) 620-7100	eddy@coretec.ca
Elgin Contracting and Restoration	(519) 633-9969	info@elgincontracting.com
Flagstone Construction	(519) 579-8811	jr.flagstone@yahoo.ca
G & B Masonry Ltd	(519) 220-8437	matt@gandbmasonry.ca
GA Masonry	(519) 648-2285	bgeorge@gamasonry.com
Jeffrey Custom Masonry Ltd.	(519) 275-1279	brad_jeffrey@wightman.ca
Konia Masonry Corp	(519) 664-1112	main@koniamasonry.com
R DEKONINCK MASONRY INC.	(519) 582-3003	rdekoninckmasonry@gmail.com

MILLWORK

Name	Phone Number	Email
Baywood Interiors Ltd	(519) 748-9577	johnl@baywoodinteriors.com
Bendt Kitchens and Millwork Inc.	(519) 743-7418	jody@bendt.ca
BEZ Industries	(519) 579-3880	john@bezindustries.com
CCW Inc	(519) 886-2728	hermes.alvarez@ccwinc.com
DM Millwork Ltd	(519) 743-1556	dmmillwork@gto.net
GL Industries Ltd	(519) 787-4379	gary@glindustries.ca
Harris Corporate Interiors Inc.	(905) 563-6111	danny@hciinc.ca
HSCJ Millwork Inc.	(226) 606-3171	sam@hscjservices.com
Interior Store Display Installations	(519) 895-0532	garry@interiorstoredisplay.com
Leedwood Ltd.	(519) 805-3556	ryan@leedwood.ca
Second Generation Furnishings	(905) 738-1403	robert@2ndgen.ca
Top Millwork Interiors Inc.	(416) 736-9868	topmillwork@msn.com
VDCM ARCHITECTURAL WOODWORK	(519) 743-4409	estimating@vdcm.ca

ROOFING

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

WINDOWS

Name	Phone Number	Email	
Aerloc Industries Ltd.	(905) 628-6061	peterdendekkerjr@aerloc.com	
Alwind Industries Ltd	(905) 738-4266	gm@alwind.com	
Barton Glass	(905) 385-3599	pdhbartonglass@quickclic.net	
Glass Canada Limited	(519) 642-4100	rdamstra@glass-canada.com	
KW Glass Systems Inc	(519) 725-9305	robw@kwglass.com	
Sherwood Windows Group	(416) 675-3262	bhorton@sherwoodwindows.com	
Shantz Windows		(519) 669-2629	bruce@shantzwindows.com
Peninsula Glass Inc.		(905) 735-2901	tim@peninsulaglass.ca
Windspec Inc	(905) 738-8311	wferri@windspec.com	

PAINTING

Name	Phone Number	Email
Aves & Shaw Painting	(519) 742-3486	avesandshawltd@rogers.com
CertaPro Painters of Waterloo	(519) 616-1167	adyck@certapro.com
Expert Painting Inc	(519) 635-8106	expertpainting@hotmail.com
Gateway Painting Ltd.	(519) 500-0772	info@gwpainting.ca
Mike McMahon's Painting Ltd	(519) 744-0169	mikes.painting.ltd@sympatico.ca
Northern Painters (div Connco Group Ltd	(800) 465-6985	northpaint@conncogroup.com
Platinum Painting & Decorating Inc.	(905) 790-2111	sandro@platinumpaintdecor.com
Westwood Painting Services Inc.	(905) 575-8458	westwoodpainting@cogeco.net

MECHANICAL

Name	Phone Number	Email
AAA Air Conditioning Inc	(519) 747-9051	igrant.aaaac@gmail.com
AIM Industrial Inc.	(519) 747-2255	craigd@aimindustrial.ca
Black & McDonald Limited	(905) 560-3100	sfernandes@blackandmcdonald.com
Brenner Mechanical Inc	(519) 746-0439	clanglois@brenner.ca
Conestogo Mechanical Inc	(519) 579-6740	wquickfall@conestogomech.com
Dean Lane Contractors Inc	(519) 585-0903	dean@dean-lane.com
Dordan Mechanical Inc.	(519) 662-9900	danielg@dordanmech.com
Jay Stewart Mechanical	(519) 576-2663	admin@jaystewart.ca
LJ Barton Mechanical Inc.	(905) 304-1976	estimating@ljbarton.com
Nelco Mechanical Ltd	(519) 744-6511	mhobson@nelcomech.com
Reitzel Heating & Sheet Metal	(519) 884-3510	alan@reitzelheating.ca
Roberts Onsite Inc	(519) 578-2230	dmagnus@robertsonsite.ca
Sutherland-Schultz Ltd	(519) 653-4123	info@sutherland-schultz.com
Trade Mark Industrial Inc	(519) 570-1511	tmoore@trade-markind.com
Velocity Mechanical Inc	(519) 896-1119	quotes@velocitymechanical.com
Wellington Plumbing & Heating	(519) 821-4130	kyle@wellington-plumbing-hvac.com
Touchstone Building Technologies	(519) 997-2792	info@touchstonebti.ca
SCT Mechanical Inc.	(519) 626-0268	jscott@sctmechanical.com

ELECTRICAL

Name	Phone Number	Email
AIM Industrial Inc.	(519) 747-2255	craigd@aimindustrial.ca
Arcadian Projects Inc.	(519) 804-9697	cory@arcadianprojects.ca
Boshart Electric Ltd.	(519) 662-1220	patf@boshartelectric.com
D&D Electric Ltd	(519) 603-2924	jquehl@ddelectric.ca
Eclipse Technology Solutions Inc.	(905) 593-1770	jbacon@eclipsetechnology.ca
Electricomm Services (ONT) Ltd	(519) 895-0777	gerry@electricomm.com
Fairway Electrical Services Incorporated	(905) 304-1133	cherd@fairwayelectrical.com
Harold Stecho Electric Ltd	(519) 746-0047	steves@stecho.ca
JM Electrical Contracting	(519) 572-3148	johnmader@sympatico.ca
Juno Electric	(519) 821-4890	steno@junoelectric.ca
KW E Inc Electrical Contractors	(519) 653-6989	jim@kweinc.com
Millers Electric Ltd	(519) 742-3465	scottg@meltd.on.ca
MJM Electric Limited	(519) 824-1989	mlang.mjm@gmail.com
NADELEC CONTRACTING INC	(905) 875-5239	john.nadelec@gmail.com
Nelco Mechanical Ltd	(519) 744-6511	mhobson@nelcomech.com
Pfaff Electric Limited	(519) 235-0909	jeff@pfaffelectric.com
Roberts Onsite Inc	(519) 578-2230	dmagnus@robertsonsite.ca
SENTRY ELECTRIC INC	(705) 436-4530	info@sentryelectric.ca
Sutherland-Schultz Ltd	(519) 653-4123	info@sutherland-schultz.com
Toth Inc	(519) 696-3916	tothelectric@rogers.com

Trade Mark Industrial Inc	(519) 570-1511	tmoore@trade-markind.com
Trade Service Group Inc.	(519) 591-8851	mikewernie@tradeservicegroup.com
Vollmer Inc.	(519) 966-6100	mshaw@vollmer.ca
Edge Electrical Solutions Inc.	(519) 747-3343	Kevin@EdgeElectricalSolutions.ca
Live Electric	(519) 265-8566	estimates@live-electric.ca

END OF SECTION

March 15, 2017
MTE File No.: C34532-909

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

Re: 2017 Asbestos Audit Update – Elmira District Secondary School
4 University Avenue, Elmira, Ontario

1.0 INTRODUCTION & SCOPE OF WORK

MTE Consultants Inc. (MTE) was authorized by the Waterloo Region District School Board (WRDSB) to conduct the 2017 asbestos inspection of the subject building.

The purpose of the assignment was to re-assess and document the location, type, and condition of identified asbestos-containing materials (ACM) present within the building and make appropriate recommendations for management, abatement or remedial activities, as required. The audit was conducted in accordance with the Ontario Ministry of Labour, *Regulation 278/05-Designated Substance-Asbestos on Construction Projects and in Buildings and Repair Operations* (O. Reg. 278/05). This report shall replace previous audit reports.

2.0 SCOPE OF WORK

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

- Review of existing or historical reports and documentation pertaining to ACM within the building;
- Visual inspection to assess the condition of previously identified ACM and address the condition, type and friability of any newly discovered ACM that was not documented in previous audits, excluding portable structures;
- Collection of bulk building material samples suspected to contain asbestos for select ACM previously identified as suspect ACM as well as any ACM previously undocumented;
- Submission of samples to an accredited laboratory, as applicable;
- Photographic log of damaged materials; and
- Preparation of this report with findings, recommendations, figures and the updated Asbestos Management Database.

3.0 METHODOLOGY AND ASSESSMENT CRITERIA

This inspection was conducted by visual and laboratory identification methods for the assessment of all known ACM and suspect ACM within the building.

The inspection was performed with good intent and purpose to determine the location and condition of all known and accessible ACM. The inspection was non-invasive, whereby ACM could be concealed by, but not necessarily limited to; ceilings, walls, bulkheads, floors, roof systems, and/or other similar features.

3.1 Condition of ACM

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

Monitor Annually: These are items which display minor damage; however do not pose an immediate risk to workers from exposure to asbestos fibres due to the current physical condition of the material and/or location. This would include, however, is not limited to such items as cracked fittings and water damaged canvas wrap. While no remediation is required at this time, these items should be monitored on a yearly basis for evidence of continued degradation. Should the condition of the material change, an evaluation should be completed by a competent person to determine remedial action.

Abatement Action Required: Items which display moderate to significant damage and require timely clean-up, repair or removal due to the potential risk to workers from exposure to asbestos fibres due to physical condition and/or location of the material. This would include, however is not limited to, such items as damaged, crumbling fittings, exposed pipe insulation on mechanical pipes which are prone to movement/vibration and asbestos debris. These items should be repaired or removed as soon as reasonably possible.

4.0 FINDINGS

An inspection of building was conducted by MTE on February 3 and March 8, 2017. The three-storey school building and was constructed in 1938 with additions in 1953, 1959, 1962, 1964, 1966.

The Asbestos Management Database and associated figures are provided as an attachment to this report and these together provides a current summary of the ACM identified throughout the building. The bulk asbestos sample location and analytical summary, photographs of damaged ACM and Laboratory Certificates of Analysis are also provided as an attachment to this report, as applicable.

4.1 Analytical Results

During this inspection, a total of 24 building material samples that are suspect ACM and damaged were collected with a total of 20 analyses being performed. The threshold of equal to or greater than 0.5% asbestos by dry weight and is classified as ACM according to O. Reg. 278/05. Samples collected were submitted for analysis to Paracel Laboratories Ltd. (Paracel), in Mississauga, Ontario. Paracel is certified under the National Voluntary Laboratory Accreditation Program to perform asbestos analysis of bulk samples by PLM. Laboratory analysis was conducted in accordance with the United States Environmental Protection Agency, Test Method EPA/600-R-93/116: Method for the Determination of Asbestos in Bulk Building Materials, June, 1993 by Polarized Light Microscopy as prescribed by O. Reg. 278/05.

Reported laboratory detections of asbestos ranged between ND to 7.2% Chrysotile.

4.2 Damaged ACM

A summary of the damaged ACM identified at the time of the inspection is provided below.

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

Table 2: Provides a summary of all ACM that has been identified as requiring Type 2, Type 2 Glove Bag or Type 3 Operations in accordance with O. Reg 278/05. All Table 2 abatement work is to be conducted by certified asbestos contractors trained and qualified to conduct the type of work required.

TABLE 1: INTERNAL ABATEMENT MANAGEMENT

MTE Room #	Room	ACM	Photo #	Quantity	Friability	Activity Required
3012	Office 201	Vinyl Floor Tile 9”x9” – Olive with Beige Streaks	1	<1m^2	Non-Friable	Monitor Annually
2032	Classroom 104	Vinyl Floor Tile – Beige with White and Brown Streak	2,3,4	<1m^2	Non-Friable	Monitor Annually
1073	Classroom 8	Hard Texture Coat Above Ceiling	5	1m^2	Non-Friable	Monitor Annually
1109	Gym Storage	Hard Texture Coat Above Ceiling	6	<1m^2	Non-Friable	Monitor Annually

MTE Room #	Room	ACM	Photo #	Quantity	Friability	Activity Required
1102	Boiler Room	Hard Texture Coat Ceiling	7,8	5m^2	Non-Friable	Monitor Annually
1071	Office	Hard Texture Coat Ceiling	9	2m^2	Non-Friable	Monitor Annually
1071	Office	Vinyl Floor Tile 12”x12” – Beige with Black and White	10	<1m^2	Non-Friable	Monitor Annually
1069	Custodial Area	Vinyl Floor Tile 9”x9” – Red with Black and White Streak	11	4m^2	Non-Friable	Monitor Annually
1067	-	Hard Texture Coat Above Ceiling	12	<1m^2	Non-Friable	Monitor Annually
1035	Classroom 31	Vinyl Floor Tile 9”x9” – Beige with Brown Streak	13	<1m^2	Non-Friable	Monitor Annually

TABLE 2: EXTERNAL ABATEMENT MANAGEMENT

MTE Room #	Room	ACM	Photo #	Quantity	Friability	Activity Required
1115	Boiler Room	Pipe Fitting	14	1	Friable	Type 2 Glove Bag Repair or Removal in accordance with O. Reg. 278/05

4.3 Removed ACM

A summary of ACM that has been removed since the previous audit/inspection is provided below:

MTE Room 1019/1020
- Pipe Fitting Debris

MTE Room 1022, 1023, 1034, 1035, 1038, 1039, 1046
- 2’x2’ & 2’x4’ Ceiling Tiles (Long Fissure Random Pinhole)

MTE Room 1042
- 2 Pipe Fittings

MTE Room 1043
- 11 Pipe Fittings

MTE Room 1044
- 2 Pipe Fittings

MTE Room 1072
- 1 Pipe Fitting

MTE Room 1115
- 3 Pipe Fittings

MTE Room 2045
- Pipe Fitting Debris

4.4 Discovery of Additional ACM

ACM or suspect ACM that was not previously identified includes the following:

Non-Friable
- MTE Room 1062 – 9”x9” Vinyl Floor Tile – Beige with Brown Streaks
- MTE Room 1069 – 9”x9” Vinyl Floor Tile – Red with Black and White Streak

4.5 Conclusions and Recommendations

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

Damaged ACM was also identified and requires removal or repair.

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

There are no requirements under current legislation to remove ACM from a building simply because it is present. However, O. Reg. 278/05 requires that an Asbestos

Management Plan be implemented and maintained. Asbestos awareness training should be provided for staff that may come in contact with ACM during routine duties or in emergency situations.

ACM that will be disturbed, or will likely be disturbed, during building maintenance, renovations, construction, or demolition activities must be handled and disposed of in accordance with the procedures prescribed by O. Reg. 278/05. Visually confirmed or suspect ACM that were not sampled are assumed to contain a type of asbestos other than Chrysotile and must be managed as such in accordance with O. Reg. 278/05.

ACM that could be present in concealed locations may become apparent during construction, renovation, alteration, or maintenance activities. If any construction, renovation, alteration, or maintenance activities are required or planned, invasive inspections of concealed locations for potential ACM must be performed prior to such activities. Should any suspect ACM be discovered during the course of construction, renovation, alteration, or maintenance activities, work should cease and the materials should not be disturbed. Suspect ACM must be treated as asbestos-containing or sampled and proven to not contain asbestos.

This audit was conducted for the long term management of ACM within the building. If any construction, renovation, alteration, or maintenance activities are required or planned, additional inspections are recommended.

5.0 LIMITATIONS

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

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

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

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

All of which is respectfully submitted,

MTE CONSULTANTS INC.

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ATTACHMENTS

School Name	Notes:
Elmira District Secondary School	**HM** - Homogenous Material - homogeneous with previously sampled material **SL** - Sample Location - Material Sampled **VC** - Visually Confirmed - Material not sampled, deemed ACM **NF** - Non-Friable **F** - Friable **AMP** - Asbestos Management Plan
Date Built:	
Original: 1938	
Addition(s): 1953, 1959, 1962, 1964, 1966	

Functional Space Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Quantity	Condition	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type	Asbestos Classification	Recommended Action	General Notes
Exterior														
-	Exterior	Overhangs	Texture Coat	-	NF	-	Good	SL	S09ABC	22-Feb-17	0.5% Chrysotile	ACM	AMP	
-	Exterior	Wall	Brick and Mortar	-	-	-	-	-	-	-	-	Non ACM	-	
Level 1														
1000	Cafeteria	Floor	Vinyl Floor Tile 12"x12"	White with Green Fleck	-	-	-	-	-	-	-	-	-	New (post 2013)
1000	Cafeteria	Floor	Vinyl Floor Tile 12"x12"	Green Dense Fleck	-	-	-	-	-	-	-	-	-	New (post 2013)
1000	Cafeteria	Floor	Vinyl Floor Tile 12"x12"	Grey Dense Fleck	-	-	-	-	-	-	-	-	-	New (post 2013)
1000	Cafeteria	Wall	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
1000	Cafeteria	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1000	Cafeteria	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
1000	Cafeteria	Deck	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1000	Cafeteria	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1000	Cafeteria	Piping	Pipe Fitting	Fibreglass/PVC	-	-	-	-	-	-	-	Non ACM	-	
1001	Classroom 46	Floor	Vinyl Floor Tile 9"x 9"	Beige with Black & White Streak	NF	-	Good	SL	S08ABC	17-May-13	1.1% Chrysotile	ACM	AMP	
1001	Classroom 46	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1001	Classroom 46	Ceiling	Ceiling Tile 2 x 2	Long Fissure Random Pinhole	NF	-	Good	SL	S01ABC	16-Mar-17	5% Amosite	ACM	AMP	
1001	Classroom 46	Deck	Metal Pan	Steel	-	-	-	-	-	-	-	Non ACM	-	
1001	Classroom 46	Piping	Pipe Fitting	Parged Cement	F	8	Good	HM	1680.252-02	28-Aug-90	50-75% Chrysotile	ACM	AMP	
1002	Storage	Floor	Terrazzo	-	-	-	-	-	-	-	-	Non ACM	-	
1002	Storage	Wall	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
1002	Storage	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1002	Storage	Ceiling	Ceiling Tile 2 x 4	Long Fissure Random Pinhole	NF	-	Good	SL	S02ABC	16-Mar-17	5% Amosite	ACM	AMP	
1002	Storage	Deck	Metal Pan	Steel	-	-	-	-	-	-	-	Non ACM	-	
1002	Storage	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1002	Storage	Piping	Pipe Fitting	Fibreglass/PVC	-	-	-	-	-	-	-	Non ACM	-	
1003	Store	Floor	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1003	Store	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1003	Store	Ceiling	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
1003	Store	Ducting	Flex Joint	-	NF	2	Good	VC	-	-	-	Suspect ACM	AMP	
1003	Store	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1003	Store	Piping	Pipe Fitting	Fibreglass/PVC	-	-	-	-	-	-	-	Non ACM	-	
1004	Kitchen	Floor	Terrazzo	-	-	-	-	-	-	-	-	Non ACM	-	
1004	Kitchen	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1004	Kitchen	Deck	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1004	Kitchen	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1004	Kitchen	Piping	Pipe Fitting	Parged Cement	F	38	Good	HM	1680.252-02	28-Aug-90	50-75% Chrysotile	ACM	AMP	
1004	Kitchen	Ducting	Duct Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1005	Cooler	-	-	-	-	-	-	-	-	-	-	-	-	

School Name	Notes:
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Functional Space Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Quantity	Condition	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type	Asbestos Classification	Recommended Action	General Notes
1006	Store	Floor	Vinyl Floor Tile 9"x 9"	Beige with Brown Fleck	NF	-	Good	SL	S07ABC	17-May-13	1.3 Chrysotile	ACM	AMP	
1006	Store	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1006	Store	Deck	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1006	Store	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1006	Store	Piping	Pipe Fitting	Parged Cement	F	14	Good	HM	1680.252-02	28-Aug-90	50-75% Chrysotile	ACM	AMP	
1006	Store	Ducting	Flex Joint	-	NF	1	Good	VC	-	-	-	Suspect ACM	AMP	
1007	Stairwell	No Data	-	-	-	-	-	-	-	-	-	-	-	
1008	Staff Dining	Floor	Vinyl Floor Tile 9"x 9"	Cream with Brown Fleck	NF	-	Good	SL	S03ABC	16-Mar-17	2.08% Chrysotile	ACM	AMP	
1008	Staff Dining	Floor	Vinyl Floor Tile 9"x 9"	Brown with Cream Fleck	NF	-	Good	SL	S06ABC	17-May-13	1.2% Chrysotile	ACM	AMP	
1008	Staff Dining	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1008	Staff Dining	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
1008	Staff Dining	Deck	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1009	Office	Floor	Carpet	-	-	-	-	-	-	-	-	Non ACM	-	
1009	Office	Floor	Vinyl Floor Tile 9"x 9"	Green with White Fleck	NF	-	Good	VC	-	-	-	Suspect ACM	AMP	Cannot sample without significant aesthetic damage
1009	Office	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1009	Office	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
1009	Office	Ceiling	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
1009	Office	Deck	Metal Pan	Steel	-	-	-	-	-	-	-	Non ACM	-	
1010	Corridor	Floor	Terrazzo	-	-	-	-	-	-	-	-	Non ACM	-	
1010	Corridor	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1010	Corridor	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
1010	Corridor	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1011	Stairwell	Floor	Terrazzo	-	-	-	-	-	-	-	-	Non ACM	-	
1011	Stairwell	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1011	Stairwell	Ceiling	Plaster	-	-	-	-	SL	S04ABC	22-Feb-17	ND	Non ACM	-	
1012	Photograph	Floor	Wood	-	-	-	-	-	-	-	-	Non ACM	-	
1012	Photograph	Wall	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
1012	Photograph	Ceiling	Ceiling Tile 1 x 1	Long Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Cellulose
1013	Office	Floor	Wood	-	-	-	-	-	-	-	-	Non ACM	-	
1013	Office	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1013	Office	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
1014	Electronics	Floor	Wood	-	-	-	-	-	-	-	-	Non ACM	-	
1014	Electronics	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1014	Electronics	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
1015	Office	No data	-	-	-	-	-	-	-	-	-	-	-	No Access with keys
1016	Washroom	Floor	Terrazzo	-	-	-	-	-	-	-	-	Non ACM	-	
1016	Washroom	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	

School Name	Notes:
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Functional Space Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Quantity	Condition	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type	Asbestos Classification	Recommended Action	General Notes
1016	Washroom	Ceiling	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
1017	Washroom	Floor	Terrazzo	-	-	-	-	-	-	-	-	Non ACM	-	
1017	Washroom	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1017	Washroom	Ceiling	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
1018	Office	Floor	Terrazzo	-	-	-	-	-	-	-	-	Non ACM	-	
1018	Office	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1018	Office	No Data	-	-	-	-	-	-	-	-	-	-	-	
1019	Boys Washroom	Floor	Terrazzo	-	-	-	-	-	-	-	-	Non ACM	-	
1019	Boys Washroom	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1019	Boys Washroom	Ceiling	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
1019	Boys Washroom	Piping	Pipe Fitting	Parged Cement	F	10	Good	HM	1680.252-02	28-Aug-90	50-75% Chrysotile	ACM	AMP	
1020	Girls Washroom	Floor	Terrazzo	-	-	-	-	-	-	-	-	Non ACM	-	
1020	Girls Washroom	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1020	Girls Washroom	Ceiling	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
1021	Classroom 44	Floor	Vinyl Floor Tile 9"x 9"	Brown with Brown Fleck	NF	-	Good	SL	S06ABC	22-Feb-17	1.69% Chrysotile	ACM	AMP	
1021	Classroom 44	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1021	Classroom 44	Ceiling	Ceiling Tile 2' x 4'	Fibreglass	-	-	-	-	-	-	-	Non ACM	-	
1021	Classroom 44	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1021	Classroom 44	Piping	Pipe Fitting	Parged Cement	F	4	Good	HM	1680.252-02	28-Aug-90	50-75% Chrysotile	ACM	AMP	
1022	Classroom 45	Floor	Vinyl Floor Tile 9"x 9"	White with Grey Fleck	-	-	-	SL	S07ABC	16-Mar-17	ND	Non ACM	-	
1022	Classroom 45	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1022	Classroom 45	Ceiling	Ceiling Tile 2 x 4	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Replaced old ceiling tile
1022	Classroom 45	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1022	Classroom 45	Piping	Pipe Fitting	Parged Cement	F	4	Good	HM	1680.252-02	28-Aug-90	50-75% Chrysotile	ACM	AMP	
1023	Corridor	Floor	Terrazzo	-	-	-	-	-	-	-	-	Non ACM	-	
1023	Corridor	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1023	Corridor	Wall	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
1023	Corridor	Ceiling	Ceiling Tile 2 x 2	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Replaced old ceiling tile
1023	Corridor	Deck	Metal Pan	Steel	-	-	-	-	-	-	-	Non ACM	-	
1023	Corridor	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1023	Corridor	Piping	Pipe Fitting	Parged Cement	F	5	Good	HM	1680.252-02	28-Aug-90	50-75% Chrysotile	ACM	AMP	
1024	P.E.O. Room	Floor	Carpet	-	-	-	-	-	-	-	-	Non ACM	-	
1024	P.E.O. Room	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1024	P.E.O. Room	Above Ceiling	Texture Coat	-	NF	-	Good	HM	S29, S32	3-Apr-09	2.5% Chrysotile	ACM	AMP	
1025	P.E.O. IT Room	Floor	Vinyl Floor Tile 12" x 12"	Beige with Brown Spots	-	-	-	SL	S09ABC	17-May-13	1.3% Chrysotile	ACM	AMP	
1025	P.E.O. IT Room	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1025	P.E.O. IT Room	Above Ceiling	Texture Coat	-	NF	-	Good	HM	S29, S32	3-Apr-09	2.5% Chrysotile	ACM	AMP	

School Name	Notes:
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Date Built:	
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Functional Space Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Quantity	Condition	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type	Asbestos Classification	Recommended Action	General Notes
1026	Store	Floor	Terrazzo	-	-	-	-	-	-	-	-	Non ACM	-	
1026	Store	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1026	Store	Above Ceiling	Texture Coat	-	NF	-	Good	HM	S29, S32	3-Apr-09	2.5% Chrysotile	ACM	AMP	
1026	Store	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1027	Store	Floor	Terrazzo	-	-	-	-	-	-	-	-	Non ACM	-	
1027	Store	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1027	Store	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
1027	Store	Above Ceiling	Texture Coat	-	NF	-	Good	HM	S29, S32	3-Apr-09	2.5% Chrysotile	ACM	AMP	
1027	Store	Ceiling	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
1028	Washroom	Floor	Terrazzo	-	-	-	-	-	-	-	-	Non ACM	-	
1028	Washroom	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
1028	Washroom	Ceiling	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
1029	Showers	Floor	Terrazzo	-	-	-	-	-	-	-	-	Non ACM	-	
1029	Showers	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
1029	Showers	Ceiling	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
1030	Boys Changeroom	Floor	Terrazzo	-	-	-	-	-	-	-	-	Non ACM	-	
1030	Boys Changeroom	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1030	Boys Changeroom	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
1030	Boys Changeroom	Ceiling	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
1031	Boys Changeroom Corridor	Floor	Terrazzo	-	-	-	-	-	-	-	-	Non ACM	-	
1031	Boys Changeroom Corridor	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1031	Boys Changeroom Corridor	Ceiling	No Data	-	-	-	-	-	-	-	-	-	-	
1032	Gym	Floor	Wood	-	-	-	-	-	-	-	-	Non ACM	-	
1032	Gym	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1032	Gym	Wall	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
1032	Gym	Ceiling	Ceiling Tile 1 x 1	Medium & Small Pinhole	NF	-	Good	VC	-	-	-	Suspect ACM	AMP	No access due to height
1032	Gym	Ceiling	Ceiling Tile 1 x 1	Medium Fissure Random Pinhole	NF	-	Good	VC	-	-	-	Suspect ACM	AMP	No access due to height
1032	Gym	Ceiling	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
1032	Gym	Deck	Wood	-	-	-	-	-	-	-	-	Non ACM	-	
1033	Classroom 33	Floor	Wood	-	-	-	-	-	-	-	-	Non ACM	-	
1033	Classroom 33	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1033	Classroom 33	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
1034	Classroom 32	Floor	Vinyl Floor Tile 9"x 9"	Beige with Brown Streak	NF	-	Good	SL	S04ABC	16-Mar-17	0.72% Chrysotile	ACM	AMP	
1034	Classroom 32	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1034	Classroom 32	Ceiling	Ceiling Tile 2 x 4	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Replaced old ceiling tile
1034	Classroom 32	Deck	Metal Pan	Steel	-	-	-	-	-	-	-	Non ACM	-	
1035	Classroom 31	Floor	Vinyl Floor Tile 9"x 9"	Beige with Brown Streak	NF	-	Fair	HM	S04	16-Mar-17	0.72% Chrysotile	ACM	AMP	
1035	Classroom 31	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	

School Name	Notes:
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Date Built:	
Original: 1938	
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Functional Space Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Quantity	Condition	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type	Asbestos Classification	Recommended Action	General Notes
1035	Classroom 31	Ceiling	Ceiling Tile 2 x 4	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Replaced old ceiling tile
1035	Classroom 31	Deck	Metal Pan	Steel	-	-	-	-	-	-	-	Non ACM	-	
1036	Classroom 26	Floor	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1036	Classroom 26	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1036	Classroom 26	Deck	Metal Pan	Steel	-	-	-	-	-	-	-	Non ACM	-	
1036	Classroom 26	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1036	Classroom 26	Piping	Pipe Fitting	Parged Cement	F	20	Good	HM	1680.252-02	28-Aug-90	50-75% Chrysotile	ACM	AMP	
1037	Vestibule	Floor	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1037	Vestibule	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1037	Vestibule	Ceiling	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
1038	Classroom 30	Floor	Vinyl Floor Tile 12"x 12"	Olive with White Streak	-	-	-	SL	S05ABC	16-Mar-17	ND	Non ACM	-	
1038	Classroom 30	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1038	Classroom 30	Ceiling	Ceiling Tile 2 x 4	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Replaced old ceiling tile
1038	Classroom 30	Ceiling	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
1039	Classroom 29	Floor	Vinyl Floor Tile 12"x 12"	Olive with White Streak	-	-	-	HM	S05ABC	16-Mar-17	ND	Non ACM	-	
1039	Classroom 29	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1039	Classroom 29	Ceiling	Ceiling Tile 2 x 4	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Replaced old ceiling tile
1039	Classroom 29	Ceiling	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
1040	Tool Crib	Floor	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1040	Tool Crib	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1040	Tool Crib	Deck	Metal Pan	Steel	-	-	-	-	-	-	-	Non ACM	-	
1040	Tool Crib	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1040	Tool Crib	Piping	Pipe Fitting	Parged Cement	F	11	Good	HM	1680.252-02	28-Aug-90	50-75% Chrysotile	ACM	AMP	
1041	Music	Floor	Carpet	-	-	-	-	-	-	-	-	Non ACM	-	
1041	Music	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1041	Music	Wall	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
1041	Music	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
1041	Music	Ceiling	Ceiling Tile 2' x 4'	Fibreglass	-	-	-	-	-	-	-	Non ACM	-	
1041	Music	Deck	Metal Pan	Steel	-	-	-	-	-	-	-	Non ACM	-	
1042	Shop	Floor	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1042	Shop	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1042	Shop	Wall	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
1042	Shop	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1042	Shop	Piping	Pipe Fitting	Parged Cement	F	3	Good	HM	1680.252-02	28-Aug-90	50-75% Chrysotile	ACM	AMP	
1043	Classroom 25	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	-	-	SL	S02abc	3-Apr-09	ND	Non ACM	-	Same as Hallway
1043	Classroom 25	Wall	Drywall	Drywall Joint Compound	-	-	-	SL	S03ABC	22-Feb-17	ND	Non ACM	-	
1043	Classroom 25	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
1043	Classroom 25	Deck	Metal Pan	Steel	-	-	-	-	-	-	-	Non ACM	-	
1043	Classroom 25	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	

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Date Built:	
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Functional Space Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Quantity	Condition	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type	Asbestos Classification	Recommended Action	General Notes
1043	Classroom 25	Piping	Pipe Fitting	Parged Cement	F	19	Good	HM	1680.252-02	28-Aug-90	50-75% Chrysotile	ACM	AMP	
1044	Tool Crib	Floor	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1044	Tool Crib	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1044	Tool Crib	Wall	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
1044	Tool Crib	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1045	Tool Crib	No Data	-	-	-	-	-	-	-	-	-	-	-	
1046	Entrance Lobby	Floor	Terrazzo	-	-	-	-	-	-	-	-	Non ACM		
1046	Entrance Lobby	Wall	Concrete	Concrete Block	-	-	-	-	-	-	-	Non ACM	-	
1046	Entrance Lobby	Ceiling	Ceiling Tile 2 x 2	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Replaced old ceiling tile
1047	Stairwell	Floor	Terrazzo	-	-	-	-	-	-	-	-	Non ACM		
1047	Stairwell	Wall	Concrete	Concrete Block	-	-	-	-	-	-	-	Non ACM		
1047	Stairwell	Ceiling	Plaster	-	-	-	-	-	-	-	-	Non ACM	-	
1048	Corridor	Floor	Terrazzo	-	-	-	-	-	-	-	-	Non ACM		
1048	Corridor	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM		
1048	Corridor	Ceiling	Ceiling Tile 2' x 2'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
1049	Classroom 19	Floor	Wood	-	-	-	-	-	-	-	-	Non ACM		
1049	Classroom 19	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM		
1049	Classroom 19	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
1050	Classroom 19A	Floor	Wood	-	-	-	-	-	-	-	-	Non ACM		
1050	Classroom 19A	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM		
1050	Classroom 19A	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
1051	Classroom 15	Floor	Vinyl Floor Tile 12"x 12"	White & Blue Streaks	-	-	-	HM	S03	3-Apr-09	ND	Non ACM	-	
1051	Classroom 15	Wall	Ceramic Tile											
1051	Classroom 15	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
1052	Stage	Floor	Wood	-	-	-	-	-	-	-	-	Non ACM	-	
1052	Stage	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1052	Stage	Deck	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1052	Above the Stage	Floor	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1052	Above the Stage	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1052	Above the Stage	Deck	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1052	Above the Stage	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1052	Above the Stage	Piping	Pipe Fitting	Parged Cement	F	1	Good	HM	1680.252-02	28-Aug-90	50-75% Chrysotile	ACM	AMP	
1053	Stores	Floor	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1053	Stores	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1053	Stores	Ceiling	Ceiling Tile 2 x 4	Long Fissure Random Pinhole	NF	-	Good	HM	S01	16-Mar-17	5% Amosite	ACM	AMP	
1053	Stores	Deck	Metal Pan	Steel	-	-	-	-	-	-	-	Non ACM	-	

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Functional Space Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Quantity	Condition	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type	Asbestos Classification	Recommended Action	General Notes
1053	Stores	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1053	Stores	Piping	Pipe Fitting	Fibreglass/PVC	-	-	-	-	-	-	-	Non ACM	-	
1054	Stores	Floor	Wood	-	-	-	-	-	-	-	-	Non ACM	-	
1054	Stores	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1054	Stores	Ceiling	Texture Coat	-	NF	-	Good	HM	S29, S32	3-Apr-09	2.5% Chrysotile	ACM	AMP	
1055	Landing	Floor	Terrazzo	-	-	-	-	-	-	-	-	Non ACM	-	
1055	Landing	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1055	Landing	Ceiling	Texture Coat	-	NF	-	Good	HM	S29, S32	3-Apr-09	2.5% Chrysotile	ACM	AMP	
1056	Girls Change Entrance	Floor	Vinyl Floor Tile 12"x 12"	Beige with Red & White Streak	NF	-	Good	SL	S33abc	3-Apr-09	0.5% Chrysotile	ACM	AMP	
1056	Girls Change Entrance	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1056	Girls Change Entrance	Ceiling	Texture Coat	-	NF	-	Good	HM	S29, S32	3-Apr-09	2.5% Chrysotile	ACM	AMP	
1057	Girls Change	Floor	Terrazzo	-	-	-	-	-	-	-	-	Non ACM	-	
1057	Girls Change	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1057	Girls Change	Ceiling	Texture Coat	-	NF	-	Good	HM	S29, S32	3-Apr-09	2.5% Chrysotile	ACM	AMP	
1058	Washroom	Floor	Terrazzo	-	-	-	-	-	-	-	-	Non ACM	-	
1058	Washroom	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1058	Washroom	Ceiling	Texture Coat	-	NF	-	Good	HM	S29, S32	3-Apr-09	2.5% Chrysotile	ACM	AMP	
1059	Shower	Floor	Terrazzo	-	-	-	-	-	-	-	-	Non ACM	-	
1059	Shower	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1059	Shower	Ceiling	Texture Coat	-	NF	-	Good	HM	S29, S32	3-Apr-09	2.5% Chrysotile	ACM	AMP	
1060	Stores	Floor	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1060	Stores	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1060	Stores	Ceiling	Texture Coat	-	NF	-	Good	HM	S29, S32	3-Apr-09	2.5% Chrysotile	ACM	AMP	
1061	Corridor	Floor	Terrazzo	-	-	-	-	-	-	-	-	Non ACM	-	
1061	Corridor	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1061	Corridor	Ceiling	Ceiling Tile 2' x 2'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
1061	Corridor	Deck	Metal Pan	Steel	-	-	-	-	-	-	-	Non ACM	-	
1061	Corridor	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1062	Gym Corridor	Floor	Vinyl Floor Tile 9"x 9"	Beige with Brown Streak	NF	-	Good	HM	S04	16-Mar-17	0.72% Chrysotile	ACM	AMP	
1062	Gym Corridor	Floor	Terrazzo	-	-	-	-	-	-	-	-	Non ACM	-	
1062	Gym Corridor	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1062	Gym Corridor	Ceiling	Ceiling Tile 2' x 2'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
1063	Gym Corridor	Floor	Vinyl Floor Tile 12"x 12"	Beige with Red & White Streak	NF	-	Good	SL	S33abc	3-Apr-09	0.5% Chrysotile	ACM	AMP	
1063	Gym Corridor	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1063	Gym Corridor	Ceiling	Ceiling Tile 2' x 2'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
1063	Gym Corridor	Deck	Metal Pan	Steel	-	-	-	-	-	-	-	Non ACM	-	

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1064	Stairwell	No Data	-	-	-	-	-	-	-	-	-	-	-	-
1065	-	Floor	Vinyl Floor Tile 12"x 12"	Beige Dense Fleck	-	-	-		-	-	-	Non ACM	-	Floor tile is noted to be "New"
1065	-	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1065	-	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
1065	-	Ceiling	Texture Coat	-	NF	-	Good	HM	S29, S32	3-Apr-09	2.5% Chrysotile	ACM	AMP	
1065	-	Deck	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1066	-	Floor	Vinyl Floor Tile 12"x 12"	Beige Dense Fleck	-	-	-		-	-	-	Non ACM	-	Floor tile is noted to be "New"
1066	-	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1066	-	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
1066	-	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1067	-	Floor	Vinyl Floor Tile 12"x 12"	Beige Dense Fleck	-	-	-		-	-	-	Non ACM	-	Floor tile is noted to be "New"
1067	-	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1067	-	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
1067	-	Above Ceiling	Texture Coat	-	NF	-	Fair	HM	S29, S32	3-Apr-09	2.5% Chrysotile	ACM	AMP	
1067	-	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1068	-	Floor	Carpet	-	-	-	-	-	-	-	-	Non ACM	-	
1068	-	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1068	-	Wall	Brick	-	-	-	-	-	-	-	-	Non ACM	-	
1068	-	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
1068	-	Above Ceiling	Texture Coat	-	NF	-	Good	HM	S29, S32	3-Apr-09	2.5% Chrysotile	ACM	AMP	
1069	-	Floor	Vinyl Floor Tile 9"x 9"	Red with Black & White Streak	NF	-	Poor	SL	S04abc	3-Apr-09	10% Chrysotile	ACM	AMP	
1069	-	Floor	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1069	-	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1069	-	Deck	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1069	-	Above Ceiling	Texture Coat	-	NF	-	Good	HM	S29, S32	3-Apr-09	2.5% Chrysotile	ACM	AMP	
1069	-	Piping	Pipe Fitting	Parged Cement	F	5	Good	HM	1680.252-02	28-Aug-90	50-75% Chrysotile	ACM	AMP	
1070	-	Floor	Terrazzo	-	-	-	-	-	-	-	-	Non ACM	-	
1070	-	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1070	-	Above Ceiling	Texture Coat	-	NF	-	Good	HM	S29, S32	3-Apr-09	2.5% Chrysotile	ACM	AMP	
1071	Office	Floor	Vinyl Floor Tile 12"x 12"	Beige with Black & White	NF	-	Fair	SL	S10ABC	17-May-13	1.5% Chrysotile	ACM	AMP	
1071	Office	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	-	-	SL	S02abc	3-Apr-09	ND	Non ACM	-	
1071	Office	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1071	Office	Ceiling	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
1071	Office	Above Ceiling	Texture Coat	-	NF	-	Fair	HM	S29, S32	3-Apr-09	2.5% Chrysotile	ACM	AMP	
1072	Kiln Room	Floor	Vinyl Floor Tile 12"x 12"	Beige with Black & White	NF	-	Good	SL	S04ABC	9-Apr-13	1.2% Chrysotile	ACM	AMP	
1072	Kiln Room	Wall	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
1072	Kiln Room	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1072	Kiln Room	Ceiling	Texture Coat	-	NF	-	Good	HM	S29, S32	3-Apr-09	2.5% Chrysotile	ACM	AMP	

School Name

Elmira District Secondary School

Date Built:

Original: 1938

Addition(s): 1953, 1959, 1962, 1964, 1966

Notes:

HM - Homogenous Material - homogeneous with previously sampled material
SL - Sample Location - Material Sampled
VC - Visually Confirmed - Material not sampled, deemed ACM
NF - Non-Friable **F** - Friable
AMP - Asbestos Management Plan

Functional Space Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Quantity	Condition	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type	Asbestos Classification	Recommended Action	General Notes
1073	Classroom 8	Floor	Wood	-	-	-	-	-	-	-	-	Non ACM	-	
1073	Classroom 8	Floor	Vinyl Floor Tile 12"x 12"	Beige with White Fleck	-	-	-	SL	S03ABC	9-Apr-13	ND	Non ACM	-	
1073	Classroom 8	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1073	Classroom 8	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
1073	Classroom 8	Above Ceiling	Texture Coat	-	NF	-	Fair	HM	S29, S32	3-Apr-09	2.5% Chrysotile	ACM	AMP	
1074	-	Floor	Vinyl Floor Tile 9"x 9"	Beige with Blue Fleck	NF	-	Good	SL	S05ABC	9-Apr-13	2.1% Chrysotile	ACM	AMP	
1074	-	Floor	Floor Tile Mastic	Black	NF	-	Good	SL	S05ABC	9-Apr-13	1.2% Chrysotile	ACM	AMP	
1074	-	Wall	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
1074	-	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1074	-	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
1074	-	Above Ceiling	Texture Coat	-	NF	-	Good	HM	S29, S32	3-Apr-09	2.5% Chrysotile	ACM	AMP	
1075	-	Floor	Vinyl Floor Tile 9"x 9"	Blue with White and Green Streak	NF	-	Good	SL	S11ABC	17-May-13	2.2% Chrysotile	ACM	AMP	
1075	-	Floor	Vinyl Floor Tile 12"x 12"	Grey with White Fleck	NF	-	Good	SL	S12ABC	17-May-13	1.4% Chrysotile	ACM	AMP	
1075	-	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1075	-	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
1075	-	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1075	-	Above Ceiling	Texture Coat	-	NF	-	Good	HM	S29, S32	3-Apr-09	2.5% Chrysotile	ACM	AMP	
1076	Corridor	Floor	Vinyl Floor Tile 12"x 12"	Yellow Oatmeal	-	-	-	SL	S30abc	3-Apr-09	ND	Non ACM	-	
1076	Corridor	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	-	-	SL	S02abc	3-Apr-09	ND	Non ACM	-	
1077	Corridor	Floor	Vinyl Floor Tile 12"x 12"	Yellow Oatmeal	-	-	-	SL	S30abc	3-Apr-09	ND	Non ACM	-	
1077	Corridor	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	-	-	SL	S02abc	3-Apr-09	ND	Non ACM	-	
1077	Corridor	Wall	No Data	-	-	-	-	-	-	-	-	-	-	
1077	Corridor	Ceiling	No Data	-	-	-	-	-	-	-	-	-	-	
1078	Classroom 24	Floor	Wood	-	-	-	-	-	-	-	-	Non ACM	-	
1078	Classroom 24	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	-	-	SL	S02abc	3-Apr-09	ND	Non ACM	-	
1078	Classroom 24	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1078	Classroom 24	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
1078	Classroom 24	Ceiling	Ceiling Tile 1' x 1'	Random Hole	-	-	-	HM	S27	3-Apr-09	ND	Non ACM	-	
1078	Classroom 24	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1078	Classroom 24	Piping	Pipe Fitting	Fibreglass/PVC	-	-	-	-	-	-	-	Non ACM	-	
1079	Classroom 23	Floor	Wood	-	-	-	-	-	-	-	-	Non ACM	-	
1079	Classroom 23	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
1079	Classroom 23	Wall	Wood	-	-	-	-	-	-	-	-	Non ACM	-	
1079	Classroom 23	Ceiling	Ceiling Tile 1' x 1'	Random Hole	-	-	-	SL	S27abc	3-Apr-09	ND	Non ACM	-	
1079	Classroom 23	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1080	Stairwell	Floor	Terrazzo	-	-	-	-	-	-	-	-	Non ACM	-	
1080	Stairwell	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1080	Stairwell	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
1080	Stairwell	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
1080	Stairwell	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	

School Name	Notes:
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Date Built:	
Original: 1938	
Addition(s): 1953, 1959, 1962, 1964, 1966	

Functional Space Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Quantity	Condition	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type	Asbestos Classification	Recommended Action	General Notes
1080	Stairwell	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1081	Corridor	Floor	Terrazzo	-	-	-	-	-	-	-	-	Non ACM	-	
1081	Corridor	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1081	Corridor	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
1081	Corridor	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
1081	Corridor	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
1081	Corridor	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1082	Storage/Receiving	Floor	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1082	Storage/Receiving	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1082	Storage/Receiving	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
1082	Storage/Receiving	Ceiling	Texture Coat	-	NF	-	Good	SL	S29abc	3-Apr-09	2.5% Chrysotile	ACM	AMP	
1082	Storage/Receiving	Piping	Pipe Fitting	Fibreglass/PVC	-	-	-	-	-	-	-	Non ACM	-	
1082	Storage/Receiving	Firespray	Firespray	-	-	-	-	-	-	-	-	Non ACM	-	
1083	Room 21	Floor	Vinyl Floor Tile 9"x 9"	Tan, Brown, & Brown	NF	-	Good	SL	S07ABC	22-Feb-17	5.25% Chrysotile	ACM	AMP	
1083	Room 21	Wall	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
1083	Room 21	Wall	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
1083	Room 21	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
1083	Room 21	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
1084	Classroom 22	Floor	Vinyl Floor Tile 9"x 9"	Brown, Black, Beige, Streaks	NF	-	Good	SL	S08ACB	22-Feb-17	7.2% Chrysotile	ACM	AMP	
1084	Classroom 22	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1084	Classroom 22	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
1084	Classroom 22	Wall	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
1084	Classroom 22	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
1084	Classroom 22	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
1085	Tech Class	Floor	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1085	Tech Class	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1085	Tech Class	Deck	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1085	Tech Class	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1085	Tech Class	Piping	Pipe Fitting	Parged Cement	NF	17	Good	HM	1680.252-02	28-Aug-90	50-75% Chrysotile	ACM	AMP	
1086	Boys Washroom	Floor	Terrazzo	-	-	-	-	-	-	-	-	Non ACM	-	
1086	Boys Washroom	Wall	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
1086	Boys Washroom	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1086	Boys Washroom	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
1086	Boys Washroom	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1087	Book Storage	Floor	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1087	Book Storage	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1087	Book Storage	Ceiling	Texture Coat	-	NF	-	Good	HM	S29, S32	3-Apr-09	2.5% Chrysotile	ACM	AMP	
1087	Book Storage	Ducting	Duct Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1087	Book Storage	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	

School Name	Notes:
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Date Built:	
Original: 1938	
Addition(s): 1953, 1959, 1962, 1964, 1966	

Functional Space Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Quantity	Condition	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type	Asbestos Classification	Recommended Action	General Notes
1088	Office	Floor	Vinyl Floor Tile 12"x 12"	Beige Oatmeal	-	-	-	HM	S02	3-Apr-09	ND	Non ACM	-	
1088	Office	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1088	Office	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
1088	Office	Ceiling	Texture Coat	-	NF	-	Good	HM	S29, S32	3-Apr-09	2.5% Chrysotile	ACM	AMP	
1089	Audio/Video Room	Floor	Vinyl Floor Tile 12"x 12"	Beige Oatmeal	-	-	-	HM	S02	3-Apr-09	ND	Non ACM	-	
1089	Audio/Video Room	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1089	Audio/Video Room	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
1089	Audio/Video Room	Ceiling	Texture Coat	-	NF	-	Good	HM	S29, S32	3-Apr-09	2.5% Chrysotile	ACM	AMP	
1090	Staff Room	Floor	Terrazzo	-	-	-	-	-	-	-	-	Non ACM	-	
1090	Staff Room	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1090	Staff Room	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
1090	Staff Room	Above Ceiling	Texture Coat	-	NF	-	Good	HM	S29, S32	3-Apr-09	2.5% Chrysotile	ACM	AMP	
1091	Library Office	Floor	Carpet	-	-	-	-	-	-	-	-	Non ACM	-	
1091	Library Office	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1091	Library Office	Wall	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
1091	Library Office	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
1091	Library Office	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
1091	Library Office	Above Ceiling	Texture Coat	-	NF	-	Good	HM	S29, S32	3-Apr-09	2.5% Chrysotile	ACM	AMP	
1092	Work Room	Floor	Vinyl Floor Tile 12"x 12"	Yellow Oatmeal	-	-	-	-	-	-	-	Non ACM	-	
1092	Work Room	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1092	Work Room	Wall	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
1092	Work Room	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
1092	Work Room	Above Ceiling	Texture Coat	-	NF	-	Good	HM	S29, S32	3-Apr-09	2.5% Chrysotile	ACM	AMP	
1092	Work Room	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1093	Library Office	Floor	Carpet	-	-	-	-	-	-	-	-	Non ACM	-	
1093	Library Office	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1093	Library Office	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
1093	Library Office	Above Ceiling	Texture Coat	-	NF	-	Good	HM	S29, S32	3-Apr-09	2.5% Chrysotile	ACM	AMP	
1094	Library	Floor	Vinyl Floor Tile 12"x 12"	Yellow Oatmeal	-	-	-	-	-	-	-	Non ACM	-	
1094	Library	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1094	Library	Wall	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
1094	Library	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
1094	Library	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
1094	Library	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1095	Study	Floor	Carpet	-	-	-	-	-	-	-	-	Non ACM	-	
1095	Study	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1095	Study	Wall	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
1095	Study	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
1095	Study	Above Ceiling	Texture Coat	-	NF	-	Good	HM	S29, S32	3-Apr-09	2.5% Chrysotile	ACM	AMP	

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Date Built:	
Original: 1938	
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Functional Space Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Quantity	Condition	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type	Asbestos Classification	Recommended Action	General Notes
1096	Listening Room	Floor	Carpet	-	-	-	-	-	-	-	-	Non ACM	-	
1096	Listening Room	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1096	Listening Room	Wall	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
1096	Listening Room	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
1096	Listening Room	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1097	Room number not used	-	-	-	-	-	-	-	-	-	-	-	-	Outdoor location
1098	Storage	No Data	-	-	-	-	-	-	-	-	-	-	-	No access with keys
1099	Finishing Room	Floor	Carpet	-	-	-	-	-	-	-	-	Non ACM	-	
1099	Finishing Room	Wall	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
1099	Finishing Room	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
1099	Finishing Room	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1100	Classroom 13	Floor	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1100	Classroom 13	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1100	Classroom 13	Ceiling	Ceiling Tile 2' x 4'	Acoustic String Tile	-	-	-	-	-	-	-	Non ACM	-	
1100	Classroom 13	Deck	Metal Pan	Steel	-	-	-	-	-	-	-	Non ACM	-	
1100	Classroom 13	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1100	Classroom 13	Piping	Pipe Fitting	Fibreglass/PVC	-	-	-	-	-	-	-	Non ACM	-	
1101	Mezzanine	Floor	Wood	-	-	-	-	-	-	-	-	Non ACM	-	
1101	Mezzanine	Wall	No Data	-	-	-	-	-	-	-	-	-	-	
1101	Mezzanine	Ceiling	Ceiling Tile 2' x 4'	Acoustic String Tile	-	-	-	-	-	-	-	Non ACM	-	
1101	Mezzanine	Deck	Metal Pan	Steel	-	-	-	-	-	-	-	Non ACM	-	
1102	Boiler Room	Floor	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1102	Boiler Room	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1102	Boiler Room	Ceiling	Texture Coat	-	NF	-	Poor	HM	S29, S32	3-Apr-09	2.5% Chrysotile	ACM	AMP	
1102	Boiler Room	Ducting	Duct Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1102	Boiler Room	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1102	Boiler Room	Piping	Pipe Fitting	Fibreglass/PVC	-	-	-	-	-	-	-	Non ACM	-	
1103	Custodial	Floor	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1103	Custodial	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1103	Custodial	Ceiling	Texture Coat	-	NF	-	Good	HM	S29, S32	3-Apr-09	2.5% Chrysotile	ACM	AMP	
1103	Custodial	Ducting	Duct Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1103	Custodial	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1103	Custodial	Piping	Pipe Fitting	Fibreglass/PVC	-	-	-	-	-	-	-	Non ACM	-	
1104	Electrical Room	Floor	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1104	Electrical Room	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
1104	Electrical Room	Ceiling	Texture Coat	-	NF	-	Good	HM	S29, S32	3-Apr-09	2.5% Chrysotile	ACM	AMP	
1104	Electrical Room	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1104	Electrical Room	Piping	Pipe Fitting	Fibreglass/PVC	-	-	-	-	-	-	-	Non ACM	-	

School Name	Notes:
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Date Built:	
Original: 1938	
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Functional Space Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Quantity	Condition	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type	Asbestos Classification	Recommended Action	General Notes
1105	Girls Washroom	Floor	Terrazzo	-	-	-	-	-	-	-	-	Non ACM	-	
1105	Girls Washroom	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1105	Girls Washroom	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
1105	Girls Washroom	Ceiling	Texture Coat	-	NF	-	Good	HM	S29, S32	3-Apr-09	2.5% Chrysotile	ACM	AMP	
1105	Girls Washroom	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1106	Boys Washroom	Floor	Terrazzo	-	-	-	-	-	-	-	-	Non ACM	-	
1106	Boys Washroom	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1106	Boys Washroom	Ceiling	Texture Coat	-	NF	-	Good	HM	S29, S32	3-Apr-09	2.5% Chrysotile	ACM	AMP	
1106	Boys Washroom	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1106	Boys Washroom	Piping	Pipe Fitting	Fibreglass/PVC	-	-	-	-	-	-	-	Non ACM	-	
1107	Office	Floor	Vinyl NFloor Tile 9"x 9"	Brown, Beige, & Tan	NNF	-	Good		-	-	-	ACM	AMP	Construction during inspection, no access
1107	Office	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1107	Office	Ceiling	Texture Coat	-	NF	-	Good	HM	S29, S32	3-Apr-09	2.5% Chrysotile	ACM	AMP	
1108	Change Room	Floor	Terrazzo	-	-	-	-	-	-	-	-	Non ACM	-	
1108	Change Room	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1108	Change Room	Ceiling	Texture Coat	-	NF	-	Good	HM	S29, S32	3-Apr-09	2.5% Chrysotile	ACM	AMP	
1109	Gym Storage	Floor	Terrazzo	-	-	-	-	-	-	-	-	Non ACM	-	
1109	Gym Storage	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1109	Gym Storage	Ceiling	Texture Coat	-	NF	-	Fair	HM	S29, S32	3-Apr-09	2.5% Chrysotile	ACM	AMP	
1110	Shower	No Data	-	-	-	-	-	-	-	-	-	-	-	
1111	Fan Room	Floor	Wood	-	-	-	-	-	-	-	-	Non ACM	-	
1111	Fan Room	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1111	Fan Room	Ceiling	Texture Coat	-	NF	-	Good	HM	S29, S32	3-Apr-09	2.5% Chrysotile	ACM	AMP	
1112	Gym	Floor	Wood	-	-	-	-	-	-	-	-	Non ACM	-	
1112	Gym	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1112	Gym	Deck	Metal Pan	Steel	-	-	-	-	-	-	-	Non ACM	-	
1113	Storage	Floor	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1113	Storage	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1113	Storage	Deck	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1113	Storage	Piping	Pipe Fitting	Parged Cement	F	12	Good	HM	1680.252-02	28-Aug-90	50-75% Chrysotile	ACM	AMP	
1114	Stairwell	Floor	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1114	Stairwell	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1114	Stairwell	Ceiling	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
1114	Stairwell	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1114	Stairwell	Piping	Pipe Fitting	Parged Cement	F	7	Good	HM	1680.252-02	28-Aug-90	50-75% Chrysotile	ACM	AMP	
1115	Boiler Room	Floor	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1115	Boiler Room	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	

School Name

Elmira District Secondary School

Date Built:

Original: 1938

Addition(s): 1953, 1959, 1962, 1964, 1966

Notes:

HM - Homogenous Material - homogeneous with previously sampled material
SL - Sample Location - Material Sampled
VC - Visually Confirmed - Material not sampled, deemed ACM
NF - Non-Friable **F** - Friable
AMP - Asbestos Management Plan

Functional Space Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Quantity	Condition	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type	Asbestos Classification	Recommended Action	General Notes
1115	Boiler Room	Deck	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1115	Boiler Room	Piping	Pipe Fitting	Parged Cement	F	120	Good	HM	1680.252-02	28-Aug-90	50-75% Chrysotile	ACM	AMP	
1115	Boiler Room	Piping	Pipe Fitting	Parged Cement	F	1	Poor	HM	1680.252-02	28-Aug-90	50-75% Chrysotile	ACM	Repair/Remove	
1115	Boiler Room	Piping	Pipe Insulation	Air Cell	F	-	Good	SL	1680.252-16	28-Aug-90	50-75% Chrysotile, 10-25% Amosite	ACM	AMP	
1115	Boiler Room	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1116	Pump Room	Floor	Carpet	-	-	-	-	-	-	-	-	Non ACM	-	
1116	Pump Room	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1116	Pump Room	Deck	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1116	Pump Room	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1116	Pump Room	Piping	Pipe Fitting	Parged Cement	F	100	Good	HM	1680.252-16	28-Aug-90	50-75% Chrysotile, 10-25% Amosite	ACM	AMP	
1116	Pump Room	Piping	Pipe Insulation	Air Cell	F	-	Good	VC	-	-	-	ACM	AMP	
1117	Stairwell	No Data	-	-	-	-	-	-	-	-	-	-	-	
1118	Washroom	Floor	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1118	Washroom	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1118	Washroom	Deck	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1118	Washroom	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1118	Washroom	Piping	Pipe Fitting	Parged Cement	F	-	Good	HM	1680.252-02	28-Aug-90	50-75% Chrysotile	ACM	AMP	
1119	Washroom	No Data	-	-	-	-	-	-	-	-	-	-	-	
1120	-	Floor	Carpet	-	-	-	-	-	-	-	-	Non ACM	-	
1120	-	Floor	Vinyl Rolled Flooring	Beige Square Pattern	-	-	-	SL	S06ABC	16-Mar-17	ND	Non ACM	-	
1120	-	Wall	Drywall	No Drywall Joint Compound	-	-	-	-	-	-	-	Non ACM	-	
1120	-	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
1120	-	Ducting	Duct Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1121	-	Floor	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1121	-	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1121	-	Deck	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
1121	-	Ducting	Duct Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
1121	-	Ducting	Flex Joint	-	NF	8	Good	VC	-	-	-	Suspect ACM	AMP	
1121	-	Piping	Pipe Fitting	Parged Cement	F	2	Good	HM	1680.252-02	28-Aug-90	50-75% Chrysotile	ACM	AMP	
1121	-	Piping	Pipe Fitting	Fibreglass/PVC	-	-	-	-	-	-	-	Non ACM	-	
Level 2														
2000	Fan Room	Ducting	Flex Joint	-	NF	7	Good	VC	-	-	-	Suspect ACM	AMP	
2000	Fan Room	Piping	Pipe Fitting	Parged Cement	F	2	Good	HM	1680.252-02	28-Aug-90	50-75% Chrysotile	ACM	AMP	
2000	Fan Room	Wall	Tar Paper	-	-	-	-	SL	S08ABC	16-Mar-17	ND	Non ACM	-	
2001	Classroom 101	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	-	-	HM	S02	3-Apr-09	ND	Non ACM	-	
2001	Classroom 101	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	

School Name	Notes:
Elmira District Secondary School	**HM** - Homogenous Material - homogeneous with previously sampled material **SL** - Sample Location - Material Sampled **VC** - Visually Confirmed - Material not sampled, deemed ACM **NF** - Non-Friable **F** - Friable **AMP** - Asbestos Management Plan
Date Built:	
Original: 1938	
Addition(s): 1953, 1959, 1962, 1964, 1966	

Functional Space Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Quantity	Condition	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type	Asbestos Classification	Recommended Action	General Notes
2001	Classroom 101	Wall	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
2001	Classroom 101	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
2001	Classroom 101	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2001	Classroom 101	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
2002	Classroom 102	Floor	Vinyl Floor Tile 12"x 12"	White & Blue Streaks	-	-	-	HM	S03	3-Apr-09	ND	Non ACM	-	
2002	Classroom 102	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
2002	Classroom 102	Wall	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
2002	Classroom 102	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
2002	Classroom 102	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2002	Classroom 102	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
2003	Conference Room	Floor	Carpet	-	-	-	-	-	-	-	-	Non ACM	-	
2003	Conference Room	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
2003	Conference Room	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
2003	Conference Room	Wall	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2003	Conference Room	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
2003	Conference Room	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2004	VP	Floor	Carpet	-	-	-	-	-	-	-	-	Non ACM	-	
2004	VP	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
2004	VP	Wall	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2004	VP	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
2004	VP	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2004	VP	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
2005	VP	Floor	Carpet	-	-	-	-	-	-	-	-	Non ACM	-	
2005	VP	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
2005	VP	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
2005	VP	Wall	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2005	VP	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
2005	VP	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2005	VP	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
2006	General Office 107	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	-	-	HM	S02	3-Apr-09	ND	Non ACM	-	
2006	General Office 107	Floor	Carpet	-	-	-	-	-	-	-	-	Non ACM	-	
2006	General Office 107	Wall	Drywall	Drywall Joint Compound	-	-	-	SL	S01C	22-Feb-17	ND	Non ACM	-	
2006	General Office 107	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
2006	General Office 107	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
2006	General Office 107	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
2007	Principal Office	Floor	Carpet	-	-	-	-	-	-	-	-	Non ACM	-	
2007	Principal Office	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
2007	Principal Office	Wall	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
2007	Principal Office	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
2007	Principal Office	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	

School Name	Notes:
Elmira District Secondary School	**HM** - Homogenous Material - homogeneous with previously sampled material **SL** - Sample Location - Material Sampled **VC** - Visually Confirmed - Material not sampled, deemed ACM **NF** - Non-Friable **F** - Friable **AMP** - Asbestos Management Plan
Date Built:	
Original: 1938	
Addition(s): 1953, 1959, 1962, 1964, 1966	

Functional Space Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Quantity	Condition	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type	Asbestos Classification	Recommended Action	General Notes
2008	Stores	Floor	Vinyl Floor Tile 9"x 9"	Black Burgundy	NF	-	Good	SL	S22abc	3-Apr-09	2.0% Chrysotile	ACM	AMP	
2008	Stores	Floor	Vinyl Floor Tile 9"x 9"	Yellow Burgundy	NF	-	Good	SL	S23abc	3-Apr-09	6.8% Chrysotile	ACM	AMP	
2008	Stores	Floor	Floor Tile Mastic	Black Mastic	-	-	-	SL	S23abc	3-Apr-09	ND	Non ACM	-	
2008	Stores	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
2008	Stores	Wall	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
2008	Stores	Ceiling	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
2009	Office	Floor	Vinyl Floor Tile 9"x 9"	Tan with Beige Streaks	NF	-	Good	SL	S21abc	3-Apr-09	1.6% Chrysotile	ACM	AMP	
2009	Office	Wall	Plaster	-	-	-	-	SL	S18c	3-Apr-09	ND	Non ACM	-	
2009	Office	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
2009	Office	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2009	Office	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
2010	Lobby	Floor	Terrazzo	-	-	-	-	-	-	-	-	Non ACM	-	
2010	Lobby	Wall	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
2010	Lobby	Ceiling	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
2011	Stairwell	Floor	Terrazzo	-	-	-	-	-	-	-	-	Non ACM	-	
2011	Stairwell	Wall	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
2011	Stairwell	Ceiling	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
2012	Career Centre	Floor	Vinyl Floor Tile 12"x 12"	White with Beige Streaks	-	-	-	SL	S20abc	3-Apr-09	ND	Non ACM	-	
2012	Career Centre	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
2012	Career Centre	Wall	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
2012	Career Centre	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
2012	Career Centre	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2012	Career Centre	Ducting	Duct Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
2013	Office	-	-	-	-	-	-	-	-	-	-	-	-	
2014	Office	Floor	Carpet	-	-	-	-	-	-	-	-	Non ACM	-	
2014	Office	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
2014	Office	Wall	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
2014	Office	Wall	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2014	Office	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2006
2014	Office	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2015	Office	Floor	Carpet	-	-	-	-	-	-	-	-	Non ACM	-	
2015	Office	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
2015	Office	Wall	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
2015	Office	Wall	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2015	Office	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2006
2015	Office	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2016	Custodial Room	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	-	-	HM	S02	3-Apr-09	ND	Non ACM	-	
2016	Custodial Room	Wall	Plaster	-	-	-	-	SL	S02B,C	22-Feb-17	ND	Non ACM	-	
2016	Custodial Room	Wall	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	

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Addition(s): 1953, 1959, 1962, 1964, 1966	

Functional Space Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Quantity	Condition	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type	Asbestos Classification	Recommended Action	General Notes
2016	Custodial Room	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2006
2016	Custodial Room	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2016	Custodial Room	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
2017	Classroom 115	Floor	Carpet	-	-	-	-	-	-	-	-	Non ACM	-	
2017	Classroom 115	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
2017	Classroom 115	Wall	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
2017	Classroom 115	Wall	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2017	Classroom 115	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2006
2017	Classroom 115	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2018	Office	Floor	Carpet	-	-	-	-	-	-	-	-	Non ACM	-	
2018	Office	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
2018	Office	Wall	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
2018	Office	Wall	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2018	Office	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2006
2018	Office	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2019	Office	Floor	Carpet	-	-	-	-	-	-	-	-	Non ACM	-	
2019	Office	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
2019	Office	Wall	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
2019	Office	Wall	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2019	Office	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2006
2019	Office	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2020	Office	Floor	Carpet	-	-	-	-	-	-	-	-	Non ACM	-	
2020	Office	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
2020	Office	Wall	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
2020	Office	Wall	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2020	Office	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2006
2020	Office	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2021	Office	Floor	Carpet	-	-	-	-	-	-	-	-	Non ACM	-	
2021	Office	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
2021	Office	Wall	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
2021	Office	Wall	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2021	Office	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2006
2021	Office	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2022	Guidance	Floor	Carpet	-	-	-	-	-	-	-	-	Non ACM	-	
2022	Guidance	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
2022	Guidance	Wall	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
2022	Guidance	Wall	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2022	Guidance	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2006
2022	Guidance	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2023	Work Room	Floor	Carpet	-	-	-	-	-	-	-	-	Non ACM	-	

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Date Built:	
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Addition(s): 1953, 1959, 1962, 1964, 1966	

Functional Space Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Quantity	Condition	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type	Asbestos Classification	Recommended Action	General Notes
2023	Work Room	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
2023	Work Room	Wall	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2023	Work Room	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2006
2023	Work Room	Deck	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
2023	Work Room	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
2023	Work Room	Piping	Pipe Fitting	Fibreglass/PVC	-	-	-	-	-	-	-	Non ACM	-	
2024	Stairwell	Floor	Terrazzo	-	-	-	-	-	-	-	-	Non ACM	-	
2024	Stairwell	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
2024	Stairwell	Ceiling	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
2025	Corridor	Floor	No Data	-	-	-	-	-	-	-	-	-	-	
2025	Corridor	Wall	No Data	-	-	-	-	-	-	-	-	-	-	
2025	Corridor	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2006
2025	Corridor	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2026	Corridor	Floor	No Data	-	-	-	-	-	-	-	-	-	-	
2026	Corridor	Wall	No Data	-	-	-	-	-	-	-	-	-	-	
2026	Corridor	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2006
2026	Corridor	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2026	Corridor	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
2027	Corridor	-	-	-	-	-	-	-	-	-	-	-	-	
2028	Gym (Upper)	Floor	No Data	-	-	-	-	-	-	-	-	-	-	
2028	Gym (Upper)	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
2028	Gym (Upper)	Deck	Metal Pan	Steel	-	-	-	-	-	-	-	Non ACM	-	
2028	Gym (Upper)	Piping	Pipe Fitting	Parged Cement	F		4 Good	HM	1680.252-02	28-Aug-90	50-75% Chrysotile	ACM	AMP	
2029	Exercise Floor	Floor	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
2029	Exercise Floor	Floor	Rubber Mats	-	-	-	-	-	-	-	-	Non ACM	-	
2029	Exercise Floor	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
2029	Exercise Floor	Wall	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2029	Exercise Floor	Deck	Metal Pan	Steel	-	-	-	-	-	-	-	Non ACM	-	
2030	Stairwell	Floor	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
2030	Stairwell	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
2030	Stairwell	Ceiling	Texture Coat	-	-	-	-	SL	S25abc	3-Apr-09	ND	Non ACM	-	
2031	Work Room	-	-	-	-	-	-	-	-	-	-	-	-	
2032	Classroom 104	Floor	Vinyl Floor Tile 9"x 9"	Yellow & Brown	NF	-	Good	SL	S24abc	3-Apr-09	10% Chrysotile	ACM	AMP	
2032	Classroom 104	Floor	Vinyl Floor Tile 9"x 9"	Beige with White and Brown Streak	NF	-	Fair	SL	S13ABC	17-May-13	1.1% Chrysotile	ACM	AMP	
2032	Classroom 104	Wall	Plaster	-	-	-	-	SL	S18e	3-Apr-09	ND	Non ACM	-	
2032	Classroom 104	Wall	Drywall	Drywall Joint Compound	-	-	-	SL	S13bc	3-Apr-09	ND	Non ACM	-	
2032	Classroom 104	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	
2032	Classroom 104	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	

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Functional Space Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Quantity	Condition	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type	Asbestos Classification	Recommended Action	General Notes
2033	Classroom 108	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	-	-	HM	S02	3-Apr-09	ND	Non ACM	-	
2033	Classroom 108	Wall	Plaster	-	-	-	-	SL	S18d	3-Apr-09	ND	Non ACM	-	
2033	Classroom 108	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
2033	Classroom 108	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2033	Classroom 108	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
2034	Office	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	-	-	HM	S02	3-Apr-09	ND	Non ACM	-	
2034	Office	Wall	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2034	Office	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
2034	Office	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
2035	Office	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	-	-	HM	S02	3-Apr-09	ND	Non ACM	-	
2035	Office	Wall	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2035	Office	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
2035	Office	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
2036	Library (Upper)	-	-	-	-	-	-	-	-	-	-	-	-	
2037	Office	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	-	-	HM	S02	3-Apr-09	ND	Non ACM	-	
2037	Office	Wall	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2037	Office	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
2037	Office	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
2037	Office	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2038	Office	Floor	Carpet	-	-	-	-	-	-	-	-	Non ACM	-	
2038	Office	Wall	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
2038	Office	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
2038	Office	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2039	Office	Floor	Vinyl Floor Tile 9"x 9"	White & Brown Streak	NF	-	Good	SL	S19abc	3-Apr-09	1.2% Chrysotile	ACM	AMP	
2039	Office	Wall	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
2039	Office	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
2039	Office	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2040	Office	Floor	Vinyl Floor Tile 9"x 9"	White & Brown Streak	NF	-	Good	HM	S19	3-Apr-09	1.2% Chrysotile	ACM	AMP	
2040	Office	Wall	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
2040	Office	Wall	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2040	Office	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
2040	Office	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2041	Elevator Machine Room	-	-	-	-	-	-	-	-	-	-	-	-	
2042	Work Room	Floor	Vinyl Floor Tile 12"x 12"	White & Blue Streaks	-	-	-	HM	S03	3-Apr-09	ND	Non ACM	-	
2042	Work Room	Wall	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
2042	Work Room	Wall	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2042	Work Room	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	

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Functional Space Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Quantity	Condition	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type	Asbestos Classification	Recommended Action	General Notes
2042	Work Room	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
2042	Work Room	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2042	Work Room	Ducting	Duct Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
2042	Work Room	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
2043	Classroom 114	Floor	Vinyl Floor Tile 12"x 12"	White & Blue Streaks	-	-	-	HM	S03	3-Apr-09	ND	Non ACM	-	
2043	Classroom 114	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
2043	Classroom 114	Wall	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2043	Classroom 114	Wall	Brick	-	-	-	-	-	-	-	-	Non ACM	-	
2043	Classroom 114	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2006
2043	Classroom 114	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2044	Lobby	Floor	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
2044	Lobby	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
2044	Lobby	Wall	Brick	-	-	-	-	-	-	-	-	Non ACM	-	
2044	Lobby	Wall	Wood Fibre Board	-	-	-	-	-	-	-	-	Non ACM	-	
2044	Lobby	Ceiling	Glass	-	-	-	-	-	-	-	-	Non ACM	-	
2044	Lobby	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
2045	Girls Washroom	Floor	Vinyl Floor Tile 9"x 9"	Red with Black & White Streak	NF	-	Good	HM	S04abc	3-Apr-09	10% Chrysotile	ACM	AMP	
2045	Girls Washroom	Wall	Plaster	-	-	-	-	SL	S18b	3-Apr-09	ND	Non ACM	-	
2045	Girls Washroom	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
2045	Girls Washroom	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
2045	Girls Washroom	Ceiling	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
2045	Girls Washroom	Piping	Pipe Fitting	Parged Cement	F		10 Good	HM	1680.252-02	28-Aug-90	50-75% Chrysotile	ACM	AMP	
2046	Classroom 117	Floor	Vinyl Floor Tile 9"x 9"	Grey, Red, Beige & Brown	NF	-	Good	SL	S17abc	3-Apr-09	6.3% Chrysotile	ACM	AMP	
2046	Classroom 117	Floor	Floor Tile Mastic	Black Mastic	NF	-	Good	SL	S17abc	3-Apr-09	10% Chrysotile	ACM	AMP	
2046	Classroom 117	Wall	Plaster	-	-	-	-	SL	S18a	3-Apr-09	ND	Non ACM	-	
2046	Classroom 117	Wall	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2046	Classroom 117	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
2046	Classroom 117	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2006
2046	Classroom 117	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2047	Classroom 120	Floor	Vinyl Floor Tile 9"x 9"	Green & Beige Streaks	NF	-	Good	HM	S16	3-Apr-09	5.2% Chrysotile	ACM	AMP	
2047	Classroom 120	Wall	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
2047	Classroom 120	Wall	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2047	Classroom 120	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
2047	Classroom 120	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2006
2047	Classroom 120	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2048	Corridor	Floor	Terrazzo	-	-	-	-	-	-	-	-	Non ACM	-	
2048	Corridor	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
2048	Corridor	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
2048	Corridor	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2006
2048	Corridor	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	

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Functional Space Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Quantity	Condition	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type	Asbestos Classification	Recommended Action	General Notes
2049	Classroom 121	Floor	Vinyl Floor Tile 9"x 9"	Green & Beige Streaks	NF	-	Good	HM	S16	3-Apr-09	5.2% Chrysotile	ACM	AMP	
2049	Classroom 121	Wall	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2049	Classroom 121	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
2049	Classroom 121	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2006
2049	Classroom 121	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2049	Classroom 121	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
2050	Classroom 122	Floor	Vinyl Floor Tile 12"x 12"	Oatmeal	-	-	-	SL	S15abc	3-Apr-09	ND	Non ACM	-	
2050	Classroom 122	Wall	Plaster	-	-	-	-	SL	S05ABC	22-Feb-17	ND	Non ACM	-	
2050	Classroom 122	Ceiling	No Data	-	-	-	-	-	-	-	-	-	-	
2051	Classroom 124	Floor	Vinyl Floor Tile 9"x 9"	Grey with Black & Beige	NF	-	Good	SL	S12abc	3-Apr-09	7.2% Chrysotile	ACM	AMP	
2051	Classroom 124	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
2051	Classroom 124	Wall	Drywall	Drywall Joint Compound	-	-	-	SL	S13a	3-Apr-09	ND	Non ACM	-	
2051	Classroom 124	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2006
2051	Classroom 124	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2052	Classroom 123	Floor	Vinyl Floor Tile 9"x 9"	Light Brown, Dark Brown with White	NF	-	Good		-	-	-	ACM	AMP	
2052	Classroom 123	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
2052	Classroom 123	Wall	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
2052	Classroom 123	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2006
2053	Stairwell	Floor	Terrazzo	-	-	-	-	-	-	-	-	Non ACM	-	
2053	Stairwell	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
2053	Stairwell	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
2053	Stairwell	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2006
2054	Greenhouse	Floor	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
2054	Greenhouse	Wall	Glass	-	-	-	-	-	-	-	-	Non ACM	-	
2054	Greenhouse	Ceiling	Glass	-	-	-	-	-	-	-	-	Non ACM	-	
2054	Greenhouse	Piping	Uninsulated	Copper	-	-	-	-	-	-	-	Non ACM	-	
Level 3														
3000	Custodial Room	Floor	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
3000	Custodial Room	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
3000	Custodial Room	Deck	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
3000	Custodial Room	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
3000	Custodial Room	Piping	Pipe Fitting	Fibreglass/PVC	-	-	-	-	-	-	-	Non ACM	-	
3001	Classroom 220	Floor	Vinyl Floor Tile 9"x 9"	Grey with Black & White Streak	NF	-	Good	SL	S01abc	3-Apr-09	5.6% Chrysotile	ACM	AMP	
3001	Classroom 220	Floor	Floor Tile Mastic	Black Mastic	NF	-	Good	SL	S01abc	3-Apr-09	0.5% Chrysotile	ACM	AMP	
3001	Classroom 220	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
3001	Classroom 220	Wall	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
3001	Classroom 220	Wall	Brick	-	-	-	-	-	-	-	-	Non ACM	-	
3001	Classroom 220	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007

School Name	Notes:
Elmira District Secondary School	**HM** - Homogenous Material - homogeneous with previously sampled material **SL** - Sample Location - Material Sampled **VC** - Visually Confirmed - Material not sampled, deemed ACM **NF** - Non-Friable **F** - Friable **AMP** - Asbestos Management Plan
Date Built:	
Original: 1938	
Addition(s): 1953, 1959, 1962, 1964, 1966	

Functional Space Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Quantity	Condition	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type	Asbestos Classification	Recommended Action	General Notes
3002	Classroom 216	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	-	-	HM	S02	3-Apr-09	ND	Non ACM	-	
3002	Classroom 216	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
3002	Classroom 216	Wall	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
3002	Classroom 216	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
3002	Classroom 216	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
3002	Classroom 216	Deck	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
3003	Office	Floor	Vinyl Floor Tile 12"x 12"	White & Blue Streaks	-	-	-	HM	S03	3-Apr-09	ND	Non ACM	-	
3003	Office	Wall	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
3003	Office	Wall	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
3003	Office	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
3004	Classroom 214	Floor	Vinyl Floor Tile 12"x 12"	White & Blue Streaks	-	-	-	HM	S03	3-Apr-09	ND	Non ACM	-	
3004	Classroom 214	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
3004	Classroom 214	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
3004	Classroom 214	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
3004	Classroom 214	Deck	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
3005	Stairwell	Floor	Terrazzo	-	-	-	-	-	-	-	-	Non ACM	-	
3005	Stairwell	Wall	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
3005	Stairwell	Ceiling	Ceiling Tile 1' x 1'	Random Pinhole	-	-	-	SL	S26abc	3-Apr-09	ND	Non ACM	-	
3005	Stairwell	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
3005	Stairwell	Piping	Pipe Fitting	Parged Cement	F		2	Good	HM	1680.252-02	28-Aug-90	50-75% Chrysotile	ACM	AMP	
3006	Classroom 212	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	-	-	HM	S02	3-Apr-09	ND	Non ACM	-	
3006	Classroom 212	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
3006	Classroom 212	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
3006	Classroom 212	Wall	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
3006	Classroom 212	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
3006	Classroom 212	Ceiling	Drywall	Drywall Joint Compound	-	-	-	SL	S06b	3-Apr-09	ND	Non ACM	-	
3007	Classroom 211	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	-	-	HM	S02	3-Apr-09	ND	Non ACM	-	
3007	Classroom 211	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
3007	Classroom 211	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
3007	Classroom 211	Wall	Plaster	-	-	-	-	SL	S05c	3-Apr-09	ND	Non ACM	-	
3007	Classroom 211	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
3007	Classroom 211	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
3007	Classroom 211	Deck	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
3007	Classroom 211	Piping	Pipe Insulation	Foam Insulation	-	-	-	-	-	-	-	Non ACM	-	
3008	Classroom 209	Floor	Vinyl Floor Tile 9"x 9"	Green with Blue & Beige Streaks	NF	-	Good	SL	S08abc	3-Apr-09	10% Chrysotile	ACM	AMP	
3008	Classroom 209	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
3008	Classroom 209	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
3008	Classroom 209	Wall	Plaster	-	-	-	-	SL	S05c	3-Apr-09	ND	Non ACM	-	
3008	Classroom 209	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
3008	Classroom 209	Ceiling	Drywall	Drywall Joint Compound	-	-	-	SL	S06b	3-Apr-09	ND	Non ACM	-	

School Name	Notes:
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Date Built:	
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Addition(s): 1953, 1959, 1962, 1964, 1966	

Functional Space Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Quantity	Condition	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type	Asbestos Classification	Recommended Action	General Notes
3009	Classroom 206	Floor	Vinyl Floor Tile 9"x 9"	Olive with Beige Streaks	NF	-	Good	SL	S09abc	3-Apr-09	10% Chrysotile	ACM	AMP	
3009	Classroom 206	Wall	Drywall	Drywall Joint Compound	-	-	-	SL	S06c	3-Apr-09	ND	Non ACM	-	
3009	Classroom 206	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
3009	Classroom 206	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
3009	Classroom 206	Wall	Plaster	-	-	-	-	SL	S05d	3-Apr-09	ND	Non ACM	-	
3009	Classroom 206	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
3009	Classroom 206	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
3010	Classroom 204	Floor	Vinyl Floor Tile 9"x 9"	Tan with Brown & Beige	NF	-	Good	SL	S10abc	3-Apr-09	8.0% Chrysotile	ACM	AMP	
3010	Classroom 204	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
3010	Classroom 204	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
3010	Classroom 204	Wall	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
3010	Classroom 204	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
3010	Classroom 204	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
3011	Classroom 202	Floor	Vinyl Floor Tile 9"x 9"	Green with Dark Green & Beige	NF	-	Good	SL	S11abc	3-Apr-09	10% Chrysotile	ACM	AMP	
3011	Classroom 202	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
3011	Classroom 202	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
3011	Classroom 202	Wall	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
3011	Classroom 202	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
3011	Classroom 202	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
3012	Office 201	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	-	-	HM	S02	3-Apr-09	ND	Non ACM	-	
3012	Office 201	Floor	Vinyl Floor Tile 9"x 9"	Olive with Beige Streaks	NF	-	Fair	HM	S09	3-Apr-09	10% Chrysotile	ACM	AMP	
3012	Office 201	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
3012	Office 201	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
3012	Office 201	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
3012	Office 201	Deck	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
3013	Corridor	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	-	-	HM	S02	3-Apr-09	ND	Non ACM	-	
3013	Corridor	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
3013	Corridor	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
3013	Corridor	Ceiling	Ceiling Tile 2' x 2'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
3013	Corridor	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
3014	Corridor	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	-	-	HM	S02	3-Apr-09	ND	Non ACM	-	
3014	Corridor	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
3014	Corridor	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
3014	Corridor	Ceiling	Ceiling Tile 2' x 2'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
3014	Corridor	Deck	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
3015	Corridor	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	-	-	HM	S02	3-Apr-09	ND	Non ACM	-	
3015	Corridor	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
3015	Corridor	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
3015	Corridor	Ceiling	Ceiling Tile 2' x 2'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
3015	Corridor	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	

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Addition(s): 1953, 1959, 1962, 1964, 1966	

Functional Space Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Quantity	Condition	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type	Asbestos Classification	Recommended Action	General Notes
3016	Stairwell	Floor	Terrazzo	-	-	-	-	-	-	-	-	Non ACM	-	
3016	Stairwell	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
3016	Stairwell	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
3017	Classroom 219	Floor	Vinyl Floor Tile 12"x 12"	White & Blue Streaks	-	-	-	SL	S03abc	3-Apr-09	ND	Non ACM	-	
3017	Classroom 219	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
3017	Classroom 219	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
3017	Classroom 219	Wall	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
3017	Classroom 219	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
3017	Classroom 219	Ducting	Duct Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
3018	Girls Washroom	Floor	Vinyl Floor Tile 9"x 9"	Red with Black & White Streak	NF	-	Good	SL	S04abc	3-Apr-09	10% Chrysotile	ACM	AMP	
3018	Girls Washroom	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
3018	Girls Washroom	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
3018	Girls Washroom	Wall	Plaster	-	-	-	-	SL	S05a	3-Apr-09	ND	Non ACM	-	
3018	Girls Washroom	Ceiling	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
3018	Girls Washroom	Deck	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
3019	Classroom 217	Floor	Vinyl Floor Tile 12"x 12"	White & Blue Streaks	-	-	-	SL	S03abc	3-Apr-09	ND	Non ACM	-	
3019	Classroom 217	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
3019	Classroom 217	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
3019	Classroom 217	Wall	Plaster	-	-	-	-	SL	S05a	3-Apr-09	ND	Non ACM	-	
3019	Classroom 217	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
3019	Classroom 217	Deck	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
3019	Classroom 217	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
3019	Classroom 217	Piping	Pipe Fitting	Fibreglass/PVC	-	-	-	-	-	-	-	Non ACM	-	
3020	Classroom 213	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	-	-	HM	S02	3-Apr-09	ND	Non ACM	-	
3020	Classroom 213	Wall	Drywall	Drywall Joint Compound	-	-	-	SL	S06a	3-Apr-09	ND	Non ACM	-	
3020	Classroom 213	Wall	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
3020	Classroom 213	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
3020	Classroom 213	Deck	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
3021	Classroom 210	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	-	-	HM	S02	3-Apr-09	ND	Non ACM	-	
3021	Classroom 210	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
3021	Classroom 210	Wall	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
3021	Classroom 210	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
3021	Classroom 210	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
3021	Classroom 210	Countertops	Countertops	-	-	-	-	VC	-	-	-	Non ACM	-	
3022	Classroom 208	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	-	-	HM	S02	3-Apr-09	ND	Non ACM	-	
3022	Classroom 208	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
3022	Classroom 208	Wall	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
3022	Classroom 208	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
3022	Classroom 208	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
3022	Classroom 208	Deck	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	

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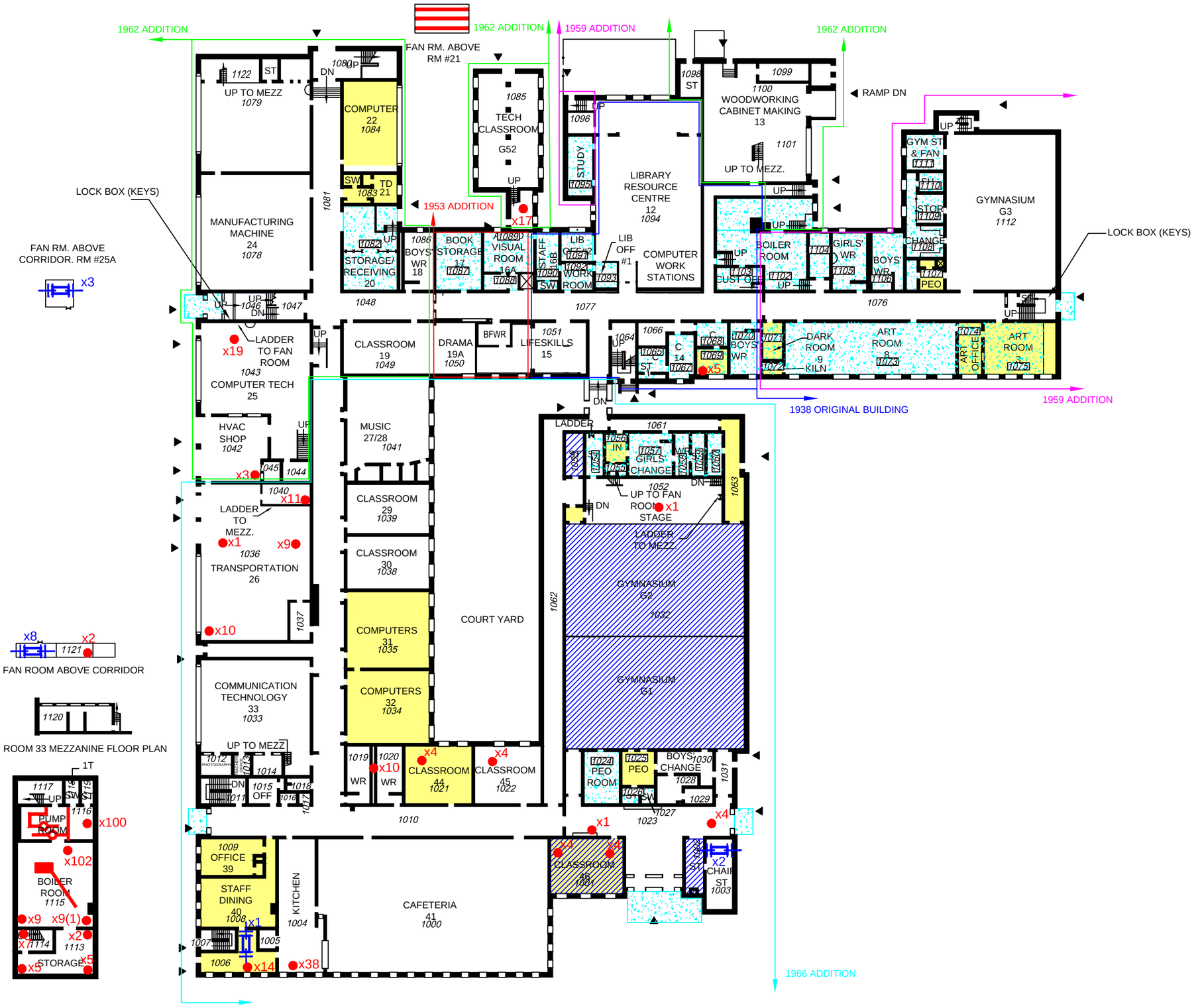
Functional Space Number	Room Description	Inspected Item	Inspected Material	Material Description	Friability	Quantity	Condition	Sample / Identification Summary	Sample ID	Sample Date	% Asbestos & Fibre Type	Asbestos Classification	Recommended Action	General Notes
3023	Office 207	Floor	Vinyl Floor Tile 12"x 12"	Brown Oatmeal	-	-	-	HM	S02	3-Apr-09	ND	Non ACM	-	
3023	Office 207	Floor	Vinyl Floor Tile 12"x 12"	White & Blue Streaks	-	-	-	HM	S03	3-Apr-09	ND	Non ACM	-	
3023	Office 207	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
3023	Office 207	Wall	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
3023	Office 207	Wall	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
3023	Office 207	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
3023	Office 207	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
3023	Office 207	Piping	Pipe Insulation	Fibreglass insulation	-	-	-	-	-	-	-	Non ACM	-	
3024	Classroom 215	Floor	Vinyl Floor Tile 12"x 12"	White & Blue Streaks	-	-	-	HM	S03	3-Apr-09	ND	Non ACM	-	
3024	Classroom 215	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
3024	Classroom 215	Wall	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
3024	Classroom 215	Wall	Drywall	Drywall Joint Compound	-	-	-	SL	S06d	3-Apr-09	ND	Non ACM	-	
3024	Classroom 215	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
3024	Classroom 215	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
3025	Classroom 203	Floor	Vinyl Floor Tile 12"x 12"	White & Blue Streaks	-	-	-	HM	S03	3-Apr-09	ND	Non ACM	-	
3025	Classroom 203	Wall	Concrete	-	-	-	-	-	-	-	-	Non ACM	-	
3025	Classroom 203	Wall	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
3025	Classroom 203	Wall	Drywall	Drywall Joint Compound	-	-	-	SL	S06e	3-Apr-09	ND	Non ACM	-	
3025	Classroom 203	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
3025	Classroom 203	Ceiling	Drywall	Drywall Joint Compound	-	-	-	HM	S06, S13	3-Apr-09	ND	Non ACM	-	
3026	Lab Storage	Floor	Vinyl Floor Tile 9"x 9"	Brown with Beige Streaks	NF	-	Good	SL	S07abc	3-Apr-09	10% Chrysotile	ACM	AMP	
3026	Lab Storage	Wall	Plaster	-	-	-	-	HM	S05, S18	3-Apr-09	ND	Non ACM	-	
3026	Lab Storage	Wall	Ceramic Tile	-	-	-	-	-	-	-	-	Non ACM	-	
3026	Lab Storage	Ceiling	Ceiling Tile 2' x 4'	Short Fissure Random Pinhole	-	-	-	-	-	-	-	Non ACM	-	Date Stamped 2007
Summary of Potential ACM Hidden or Not Assessed														
-	Exterior	Not Inspected	Not Inspected	Roofing										
-	Interior & Exterior	Not Inspected	Not Inspected	Caulking on Doors/Windows										
-	Interior & Exterior	Not Inspected	Not Inspected	Vermiculite Insulation (wall cavities)										
-	Throughout Interior	Not Inspected	Not Inspected	Floor Tile Mastic										
-	Throughout Interior	Not Inspected	Not Inspected	Ceiling Tile Mastic										
-	Interior & Exterior	Not Inspected	Not Inspected	Door Core Insulation										



Notes:

ALL DRAWINGS TO BE REFERENCED WITH THE ASBESTOS AUDIT UPDATE REPORT, LOCATIONS AND QUANTITIES ARE APPROXIMATE.

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

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

Asbestos-Containing Materials Legend

- Ceiling Tile
- Friable Soft Textured Finish Ceiling
- Spray-Applied Fire Proofing
- Trowel Applied Fire Proofing
- Non-Friable Hard Stipple Coat / Textured Plaster Ceilings
- Transite (Asbestos Cement) Paneling
- Floor Tile
- Rolled Flooring
- No Access
- Outside Scope of Work
- x2(1) Pipe Fitting Insulation with Quantity (Brackets indicate No. of damaged fittings)
- Pipe Insulation (Vertical and Horizontal)
- Transite (Asbestos Cement) Pipe (Vertical and Horizontal)
- x#(1) Duct Expansion Joints with Quantity (Brackets indicates No. of damaged joints)
- Fire Door
- 1074 Functional Space Number

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PROJECT
2017 ASBESTOS AUDIT UPDATE

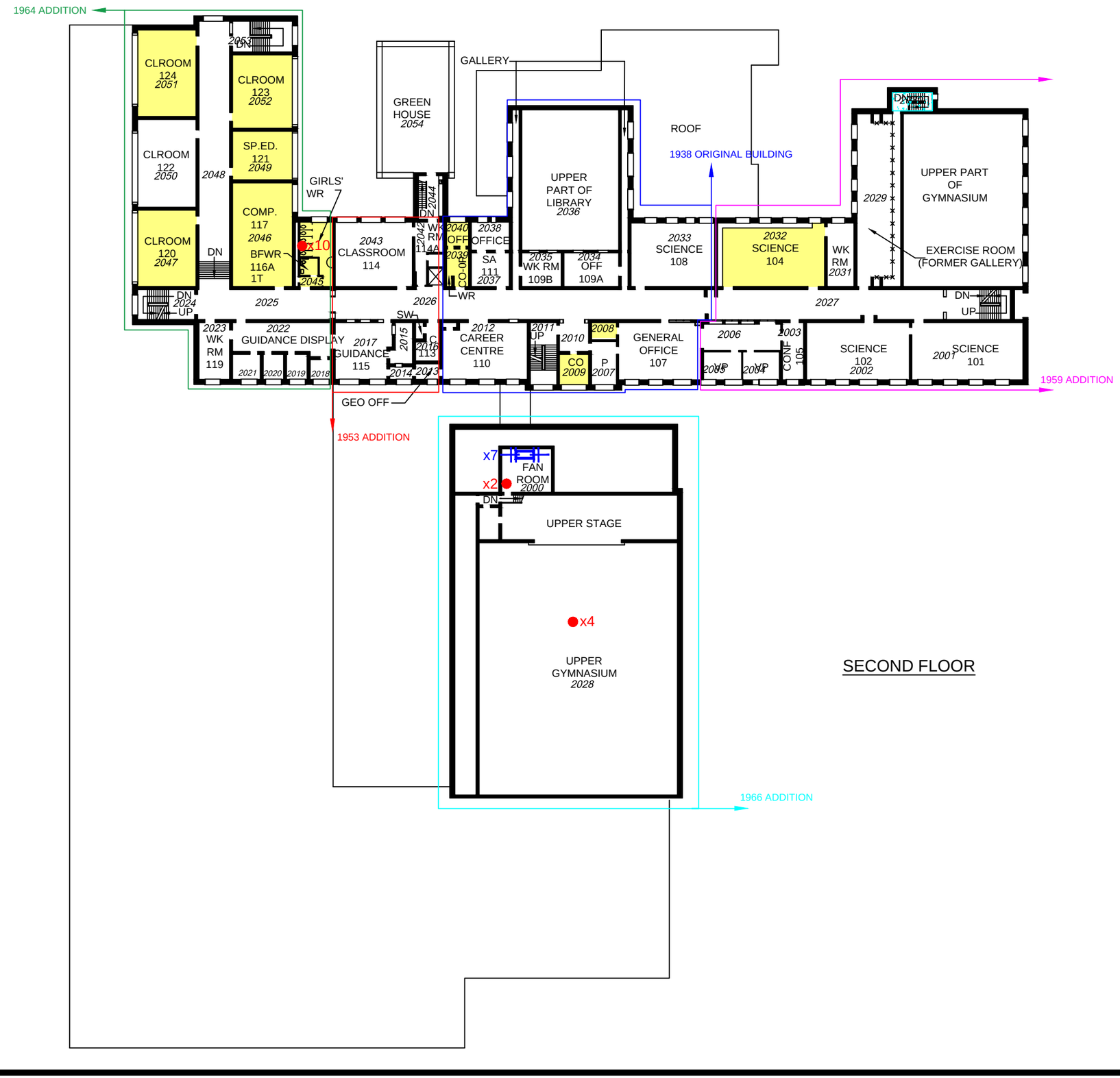
DRAWING
ELMIRA DISTRICT SECONDARY SCHOOL

LEVEL 1

Project Manager	A. DENNETT	Date	MARCH 2017
Baseplan By	WRDSB	Project No.	34532-909
Figure By	SJN	Drawing No.	1.0
Scale	N.T.S.		

Project: 34532-909 CAD: P:\P_34532\909\EDSS - MARCH 2017.DWG

February 28, 2017 - 10:00am - Plotted By: Shieboer



Notes:

ALL DRAWINGS TO BE REFERENCED WITH THE ASBESTOS AUDIT UPDATE REPORT, LOCATIONS AND QUANTITIES ARE APPROXIMATE.

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

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

Asbestos-Containing Materials Legend

- Ceiling Tile
- Friable Soft Textured Finish Ceiling
- Spray-Applied Fire Proofing
- Trowel Applied Fire Proofing
- Non-Friable Hard Stipple Coat / Textured Plaster Ceilings
- Transite (Asbestos Cement) Paneling
- Floor Tile
- Rolled Flooring
- No Access
- Outside Scope of Work
- x2(1) Pipe Fitting Insulation with Quantity (Brackets indicate No. of damaged fittings)
- Pipe Insulation (Vertical and Horizontal)
- Transite (Asbestos Cement) Pipe (Vertical and Horizontal)
- x#(1) Duct Expansion Joints with Quantity (Brackets indicates No. of damaged joints)
- Fire Door
- 1074 Functional Space Number

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PROJECT
2017 ASBESTOS AUDIT UPDATE

DRAWING
ELMIRA DISTRICT SECONDARY SCHOOL

LEVEL 2

Project Manager A. DENNETT	Date MARCH 2017
Baseplan By WRDSB	Project No. 34532-909
Figure By SJN	Drawing No. 1.1
Scale N.T.S.	

Project: 34532-909 CAD: P:\34532\909\EDSS - MARCH 2017.DWG
February 28, 2017 - 10:00am - Plotted By: SNieboer

THIRD FLOOR

Notes:

ALL DRAWINGS TO BE REFERENCED WITH THE ASBESTOS AUDIT UPDATE REPORT, LOCATIONS AND QUANTITIES ARE APPROXIMATE.

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Asbestos-Containing Materials Legend

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- Transite (Asbestos Cement) Pipe (Vertical and Horizontal)
- x#(1) Duct Expansion Joints with Quantity (Brackets indicates No. of damaged joints)
- Fire Door
- 1074 Functional Space Number

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PROJECT
2017 ASBESTOS AUDIT UPDATE

DRAWING
ELMIRA DISTRICT SECONDARY SCHOOL

LEVEL 3

Project Manager: A. DENNETT	Date: MARCH 2017
Baseplan By: WRDSB	Project No.: 34532-909
Figure By: SJN	Drawing No.: 1.2
Scale: N.T.S.	

Project: 34532-909 CAD: P:\P\34532\909\EDSS - MARCH 2017.DWG

February 28, 2017 - 10:00am - Plotted By: SNieboer

TABLE 3: BULK ASBESTOS SAMPLING SUMMARY					
Sample #	**Location**	**Material Description**	**Asbestos Content (%)**	**Fibre Type**	**Is Material ACM**
2009					
S01A	**3001**	**9" x 9" Floor Tile - Grey/Black and White Streaks**	**5.6**	**Chrysotile**	**Yes**
S01B	**3001**		**NA**	**-**	**Yes**
S01C	**3001**		**NA (tile)**	**Chrysotile**	**Yes**
			0.5 (mastic)		**Yes**
S02A	3015	12" x 12" Floor Tile - Brown Oatmeal	ND	-	No
S02B	3015		ND	-	No
S02C	3015		ND	-	No
S03A	**-**	**12" x 12" Floor Tile - White with Blue Streaks**	**ND (tile)**	**-**	No
			1.3 (mastic)	**Chrysotile**	**Yes**
S03B	**-**		**ND (tile)**	**-**	No
			NA (mastic)	**-**	**Yes**
S03C	**-**		**ND (tile)**	**-**	No
			NA (mastic)	**-**	**Yes**
S04A	**3018**	**9" x 9" Floor Tile - Red/Black and White Streaks**	**6.9 (tile)**	**Chrysotile**	**Yes**
			10 (mastic)	**Chrysotile**	**Yes**
S04B	**3018**		**NA**	**-**	**Yes**
S04C	**3018**		**NA**	**-**	**Yes**
S05A	3018	Wall Plaster (1964)	ND	-	No
S05B	3019	Wall Plaster (1953)	ND	-	No
S05C	3007	Wall Plaster (1938)	<0.25	Chrysotile	No
S05D	3009	Wall Plaster (1959)	ND	-	No
S05E	3025	Wall Plaster (1959)	ND	-	No
S06A	3020	Drywall Joint Compound (1938)	ND	-	No
S06B	3006	Drywall Joint Compound (1938)	ND	-	No
S06C	3009	Drywall Joint Compound (1959)	ND	-	No
S06D	3024	Drywall Joint Compound (1959)	ND	-	No
S06E	3025	Drywall Joint Compound (1959)	ND	-	No
S07A	**3026**	**9" x 9" Floor Tile - Brown with Beige Streaks**	**10**	**Chrysotile**	**Yes**
S07B	**26**		**NA**	**-**	**Yes**
S07C	**3026**		**NA**	**-**	**Yes**
S08A	**3008**	**9" x 9" Floor Tile - Green/Blue and Beige Streaks**	**10**	**Chrysotile**	**Yes**
S08B	**3008**		**NA**	**-**	**Yes**
S08C	**3008**		**NA**	**-**	**Yes**
S09A	**3009**	**9" x 9" Floor Tile - Olive with Beige Streaks**	**10**	**Chrysotile**	**Yes**
S09B	**3009**		**NA**	**-**	**Yes**
S09C	**3009**		**NA**	**-**	**Yes**
S10A	**3011**	**9" x 9" Floor Tile - Tan/Brown and Beige Streaks**	**10**	**Chrysotile**	**Yes**
S10B	**3011**		**NA**	**-**	**Yes**
S10C	**3011**		**NA**	**-**	**Yes**
S11A	**3011**	**9" x 9" Floor Tile - Green/Dark Green and Beige Streaks**	**10**	**Chrysotile**	**Yes**
S11B	**3011**		**NA (tile)**	**-**	**Yes**
			ND (mastic)	-	No
S11C	**3011**		**NA**	**-**	**Yes**
S12A	**2051**	**9" x 9" Floor Tile - Grey/Black and Beige Streaks**	**7.2**	**Chrysotile**	**Yes**
S12B	**2051**		**NA**	**-**	**Yes**
S12C	**2051**		**NA**	**-**	**Yes**
S13A	2051	Drywall Joint Compound (1964)	ND	-	No
S13B	2032	Drywall Joint Compound (1959)	ND	-	No
S13C	2032	Drywall Joint Compound (1959)	ND	-	No

TABLE 3: BULK ASBESTOS SAMPLING SUMMARY					
Sample #	**Location**	**Material Description**	**Asbestos Content (%)**	**Fibre Type**	**Is Material ACM**
S14A	**2052**	**9” x 9” Floor Tile - Light Brown/White and Dark Brown Streaks**	**6.7**	**Chrysotile**	**Yes**
S14B	**2052**		**NA (tile)**	**-**	**Yes**
			ND (mastic)	-	No
S14C	**2052**		**NA (tile)**	**-**	**Yes**
			ND (mastic)	-	No
S15A	2050	12” x 12” Floor Tile - Oatmeal	ND	-	No
S15B	2050		ND	-	No
S15C	2050		ND	-	No
S16A	**2049**	**9” x 9” Floor Tile - Green with Beige Streaks**	**5.2 (tile)**	**Chrysotile**	**Yes**
			ND (mastic)	-	No
S16B	**2049**		**NA (tile)**	**-**	**Yes**
			ND (mastic)	-	No
S16C	**2049**		**NA**	**-**	**Yes**
S17A	**2046**	**9” x 9” Floor Tile - Red/Brown with Beige Streaks**	**6.3 (tile)**	**Chrysotile**	**Yes**
			10 (mastic)	**Chrysotile**	**Yes**
S17B	**2046**		**NA**	**-**	**Yes**
S17C	**2046**		**NA**	**-**	**Yes**
S18A	2046	Wall Plaster (1964)	ND	-	No
S18B	2045	Wall Plaster (1964)	ND	-	No
S18C	2009	Wall Plaster (1938)	ND	-	No
S18D	2033	Wall Plaster (1938)	ND	-	No
S18E	2032	Wall Plaster (1959)	ND	-	No
S19A	**2039**	**9” x 9” Floor Tile - White with Brown Streaks**	**1.2 (tile)**	**Chrysotile**	**Yes**
			ND (mastic)	-	No
S19B	**2039**		**NA (tile)**	**-**	**Yes**
			ND (mastic)	-	No
S19C	**2039**		**NA**	**-**	**Yes**
S20A	2012	12” x 12” Floor Tile - White with Beige Streaks	ND	-	No
S20B	2012		ND	-	No
S20C	2012		ND	-	No
S21A	**2009**	**9” x 9” Floor Tile - Tan with Beige Streaks**	**1.6 (tile)**	**Chrysotile**	**Yes**
			ND (mastic)	-	No
S21B	**2009**		**NA (tile)**	**-**	**Yes**
			ND (mastic)	-	No
S21C	**2009**		**NA**	**-**	**Yes**
S22A	**2008**	**9” x 9” Floor Tile - Burgundy and Black**	**2.0 (tile)**	**Chrysotile**	**Yes**
			ND (mastic)	-	No
S22B	**2008**		**NA (tile)**	**-**	**Yes**
			ND (mastic)	-	No
S22C	**2008**		**NA (tile)**	**-**	**Yes**
			ND (mastic)	-	No
S23A	**2008**	**9” x 9” Floor Tile - Burgundy and Yellow**	**6.8 (tile)**	**Chrysotile**	**Yes**
			ND (mastic)	-	No
S23B	**2008**		**NA (tile)**	**-**	**Yes**
			ND (mastic)	-	No
S23C	**2008**		**NA (tile)**	**-**	**Yes**
			ND (mastic)	-	No
S24A	**2032**	**9” x 9” Floor Tile - Yellow with Brown Streaks**	**10**	**Chrysotile**	**Yes**
S24B	**2032**		**NA (tile)**	**-**	**Yes**
			ND (mastic)	-	No
S24C	**2032**		**NA (tile)**	**-**	**Yes**
			ND (mastic)	-	No

TABLE 3: BULK ASBESTOS SAMPLING SUMMARY					
Sample #	**Location**	**Material Description**	**Asbestos Content (%)**	**Fibre Type**	**Is Material ACM**
S25A	2030	Texture Coat Ceiling	ND	-	No
S25B	2030	Texture Coat Ceiling	ND	-	No
S25C	2030	Texture Coat Ceiling	ND	-	No
S26A	3005	1” x1” Ceiling Tile - Random Pinhole	ND	-	No
S26B	3005	1” x1” Ceiling Tile - Random Pinhole	ND	-	No
S26C	3005	1” x1” Ceiling Tile - Random Pinhole	ND	-	No
S27A	1079	1” x1” Ceiling Tile - Random Pinhole	ND	-	No
S27B	1079	1” x1” Ceiling Tile - Random Pinhole	ND	-	No
S27C	1079	1” x1” Ceiling Tile - Random Pinhole	ND	-	No
S28A	1084	Wall Plaster (1962)	ND	-	No
S28B	1083	Wall Plaster (1962)	ND	-	No
S29A	**1082**	**Texture Coat Ceiling**	ND	**-**	No
S29B	**1082**	**Texture Coat Ceiling**	**2.5**	**Chrysotile**	**Yes**
S29C	**1082**	**Texture Coat Ceiling**	**NA**	**-**	**Yes**
S30A	1077	12” x 12” Floor Tile - Yellow Oatmeal	ND	-	No
S30B	1077	12” x 12” Floor Tile - Yellow Oatmeal	ND	-	No
S30C	1077	12” x 12” Floor Tile - Yellow Oatmeal	ND	-	No
S31A	1077	Texture Coat Ceiling	ND	-	No
S31B	1077	Texture Coat Ceiling	ND	-	No
S31C	1077	Texture Coat Ceiling	ND	-	No
S32A	**1025**	**Texture Coat Ceiling**	**1.6**	**Chrysotile**	**Yes**
S32B	**1025**	**Texture Coat Ceiling**	**NA**	**-**	**Yes**
S32C	**1025**	**Texture Coat Ceiling**	**NA**	**-**	**Yes**
S33A	**1056**	**12” x 12” Floor Tile - Beige/Red and White Streak**	**0.5 (tile)**	**Chrysotile**	**Yes**
			ND (mastic)	**-**	No
			ND (caulk)	**-**	No
S33B	**1056**		**NA (tile)**	**-**	**Yes**
			ND (mastic)	-	No
S33C	**1056**		**NA (tile)**	**-**	**Yes**
			ND (mastic)	-	No
S34A	**1038**	**12” x 12” Floor Tile - Olive with White Streaks**	**1.2 (tile)**	**Chrysotile**	**Yes**
			ND (mastic)	-	No
S34B	**1038**		**NA (tile)**	**-**	**Yes**
			ND (mastic)	-	No
S34C	**1038**		**NA (tile)**	**-**	**Yes**
			ND (mastic)	-	No
S35A	1091	Texture Coat Ceiling	ND	-	No
S35B	1090	Texture Coat Ceiling	ND	-	No
S35C	1089	Texture Coat Ceiling	ND	-	No
2013					
34532-700-EDSS-S01A	1000	9” x 9” Floor Tile - White with Green Fleck	0.25 (tile)	Chrysotile	No
			ND (mastic)	-	No
34532-700-EDSS-S01B			0.25 (tile)	Chrysotile	No
			ND (mastic)	-	No
34532-700-EDSS-S01C			0.25 (tile)	Chrysotile	No
			ND (mastic)	-	No
34532-700-EDSS-S02A	**1000**	**9” x 9” Floor Tile - Green with White Fleck**	**1.2 (tile)**	**Chrysotile**	**Yes**
			ND (mastic)	**-**	No
34532-700-EDSS-S02B			**NA (tile)**	**-**	**Yes**
			ND (mastic)	**-**	No
34532-700-EDSS-S02C			**NA (tile)**	**-**	**Yes**
			ND (mastic)	-	No

TABLE 3: BULK ASBESTOS SAMPLING SUMMARY					
Sample #	**Location**	**Material Description**	**Asbestos Content (%)**	**Fibre Type**	**Is Material ACM**
34532-700-EDSS-S03A	1073	12" x 12" Floor Tile - Beige with White Fleck	ND (tile)	-	No
			ND (mastic)		No
34532-700-EDSS-S03B			ND (tile)	-	No
			ND (mastic)		No
34532-700-EDSS-S03C			ND (tile)	-	No
			ND (mastic)		No
34532-700-EDSS-S04A	**1072**	**12" x 12" Floor Tile - Beige with Black and White**	**1.2 (tile)**	**Chrysotile**	**Yes**
			ND (mastic)	-	No
34532-700-EDSS-S04B			**NA (tile)**	**-**	**Yes**
			ND (mastic)	-	No
34532-700-EDSS-S04C			**NA (tile)**	**-**	**Yes**
			ND (mastic)	-	No
34532-700-EDSS-S05A	**1074**	**9" x 9" Floor Tile - Beige with Blue Fleck**	**2.1 (tile)**	**Chrysotile**	**Yes**
			1.4 (mastic)		**Yes**
34532-700-EDSS-S05B			**NA (tile)**	**-**	**Yes**
			NA (mastic)		**Yes**
34532-700-EDSS-S05C			**NA (tile)**	**-**	**Yes**
			NA (mastic)		**Yes**
34532-700-EDSS-S06A	**1008**	**9" x 9" Floor Tile - Brown with Cream Fleck**	**1.2**	**Chrysotile**	**Yes**
34532-700-EDSS-S06B					**Yes**
34532-700-EDSS-S06C					**Yes**
34532-700-EDSS-S07A	**1006**	**9" x 9" Floor Tile - Beige with Brown Fleck**	**1.3 (tile)**	**Chrysotile**	**Yes**
			ND (mastic	-	No
34532-700-EDSS-S07B			**NA (tile)**	**-**	**Yes**
			ND (mastic)	**-**	No
34532-700-EDSS-S07C			**NA (tile)**	**-**	**Yes**
34532-700-EDSS-S08A	**1001**	**9" x 9" Floor Tile - Beige with Black and White Streak**	**1.1 (tile)**	**Chrysotile**	**Yes**
			ND (mastic)	-	No
34532-700-EDSS-S08B			**NA (tile)**	**-**	**Yes**
			ND (mastic)	**-**	No
34532-700-EDSS-S08C			**NA (tile)**	**-**	**Yes**
			ND (mastic)	**-**	No
34532-700-EDSS-S09A	**1025**	**12" x 12" Floor Tile - Beige with Brown Spots**	**1.3**	**Chrysotile**	**Yes**
34532-700-EDSS-S09B			**NA**	**-**	**Yes**
34532-700-EDSS-S09C			**NA**	**-**	**Yes**
34532-700-EDSS-S10A	**1071**	**12" x 12" Floor Tile - Beige with Black and White**	**1.5**	**Chrysotile**	**Yes**
34532-700-EDSS-S10B			**NA**	**-**	**Yes**
34532-700-EDSS-S10C			**NA**	**-**	**Yes**
34532-700-EDSS-S11A	**1075**	**9" x 9" Floor Tile - Blue with White and Green Streak**	**2.2**	**Chrysotile**	**Yes**
34532-700-EDSS-S11B			**NA**	**-**	**Yes**
34532-700-EDSS-S11C			**NA**	**-**	**Yes**
34532-700-EDSS-S12A	**1075**	**12" x 12" Floor Tile - Grey with White Fleck**	**1.4**	**Chrysotile**	**Yes**
34532-700-EDSS-S12B			**NA**	**-**	**Yes**
34532-700-EDSS-S12C			**NA**	**-**	**Yes**
34532-700-EDSS-S13A	**2032**	**9" x 9" Floor Tile - Beige with White and Brown Streak**	**1.1**	**Chrysotile**	**Yes**
34532-700-EDSS-S13B			**NA**	**-**	**Yes**
34532-700-EDSS-S13C			**NA**	**-**	**Yes**
February 2017 Asbestos Audit Update					
S01C	2006	Drywall Joint Compound (1938)	ND	-	No
S02B	2016	Plaster (1953)	ND	-	No
S02C			ND	-	No

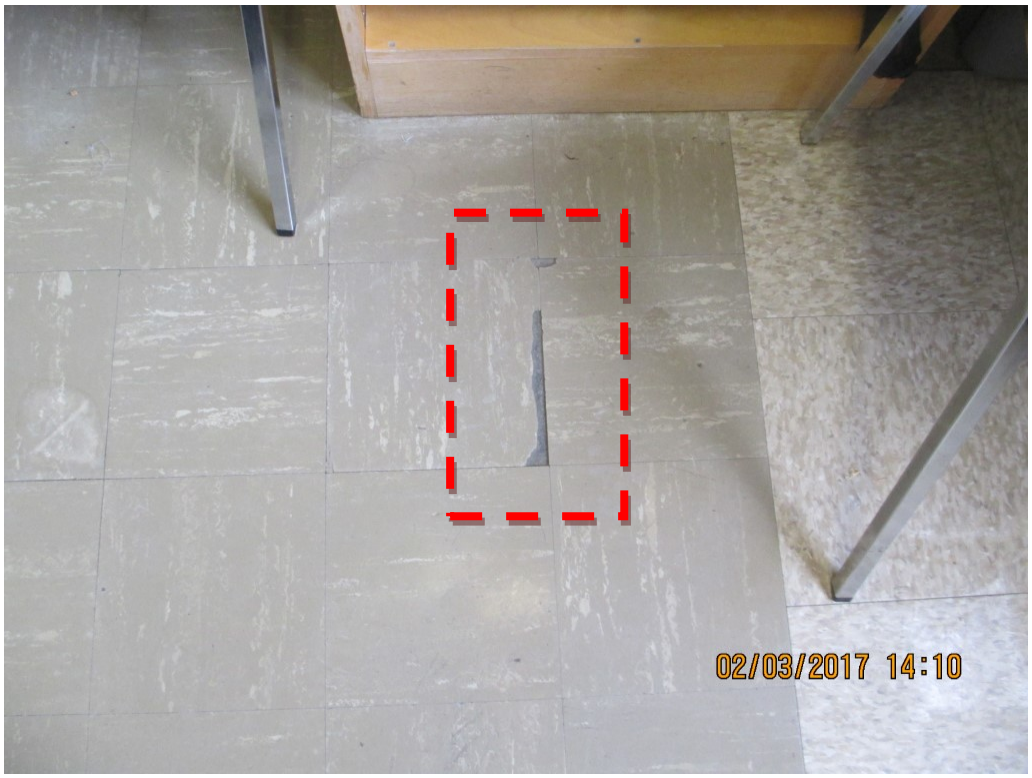
TABLE 3: BULK ASBESTOS SAMPLING SUMMARY					
Sample #	**Location**	**Material Description**	**Asbestos Content (%)**	**Fibre Type**	**Is Material ACM**
S03A	1043	Drywall Joint Compound (1962)	ND	-	No
S03B			ND	-	No
S03C			ND	-	No
S04A	1011	Plaster (1966)	ND	-	No
S04B			ND	-	No
S04C			ND	-	No
S05A	2050	Plaster (1964)	ND	-	No
S05B			ND	-	No
S05C			ND	-	No
S06A	**1021**	**9"x9" Vinyl Floor Tile - Brown with Brown Fleck**	**1.69 (tile)**	**Chrysotile**	**Yes**
			ND (mastic)	-	No
S06B			**NA (tile)**	**-**	**Yes**
			ND (mastic)	-	No
S06C			**NA (tile)**	**-**	**Yes**
S07A	**1083**	**9"x9" Vinyl Floor Tile - Tan, Brown, and Brown**	**5.25**	**Chrysotile**	**Yes**
S07B			**NA**	**-**	**Yes**
S07C			**NA**	**-**	**Yes**
S08A	**1084**	**9"x9" Vinyl Floor Tile - Brown, Black, Beige, Streaks**	**7.2 (tile)**	**Chrysotile**	**Yes**
S08B			**NA (tile)**	**-**	**Yes**
			ND (mastic)	-	No
S08C			**NA (tile)**	**-**	**Yes**
S09A	**Exterior**	**Hard Texture Coat**	**0.5**	**Chrysotile**	**Yes**
S09B			**NA**	**-**	**Yes**
S09C			**NA**	**-**	**Yes**
March 2017 Asbestos Audit Update					
S01A	**1001**	**2'x2' Ceiling Tile - Long Fissure Random Pinhole**	**5**	**Amosite**	**Yes**
S01B			**NA**		**Yes**
S01C			**NA**		**Yes**
S02A	**1002**	**2'x4' Ceiling Tile - Long Fissure Random Pinhole**	**5**	**Amosite**	**Yes**
S02B			**NA**		**Yes**
S02C			**NA**		**Yes**
S03A	**1008**	**9"x9" Vinyl Floor Tile - Cream with Brown Fleck**	**2.08**	**Chrysotile**	**Yes**
S03B			**NA**		**Yes**
S03C			**NA**		**Yes**
S04A	**1034**	**9"x9" Vinyl Floor Tile - Beige with Brown Streak**	**0.72**	**Chrysotile**	**Yes**
S04B			**NA**		**Yes**
S04C			**NA**		**Yes**
S05A	1038	12"x12" Vinyl Floor Tile - Olive with White Streak	ND		No
S05B			ND		No
S05C			ND		No
S06A	1120	Vinyl Sheet Flooring - Beige Square Pattern	ND		No
S06B			ND		No
S06C			ND		No
S07A	1022	9"x9" Vinyl Floor Tile - White with Grey Fleck	ND		No
S07B			ND		No
S07C			ND		No

TABLE 3: BULK ASBESTOS SAMPLING SUMMARY					
Sample #	**Location**	**Material Description**	**Asbestos Content (%)**	**Fibre Type**	**Is Material ACM**
S08A	2000	Tar Paper on Wall	ND		No
S08B			ND		No
S08C			ND		No

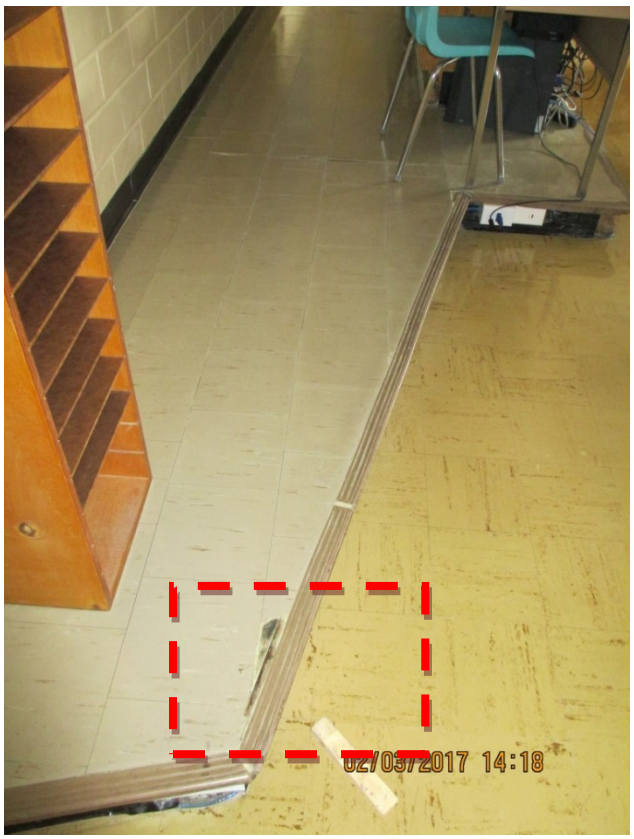
NA: Not Analyzed due to stop positive method **ND**: No asbestos fibres detected above the laboratory minimum detection limit

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

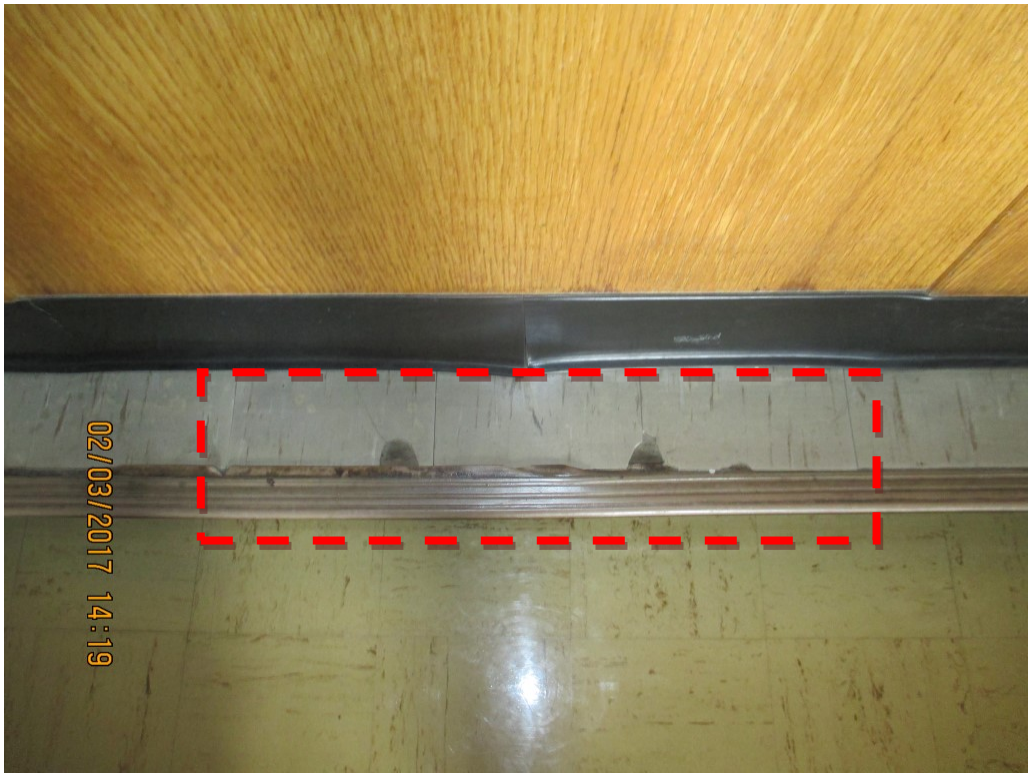
Photographic Log



Photograph No. 1 – MTE Room 3012

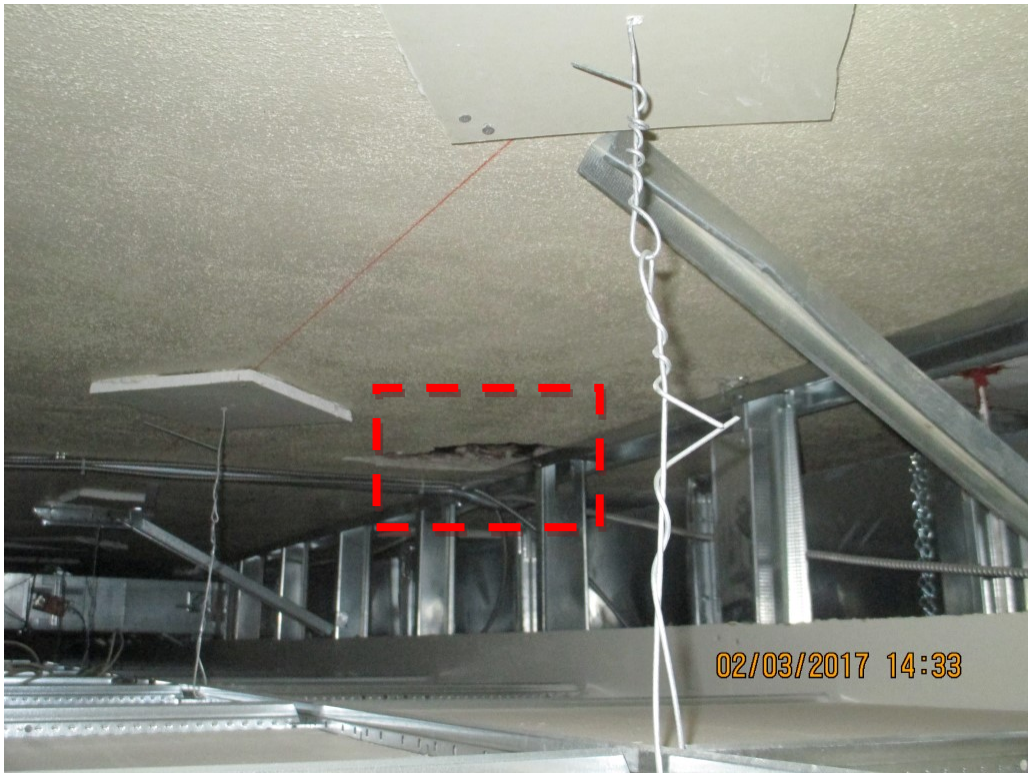


Photograph No. 2 – MTE Room 2032



Photograph No. 3 – MTE Room 2032

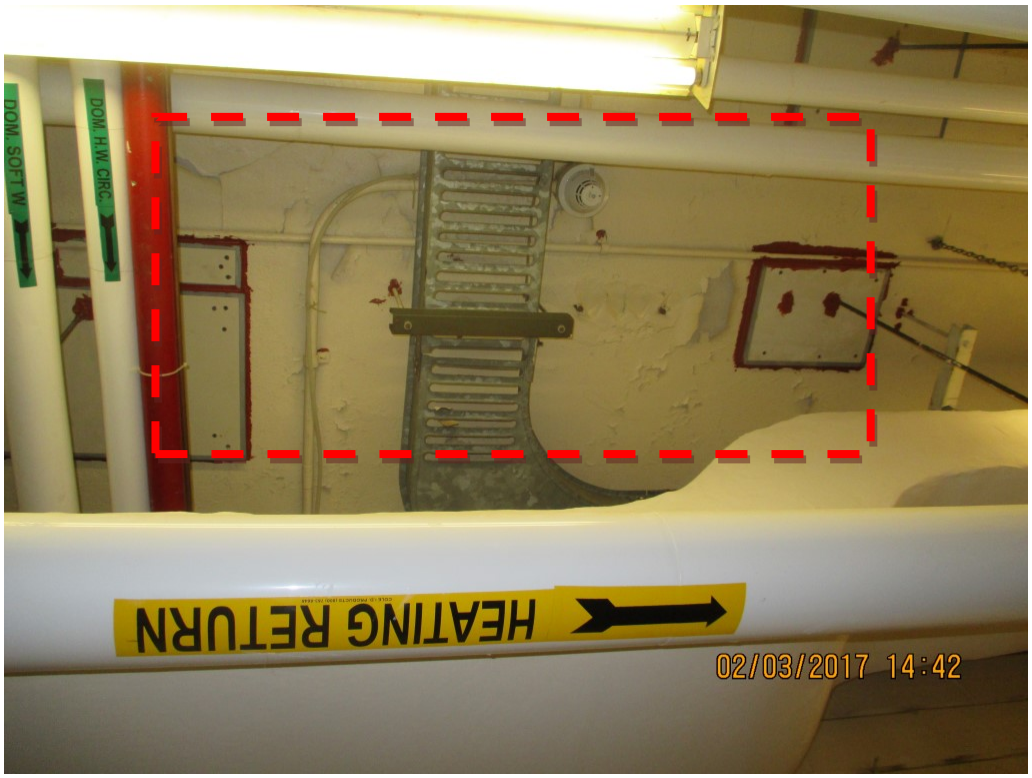
Photograph No. 4 – MTE Room 2032



Photograph No. 5 – MTE Room 1073

Photograph No. 6 – MTE Room 1109

Photograph No. 7 – MTE Room 1102

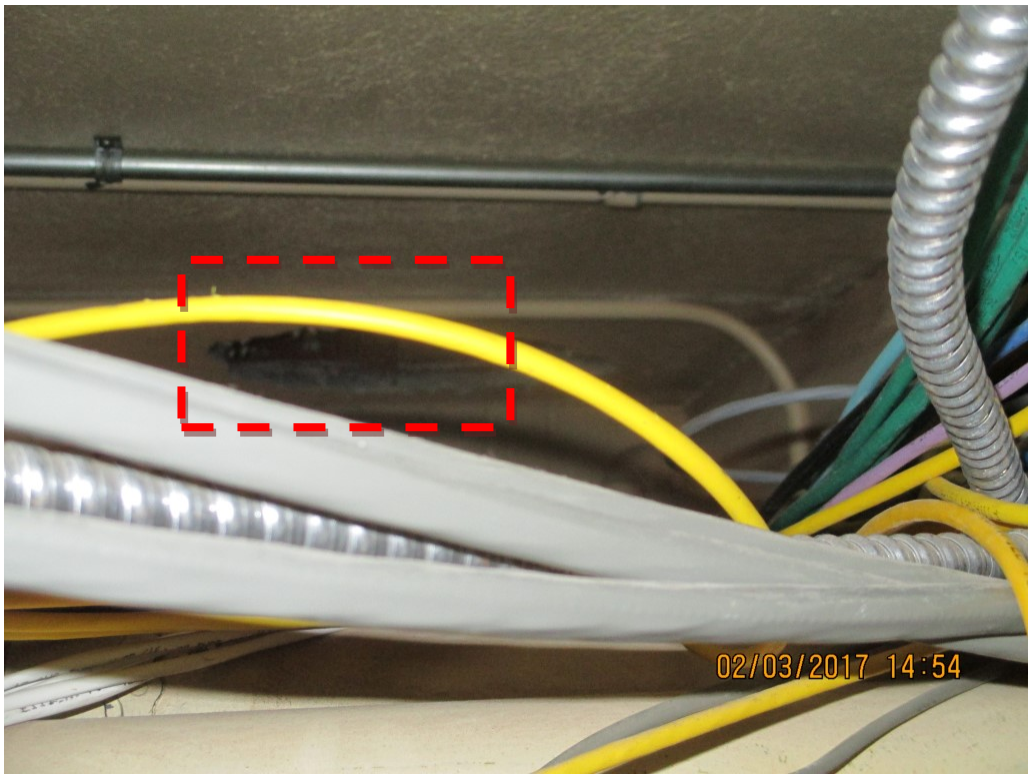


Photograph No. 8 – MTE Room 1102

Photograph No. 9 – MTE Room 1071

Photograph No. 10 – MTE Room 1071

Photograph No. 11 – MTE Room 1069



Photograph No. 12 – MTE Room 1067

Photograph No. 13 – MTE Room 1035

Photograph No. 14 – MTE Room 1115

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Certificate of Analysis

MTE Consultants Inc. (Kitchener)

520 Bingemans Centre Dr.
Kitchener, ON N2B 3X9
Attn: Steven Nieboer

Client PO:
Project: 34532-909 - EDSS AAU
Custody:

Report Date: 28-Feb-2017
Order Date: 22-Feb-2017

Order #: 1708088

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

Paracel ID	Client ID
1708088-01	S01C-2006
1708088-02	S02B-2016
1708088-03	S02C-2016
1708088-04	S03A-1043
1708088-05	S03B-1043
1708088-06	S03C-1043
1708088-07	S04A-1011
1708088-08	S04B-1011
1708088-09	S04C-1011
1708088-10	S05A-1050
1708088-11	S05B-1050
1708088-12	S05C-1050
1708088-13	S06A-1021 (Tile)
1708088-14	S06B-1021 (Tile)
1708088-15	S06C-1021 (Tile)
1708088-16	S06A-1021 (Mastic)
1708088-17	S06B-1021 (Mastic)
1708088-18	S06C-1021 (Mastic)
1708088-19	S07A-1083 (Tile)
1708088-20	S07B-1083 (Tile)
1708088-21	S07C-1083 (Tile)
1708088-22	S07A-1083 (Mastic)
1708088-23	S07B-1083 (Mastic)
1708088-24	S07C-1083 (Mastic)
1708088-25	S08A-1084 (Tile)
1708088-26	S08B-1084 (Tile)

Approved By:

Emma Diaz

Senior Analyst

Certificate of Analysis

Report Date: 28-Feb-2017

Client: MTE Consultants Inc. (Kitchener)

Order Date: 22-Feb-2017

Client PO:

Project Description: 34532-909 - EDSS AAU

1708088-27	S08C-1084 (Tile)
1708088-28	S08A-1084 (Mastic)
1708088-29	S08B-1084 (Mastic)
1708088-30	S08C-1084 (Mastic)
1708088-31	S09A-Ext
1708088-32	S09B-Ext
1708088-33	S09C-Ext

Certificate of Analysis

Client: MTE Consultants Inc. (Kitchener)

Client PO:

Report Date: 28-Feb-2017

Order Date: 22-Feb-2017

Project Description: 34532-909 - EDSS AAU

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

Paracel I.D.	*Sample Date*	*Layers Analyzed*	*Colour*	*Description*	*Asbestos Detected:*	*Material Identification*	*% Content*
1708088-01	18-Feb-17	sample homogenized	White	Drywall Joint Compound	No	Client ID: S01C-2006	
						Non-Fibers	100
1708088-02	18-Feb-17	sample homogenized	White/Grey	Plaster	No	Client ID: S02B-2016 [ASLYR]	
						Non-Fibers	100
1708088-03	18-Feb-17	sample homogenized	White/Grey	Plaster	No	Client ID: S02C-2016 [ASLYR]	
						Non-Fibers	100
1708088-04	18-Feb-17	sample homogenized	White	Drywall Joint Compound	No	Client ID: S03A-1043	
						Non-Fibers	100
1708088-05	18-Feb-17	sample homogenized	White	Drywall Joint Compound	No	Client ID: S03B-1043	
						Non-Fibers	100
1708088-06	18-Feb-17	sample homogenized	White	Drywall Joint Compound	No	Client ID: S03C-1043	
						Non-Fibers	100
1708088-07	18-Feb-17	sample homogenized	White/Grey	Plaster	No	Client ID: S04A-1011 [ASLYR]	
						Non-Fibers	100
1708088-08	18-Feb-17	sample homogenized	White/Grey	Plaster	No	Client ID: S04B-1011 [ASLYR]	
						Non-Fibers	100
1708088-09	18-Feb-17	sample homogenized	White/Grey	Plaster	No	Client ID: S04C-1011 [ASLYR]	
						Non-Fibers	100
1708088-10	18-Feb-17	sample homogenized	White/Grey	Plaster	No	Client ID: S05A-1050 [ASLYR]	
						Non-Fibers	100
1708088-11	18-Feb-17	sample homogenized	Grey	Plaster	No	Client ID: S05B-1050	
						Non-Fibers	100
1708088-12	18-Feb-17	sample homogenized	White/Grey	Plaster	No	Client ID: S05C-1050 [ASLYR]	
						Non-Fibers	100
1708088-13	18-Feb-17	sample homogenized	Beige	Floor Tile	Yes	Client ID: S06A-1021 (Tile) [AS-PRE]	
						Chrysotile	1.69
						Non-Fibers	98.31
1708088-14	18-Feb-17					Client ID: S06B-1021 (Tile)	
						not analyzed	
1708088-15	18-Feb-17					Client ID: S06C-1021 (Tile)	
						not analyzed	
1708088-16	18-Feb-17	sample homogenized	Black	Mastic	No	Client ID: S06A-1021 (Mastic) [AS-PRE]	
						Non-Fibers	100
1708088-17	18-Feb-17	sample homogenized	Black	Mastic	No	Client ID: S06B-1021 (Mastic) [AS-PRE]	
						Non-Fibers	100

Certificate of Analysis

Client: MTE Consultants Inc. (Kitchener)

Client PO:

Report Date: 28-Feb-2017

Order Date: 22-Feb-2017

Project Description: 34532-909 - EDSS AAU

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

Paracel I.D.	*Sample Date*	*Layers Analyzed*	*Colour*	*Description*	*Asbestos Detected:*	*Material Identification*	*% Content*
1708088-18	18-Feb-17					Client ID: S06C-1021 (Mastic) [Z-01a]	
						not analyzed	
1708088-19	18-Feb-17	sample homogenized	Beige	Floor Tile	**Yes**	Client ID: S07A-1083 (Tile) [AS-PRE]	
						Chrysotile	5.25
						Non-Fibers	94.75
1708088-20	18-Feb-17					Client ID: S07B-1083 (Tile)	
						not analyzed	
1708088-21	18-Feb-17					Client ID: S07C-1083 (Tile)	
						not analyzed	
1708088-22	18-Feb-17					Client ID: S07A-1083 (Mastic) [Z-01]	
						not analyzed	
1708088-23	18-Feb-17					Client ID: S07B-1083 (Mastic) [Z-01]	
						not analyzed	
1708088-24	18-Feb-17					Client ID: S07C-1083 (Mastic) [Z-01]	
						not analyzed	
1708088-25	18-Feb-17	sample homogenized	Brown	Floor Tile	**Yes**	Client ID: S08A-1084 (Tile) [AS-PRE]	
						Chrysotile	7.2
						Non-Fibers	92.8
1708088-26	18-Feb-17					Client ID: S08B-1084 (Tile)	
						not analyzed	
1708088-27	18-Feb-17					Client ID: S08C-1084 (Tile)	
						not analyzed	
1708088-28	18-Feb-17					Client ID: S08A-1084 (Mastic) [Z-01]	
						not analyzed	
1708088-29	18-Feb-17	sample homogenized	Black	Mastic	No	Client ID: S08B-1084 (Mastic) [AS-PRE]	
						Non-Fibers	100
1708088-30	18-Feb-17					Client ID: S08C-1084 (Mastic) [Z-01]	
						not analyzed	
1708088-31	18-Feb-17	sample homogenized	White	Texture Coat	**Yes**	Client ID: S09A-Ext [AS-PT]	
						Chrysotile	0.5
						Non-Fibers	99.5
1708088-32	18-Feb-17					Client ID: S09B-Ext	
						not analyzed	
1708088-33	18-Feb-17					Client ID: S09C-Ext	
						not analyzed	

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

Analysis Summary Table

Analysis	Method Reference/Description	Lab Location	NVLAP Lab Code *	Analysis Date
Asbestos, PLM Visual Estimation	by EPA 600/R-93/116	1 - Mississauga	200863-0	27-Feb-17

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

Qualifier Notes

Sample Qualifiers :

ASLYR: Layers were noted for this sample, however, the entire sample was homogenized per client request.

AS-PRE: Due to the difficult nature of the bulk sample (interfering fibers/binders), additional NOB preparation was required prior to analysis

AS-PT: Asbestos quantitation by PLM Point Count method.

Z-01: Insufficient Sample

Z-01a: No Sample

Work Order Revisions / Comments

None

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Chain of Custody
(Lab Use Only)

Page 1 of 1

Client Name: MTE Consultants Inc	Project Reference: 34532-909 - EDSS AAU
Contact Name: Steven Nieboer	Quote #:
Address: 520 Bingemans Centre Drive, Kitchener, ON, N2B3X9	PO #:
Telephone: 519-743-6500	Email Address: snieboer@mte85.com, adennett@mte85.com

Turnaround Time:
☐ Immediate ☐ 1 Day
☐ 4 Hour ☐ 2 Day
☐ 8 Hour ☐ 3 Day
☒ Regular

Date Required: _____

ASBESTOS & MOLD ANALYSIS

Matrix: ☐Air ☐Bulk ☐Tape Lift ☐Swab ☐Other **Regulatory Guideline:** _____

Required Analyses: ☐Microscopic Mold ☐Culturable Mold ☐Bacteria GRAM ☐PCM ☐PLM ☐Chatfield ☐TEM

Paracel Order Number: 1708088

	Sample ID	Sampling Date	Air Volume (L)	Analysis Required	Asbestos - Bulk: Matrix Description	Positive Stop? (Y/N)	Is the Sample Layered? (Y/N)	If layered, Describe Layer(s) to be Analyzed Separately* or Homogenize all **
1	S01C - 2006	18-Feb	-	PLM	DWJC - 1938	Y	N	
2	S02BC - 2016	18-Feb	-	PLM	Plaster - 1953	Y	N	
3	S03ABC - 1043	18-Feb	-	PLM	DWJC - 1962	Y	N	
4	S04ABC - 1011	18-Feb	-	PLM	Plaster - 1966	Y	N	
5	S05ABC - 1050	18-Feb	-	PLM	Plaster - 1964	Y	N	
6	S06ABC - 1021	18-Feb	-	PLM	9x9 VFT - Brown with Brown Fleck	Y	Y	Tile + Mastic
7	S07ABC - 1083	18-Feb	-	PLM	9x9 VFT - Tan, Brown, and Brown	Y	Y	Tile + Mastic
8	S08ABC - 1084	18-Feb	-	PLM	9x9 VFT - Brown, Black, Beige, Streaks	Y	Y	Tile + Mastic
9	S09ABC - Ext	18-Feb	-	PLM	Hard Texture Coat	Y	N	
10								
11								
12								
13								
14								
15								

*Each layer will be analyzed and charged separately **Homogenize = All layers are blended into a single uniform sample.

Comments:

Method of Delivery:

Relinquished By (Sign):	Received at Depot:	Received at Lab:	Verified By:
Relinquished By (Print): Steven Nieboer			
Date/Time: February 21, 2017	Date/Time:	Date/Time: Feb 22/17 8:30	Date/Time: Feb 22-17 9:40

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Certificate of Analysis

MTE Consultants Inc. (Kitchener)

520 Bingemans Centre Dr.
Kitchener, ON N2B 3X9
Attn: Steven Nieboer

Client PO:
Project: 34532-909 - EDSS
Custody:

Report Date: 16-Mar-2017
Order Date: 10-Mar-2017

Order #: 1710470

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

Paracel ID	Client ID
1710470-01	S01A-1001
1710470-02	S01B-1001
1710470-03	S01C-1001
1710470-04	S02A-1002
1710470-05	S02B-1002
1710470-06	S02C-1002
1710470-07	S03A-1008 (Tile)
1710470-08	S03B-1008 (Tile)
1710470-09	S03C-1008 (Tile)
1710470-10	S03A-1008 (Mastic)
1710470-11	S03B-1008 (Mastic)
1710470-12	S03C-1008 (Mastic)
1710470-13	S04A-1034 (Tile)
1710470-14	S04B-1034 (Tile)
1710470-15	S04C-1034 (Tile)
1710470-16	S04A-1034 (Mastic)
1710470-17	S04B-1034 (Mastic)
1710470-18	S04C-1034 (Mastic)
1710470-19	S05A -1038 (Tile)
1710470-20	S05B -1038 (Tile)
1710470-21	S05C -1038 (Tile)
1710470-22	S05A -1038 (Mastic)
1710470-23	S05B -1038 (Mastic)
1710470-24	S05C -1038 (Mastic)
1710470-25	S06A-1120 (Flooring)
1710470-26	S06B-1120 (Flooring)

Approved By:

Emma Diaz

Senior Analyst

1710470-27	S06C-1120 (Flooring)
1710470-28	S06A-1120 (Paper)
1710470-29	S06B-1120 (Paper)
1710470-30	S06C-1120 (Paper)
1710470-31	S07A-1022 (Tile)
1710470-32	S07B-1022 (Tile)
1710470-33	S07C-1022 (Tile)
1710470-34	S07A-1022 (Mastic)
1710470-35	S07B-1022 (Mastic)
1710470-36	S07C-1022 (Mastic)
1710470-37	S08A-2000
1710470-38	S08B-2000
1710470-39	S08C-2000

PARACEL LABORATORIES LTD.

Order #: 1710470

Certificate of Analysis

Report Date: 16-Mar-2017

Client: MTE Consultants Inc. (Kitchener)

Order Date: 10-Mar-2017

Client PO:

Project Description: 34532-909 - EDSS

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

Paracel I.D.	Sample Date	Layers Analyzed	Colour	Description	Asbestos Detected:	Material Identification	% Content
1710470-01	08-Mar-17	sample homogenized	Beige	Fireproofing	Yes	Client ID: S01A-1001	
						Amosite	5
						MMVF	15
						Non-Fibers	80
1710470-02	08-Mar-17					Client ID: S01B-1001	
						not analyzed	
1710470-03	08-Mar-17					Client ID: S01C-1001	
						not analyzed	
1710470-04	08-Mar-17	sample homogenized	Beige	Fireproofing	Yes	Client ID: S02A-1002	
						Amosite	5
						MMVF	15
						Non-Fibers	80
1710470-05	08-Mar-17					Client ID: S02B-1002	
						not analyzed	
1710470-06	08-Mar-17					Client ID: S02C-1002	
						not analyzed	
1710470-07	08-Mar-17	sample homogenized	Cream/Brown	Vinyl Floor Tile	Yes	Client ID: S03A-1008 (Tile)	[AS-PRE]
						Chrysotile	2.08
						Non-Fibers	97.92
1710470-08	08-Mar-17					Client ID: S03B-1008 (Tile)	
						not analyzed	
1710470-09	08-Mar-17					Client ID: S03C-1008 (Tile)	
						not analyzed	
1710470-10	08-Mar-17					Client ID: S03A-1008 (Mastic)	[Z-01a]
						not analyzed	
1710470-11	08-Mar-17					Client ID: S03B-1008 (Mastic)	[Z-01a]
						not analyzed	
1710470-12	08-Mar-17					Client ID: S03C-1008 (Mastic)	[Z-01a]
						not analyzed	
1710470-13	08-Mar-17	sample homogenized	Beige/Brown	Vinyl Baseboard	Yes	Client ID: S04A-1034 (Tile)	[AS-PRE]
						Chrysotile	0.72
						Non-Fibers	99.28
1710470-14	08-Mar-17					Client ID: S04B-1034 (Tile)	
						not analyzed	

Certificate of Analysis

Client: MTE Consultants Inc. (Kitchener)

Client PO:

Report Date: 16-Mar-2017

Order Date: 10-Mar-2017

Project Description: 34532-909 - EDSS

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

Paracel I.D.	*Sample Date*	*Layers Analyzed*	*Colour*	*Description*	*Asbestos Detected:*	*Material Identification*	*% Content*
1710470-15	08-Mar-17					**Client ID: S04C-1034 (Tile)**	
						not analyzed	
1710470-16	08-Mar-17					**Client ID: S04A-1034 (Mastic)** [Z-01a]	
						not analyzed	
1710470-17	08-Mar-17					**Client ID: S04B-1034 (Mastic)** [Z-01a]	
						not analyzed	
1710470-18	08-Mar-17					**Client ID: S04C-1034 (Mastic)** [Z-01a]	
						not analyzed	
1710470-19	08-Mar-17	sample homogenized	Olive/White	Vinyl Floor Tile	No	**Client ID: S05A -1038 (Tile)** [AS-PRE]	
						Non-Fibers	100
1710470-20	08-Mar-17	sample homogenized	Olive/White	Vinyl Floor Tile	No	**Client ID: S05B -1038 (Tile)** [AS-PRE]	
						Non-Fibers	100
1710470-21	08-Mar-17	sample homogenized	Olive/White	Vinyl Floor Tile	No	**Client ID: S05C -1038 (Tile)** [AS-PRE]	
						Non-Fibers	100
1710470-22	08-Mar-17					**Client ID: S05A -1038 (Mastic)** [Z-01a]	
						not analyzed	
1710470-23	08-Mar-17					**Client ID: S05B -1038 (Mastic)** [Z-01a]	
						not analyzed	
1710470-24	08-Mar-17					**Client ID: S05C -1038 (Mastic)** [Z-01a]	
						not analyzed	
1710470-25	08-Mar-17	sample homogenized	Beige/Grey	Vinyl Sheet Flooring/Paper	No	**Client ID: S06A-1120 (Flooring)** [AS-PRE, Z-01]	
						Cellulose	30
						Non-Fibers	0.7
						Other fibers	69.3
1710470-26	08-Mar-17	sample homogenized	Beige/Grey	Vinyl Sheet Flooring/Paper	No	**Client ID: S06B-1120 (Flooring)** [AS-PRE, Z-01]	
						Cellulose	30
						Non-Fibers	66.98
						Other fibers	3.02
1710470-27	08-Mar-17	sample homogenized	Beige/Grey	Vinyl Sheet Flooring/Paper	No	**Client ID: S06C-1120 (Flooring)** [AS-PRE, Z-01]	
						Cellulose	30
						Non-Fibers	67.16
						Other fibers	2.84
1710470-28	08-Mar-17					**Client ID: S06A-1120 (Paper)** [Z-01]	
						not analyzed	

Certificate of Analysis

Client: MTE Consultants Inc. (Kitchener)

Client PO:

Report Date: 16-Mar-2017

Order Date: 10-Mar-2017

Project Description: 34532-909 - EDSS

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

Paracel I.D.	*Sample Date*	*Layers Analyzed*	*Colour*	*Description*	*Asbestos Detected:*	*Material Identification*	*% Content*
1710470-29	08-Mar-17					**Client ID: S06B-1120 (Paper)** [Z-01]	
						not analyzed	
1710470-30	08-Mar-17					**Client ID: S06C-1120 (Paper)** [Z-01]	
						not analyzed	
1710470-31	08-Mar-17	sample homogenized	White/Grey	Vinyl Floor Tile	No	**Client ID: S07A-1022 (Tile)** [AS-PRE]	
						Non-Fibers	100
1710470-32	08-Mar-17	sample homogenized	White/Grey	Vinyl Floor Tile	No	**Client ID: S07B-1022 (Tile)** [AS-PRE]	
						Non-Fibers	100
1710470-33	08-Mar-17	sample homogenized	White/Grey	Vinyl Floor Tile	No	**Client ID: S07C-1022 (Tile)** [AS-PRE]	
						Non-Fibers	100
1710470-34	08-Mar-17					**Client ID: S07A-1022 (Mastic)** [Z-01a]	
						not analyzed	
1710470-35	08-Mar-17					**Client ID: S07B-1022 (Mastic)** [Z-01a]	
						not analyzed	
1710470-36	08-Mar-17					**Client ID: S07C-1022 (Mastic)** [Z-01a]	
						not analyzed	
1710470-37	08-Mar-17	sample homogenized	Black	Tar Paper	No	**Client ID: S08A-2000** [AS-PRE]	
						Cellulose	70
						MMVF	0.67
						Non-Fibers	29.33
1710470-38	08-Mar-17	sample homogenized	Black	Tar Paper	No	**Client ID: S08B-2000** [AS-PRE]	
						Cellulose	70
						MMVF	0.71
						Non-Fibers	29.29
1710470-39	08-Mar-17	sample homogenized	Black	Tar Paper	No	**Client ID: S08C-2000** [AS-PRE]	
						Cellulose	70
						MMVF	0.73
						Non-Fibers	29.27

** MMVF: Man Made Vitreous Fibers: Fiberglass, Mineral Wool, Rockwool, Glasswool*

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

Certificate of Analysis

Report Date: 16-Mar-2017

Client: MTE Consultants Inc. (Kitchener)

Order Date: 10-Mar-2017

Client PO:

Project Description: 34532-909 - EDSS

Analysis Summary Table

Analysis	Method Reference/Description	Lab Location	NVLAP Lab Code *	Analysis Date
Asbestos, PLM Visual Estimation	by EPA 600/R-93/116	1 - Mississauga	200863-0	10-Mar-17

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

Qualifier Notes

Sample Qualifiers :

AS-PRE: Due to the difficult nature of the bulk sample (interfering fibers/binders), additional NOB preparation was required prior to analysis

Z-01: Inseparable layers

Z-01a: Insufficient sample

Work Order Revisions / Comments

None

PARACEL LABORATORIES LTD.

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Head Office
300-2319 St. Laurent Blvd.
Ottawa, Ontario K1G 4J8
p: 1-800-749-1947
e: paracel@paracellabs.com

Chain of Custody
(Lab Use Only)

Client Name: MTE Consultants Inc	Project Reference: 34532-909 - EDSS
Contact Name: Steven Nieboer	Quote #:
Address: 520 Bingemans Centre Drive, Kitchener, ON, N2B3X9	PO #:
Telephone: 519-743-6500	Email Address: snieboer@mte85.com, adennett@mte85.com

Turnaround Time:
☐ Immediate ☐ 1 Day
☐ 4 Hour ☐ 2 Day
☐ 8 Hour ☐ 3 Day
☒ Regular
Date Required: _____

ASBESTOS & MOLD ANALYSIS

Matrix: ☐Air ☐Bulk ☐Tape Lift ☐Swab ☐Other **Regulatory Guideline:** _____

Required Analyses: ☐Microscopic Mold ☐Culturable Mold ☐Bacteria GRAM ☐PCM ☐PLM ☐Chatfield ☐TEM

Paracel Order Number: 1710470

	Sample ID	Sampling Date	Air Volume (L)	Analysis Required	Asbestos - Bulk: Matrix Description	Positive Stop? (Y/N)	Is the Sample Layered? (Y/N)	If layered, Describe Layer(s) to be Analyzed Separately* or Homogenize all **
1	S01ABC - 1001	8-Mar	-	PLM	2'x2' LFRPH	Y	N	-
2	S02ABC - 1002	8-Mar	-	PLM	2'x4' LFRPH	Y	N	-
3	S03ABC - 1008	8-Mar	-	PLM	9"x9" VFT - Cream with Brown Fleck	Y	Y	Tile + Mastic
4	S04ABC - 1034	8-Mar	-	PLM	9"x9" VFT - Beige with Brown Streak	Y	Y	Tile + Mastic
5	S05ABC - 1038	8-Mar	-	PLM	12"x12" VFT - Olive with White Streak	Y	Y	Tile + Mastic
6	S06ABC - 1120	8-Mar	-	PLM	VSF - Beige Square Pattern	Y	Y	Flooring + Paper
7	S07ABC - 1022	8-Mar	-	PLM	9"x9" VFT - White with Grey Fleck	Y	Y	Tile + Mastic
8	S08ABC - 2000	8-Mar	-	PLM	Tar Paper on Wall	Y	N	-
9								
10								
11								
12								
13								
14								
15								

*Each layer will be analyzed and charged separately **Homogenize = All layers are blended into a single uniform sample.

Comments:

Method of Delivery: Fier

Relinquished By (Sign): Steven Nieboer	Received at Depot:	Received at Lab:	Verified By:
Relinquished By (Print): Steven Nieboer			
Date/Time: March 9, 2017	Date/Time:	Date/Time: March 10/17 9:00	Date/Time: March 10/17 12:00

POST TENDER CLOSING REQUIREMENTS

The Board will solicit additional information after the closing of the bids from the lowest compliant bidder to support bid evaluation. The evaluation of the bids submitted and the decision to award the contract will be made by the Board on the basis of fulfilling the post tender closing requirements listed below:

- ❒ Available to meet with the Board at the Board Education Center within the following time period of being notified: **Two (2) days.**
- ❒ The Proponent is to attend the meeting with their key personnel.
- ❒ The Proponent is to present one copy of a C.V. for their key personnel outlining their roles and responsibilities and a brief line card describing the company.
- ❒ The Proponent is to provide a project schedule in a GANNT type of format, non handwritten, identifying milestone dates.
- ❒ The Proponent is to provide a listing of similar porjects.
- ❒ The Proponent is to engage in a dialogue with the Board and answer questions related to the project and schedule.

The proponent is to provide the information in written format, not verbal

A Proponent that is unable to fulfill the post bid closing requirements listed will no longer be viewed as the lowest compliant bidder and will not be awarded the contract.

END OF SECTION

TERMS AND CONDITIONS

1.0 PROVISIONS

1.1 Proceedings against the Board

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

1.2 Standard of Behavior

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

1.3 Federal, Provincial, Regional, Municipal Laws

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

1.3.1 No Smoking and Scent Free

The Board has designated all the Board properties to be "smoke free" and most Board properties are “scent free”. Smoking will not be permitted on-site. Offenders will be asked to leave the site, and infractions could result in corrective action.

1.4 Paramountcy Clause

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

1.5 Freedom of Information

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

1.6 Criminal Background Checks and Collection of Personal Information

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

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

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

Termination of contracts and indemnification by the Awarded Bidder will result from non-compliance.

1.7 Accessibility

Proponents shall comply with the provisions of the Accessibility for Ontarians with Disabilities Act, 2005, and the Regulations there under with regard to the provision of its goods or service to persons with disabilities. Proponents acknowledge that pursuant to the Accessibility for Ontarians with Disabilities Act, 2005, the Board must, in deciding to purchase goods or service through its procurement process, consider the accessibility for persons with disabilities to such goods or service.

2.0 COMMUNICATION

2.1 Verbal Communication

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

2.2 Addenda

It is the responsibility of the Bidder to have received all Addenda that are issued. Bidders should check online at https://wrdsb.bidsandtenders.ca prior to submitting their Bid and up until Bid closing time and date in the event additional addenda are issued.

If a Bidder submits their bid prior to the Bid closing time and date and an addenda is issued, the Bidding System shall withdraw the Bid submission and the bid status will change to an **INCOMPLETE STATUS** and withdraw the Bid. The Bidder can view this status change in the "**MY BIDS**" section of the Bidding System. The Bidder is solely responsible to:

i) make any required adjustments to their Bid;
ii) acknowledge the addenda; and
iii) Ensure the re-submitted Bid is **RECEIVED** by the Bidding System no later than the stated bid closing time and date.

2.3 Request for Clarification

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

3.0 SPECIFICATION

Bid only on new materials in perfect condition. Demonstrators, seconds or defective materials are unacceptable. Any materials found not to be in a new condition or as specified will be returned to the Awarded Bidder at the Awarded Bidder's expense.

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

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

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

4.0 BID PREPARATION

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

4.1 Online Submission Forms

All forms are submitted online through the bidding system.

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

4.2 Bid Price

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

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

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

Bid prices must be in Canadian Funds.

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

4.3 Bonding Requirements

4.3.1 Bid Amount

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

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

4.3.2 Bid Bond and Agreement to Bond

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

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

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

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

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

4.3.3 Performance Securities

For bid amounts where bonding is required, inclusive of all taxes, upon award the successful Bidder shall provide a digital Bid Performance and Labour and Materials Bond in an electronically verifiable and enforceable (e-Bond) format in the amount(s) of not less than 50% Performance Bond and a 50% Labour and Materials Bond of the total Contract Value made payable to the Waterloo Region District School Board (the 'Board") as surety that, if the Bid is accepted, a Contract will be entered into for the proper performance of the work. For more information, contact your surety company or visit the Surety Association of Canada website: https://www.surety-canada.com/en/ebonding/index.html

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

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

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

The Awarded Bidder must email the bonds to procurement@wrdsb.ca, referencing "Bonding for tender # "in the subject line seven (7) working days of receiving a purchase order.

4.4 INSURANCE

4.4.1 Proof of WSIB Coverage (Onsite work only)

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

4.4.2 Insurance (Onsite Construction work only)

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

4.4.3 General & Vehicle

General and vehicle liability insurance covering incidents of property damage or bodily injury (including death) for owned and non-owned vehicle accidents occurring during the work in this Tender, or actions of the employees of the Awarded Bidder while acting within the scope of their duties as required in this Tender shall be maintained. Verification of current "Good Standing" may be requested.

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

5.0 BID SUBMISSION

ELECTRONIC BID SUBMISSIONS ONLY, shall be received by the Bidding System.

Bidders are cautioned that the timing of their Bid Submission is based on when the Bid is received by the Bidding System, not when a Bid is submitted by a Bidder, as Bid transmission can be delayed due to file transfer size, transmission speed, etc.

For the above reasons, it is recommended the Bidders allow sufficient time to upload their Bid Submission and attachment(s) (if applicable) and to resolve any issues that may arise. The closing time and date shall be determined by the Bidding System's web clock.

Bidders should contact bids & tenders support listed below, at least twenty-four (24) hours prior to the closing time and date, if they encounter any problems. The Bidding System will send a confirmation email to the Bidder advising that their bid was submitted successfully. If you do not receive a confirmation email, contact bids & tenders support at support@bidsandtenders.ca.

Late Bids are not permitted by the Bidding System.

To ensure receipt of the latest information and updates via email regarding this bid, or if a Bidder has obtained this Bid Document from a third party, the onus is on the Bidder to create a Bidding System Vendor account and register as a Plan Taker for the bid opportunity.

6.0 BID WITHDRAWAL

Bidders may edit or withdraw their Bid Submission prior to the closing time and date. However, the Bidder is solely responsible to ensure the re-submitted bid is received by the Bidding System no later than the stated closing time and date. Following closing, no bid may be withdrawn

7.0 BID EVALUATION

Preference will be given to the lowest compliant bid.

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

In the event of tie compliant bids, an award will be made to the Proponent with the earliest date time stamp.

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

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

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

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

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

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

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

8.0 BID RESULTS NOTIFICATION

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

9.0 AWARD NOTIFICATION

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

Construction Projects

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

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

10.0 POST AWARD

10.1 Bonding (Construction)

The Awarded Bidder is solely responsible for forwarding the Bonding documents, original documents not a copy, to Procurement Services at the Board Education Centre. Payments to the Awarded Bidder will not be processed without bonding being submitted. Failure to submit bonding

to Procurement Services within seven (7) working days may result in the cancellation of the contract.

10.2 Purchase Order

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

10.3 Changes

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

11.0 SUBCONTRACTING

11.1 Subcontracting

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

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

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

11.2 Assignment

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

12.0 FORCE MAJEURE

If as a result of an event of Force Majeure, a party fails to perform or comply with any of its obligations under this Agreement, such failure shall not constitute a default or breach of the Agreement. Dates and times by which a party is required to render performance under the Agreement shall be postponed automatically to the extent and for the period of time that such party is prevented from meeting them by causes beyond its control, which are not avoidable, by the exercise of reasonable foresight. Such causes (each such cause, an event of “Force Majeure”) shall include but not limited to: Acts of God, Acts of War, Riots, Epidemics, Fire, Strikes, Labour Disruptions or “Lock Outs”.

13.0 TERMINATION

13.1 Sufficient Cause

The Board reserves the right to terminate any contract Tender purchase order resulting from this Tender call for sufficient cause, such as: non-performance, late deliveries, inferior quality, pricing problems, customer service, etc. Should such action be necessary, the Board would provide written notice to the Awarded Bidder.

13.2 Funding Out

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

14.0 RESULT DISPUTE PROCESS

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

(a) The Proponent is to file in writing their protest with the Manager of Procurement & Risk Services by certified mail, within 15 business days of the Debriefing. The Protest Notice shall include:

(i) The name and address of the Proponent.

(ii) Identification of the RFX.

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

(iv) Supporting documentation.

(v) Desired relief, action ruling.

(b) The Manager of Procurement & Risk Services will respond to the Proponent, by certified mail, within 20 business days of receiving the written notice.

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

15.0 RIGHTS OF THE BOARD

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

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

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

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

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

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

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

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

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

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

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

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

(xii) cancel this TENDER process at any stage;

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

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

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

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

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

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

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

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

14.1 Volume and Exclusivity

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

END OF SECTION

1.0 GENERAL REQUIREMENTS – SECTION 01001

1.1 CONTRACT BID DOCUMENTS

1.1.1 Examination

Immediately notify the Board contact upon finding design errors, inconsistencies or omissions in the Bid Documents and site examination. The Board contact and Consultants will not accept claims for extras from the Contractor, based on his failure to detect and report same found in the Bid Documents, and site examination before Tender closing.

1.2 PROJECT CO-ORDINATION

1.2.1 Site Examination

1. The Contractor is expected to be totally familiar with site conditions and shall assume full responsibility for the cost involved in repairing any damage to the building, site and it's services, city property, adjacent buildings, etc., during general construction, regardless of the extent of the damage.
2. The Contractor expressly agrees that conditions above existing suspended acoustic tile ceilings but below the level of gypsum board at the underside of the structure shall be considered **exposed conditions** for the purposes of making findings under the provisions of this Contract. There shall be no claims for extra costs for extra Work in these areas.
3. The Contractor shall provide all equipment necessary to make a full and detailed site evaluation. This shall include but not be limited to ladders, flashlights and hand tools.

1.2.2 Site Supervisor and Project Manager

1. The Contractor shall provide if requested, in writing, the name of the Project Manager and Site Supervisor and proof of experience and competence in similar projects.
2. The Project Manager, and/or Site Supervisor shall be replaceable within 24 hour of receipt of such request.

1.2.3 Control of the Work

1. The Contractor shall have total control of the Work and shall effectively direct and supervise the Work so as to ensure conformity with the Contract Documents and within the Contract Time.
2. The Contractor shall be solely responsible for the construction means, methods, sequences, and procedures and for coordinating parts of the Work under the contract.
3. Co-ordinate progress of the Work, progress schedules, submittals, use of site, temporary utilities, construction facilities, safety regulations and fire protection, as per authorities having jurisdiction codes.
4. The Board contact in consultation with the Consultant has the authority to stop the Work whenever it is deemed necessary to protect the interests of the Board.
5. **The Board will obtain & pay for all building permits, but the Contractor is responsible for all other permits, including electrical inspection and fire alarm verification.**

1.2.4 Asbestos and Other Designated Substances

1. An Asbestos Audit, prepared by MTE Consultants Inc. for each facility is available at the school's main office, for review by the Contractor. A duplicate set is also available in the Facility Services department located in the Education Centre. Unless otherwise covered by Cash Allowance or Contingency Allowance, Include in this contract the required removal of all asbestos containing material to complete the Work. No claims for extra cost will be accepted for areas known to contain asbestos containing materials.

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

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

1.2.5 Qualified Fire Alarm Installers

1. Any Modifications to Fire Alarm system and it's devices including service, additions and changes in device location must be performed only by a Certified Fire Alarm Technician as per the Ontario Fire Code section 1.1, subsection 1.1.5.

1.2.6 Hot Work

1. Take all precautions to Work safely and to provide the necessary protection to persons and property from Hot Work. This includes, but is not limited to Brazing, Cutting, Grinding, Soldering, Thawing Pipe, Torch Applied Roofing and Welding. With all such activity these steps are to be followed:

    A. Whenever possible, complete Hot Work in a welding shop or out of doors at the school.

    B. Flammable liquids, dust lint and oily deposits to be removed from within 50-ft (15m) of Work. Remove other combustibles where possible. Otherwise protect with fire-resistive tarpaulins or metal shields.

    C. Explosive atmosphere in area eliminated. Floors swept clean. Combustible floors wet down, covered with damp sand or fire-resistive tarpaulins.

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

    E. For Work on walls or ceilings, remove combustibles away on other side.

2. For on-site Work (indoor, out of doors), advise the Head Custodian and Principal prior to Work being performed, and of related dangers.

3. In the event of a fire as a result of the Hot Work, notify the fire department and the head custodian immediately, whether extinguished or not.

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

5. Have all necessary doors, windows and/or drapes closed. Request of the head custodian to shut down all fan systems in the area to reduce or eliminate smoke distribution.

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

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

1.2.7 After Hours Work

1. Schedule Work with school staff through the Board's contact so as to limit disruption to school operations. Include for any overtime, to ensure orderly and continuous progression of Work and operation of school.
2. Direct calls from Contractors to Board staff to adjust alarms and to arrange for access will not be accepted. All correspondence must be through the Project Manager.
3. Arrange 48 hours in advance with Board to obtain an access card and adjust security alarms for overtime Work.
4. Bidders are cautioned that the Board will impose a penalty for false alarms. A $100.00 penalty for each false alarm may be levied for false fire alarm activation or security alarm activation.
5. Contractors are responsible for ensuring doors and windows are secured prior to leaving school.

1.3 CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

1.3.1 Safety Barriers

1. Erect and maintain for the duration of the Work, safety devices and barricades including boarding, as required, to protect the staff, students, public and private property, from injury and damage. The Contractor is to ensure that all requirements from authorities having jurisdiction are met.
2. The Contractor is to assume full responsibility for any damage caused due to his failure to comply with paragraph 1 above.
3. Hazardous conditions on the exterior shall be fenced. The recommended safety barricade: Insta-fence Inc. or approved equal is Board standard.

1.3.2 Lockout Procedures

1. All Work to be done on electrical systems or machinery, where the unexpected switching on of the system or machinery could result in personal injury to a student, staff, employee, or the Contractor’s employee, must be done in accordance with the Contractor’s standard lockout procedure.
2. The Contractor shall provide his/her own locks for the above procedure.

1.3.3 Warning Signs and Notices

1. Wherever the Contractor’s Work may expose a student, staff, or public to danger the Contractor shall notify the supervisor and post notices advising of the hazard.

1.3.4 Dust-tight Screens

1. Provide dust-tight screens or partitions to localize dust generating activities, and for the protection of Workers, finished areas or Work and public.
2. Maintain and relocate protection until such Work is completed.

1.3.5 Sanitary Facilities

1. The use of existing staff sanitary facilities for Workers is permitted. The use of student facilities is not permitted.
2. Maintain in clean condition.

1.3.6 Project Cleanliness

1. Maintain the Work in a tidy condition, free from the accumulation of waste products and debris disposed of in appropriate waste containers as the Work progresses.
2. Waste containers (roll off style or front-end load style) must be supplied by the Contractor and located as directed by Board contact.
3. Clean interior areas prior to start of finish Work, and maintain areas free of dust and other contaminants during finishing operations.

1.3.7 Roof and Structure Protection

1. Ensure no part of Work or existing structures are subjected to a load, which will endanger its safety or will cause permanent deformation.
2. The Contractor when indicated by the Board Contact or Consultant shall provide roof protection. Ensure all precautions are taken to avoid liability for roof damage.
3. Typical roof protection shall consist of a layer of 1inch rigid foam insulation set directly on the roof surface and a layer of 19 mm (3/4 inch) plywood in all places under scaffold legs, ladder legs and in areas of foot traffic or falling debris.

1.3.8 Overhead Lifting

1. Any condition requiring the use of a crane or lifting device over a Board structure must be scheduled and coordinated through the Project Manager.

1.4 INSPECTIONS

1.4.1 Reviews and Inspection

1. The Board reserves the right to perform safety inspections at any time, and will report all safety deficiencies to the Contractor.
2. All safety deficiencies shall be corrected immediately. Failure to do so could result in loss of future business.
3. The Contractor shall report all accidents to the Board’s contact immediately.
4. The Board’s contact and the Consultant shall have access to the Work. If parts of the Work are in preparation at locations other than the place of Work, access shall be given to such Work whenever it is in progress.
5. Give timely notice requesting review if Work is designated for special tests, reviews by Consultants, inspections by inspectors, or review by authorities having jurisdiction.
6. If the Contractor covers or permits to be covered Work that has been designated for special tests, reviews, inspections, or approvals before such is made, uncover such Work, have the inspections or tests satisfactorily completed and make good such Work at no cost to the Board.
7. The Board’s contact or the Consultant may order any part of the Work to be examined if such Work is suspected to be not in accordance with the contract Documents.
8. The Consultant’s general review of the Work is for the purposes of informing the Board and Board’s contact of the general progress and quality of the Work. It does not relieve the Contractor of his full responsibility for inspection and examination of the Work in whole or in part to ensure compliance with the contract Documents.
9. The Contractor shall bring to the Consultant’s attention any part of the Work which does not conform to the requirements of the contract Documents and provides such remedial measures, products and labour required to correct such parts of the Work in order that they meet the requirements of the contract Documents with no cost to the Board or Consultant.

10. The Contractor acknowledges that inspection and supervision form an integral part of the Work. Failure to fully provide such Work constitutes a reduction in the value of the contract, which will result in a commensurate decrease in the contract price through change to the Work, should the Consultant find that such a decrease is warranted.

1.4.2 Independent Inspection Agencies

1. The Board for the purpose of inspecting and/or testing portions of the Work may engage Independent inspection/testing agencies.
2. The Board, under cash allowances shall pay costs of such inspections engaged by the Board, or directly to the inspection agency, and as outlined herein.
3. Provide equipment required for executing inspection and testing by the appointed agencies.
4. The Contractor must comply with current Federal, Provincial Codes, Acts and Regulations, and local By-laws including those listed in other parts of the Contract Documents.
5. Employment of inspection/testing agencies does not relax the Contractor's responsibility to perform Work in accordance with the contract Documents, and to supervise and inspect the progress of the Work to ensure performance of the Work in accordance with the contract Documents.
6. If defects are revealed during inspection and/or testing, the appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defects and irregularities as advised by Consultant at no cost to the Board. Pay costs for all re-testing and/or re-inspection.

1.4.3 Rejected Work

1. Remove defective Work, whether the result of poor Workmanship, use of defective products, or damage, and whether incorporated in the Work or not, which has been rejected by the Board’s contact or the Consultant as failing to conform to the contract Documents. Replace or re-execute in accordance with the contract’s Documents.
2. Make good other Contractor's Work and/or existing conditions affected by the Work damaged by such removals or replacements promptly.
3. If, in the opinion of the Consultant, it is not expedient to correct defective Work or Work not performed in accordance with the contract Documents, the Board may deduct this amount from the contract price. This shall be the difference in value between the Work performed and that called for by the contract Documents, the amount of which shall be found by the Board’s contact or the Consultant.

1.5 MATERIAL AND EQUIPMENT

1.5.1 Product and Material Quality

1. Products, materials, equipment and articles referred to as "Products" throughout the specifications incorporated in the Work, shall be new, not damaged or defective, and of the best quality, compatible with specifications for the purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
2. Defective products will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is a precaution against oversight or error. Remove and replace defective products at own expense, and be responsible for delays and expenses caused by rejections.
3. Should any dispute arise as to the quality or fitness of products, the decision rests strictly with the Board contact, based upon requirements of the Contract Documents.

4. Current Material Safety Data Sheets shall be on file with the successful Contractor and shall be provided to the Board contact upon request, within twenty-four (24) hours.
5. Material safety data sheets are not required for products currently W.H.M.I.S. exempt.

1.5.2 Equipment/Tool Materials Storage, Handling and Protection

1. Handle and store products in a manner to prevent damage, adulterations, deterioration, and soiling, and in accordance with manufacturer's instructions.
2. Store packaged or bundled products in original and undamaged condition, with manufacturer's seals and labels intact.
3. Store products subject to damage from weather in weatherproof enclosures.
4. Provide and maintain tools, equipment and materials in a clean and orderly condition. Board tools, ladders, lifts, power cords, flashlights etc. are not to be used.
5. Materials are to be stored in a manner to cause the least interference with Work activities.
6. The Contractor shall determine with the Board contact, prior to ordering materials, those locations that are suitable for receiving and storage of materials and equipment.
7. All materials and equipment shall be kept in a secure area, at Contractor’s expense, or removed from the job site when Work is not actually in progress.
8. Vehicles, trailers or other similar apparatus may not be stored or parked overnight at site without written authorization from Board contact. Written requests are to be forwarded directly to the Board contact.
9. Approval for parking does not imply any liability or responsibility for safe keeping by the Board.
10. The Contractor may use the existing electrical and water services, as required, for the Work, and the costs of these services shall be borne by the Board.

1.5.3 Workmanship

1. Workmanship shall be the best quality, executed by Workers experienced and skilled in the respective duties for which they are employed. Immediately notify the Consultant if required Work is such as to make it impractical to produce required results.
2. Do not employ any unfit persons or anyone unskilled in their required duties.
3. Decisions as to the quality or fitness of Workmanship in cases of dispute rest solely with the Board contact, whose decision is final.
4. All Contractor personnel are restricted to the job site and necessary access routes. No personnel shall visit other areas or buildings without specific authorization.
5. The Contractor shall make their own arrangements for emergency treatment of accidents. Any accidents shall be reported immediately to the Board contact.
6. The Contractor agrees to hold the Board harmless of any and all liability of every nature and description, which may be suffered through bodily injuries, involving deaths of any persons, by reasons of negligence of the Contractor, his agents, employees, or his sub-Contractors.
7. The Contractor shall supply constant on-site supervision in the form of a Project Superintendent. The Project Superintendent shall have within their authority to negotiate minor changes regarding scheduling, manpower and equipment.

1.5.4 Manufacturer's Instructions

1. Unless otherwise indicated in the specifications, install, apply 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.

1.5.5 Tools of the Trade

1. The Board will not pay the Awarded Bidder a fee for tools and equipment that are considered “tools of the trade” that are required to perform the work in this Tender or any change orders.

1.6 CHANGES IN THE WORK

1.6.1 Notification of Changes and Mark-ups

1. The Contractor shall inform the Insurance and Surety Company or Companies who have issued Performance Bonds, Labour and Materials Payment Bonds, Liability Insurance and Fire Insurance for this Contract, of any changes to the Contract in accordance with the Contract Documents. If any changes to the Contract require adjustments of the bonds or insurances the Contractor shall initiate and pay for such adjustments subject to the approval of the Board.
2. Allowable mark-ups on changes to the Work will be subject to the following schedule:

- Contractor on Work of their own forces, 5% overhead, 5% profit
- Sub-Contractor on Work of their own forces, 5% overhead, 5% profit plus
- Contractor on Work of sub-Contractor, 5% overhead only

The above includes all site and office-related overhead costs.

3. On credits, the amount shall be the net cost, without deduction for overhead or profit.
4. Once the Consultant has issued a proposed change order, it shall be the responsibility of the Contractor to ensure that no Work is carried out that may increase the cost of the variation contemplated without prior notice and agreement with project manager.
5. The Board’s contact and Consultant will assess the cost of each change before issuing a change order. To assist the Board contact and Consultant in the task of assessing the Tenders on variations, full details of the following may be required:

- Quantity of each material
- Unit cost of each material
- Man-hours involved
- Cost per hour
- Copies of sub-Contractor quotations
- Approved mark-ups

6. The Board’s contact and Consultant may require further quotations in order to review a breakdown of the costs.
7. Unless stated to the contrary, Work shall not be carried out with respect to all proposed changes, nor shall the Board incur any costs until a Change Order is issued.

1.6.2 Extra Claims

1. No claim can be made by the Contractor (and sub-Contractors) for a price increase to cover the additional cost of shut-down, delay and start-up, if it's Work is stopped due to the discovery of hazardous materials or substances, and/or external forces that are beyond the direct control and influence of the Board. E.g.: Hydro shutdown

1.7 PAYMENTS

1.7.1 Progress Payments

1. Applications for payment on account may be made monthly, as the Work progresses.
2. Applications for payment shall be dated the last day of the agreed monthly payment period and the amount claimed shall be for the value, proportionate to the amount of the contract, of Work performed and products delivered to the place of Work at that time.
3. No claim for payment, in whole or in part, will be accepted for material stored off site.
4. The Contractor shall include a statement based on the schedule of values with each application for payment.
5. The Contractor shall include a summary of changes with their draw or application for payment.
6. Such evidence shall support claims for products delivered to the place of Work, but not yet incorporated into the Work, as the Consultant may reasonably require establishing the value and delivery of the products.

1.7.2 Final Payment

1. When the Contractor considers that the Work is completed, the Contractor shall submit an application for final payment.
2. When the Consultant finds the Contractor's application for final payment valid, the Consultant will issue a final certificate of payment.
3. The Board reserves the rights to withhold all or part of the final payment until school access card(s) have been returned. In the event that the access card(s) cannot be returned, the cost of programming will be deducted from the final payment plus 18% for overhead.
4. The cost to reprogram the card(s) access system is estimated at $100.00 (one hundred dollars) for each card issued.

1.7.3 Payment of Holdback upon Substantial Performance of the Work or Deemed Completion

1. The Contractor shall submit an application for payment of the holdback amount.
2. Submit a sworn statement that all accounts for labour, subcontracts, products, construction machinery and equipment, and other indebtedness, which may have been incurred by the Contractor in the substantial performance of the Work and for which the Board might in any way be held responsible, have been paid in full, except for amounts properly retained as a holdback or as an identified amount in dispute.
3. After the receipt of an application for payment from the Contractor and the sworn statement as provided in paragraph 2 above, the Board will issue a certificate for payment of the holdback amount.

1.8 PROJECT CLOSE-OUT

1.8.1 Inspection/Takeover Procedures

1. The Contractor shall supply, upon completion of the job, two copies of written manufacturer's warranties for any applicable items such as but not limited to, doors, windows, etc. Photocopies are acceptable.
2. The Contractor shall carefully inspect the Work and ensure it is complete, that the major and minor construction deficiencies are complete, defects are corrected, and the building is clean and in condition for occupancy. Notify the Board’s contact and Consultant in writing of satisfactory completion of the Work and request an inspection.

3. During the Board contact's site review, a list of deficiencies and defects will be tabulated. Correct Work noted.
4. When the Board contact considers that deficiencies and defects have been corrected, and requirements of the contract have been performed, make application for Certificate of Substantial Performance.
5. Any defects or damages caused to other equipment by such defects, which appear in any of the Work within two (2) years after the written acceptance of same by the Board's contact, shall be repaired or replaced by the Contractor. These repairs or replacements must be made without delay, expense or inconvenience to the Board.
6. The manufacturer of the materials chosen for each “Assembly” shall provide a written warranty. Warranty is to state that the products used in each assembly will be free from manufacturing defects, so that these products will not break down or deteriorate for the period of the warranty when installed in accordance with the manufacture’s written specifications and guidelines. The warranty to include the cost of labour and material.
7. Extended warranties on parts and labour on manufactured products and extended warranties on the Workmanship may be found in other parts of the Contract Documents.

1.8.2 Deficiencies

1. Upon determination of the defect and deficiency list, submit to the Board’s contact within 5 Working days written notification of any items, which may not be corrected within 28 calendar days.
2. The Board will retain a minimum holdback of 2% of the Contract Price or funds equal to the estimated value of the deficient work, whichever is greater, for the completion of deficiencies.
3. In the event of failure to correct defects and deficiencies within this time, the Board reserves the right to correct defects and deficiencies and deduct the cost thereof from any payments due the Contractor.

1.8.3 Final Cleaning

1. When the Work is substantially completed, remove surplus products, tools, construction machinery and equipment not required for the performance of the remaining Work.
2. Remove waste materials and debris from the site within 48 hours of completion of the Work and prepare site for future, which may include paving or seeding.
3. Leave the Work “broom clean” before the inspection process commences.
4. Remove stains, spots, marks and dirt from decorative Work, fixtures, furniture fitments, walls, and any other exposed areas, as required.
5. Vacuum clean and dust building interior including behind grilles, louvers and screens.

1.9 CUTTING AND PATCHING

1.9.1 Approvals

1. Submit written request in advance of cutting or alteration, which affects:

a. Structural integrity of any element of the project

b. Integrity of weather-exposed or moisture-resistant elements

c. Efficiency, maintenance or safety of any operations element

d. Visual qualities of sight exposed elements.

e. Work of the Board or separate Contractor.

1.9.2 Existing Condition Review

1. Review existing conditions, including elements subject to damage or movement during cutting and patching.
2. After uncovering, inspect the conditions affecting performance of Work.
3. Beginning of cutting and patching means acceptance of existing conditions.

1.9.3 Execution

1. Perform cutting, fitting and patching to complete Work. Perform Work to avoid damage to other Work.
2. Remove and replace defective and non-conforming Work.
3. Prepare surfaces to receive patching and finishing.
4. Restore Work with new products, in accordance with contract Documents.
5. At penetration of fire-rated wall, ceiling or floor construction, completely seal voids with fire-rated and/or fire-resistant materials, to ensure the fire rating of the assembly being penetrated is maintained. Applied materials as outlined by manufacture for the construction element involved.
6. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to the nearest intersection. For assembly, refinish entire unit

1.10 FIRE PROTECTION SYSTEMS

1.10.1 Fire Alarm Shut Down Procedure

1. Any Modifications to Fire Alarm system and it's devices including service, additions and changes in device location must be performed only by a Certified Fire Alarm Technician as per the Ontario Fire Code section 1.1, subsection 1.1.5
2. Do not shut the system down unless you have to. Plan the operation required to reduce system down time to the least amount possible.
3. Wherever possible, shut down only the zone needing Work and schedule this down time in unoccupied school hours. Allow for this in your bid pricing.
4. Discuss the possible down time with the head custodian and principal prior to any partial or whole system shut down.
5. The school administration shall advise all staff of fire alarm system shut down. This will include instructions to call 911 if they see a fire and when system is back on line.
6. A fire patrol may need to be established and will include the following at the Contractor's expense:
    - Patrol all halls and high-risk areas affected.
    - Fire patrol shall have access to a phone and call 911 if they see a fire.
    - Report all other problems they encounter.
    - Remain on patrol until system is back on.
7. Successful Contractor will receive from the Board's contact a contact number for the monitoring service and a school system number.
8. The Contractor shall provide full detail to monitoring company as requested including contact name, company name, and length of time system is down. Call shall be placed just prior to any shut down.
9. Unless indicated, the system will be back on line at the monitor service one hour after shut down call. After such time false alarm penalties noted below shall be levied for each false alarm.

10. Bidders are cautioned that the Board will impose a penalty for false alarms. A $100.00 penalty for each false alarm may be levied for false fire alarm activation or security alarm activation.
11. An approved inspection firm shall verify all new fire alarm devices, in accordance to CSA regulations. Certificate of Verification is required before occupancy.
12. An activated system **must not be reset** until authorized by the Fire Department and the cause of the alarm has been investigated.

1.10.2 Fire Alarm Modifications and Maintenance

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

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

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

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

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

D. Clause 5.6 "Where an existing fire alarm system control unit is replaced with a new control unit, it shall be verified in accordance with CAN/ULC-S536, Standard for the Inspection and Testing of Fire Alarm Systems. **Replacement of any control panel will require the testing of all existing fire alarm devices.**

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

1.10.3 Fire Protection Equipment Impairment (hydrants, sprinklers, hose cabinets)

1. Fire Protection Equipment referred to in this section includes sprinkler systems, special fire suppression systems, and kitchen hood suppression systems.
2. The Contractor will take all precautions including restrict all hot Work operations and shut down hazardous processes during all Fire protection equipment impairment.
3. Do not shut the Fire protection equipment down unless you have to. Plan the operation required to reduce system impairment time to the least amount possible.
4. Wherever possible, shut down only the Fire protection equipment needing Work and schedule this impairment time for unoccupied school hours. Allow for this in your bid pricing.

5. Discuss the possible down time with the head custodian and principal prior to any partial or whole system impairment.
6. The school administration shall advise all staff of Fire protection equipment shut down. This will include instructions to call 911 if they see a fire and when system is back on line
7. The Contractor will plan to use temporary protection such as extra extinguishers, charged hose lines and temporary sprinkler protection during all Fire protection equipment impairment.
8. If the sprinkler system is restorable, either in whole or in part, the Contractor or sub-Contractor shall assign someone to restore the system promptly in the event of a fire.
9. A fire patrol may need to be established and will include the following at the Contractor's expense:

- Patrol all halls and high-risk areas affected.
- Fire patrol shall have access to a phone and call 911 if they see a fire.
- Report all other problems they encounter.
- Remain on patrol until system is back on.

10. The Contractor shall inform all sub trades that the Board has a Red Tag Permit System and it shall be used for all Fire protection equipment impairment.
11. For ease of use, a Factory Mutual hanging wall kit has been place at all Board Fire protection equipment locations. Supplies of Red Tag Permits are provided there.

1.11 DRAWING FORMAT

AutoCAD (.dwg) or Revit (.rvt) files are the standard file formats used by the Board. PDF files may be submitted in addition to the other files but not in place of. The files created during all phases of the project must be available to the Board for use by the Board through use of ftp site or similar or provided on CD/DVD. The files must be complete sets matching documentation used at the time of Tender. A further submission is required at the midpoint of construction and at Substantial Completion detailing changes noted in change orders or site instructions. It is also required that the files be showing the as built condition within 60 days of Substantial Completion.

END OF SECTION

APPENDIX A – BUSINESS CONDUCT

FOR BOARD EMPLOYEES

1. Preamble

The Principles of Business Conduct procedure describes the manner in which the Board does business and specifies the standards of behaviour expected from employees. They are a formal guide to ethical practices to be followed in all business dealings. They are not a substitute for personal integrity and good judgement; they are intended to serve as a minimum standard of behaviour.

The Principles of Business Conduct provide guidance to Board employees to ensure its relationship with the private sector is beyond reproach. The overall image of the Board would clearly be harmed by cases of employees receiving, or perceived to be receiving, any undue benefits or otherwise benefiting or appearing to benefit, from their relationships with the private sector.

2. General

The Board is committed to the highest level of personal and corporate ethical standards in the conduct of doing business. A key ingredient in its business dealings is the treatment of all suppliers in a fair and equitable manner.

3. Principles

3.1. Board employees must act honestly and uphold the highest ethical standards. This will maintain and enhance public confidence and trust in the integrity, objectivity and impartiality of the Board.

3.2. Board employees are obligated to perform their official duties and conduct themselves in a manner that will bear the closest public scrutiny.

3.3. When dealing with suppliers, Board employees must declare any conflict of interest (i.e., where an employee's personal interest may be in conflict with the employee's role and responsibility for the Board).

3.4. Civil or criminal action may be taken against any employee who fails to comply with the Board's rules of conduct. If an employee fails to comply with the Principles of Business Conduct, the employee will be disciplined, as appropriate, up to and including dismissal.

4. Guidelines

4.1. *Personal Benefits*

4.1.1. Board employees shall not have private interests in companies that either supply the Board or wish to supply the Board with goods and/or services that would be affected particularly or significantly by Board actions in which the employees participate.

4.1.2. An employee must not use confidential information obtained as part of their job for personal benefit.

4.1.3. Nor should the employee use their influence to award a contract or other commitment to a relative (i.e., family member or friend).

4.2. *Gifts, Hospitality and other Benefits*

4.2.1. An employee must refuse from any persons or organizations doing business with the Board all personal gifts, benefits or hospitality.

4.3. *Bribery and Fraud*

4.3.1. To conform to the laws of Canada an employee must not accept or offer money, valuable consideration, office, place or employment for themselves or someone else while doing their job.

4.3.2. Employees will not give, offer or agree to give, offer, demand, accept or agree to accept a loan, reward, advantage or benefit of any kind as consideration for cooperation, assistance, exercise of influence or an act of omission in connection with the transaction of procurement or a claim against the Board regardless whether the employee has the ability to do so or not.

4.4. *Preferential Treatment*

4.4.1. An employee must not give any advantage or preferential treatment to anyone.

4.4.2. An employee must not enter a contract on the Board's behalf with a friend(s) or family member(s).

4.4.3. An employee must refuse to help outside entities or organizations in any transactions or dealing with the Board in a way that contravenes the provisions of the Principles of Business Conduct.

4.5. *Discrimination*

4.5.1. An employee must not knowingly participate in acts of discrimination or harassment towards any person with whom that employee has business relations.

4.6. *Environmental Issues*

4.6.1. Employees should recognize their responsibility to environmental issues/conflicts consistent with the Board's goals or mission.

When in doubt on the interpretation of the above, the employee should consult with the Executive Superintendent of Business Services and Treasurer.

END OF SECTION

APPENDIX B

VENDOR PERFORMANCE EVALUATION FORM AND GUIDELINES

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

The evaluation may occur at or near substantial completion.

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

The Board will evaluate prime contractors.

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

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

A Vendor Performance Evaluation that:

1) Meets or exceeds expectations:

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

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

2) Is below expectations:

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

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

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

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

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

END OF SECTION

Business Services Division *Procurement Services*

VENDOR PERFORMANCE EVALUATION

Vendor Name: _____

Project Name: _____

Tender Number: _____

Classification: ❒ Prime Contractor ❒ Subcontractor

CIRCLE ONE					
Not Applicable	Far below expectations: inadequate, containing little detail insufficient knowledge	Does not fully meet expectations: limited knowledge and requirements	Meets expectations: demonstrates ability and knowledge to address basic requirements	Exceeds expectations: demonstrates clear, concise knowledge of requirements	Far exceeds expectations: highly comprehensive, excellent response

1. **Safety & Security:** (Understands & follows requirement guides)
   Comments: _____
   _____

NA	1	2	3	4	5

2. **Site Supervision:**
   Comments: _____
   _____

NA	1	2	3	4	5

3. **Billing Accuracy:**
   Comments: _____
   _____

NA	1	2	3	4	5

4. **Ability to Minimize Deficiencies:**
   (Timing, follow up, documentation of actions)
   Comments: _____
   _____

NA	1	2	3	4	5

5. **Ability to Maintain Schedule & React to Changes:**
   (Completeness of work, providing appropriate manpower)
   Comments: _____
   _____

NA	1	2	3	4	5

6. **Ability to stay focused on Scope:** (Does not seek additional work)
   Comments: _____
   _____

NA	1	2	3	4	5

7. **Approximate dollar value evaluated:**

0-50,000	50,000. – 500,000.	500, 000. +

8. **Additional Comments:** _____
   _____

Score:

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

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

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

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

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

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

APPENDIX C

WRDSB PROJECT WARRANTY CARD

1.0 WRDSB PROJECT WARRANTY CARD

1. The WRDSB Project Warranty Card shall be filled out and completed for any project or work that calls for the replacement or the new installation of any item that has warranty and requires ongoing preventative maintenance.

A. The information for the Warranty Card shall be collected and coordinated by General Contractor responsible for the overall project. The Warranty Card shall be filled out and submitted to the Board at the point in time where the project is deemed “Substantially Complete” or at the start of the Warranty Period for said item. On any project without a General Contractor the Contractor or Trade responsible for the installation of the item shall complete the Warranty Card and submit it to the Board.

B. All items shall include the item name, location, make, model, serial number, and warranty end date.

C. NO Warranty Period shall start without the written permission of the Board prior to the point of “Substantial Completion”

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

END OF SECTION

APPENDIX C
WRDSB PROJECT WARRANTY CARD

School name/location:_____

Information provided by:_____

Sub Contractor:_____

Please select all that apply

- ☐ Air Compressor
- ☐ Air Handler- ERV, Heat Pump, RTU
- ☐ AC Split -Indoor/Outdoor Unit
- ☐ Automatic Doors
- ☐ Backflow Preventer
- ☐ Boiler
- ☐ Chiller
- ☐ Cooling Tower
- ☐ Elevator/Lift
- ☐ Eyewash Station-location only
- ☐ Fire Panel
- ☐ Grease Trap
- ☐ Hoods- Kitchen/Fume
- ☐ Sprinkler System -area covered
- ☐ Tech Equipment
- ☐ Other Not Listed:

_____

ITEM/ ROOM NUMBER (as selected from above)	MAKE	MODEL	SERIAL NUMBER	WARRANTY END DATE

Maintenance services covered during the warranty period to include as a minimum:
-Air handling equipment filter changes, *3x* per year minimum- fall (at heating service), winter & spring (at cooling service)- as applicable and per manufacturers recommendations. Filters after project turn over set shall be Board supplied - installed by maintenance provider.
- Service for testable backflow protection devices shall include annual inspection and associated municipal fees (if any).
-Maintenance for all other equipment as listed above hall follow the recommendation of each manufacturer.

Contact information for warranty:

General Contractor: _____

General Email Address: _____

Photocopy as required

AMENDMENTS TO THE STIPULATED PRICE CONTRACT, CCDC2-2008

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

1. AGREEMENT BETWEEN OWNER AND CONTRACTOR

1.1 ARTICLE A-5 - PAYMENT

1.1.1 Amend paragraph 5.1.3, in the first line, by deleting the words "the issuance of the" and replacing them with "receipt of the *Consultant*'s".

1.1.2 Delete paragraph 5.3.1 and replace it with the following:

"Should either party fail to make payments as they become due under the terms of the *Contract* or in an award by arbitration or a court, interest shall also become due and payable on such unpaid amounts at 2% above the prime rate. Such interest shall be compounded on a monthly basis. The prime rate shall be the rate of interest quoted by **[named of chartered lending institution]** for prime business loans as it may change from time to time."

1.2 ARTICLE A-6 – RECEIPT AND ADDRESSES FOR NOTICES IN WRITING

1.2.1 Delete paragraph 6.1 and replace it with the following:

"*Notices in Writing* between the parties or between them and the *Consultant* shall be considered to have been received by the addressee on the date of receipt if delivered by hand or by commercial courier or if sent during normal business hours by fax and addressed as set out below. Such *Notices in Writing* will be deemed to be received by the addressee on the next business day if sent by fax after normal business hours or if sent by overnight commercial courier. Such *Notices in Writing* will be deemed to be received by the addressee on the fifth *Working Day* following the date of mailing, if sent by pre-paid registered post, when addressed as set out below. An address for a party may be changed by *Notice in Writing* to the other party setting out the new address in accordance with this Article."

2. DEFINITIONS

2.1.1 Amend Definition 4, "*Consultant*", by adding the following to the end of that Definition:

"For purposes of the Contract, the terms "*Consultant*", "Architect" and "Engineer" shall be considered synonymous."

2.1.2 Add a new Definition 27, Act, as follows:

"'Act' means the Construction Act (Ontario)."

2.1.3 Add a new Definition 28, "Environmental Programs", as follows:

"'*Environmental Programs*' means the environmental plans, programs, procedures and requirements of the *Owner*. The *Environmental Programs* incorporate *Owner's* infection

control program including measures to suppress dust and noise and to avoid conditions likely to propagate mould or fungus of any kind."

2.1.4 Add a new Definition 29, OHSA, as follows:

"'OHSA' means the Occupational Health and Safety Act (Ontario)."

2.1.5 Add a new Definition 30, Submittals, as follows:

"27. Submittals

Submittals are documents or items required by the *Contract Documents* to be provided by the *Contractor*, such as:

- *Shop Drawings,* interference drawings, samples, models, mock-ups to indicate details or characteristics, before the portion of the *Work* that they represent can be incorporated into the *Work*; and

- Record *Drawings* and manuals to provide instructions to the operation and maintenance of the *Work*.

2.1.6 Add a new Definition 31, WSIB, as follows:

"'WSIB' means the Work Place Safety & Insurance Board."

3. GENERAL CONDITIONS OF THE STIPULATED PRICE CONTRACT

Where a General Condition or paragraph of the General Conditions of the Stipulated Price Contract is deleted by these Supplementary Conditions, the numbering of the remaining General Conditions or paragraphs shall remain unchanged, and the numbering of the deleted item will be retained, unused.

3.1 GC 1.1 - CONTRACT DOCUMENTS

3.1.1 Add the following to the end of paragraph 1.1.6:

"The S*pecifications* are divided into divisions and sections for convenience but shall be read as a whole and neither such division nor anything else contained in the *Contract Documents* will be construed to place responsibility on the *Consultant* to settle disputes among the *Subcontractors* and *Suppliers* in respect to such divisions. The *Drawings* are, in part, diagrammatic and are intended to convey the scope of the *Work* and indicate general and appropriate locations, arrangement and sizes of fixtures, equipment and outlets. The *Contractor* shall obtain more accurate information about the locations, arrangement and sizes from study and coordination of the *Drawings*, including shop *Drawings* and shall become familiar with conditions and spaces affecting these matters before proceeding with the *Work*. Where site conditions require reasonable minor changes in indicated locations and arrangements, the *Contractor* shall make such changes at no additional cost to the *Owner*. Similarly, where known conditions or existing conditions interfere with new installation and require relocation, the *Contractor*

shall include such relocation in the *Work*. The *Contractor* shall arrange and install fixtures and equipment in such a way as to conserve as much headroom and space as possible. The schedules are that portion of the *Contract Documents* wherever located and whenever issued, compiling information of similar content and may consist of *Drawings*, tables and/or lists."

3.1.2 Revise subparagraph 1.1.7.1 to read:

"the order of priority of documents, from highest to lowest, shall be
- the Agreement between the *Owner* and the *Contractor*,
- the Definitions,
- Supplementary Conditions,
- Tender Terms & Conditions, & General Requirements
- Instruction to Bidders
- the General Conditions
- Division 1 of the *Specifications*,
- technical *Specification*
- material and finishing schedules
- the *Drawings*"

3.1.3 Add new subparagraph 1.1.7.5:

"1.1.7.5 In case of discrepancies, noted materials and annotations shall take precedence over graphic indications in the *Contract Documents.*"

3.1.4 Delete paragraph 1.1.8 in its entirety and substitute new paragraph 1.1.8:

"1.1.8 The *Owner* shall provide the *Contractor*, without charge, six copies of the *Contract Documents.* Additional copies of the Contract Documents may be obtained from the Consultant at a reasonable cost."

3.2 GC 2.2 - ROLE OF THE CONSULTANT

3.2.1 Amend paragraph 2.2.7 by deleting the words "Except with respect to GC 5.1 – FINANCING INFORMATION REQUIRED OF THE OWNER."

3.2.2 Add at the end of paragraph 2.2.9. "The Owner and the Contractor shall waive any claims against the Consultant arising out of the making of such interpretations and findings made in accordance with paragraphs 2.2.7., 2.2.8. and 2.2.9".

3.2.3 Delete the comma after the word "submittals" and add the words "which are provided" before the words "in accordance" in paragraph 2.2.14

3.2.4 Amend paragraph 2.2.13 by adding the following to the end of that paragraph:

"If, in the opinion of the *Contractor*, the *Supplemental Instruction* involves an adjustment in the *Contract Price* or the *Contract Time*, the *Contractor* shall, within ten (10) *Working Day*s of receipt of a *Supplemental Instruction* provide the *Consultant* with a written notice to that effect. In the event that the *Contractor* needs additional information to determine whether a *Supplemental Instruction* involves an adjustment of the *Contract Price* or the *Contract Time*, the *Contractor* may issue a written request to the *Consultant* seeking such additional information. Following receipt of such information the *Contractor* shall, within ten (10) *Working Day*s of receipt of such additional information, provide the *Consultant* with the written notice described in the first sentence of this paragraph 2.2.13 if, in the

opinion of the *Contractor*, the *Supplemental Instruction* involves an adjustment in the *Contract Price* or the *Contract Time*. Failure to provide written notification within the time stipulated in this paragraph 2.2.13 shall be deemed an acceptance of the *Supplemental Instruction* by the *Contractor* without adjustment in the *Contract Price* or *Contract Time*. Without limiting the generality of the foregoing, every item on the Drawings shall be deemed as included within the scope of the Work unless noted "not in contract"."

3.2.5 Add new paragraphs 2.2.19 and 2.2.20 as follows:

"2.2.19 Neither the *Contractor* nor any *Subcontractor*, Supplier or other third party shall have any claim against the *Consultant* as a result of the performance or non-performance of the *Consultant*'s services. The *Contractor* shall include this provision in any *Contract*s it makes with its *Subcontractor*s, *Suppliers* and others and shall require such *Subcontractor*s, *Suppliers* and others to include the same term in their *Contract*s with sub-*Subcontractor*s, sub-suppliers and others.

2.2.20 The Specifications are divided into divisions and sections for convenience but shall be read as a whole and neither such division nor anything else contained in the *Contract Documents* will be construed to place responsibility on the *Consultant* to settle disputes among *Subcontractor*s and *Suppliers* in respect to such divisions."

3.3 **GC 2.4 - D**EFECTIVE WORK

3.3.1 Amend paragraph 2.4.1 by adding the following sentence to the end of the existing paragraph:

"The *Contractor* shall rectify, in a manner acceptable to the *Owner* and the *Consultant*, all defective *Work* and deficiencies throughout the *Work*, whether or not they are specifically identified by the *Consultant*.

3.3.2 Amend paragraph 2.4.2 by adding the following sentence to the end of the existing paragraph:

"The *Contractor* shall prioritize the correction of any defective *Work* which, in the sole discretion of the *Owner*, adversely affects the day to day operation of the *Owner*."

3.4 GC 3.1 - CONTROL OF THE WORK

3.4.1 Add new paragraph 3.1.3:

"3.1.3 Prior to commencing individual procurement, fabrication and construction activities, the *Contractor* shall verify, at the *Place of the Work*, all relevant measurements and levels necessary for proper and complete fabrication, assembly and installation of the *Work* and shall further carefully compare such field measurements and conditions with the requirements of the *Contract Documents*. Where dimensions are not included or exact locations are not apparent, the *Contractor* shall immediately notify the *Consultant* in writing and obtain written instructions from the *Consultant* before proceeding with any part of the affected *Work*."

3.5 GC 3.2 - CONSTRUCTION BY OWNER OR OTHER CONTRACTORS

3.5.1 Delete subparagraphs 3.2.2.1 and 3.2.2.2 in their entirety.

3.5.2 Delete paragraph 3.2.3.2 and replace it with the following:

"3.2.3.2 Coordinate and schedule the activities and work of other contractors and Owner's own forces with the Work of the Contractor and connect as specified or shown in the Contract Documents;"

3.5.3 Add new subparagraph 3.2.3.4:

"3.2.3.4 Subject to GC 9.4 CONSTRUCTION SAFETY, for the *Owner's* own forces and for other *Contractor*s, assume overall responsibility for compliance with all aspects of the applicable health and safety legislation in the *Place of the Work*, including all of the responsibilities of the constructor under the *OHSA*."

3.6 GC 3.4 - DOCUMENT REVIEW

3.6.1 Delete paragraph 3.4.1 in its entirety and substitute new paragraph 3.4.1:

"3.4.1 The *Contractor* shall review the *Contract Documents* and shall report promptly to the *Consultant* any error, inconsistency or omission the *Contractor* may discover. Such review by the *Contractor* shall comply with the standard of care described in GC3.14 STANDARD OF CARE. Except for its obligation to make such review and report the result, the *Contractor* does not assume any responsibility to the *Owner* or to the *Consultant* for the accuracy of the *Contract Document*s. The *Contractor* shall not be liable for damage or costs resulting from such errors, inconsistencies, or omissions in the *Contract Documents*, which the *Contractor* could not reasonably have discovered. If the *Contractor* does discover any error, inconsistency or omission in the *Contract Documents,* the *Contractor* shall not proceed with the *Work* affected until the *Contractor* has received corrected or missing information from the *Consultant*."

3.6.2 Add new paragraph 3.4.2:

"3.4.2 If the *Contractor* finds discrepancies in and/or omissions from the *Contract Documents* or has any doubt as to the meaning or intent of any part thereof, the *Contractor* must immediately notify the *Consultant*, who will provide written instructions or explanations. Neither the *Owner* nor the *Consultant* will be responsible for oral instructions."

3.7 GC 3.5 - CONSTRUCTION SCHEDULE

3.7.1 Delete paragraph 3.5.1.1 and replace it with the following:

"3.5.1.1 prior to site mobilization, submit to the *Owner* and the *Consultant* for their approval a construction schedule indicating critical milestone dates for the *Project* using a scheduling program which is the most current version of MS Project or Primavera, to demonstrate that the *Work* will be performed in conformity with the *Contract Time*. The *Contractor* shall provide the schedule information required by this paragraph 3.5.1.1 in both electronic format and hard copy;"

3.7.2 Delete paragraph 3.5.1.2 and replace it with the following:

"3.5.1.2 provide the expertise and resources, including manpower and equipment, as are necessary to maintain progress under the construction schedule or any successor or revised schedule approved by the *Owner*;"

3.7.3 Delete paragraph 3.5.1.3 and replace it with the following:

"3.5.1.3 monitor the progress of the *Work* relative to the Construction Schedule, or any successor or revised schedule approved by the *Owner*, update the schedule on a monthly basis, and advise the *Consultant* in writing of any deviation from or delay in the construction schedule or any other schedule; and"

3.7.4 Add a new paragraph 3.5.1.4 as follows:

"3.5.1.4 if after applying the expertise and resources required under paragraph 3.5.1.2, the *Contractor* forms the opinion that there has been a deviation from or a delay in the construction schedule or any other schedule cannot be recovered by the *Contractor*, it shall, in the same notice provided under paragraph 3.5.1.3, indicate to the *Consultant* if the *Contractor* intends to apply for an extension of *Contract Time*."

3.7.5 Add a new paragraph 3.5.2 as follows:

"3.5.2 Without limiting the other obligations of the *Contractor* under GC 3.5, the *Contractor* shall not amend the construction schedule without the prior written consent of the *Owner*. In addition, at each site construction meeting, the *Contractor* shall provide to the *Owner* and the *Consultant* a two (2) week look-ahead schedule indicating the major activities to be undertaken or constructed in such two (2) week period."

3.7.6 Add new paragraph 3.5.3:

"3.5.3 If at any time it should appear to the *Owner* or the *Consultant* that the actual progress of the *Work* is behind schedule or is likely to fall behind schedule, based on critical path methodology, or if the *Contractor* has given notice of such to the *Owner* or the *Consultant* pursuant to 3.5.1.3, the *Contractor* shall take appropriate steps to cause the actual progress of the *Work* to conform to the schedule and shall produce and present to the *Owner* and the *Consultant* a recovery plan demonstrating how the *Contractor* will achieve the recovery of the schedule. If the *Contractor* intends to apply for a change in the *Contract Price* in relation to a schedule recovery plan, the *Contractor* shall proceed with PART 6 – CHANGES IN THE *WORK*. "

3.8 GC 3.6 - SUPERVISION

3.8.1 Delete paragraph 3.6.1 in its entirety and substitute new paragraph 3.6.1:

"3.6.1 The *Contractor* shall provide all necessary supervision and appoint competent representatives who shall be in attendance at the *Place of the Work* while *Work* is being performed. The appointed representatives shall not be changed except for valid reasons, and upon the *Contractor* obtaining the *Consultant's* written consent, which consent will not be unreasonably withheld."

3.8.2 Add new paragraphs 3.6.3, 3.6.4 and 3.6.5 as follows:

"3.6.3 The *Owner* acting reasonably, shall have the right to order the *Contractor* to remove from the *Project* any representative or employee of the *Contractor, Subcontractors* or *Suppliers* who, in the opinion of the *Owner*, are a detriment to the *Project*.

3.6.4 Where the *Work* is being carried out at or near an existing school which is still in operation, the *Owner* has the discretion to require the *Contractor* to provide to the *Owner* criminal background checks on all of the *Contractor's* employees who will be providing work or services at the *Place of the Work* and will require its *Subcontractors* and *Suppliers* to provide criminal background checks on any of their employees who will be providing work or services at the *Place of the Work*. Where such background checks indicate that an employee of the *Contractor* or any *Subcontractor* has a criminal record, the *Owner* shall be entitled to cause the removal of that person from the *Project* pursuant to paragraph 3.6.3 of these General Conditions."

3.9 GC 3.7 - SUBCONTRACTORS AND SUPPLIERS

3.9.1 Delete paragraph 3.7.2 in its entirety and substitute new paragraph 3.7.2:

"3.7.2 The *Contractor* agrees not to change *Subcontractors* without prior written approval of the *Owner*, which approval will not be unreasonably withheld."

3.9.2 Add a new paragraph 3.7.7 as follows:

"3.7.7 The *Owner* may assign to the *Contractor*, and the *Contractor* agrees to accept, any *Contract* procured by the *Owner* for *Work* or services or *Products* required on the *Project* that has been pre-tendered or pre-negotiated by the *Owner*."

3.10 GC 3.8 - LABOUR AND PRODUCTS

3.10.1 Amend paragraph 3.8.1 by adding the following sentence at the end of that paragraph:

"The *Contractor* represents and warrants that the *Products* provided in accordance with the *Contract Documents* are not subject to any conditional sales *Contract*s and are not subject to any security rights claimed or obtained by any third party which may subject any of the *Products* to seizure and/or removal from the *Place of the Work*."

3.10.2 Delete paragraph 3.8.2 and replace it with the following:

"3.8.2 *Products* provided shall be new and shall conform to all current applicable specifications of the Canadian Standards Association, Canadian Standards Board or General Standards Board, ASTM, National Building Code, Ontario Building Code and all governmental authorities having jurisdiction at the *Place of the Work*, unless otherwise specified. *Products* which are not specified shall be of a quality consistent with those specified and their use acceptable to the *Consultant*. *Products* brought on to the *Place of the Work* by the *Contractor* shall be deemed to be the property of the *Owner*, but the *Owner* shall be under no liability for loss thereof or damage thereto arising from any cause whatsoever, and such *Products* shall be at the sole risk of the *Contractor*."

3.10.3 Amend paragraph 3.8.3 by adding the words "agents, *Subcontractor*s and *Suppliers*" after the word "employees" toward the end of the first line.

3.10.4 Further amend paragraph 3.8.3 by adding the following three new sentences to the end of that paragraph:

"Without in any way limiting the generality of the foregoing, the *Contractor* shall prepare and implement the job site rules more particularly described in the *Contract Documents*.

If no job site rules are described in the *Contract Documents*, the *Contractor* shall draft job site rules for the review and approval of the *Owner*. Any such job site rules prepared by the *Contractor* shall be consistent with the *Contractor*'s duties and obligations under the *OHSA* and shall also include provisions making smoking and the consumption of alcohol or non-prescription drugs on the *Project* site the subject of discipline proceedings and/or termination of employment."

3.10.5 Add new paragraphs 3.8.4, 3.8.5 and 3.8.6 as follows:

""3.8.4 The *Contractor* is responsible for the safe on-site storage of *Products* and their protection (including *Products* supplied by the *Owner* and other *Contractor*s to be installed under the *Contract*) in such ways as to avoid dangerous conditions or contamination to the *Products* or other persons or property and in locations at the *Place of the Work* to the satisfaction of the *Owner* and the *Consultant*. The *Owner* shall provide all relevant information on the *Products* to be supplied by the *Owner*."

3.8.5 The *Contractor* shall not employ any persons on the *Work* whose labour affiliation, or lack thereof, is incompatible with other labour employed in connection with the *Work*. Any costs arising from labour disputes as a result of the employment of any such person by the *Contractor*, its *Subcontractor*s or *Suppliers*, shall be the sole expense of the *Contractor*.

3.8.6 The *Contractor* shall cooperate with the *Owner* and its representatives and shall take all reasonable and necessary actions to maintain stable and harmonious labour relations with respect to the *Work* at the *Place of the Work*, including cooperation to attempt to avoid *Work* stoppages, trade union jurisdictional disputes, and other labour disputes."

3.11 GC 3.9 - DOCUMENTS AT THE SITE

3.11.1 Delete paragraph 3.9.1 in its entirety and substitute new paragraph 3.9.1:

"3.9.1 The *Contractor* shall keep one copy of the current *Contract Documents*, *Supplemental Instructions*, Contemplated *Change Orders*, *Change Orders*, *Change Directives*, Cash Allowance Disbursement Authorizations, reviewed *Shop Drawings*, *Submittals*, reports and records of meetings at the *Place of the Work*, in good order and available to the *Owner* and *Consultant*."

3.12 GC 3.10 - SHOP DRAWINGS

3.12.1 Add the words "AND OTHER SUBMITTALS" to the Title after SHOP DRAWINGS.

3.12.2 Add "and Submittals" after the words "Shop Drawings" in paragraphs 3.10.1, 3.10.2, 3.10.4, 3.10.7, 3.10.8, 3.10.8.2, 3.10.9, 3.10.10, 3.10.11, and 3.10.12.

3.12.3 Delete paragraph 3.10.3 in its entirety and substitute new paragraph 3.10.3:

"GC 3.10.3 Prior to the first application for payment, the *Contractor* and the *Consultant* shall jointly prepare a schedule of the dates for submission and return of *Shop Drawings* and any *Submittals*.

3.12.4 Delete subparagraph 3.10.8.1 in its entirety and substitute new subparagraph 3.10.8.1:

"3.10.8.1 the *Contractor* has determined and correlated the field measurements with the

Shop Drawings and any *Submittals* and field construction conditions, *Product* requirements, catalogue numbers and similar data, or will do so if not possible at that time, and

3.12.5 Delete paragraph 3.10.12 in its entirety and substitute new paragraph 3.10.12:

"3.10.12 The *Consultant* will review and return Shop *Drawings* and *Submittals* in accordance with the schedule agreed upon in 3.10.3, or, in the absence of such schedule, with reasonable promptness. If, for any reason, the *Consultant* cannot process them within the agreed-upon schedule or with reasonable promptness, the *Consultant* shall notify the *Contractor* and they shall meet to review and arrive at an acceptable revised schedule for processing. The *Contractor* shall update the Shop *Drawings* and *Submittals* schedule to correspond to changes in the construction schedule. Changes in the *Contract Price* or *Contract Time* may be made only as provided in the *Contract*."

3.13 GC 3.14 – STANDARD OF CARE

3.13.1 Add new General Condition 3.14 as follows:

"3.14.1 In performing its services and obligations under the *Contract*, the *Contractor* shall exercise a standard of care, skill and diligence that would normally be provided by an experienced and prudent *Contractor* supplying similar services for similar projects. The *Contractor* acknowledges and agrees that throughout the *Contract,* the *Contractor's* obligations, duties and responsibilities shall be interpreted in accordance with this standard. The *Contractor* shall exercise the same standard of due care and diligence in respect of any *Products*, personnel, or procedures which it may recommend to the *Owner*.

3.14.2 The *Contractor* further represents, covenants and warrants to the *Owner* that:

.1 The personnel it assigns to the *Project* are appropriately experienced;

.2 It has a sufficient staff of qualified and competent personnel to replace its designated supervisor and project manager, subject to the *Owner's* approval, in the event of death, incapacity, removal or resignation; and

.3 There are no pending, threatened or anticipated claims that would have a material effect on the financial ability of the *Contractor* to perform its *Work* under the *Contract*."

3.14 GC 3.15 OCCUPANCY OF THE WORK

3.14.1 Add a new GC 3.15 as follows:

"GC 3.15 OCCUPANCY OF THE *WORK*

3.15.1 The *Owner* reserves the right to take possession of and use for any intended purpose any portion or all of the undelivered portion of the *Project*, even though the *Work* may not have reached *Substantial Performance of the Work*, provided that such taking of possession and use will not interfere, in any material way, with the progress of the *Work*. The taking of possession or use of any such portion of the *Project* shall not be deemed to be the *Owner's* acknowledgement or acceptance of the *Work* or *Project*, nor shall it relieve the *Contractor* of any of its obligations under the *Contract*.

3.15.2 Where the *Project* contemplates *Work* by way of renovations in buildings which will be in use or be occupied during the course of the *Work*, or where the *Project* involves *Work* that is adjacent to a structure which is in use or is occupied, the *Contractor*, without in any way limiting its responsibilities under this *Contract*, shall take all reasonable steps to avoid interference with fire exits, building access and egress, continuity of electric power and all other utilities, to suppress dust and noise, to avoid conditions likely to propagate mould or fungus of any kind, and all other steps reasonably necessary to promote and maintain the safety and comfort of the users and occupants of such structures or adjacent structures. Without *Owner's* prior approval, the *Contractor* shall not permit any *Work*er or *Subcontractor*s to use any existing facilities including, without limitation, lavatories, toilets, entrances and parking areas other than those designated by the *Owner*."

3.15 GC 3.16 – CONTRACTOR'S USE OF PERMANENT EQUIPMENT OR SYSTEMS

3.15.1 Add a new GC 3.16 as follows:

"GC 3.16 *CONTRACTOR*'S USE OF PERMANENT EQUIPMENT OR SYSTEMS

3.16.1 With the prior written approval of the *Owner*, the *Contractor* may make use of elements of the mechanical and electrical systems or equipment comprising a permanent part of the *Work* for the purpose of providing heat or power to the *Project* during the final stages of construction. In such event, and before the issuance of the certificate of Substantial Performance of the *Work*, the *Contractor* shall clean and make good, to the satisfaction of the *Consultant*, such systems and equipment as it had been permitted to use. The *Contractor* shall pay any and all costs associated with such use, cleaning and making good.

3.16.2 Where the *Contractor* has made use of elements of the mechanical and electrical systems or equipment comprising a permanent part of the *Work*, as described in paragraph 3.16.1 above, the *Contractor* shall obtain, from the manufacturer or *Supplier* of the systems or equipment used, a confirmation from such manufacturer or *Supplier* that the warranty on such systems or equipment begins on the date of Substantial Performance of the *Work* and is not impaired in scope or reduced in time by virtue of the Contractor's use of such systems or equipment."

3.16 GC 4.1 - CASH ALLOWANCES

3.16.1 Delete paragraph 4.1.4 in its entirety and substitute new paragraph 4.1.4:

"4.1.4 Where costs under a cash allowance exceed the amount of the allowance, unexpended amounts from other cash allowances shall be reallocated at the *Consultant*'s direction to cover the shortfall."

3.16.2 Delete paragraph 4.1.5 in its entirety and substitute new paragraph 4.1.5:

"4.1.5 The unexpended total cash allowance amount shall be deducted from the *Contract Price* by *Change Order.*"

3.16.3 Delete paragraph 4.1.7 in its entirety and substitute new paragraph 4.1.7.

"4.1.7 At the commencement of the Work, the Contractor shall prepare for the review and

acceptance of the Owner and the Consultant, a schedule indicating the times, within the construction schedule referred to in GC 3.5, that items called for under cash allowances and items that are specified to be Owner purchased and Contractor installed or hooked up are required at the site to avoid delaying the progress of the Work.

3.16.4 Add new paragraph 4.1.8:

"4.1.8 The *Owner* reserves the right to call, or to have the *Contractor* call, competitive bids for portions of the *Work*, to be paid for from cash allowances."

3.17 GC 5.1 - FINANCING INFORMATION REQUIRED OF THE OWNER

3.17.1 Delete GC 5.1 in its entirety and replace it with “Intentionally left blank.”

3.17.2 Delete paragraph 5.1.2 in its entirety.

3.18 GC 5.2 - APPLICATIONS FOR PROGRESS PAYMENT

3.18.1 Amend paragraph 5.2.3 by adding the following to the end of that paragraph:

“No amount claimed shall include *Products* delivered to the Place of the *Work* unless the *Products* are free and clear of all security interests, liens, and other claims of third parties.”

3.18.2 Add to the end of paragraph 5.2.7 the following new sentence:

"Any *Products* delivered to the *Place of the Work* but not yet incorporated into the *Work* shall remain at the risk of the *Contractor* notwithstanding that title has passed to the *Owner* pursuant to GC 13.1 *OWNER*SHIP OF MATERIALS."

3.18.3 Add new paragraph 5.2.8, 5.2.9 and 5.2.10:

"5.2.8 The *Contractor* shall submit, with each application for progress payment after the first, a Statutory Declaration, on an original form of CCDC Document 9A-2001, stating that payments in connection with the *Work*, as noted in the Statutory Declaration, have been made to the end of the period immediately preceding that covered by the current application.

5.2.9 The *Contractor* shall submit WSIB Clearance Certificate, with each application for progress payment.

5.2.10 The *Contractor* shall prepare and maintain current as-built *Drawings* which shall consist of the *Drawings* and *Specifications* revised by the *Contractor* during the *Work*, showing changes to the *Drawings* and *Specifications*, which current as-built *Drawings* shall be maintained by the *Contractor* and made available to the *Consultant* for review with each application for progress payment. The *Consultant* reserves the right to retain a reasonable amount for the value of the as-built *Drawings* not presented for review."

3.19 GC 5.3 - PROGRESS PAYMENT

3.19.1 Delete from the first line of subparagraph 5.3.1.2, the words, "calendar days" and substitute the words: "*Working Days*".

3.19.2 Delete from the first and second lines of subparagraph 5.3.1.2, the words, "the application for payment" and substitute the words, "an application for payment acceptable to the Consultant,"

3.19.3 Delete subparagraph 5.3.1.3 in its entirety and substitute new subparagraph 5.3.1.3:

"5.3.1.3 The *Owner* shall make payment to the *Contractor* on account as provided in Article A-5 of the Agreement – PAYMENT no later than 10 *Working Days* after the date of a certificate of payment issued by the *Consultant*."

3.19.4 Add a new paragraph 5.3.3 as follows:

"5.3.3 If the *Contractor* fails to provide a statutory declaration as required by paragraph 5.2.8, or if the *Contractor* fails to demonstrate compliance with GC 10.4 – *WORK*ERS' COMPENSATION, the *Owner* shall be entitled to deduct from amounts otherwise payable to the *Contractor* an amount sufficient to cover any liability which it might incur as a result of the *Contractor*'s failure to provide a statutory declaration or to demonstrate compliance with GC 10.4."

3.20 GC 5.4 - SUBSTANTIAL PERFORMANCE OF THE WORK

3.20.1 Delete paragraph 5.4.3 in its entirety and substitute new paragraph 5.4.3:

"5.4.3 Immediately following the issuance of the certificate of *Substantial Performance of the Work*, the *Contractor*, in consultation with the *Consultant*, shall establish reasonable dates for finishing the *Work* and correcting deficient *Work*."

3.20.2 Add new paragraphs 5.4.4, 5.4.5 and 5.4.6:

"5.4.4 The *Contractor* shall publish, in a construction trade newspaper in the area of the location of the *Work,* a copy of the Certificate of *Substantial Performance of the Work* within seven (7) days of receiving a copy of the Certificate signed by the *Consultant*, and the *Contractor* shall provide suitable evidence of the publication to the *Consultant* and *Owner*. If the *Contractor* fails to publish such notice, the *Owner* shall be at liberty to publish and back charge the *Contractor* its reasonable costs for doing so.

5.4.5 Prior to submitting its application for *Substantial Performance of the Work*, the *Contractor* shall submit to the *Consultant* all:

.1 guarantees,

.2 warranties,

.3 certificates,

.4 testing and balancing reports,

.5 distribution system diagrams,

.6 maintenance, spare parts and operating manuals,

and other materials or documentation required to be submitted under the *Contract*, together with written proof acceptable to the *Owner* and the *Consultant* that the *Work* has been substantially performed in conformance with the

requirements of municipal, government and utilities authorities having jurisdiction. The *Contractor* shall deliver the materials and documentation listed in this paragraph 5.4.5 in an electronic format that is readable on the *Owner's* information technology infrastructure.

5.4.6 Where the *Contractor* is unable to deliver the documents and materials described in paragraph 5.4.5, then, provided that none of the missing documents and materials interferes, in a material way, with the use and occupancy of the *Work*, failure to deliver shall not be grounds for the *Consultant* to refuse to certify *Substantial Performance of the Work*. Any documents or materials not delivered in accordance with paragraph 5.4.5 shall be delivered as provided in GC 5.7, "

3.21 GC 5.5 - PAYMENT OF HOLDBACK UPON SUBSTANTIAL PERFORMANCE OF THE WORK

3.21.1 Add new subparagraphs 5.5.1.3, 5.5.1.4 and 5.5.1.5:

"5.5.1.3 Submit a written request for release of holdback including a declaration that no written notices of lien have been received by it.

5.5.1.4 Submit a Statutory Declaration CCDC 9A-2001.

5.5.1.5 Submit WSIB Clearance Certificate."

3.21.2 Delete from line 1 of paragraph 5.5.2, the words, "the statement" and substitute the words "the documents".

3.21.3 Delete paragraph 5.5.3 in its entirety.

3.22 GC 5.6 - PROGRESSIVE RELEASE OF HOLDBACK

3.22.1 Delete GC 5.6 Progressive release of holdback

3.23 GC 5.7 - FINAL PAYMENT

3.23.1 Delete from the first line of paragraph 5.7.2 the words, "calendar days" and substitute the words "*Working Days*".

3.23.2 Delete from the second line of paragraph 5.7.4 the words, "calendar days" and substitute the words: *"Working Days*".

3.23.3 Add new paragraph 5.7.5:

"5.7.5 As additional requirements for release of finishing construction lien holdback, the *Contractor* shall submit the following documentation:

.1 *Contractor's* written request for release of holdback, including a declaration that no written notices of lien have been received by it.

.2 *Contractor's* Statutory Declaration CCDC 9A-2001.

.3 *Contractor's* WSIB Clearance Certificate.

3.24 GC 6.3 - CHANGE DIRECTIVE

3.24.1 Further amend paragraph 6.3.6.3 by adding the following to the end of that paragraph:

"Such allowance for overhead and profit shall be as described in paragraphs 6.2.3.3 and 6.2.3.4."

3.24.2 Delete paragraph 6.3.7.1 the introductory language and replace it with the following:

.1 salaries, wages and benefits paid to personnel in the direct employ of the *Contractor*, applying the labour rates set out in the wage schedule in the *Contract Documents* or as otherwise agreed between the *Owner* and *Contractor* for personnel…"

3.24.3 Delete paragraphs 6.3.7.1(1), (2), (3) and (4) and replace them with the following:

"(1) carrying out the *Work*, including necessary supervisory services;

(2) intentionally left blank;

(3) engaged in the preparation of *Shop Drawings*, fabrication *Drawings*, coordination *Drawings* and *Project* record *Drawings*: or…

(4) including clerical staff engaged in processing changes in the *Work*."

3.24.4 Add new paragraph 6.3.14 as follows:

"6.3.14 Without limitation, the cost of performing the *Work* attributable to the Change Directive does not include:

.1 head office salaries and benefits and all other overhead or general expenses, except only for the salaries, wages and benefits of personnel described in paragraph 6.3.4.2 and the contributions, assessments or taxes referred to in paragraphs 6.3.4.3;

.2 capital expenses and interest on capital;

.3 general clean-up, except where the performance of the *Work* in the Change Directive causes specific additional clean-up requirements;

.4 wages paid for field supervision of *Subcontractors*;

.5 wages, salaries, rentals, or other expenses that exceed the rates that are standard in the locality of the *Place of the Work* that are otherwise deemed unreasonable by the *Consultant*;

.6 any costs or expenses attributable to the negligence, improper *Work*, deficiencies, or breaches of *Contract* by the *Contractor* or *SubContractor*; and

.7 any cost of quality assurance, such as inspection and testing services, charges levied by authorities, and any legal fees unless any such costs or fees are pre-approved in writing by the *Owner*."

3.25 GC 6.4 - CONCEALED OR UNKNOWN CONDITIONS

3.25.1 Delete paragraph 6.4.1 and replace it with the following:

"6.4.1 The *Contractor* confirms that, prior to tendering the *Project*, it carefully investigated the Place of the *Work* to fully ascertain existing conditions, circumstances and limitations affecting the *Work*, and applied to that investigation the degree of care and skill described in paragraph 3.14.1. If the *Contractor* has not conducted such careful investigation, it is deemed to assume all risk of conditions or circumstances now existing or arising in the course of the *Work* which could make the *Work* more expensive or more difficult to perform than was contemplated at the time the *Contract* was executed. No allowances will be made for additional costs and no claims by the *Contractor* will be entertained in connection with conditions which could reasonably have been ascertained by such investigation or other due diligence undertaken prior to the execution of the *Contract*."

3.25.2 Amend paragraph 6.4.2 by adding a new first sentence which reads as follows:

"Having regard to paragraph 6.4.1, if the *Contractor* believes that the conditions of the Place of the *Work* differ materially from those reasonably anticipated, or differ materially from those indicated in the *Contract Documents*, or were concealed from discovery notwithstanding the conduct of the investigation described in paragraph 6.4.1, it shall

notify the *Owner* and *Consultant* in writing no later than five (5) *Working Day*s after the first observation of such conditions."

3.25.3 Amend the existing second sentence of paragraph 6.4.2, in the second line, following the word "materially", by adding the words "or were concealed from discovery notwithstanding the conduct of the investigation described in paragraph 6.4.1".

3.25.4 Delete paragraph 6.4.3 and substitute the following:

"6.4.3 If the *Consultant* makes a finding pursuant to paragraph 6.4.2 that no change in the *Contract Price* or *Contract Time* is justified, the *Consultant* shall report in writing the reasons for this finding to the *Owner* and the *Contractor*."

3.26 GC 6.5 - DELAYS

3.26.1 Delete the period at the end of paragraph 6.5.1, and substitute the following words ", but excluding any consequential, indirect or special damages."

3.26.2 Add new subparagraph 6.5.6.

6.5.6 If the *Contractor* is delayed in the performance of the *Work* by an act or omission of the *Contractor* or anyone employed or engaged by the *Contractor* directly or indirectly, or by any cause within the *Contractor's* control, then the *Contract Time* shall be extended for such reasonable time as the *Consultant* may decide in consultation with the *Contractor*. The *Owner* shall be reimbursed by the *Contractor* for all reasonable costs incurred by the *Owner* as the result of such delay, including all services required by the *Owner* from the *Consultant* as a result of such delay by the *Contractor* and, in particular, the cost of the *Consultant's* services during the period between the date of *Substantial Performance of the Work* stated in Article A-1 herein as the same may be extended through the provisions of these General Conditions and any later, actual date of *Substantial Performance of the Work* achieved by the *Contractor*."

3.26.3 Add new paragraphs 6.5.7 and 6.5.8 as follows:

"6.5.7 The *Contractor* shall be responsible for the care, maintenance and protection of the *Work* in the event of any suspension of construction as a result of the delay described in paragraphs 6.5.1, 6.5.2 or 6.5.3. In the event of such suspension, the *Contractor* shall be reimbursed by the *Owner* for the reasonable costs incurred by the *Contractor* for such care, maintenance and protection, but excluding the costs of the *Contractor*'s head office personnel. The *Contractor*'s entitlement to costs pursuant to this paragraph 6.5.7, if any, shall be in addition to amounts, if any, to which the *Contractor* is entitled pursuant to paragraphs 6.5.1, 6.5.2 or 6.5.3.

6.5.8 Without limiting the obligations of the *Contractor* described in GC 3.2 – CONSTRUCTION BY OWNER OR OTHER CONTRACTORS and GC 9.4 – CONSTRUCTION SAFETY, the *Owner* may, by *Notice in Writing*, direct the *Contractor* to stop the *Work* where the *Owner* determines that there is an imminent risk to the safety of persons or property at the Place of the *Work*. In the event that the *Contractor* receives such notice, it shall immediately stop the *Work* and secure the *Project* site. The *Contractor* shall not be entitled to an extension of the *Contract Time* or to an increase in the *Contract Price* unless the resulting delay, if any, would entitle the *Contractor* to an extension of the *Contract Time* or the reimbursement of the *Contractor*'s costs as provided in paragraphs 6.5.1, 6.5.2 or 6.5.3."

3.27 GC 6.6 - CLAIMS FOR A CHANGE IN CONTRACT PRICE

3.27.1 Add the words "as noted in paragraph 6.6.3" after the words "of the claim" in paragraph 6.6.5 and add the words "and the Consultant", at the end of paragraph 6.6.5.

3.28 GC 7.1 - OWNER'S RIGHT TO PERFORM THE *WORK*, STOP THE WORK, OR TERMINATE THE CONTRACT

3.28.1 Amend paragraph 7.1.2 by adding the words "or fails or neglects to maintain the latest construction schedule" immediately following the word "properly" in the first line.

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

3.29.1 Amend paragraph 7.2.2, in line 1, by deleting "20" and replacing it with "35".

3.29.2 Delete subparagraph 7.2.3.1 in its entirety.

3.29.3 Delete subparagraph 7.2.3.3 in its entirety and substitute new subparagraph 7.2.3.3:

"7.2.2.3 the *Owner* fails to pay the *Contractor* when due the amount certified by the *Consultant* or awarded by arbitration or a Court, except where the *Owner* has a bona fide claim for set off, or"

3.29.4 Delete from line 2 of subparagraph 7.2.3.4, the words, "OF THE *OWNER*".

3.29.5 Delete paragraph 7.2.5 and replace it with the following:

"7.2.5 If the default cannot be corrected within the 5 *Working Day*s specified in paragraph 7.2.4, the *Owner* shall be deemed to have cured the default if it

.1 commences the correction of the default within the specified time; and

.2 provides the *Contractor* with an acceptable schedule for such correction; and

.3 completes the correction in accordance with such schedule."

3.29.6 Add new paragraph 7.2.6:

"7.2.6 If the *Contractor* terminates the *Contract* under the conditions described in this GC 7.2, the *Contractor* shall be entitled to be paid for all *Work* performed to the date of termination. The *Contractor* shall also be entitled to recover the direct costs associated with termination, including the costs of demobilization, losses sustained on *Products* and construction machinery and equipment. The *Contractor* shall not be entitled to any recovery for special, indirect or consequential losses or loss of profit or loss of use."

3.30 GC 8.1 - AUTHORITY OF THE CONSULTANT

3.30.1 Delete last sentence of 8.1.3 and substitute the following sentence:

"If it is subsequently determined that such instructions were at variance with the *Contract Documents*, the *Owner* shall pay the *Contractor* costs incurred by the *Contractor* in carrying out such instructions which the *Contractor* was required to do beyond the requirements of the *Contract Documents*, including costs resulting from interruption of the *Work*."

3.31 GC 8.2 - NEGOTIATION, MEDIATION AND ARBITRATION

3.31.1 Amend paragraph 8.2.1 by adding the words "...(the "Rules"), subject to amendments to the Rules attached to these Supplementary Conditions as Appendix 2..." following the term "Construction Disputes" in line 1.

3.31.2 Amend paragraph 8.2.4 by adding the words "…subject to the amendments to the Rules made as described in paragraph 8.2.1", following the words "Construction Disputes" in the last line.

3.31.3 Delete paragraph 8.2.6 and replace it with the following:

Amend paragraph 8.2.7 by changing the number "10" in line 1 to "20".

3.31.4 Add a new paragraph 8.2.9, 8.2.10, 8.2.11, 8.2.12, 8.2.13, and 8.2.14 as follows:

"8.2.9 Within five days of receipt of the notice of arbitration by the responding party under paragraph 8.2.6, the *Owner* and the *Contractor* shall give the *Consultant* a written notice containing:

.1 a copy of the notice of arbitration

.2 a copy of supplementary conditions 8.2.9 to 8.2.15 of the *Contract*, and;

.3 any claims or issues which the *Contractor* or the *Owner*, as the case may be, wishes to raise in relation to the *Consultant* arising out of the issues in dispute in the arbitration.

8.2.10 The *Owner* and the *Contractor* agree that the *Consultant* may elect, within ten days of receipt of the notice under paragraph 8.2.9, to become a full party to the arbitration under paragraph 8.2.6 if the *Consultant*:

.1 has a vested or contingent financial interest in the outcome of the arbitration;

.2 gives the notice of election to the *Owner* and the *Contractor* before the arbitrator is appointed;

.3 agrees to be a party to the arbitration within the meaning of the rules referred to in paragraph 8.2.6; and,

.4 agrees to be bound by the arbitral award made in the arbitration.

8.2.11 If an election is made under paragraph 8.2.10, the *Consultant* may participate in the appointment of the arbitrator and notwithstanding the rules referred to in paragraph 8.2.6, the time period for reaching agreement on the appointment of the arbitrator shall begin to run from the date the *Owner* receives a copy of the notice of arbitration.

8.2.12 The arbitrator in the arbitration in which the *Consultant* has elected under paragraph 8.2.10 to become a full party may:

.1 on application of the *Owner* or the *Contractor*, determine whether the *Consultant* has satisfied the requirements of paragraph 8.2.10; and

.2 make any procedural order considered necessary to facilitate the addition of the *Consultant* as a party to the arbitration.

8.2.13 The provisions of paragraph 8.2.9 shall apply mutatis mutandis to written notice to be given by the *Consultant* to any sub-*Consultant*.

8.2.14 In the event of notice of arbitration given by a *Consultant* to a sub-consultant, the sub-consultant is not entitled to any election with respect to the proceeding as outlined in 8.2.10, and is deemed to be bound by the arbitration proceeding."

3.32 GC 8.3 - RETENTION OF RIGHTS

3.32.1 Add new subparagraph 8.3.3:

"8.3.3 If the *Owner* gives the *Notice in Writing* described in paragraph 8.2.6 to have a dispute resolved by arbitration, the *Contractor* agrees that this paragraph 8.3.3 shall be construed as a formal consent to the stay of any lien proceedings until an award is rendered in the arbitration or such dispute is otherwise resolved between the parties. In no event shall the *Contractor* be deprived of its right to enforce its lien against the *Project* should the *Owner* fail to satisfy any arbitral award against it in full on the dispute in respect of which the lien proceedings were commenced. Provided nothing in this paragraph 8.3.3 shall prevent the *Contractor* from taking the steps required by the *Act* to preserve and/or perfect a lien to which it may be entitled."

3.33 GC 9.1 - PROTECTION OF WORK AND PROPERTY

3.33.1 Delete subparagraph 9.1.1.1 in its entirety and substitute new subparagraph 9.1.1.1:

"9.1.1.1 errors in the *Contract Documents* which the *Contractor* could not have discovered applying the standard of care described in GC3.14 STANDARD OF CARE."

3.33.2 Delete paragraph 9.1.2 in its entirety and substitute the following new paragraph 9.1.2:

"9.1.2 Before commencing any *Work*, the *Contractor* shall determine the locations of all underground utilities and structures indicated in the *Contract Documents* or that are discoverable by applying to an inspection of the Place of the *Work* the degree of care and skill described in GC14 STANDARD OF CARE.

3.33.3 Add a new paragraph 9.1.5 as follows:

"9.1.5 Without in any way limiting the *Contractor*'s obligations under this GC 9.1, should the *Contractor* or any *Subcontractor* or Supplier cause loss or damage to trees or other plantings, whether owned by the *Owner* or third parties, the *Contractor* shall be liable for the replacement cost of the trees or other plantings damaged, including the cost of any arborist or other *Consultant*, and such costs may be deducted by the *Owner* from amounts otherwise owing to the *Contractor*."

3.33.4 Add new paragraph 9.1.6:

"9.1.6 The *Contractor* shall neither undertake to repair and/or replace any damage whatsoever to the *Work* of other *Contractor*s, or to adjoining property, nor acknowledge the same was caused or occasioned by the *Contractor*, without first consulting the *Owner* and receiving written instructions as to the course of action to be followed from either the *Owner* or the *Consultant*. However, where there is danger to life or public safety, the *Contractor* shall take such emergency action as it deems necessary to remove the danger."

3.34 GC 9.2 - TOXIC AND HAZARDOUS SUBSTANCES

3.34.1 Add to paragraph 9.2.6 after the word "responsible", the following new words:

"or whether any toxic or hazardous substances or materials already at the *Place of the Work* (and which were then harmless or stored, contained or otherwise dealt with in accordance with legal and regulatory requirements) were dealt with by the *Contractor* or anyone for whom the *Contractor* is responsible in a manner which does not comply with legal and regulatory requirements, or which threatens human health and safety or the environment, or material damage to the property of the *Owner* or others,".

3.34.2 Add "and the Consultant" after the word "Contractor" in subparagraph 9.2.7.4.

3.34.3 Add to paragraph 9.2.8 after the word "responsible", the following new words:

"or that any toxic or hazardous substances or materials already at the *Place of the Work* (and which were then harmless or stored, contained or otherwise dealt with in accordance with legal and regulatory requirements) were dealt with by the *Contractor* or anyone for whom the *Contractor* is responsible in a manner which does not comply with legal and regulatory requirements, or which threatens human health and safety or the environment, or material damage to the property of the *Owner* or others,".

3.34.4 Add a new paragraph 9.2.10 as follows:

"9.2.10 Without limiting its other obligations under this GC 9.2, the *Contractor* acknowledges that its obligations under the *Contract* include compliance with the *Environmental Programs*. The *Contractor* acknowledges that the *Owner* may suffer loss and damage should the *Contractor* fail to comply with the *Environmental Programs* and agrees to indemnify and hold harmless the *Owner* with respect to any loss or damage to which the *Owner* is exposed by the *Contractor*'s failure to comply. The *Contractor* expressly agrees that such loss and damage shall be included within the scope of the *Contractor*'s indemnity described in paragraph 12.1.1. The *Contractor* acknowledges that should it fail to comply with the *Environmental Programs*, such failure will constitute a failure to comply with the *Contract* to a substantial degree within the meaning of paragraph 7.1.2."

3.35 GC 9.4 - CONSTRUCTION SAFETY

Delete paragraph 9.4.1 in its entirety and substitute new paragraph 9.4.1

"9.4.1 The *Contractor* shall be solely responsible for construction safety at the *Place of the Work* and for compliance with the rules, regulations and practices required by the applicable construction health and safety legislation and shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the *Work*."

3.35.1 Add new paragraphs 9.4.2, 9.4.3, 9.4.4 and 9.4.5.

"9.4.2 Prior to the commencement of the *Work*, the *Contractor* shall submit to the *Owner*:

.1 a current *WSIB* clearance certificate;

.2 copies of the *Contractor's* insurance policies having application to the *Project* or certificates of insurance, at the option of the *Owner*;

.3 documentation of the *Contractor's* in-house safety-related programs;

.4 a copy of the Notice of *Project* filed with the Ministry of Labour naming itself as "constructor" under *OHSA*.

9.4.3 The *Contractor* hereby represents and warrants to the *Owner* that appropriate health and safety instruction and training have been provided and will be provided to the Contractor's employees, Subcontractors and Suppliers, before the Work is commenced. The *Contractor* also undertakes to provide such health and safety instruction and training to the *Owner's* representatives, the *Owner's* own forces and other contractors, should they fall under the jurisdiction of the *Contractor* as more particularly described in paragraph 9.4.1 above.

9.4.4 The *Contractor* shall indemnify and save harmless the *Owner*, its agents, officers, directors, employees, *Consultant*s, successors and assigns from and against the consequences of any and all safety infractions committed by the *Contractor* under *OHSA*, including the payment of legal fees and disbursements on a solicitor and client basis. Such indemnity shall apply to the extent to which the *Owner* is not covered by insurance, provided that the indemnity contained in this paragraph shall be limited to costs and damages resulting directly from such

infractions and shall not extend to any consequential, indirect or special damages.

9.4.5 The *Owner* undertakes to include in its *Contract*s with other *Contractor*s and/or in its instructions to its own forces the requirement that the other *Contractor* or own forces, as the case may be, will comply with directions and instructions from the *Contractor* with respect to occupational health and safety and related matters. The text of such instruction is attached to these Supplementary Conditions as Appendix 1."

3.36 GC 9.5 - MOULD

3.36.1 Delete paragraph 9.5.3.3 in its entirety and substitute new paragraph 9.5.3.3

"9.5.3.3 extend the *Contract Time* for such reasonable time as the *Consultant* may recommend in consultation with the *Contractor*. If, in the opinion of the *Consultant*, the *Contractor* has been delayed in performing the *Work* and / or has incurred additional costs under paragraph 9.5.1.2, the *Owner* shall reimburse the *Contractor* for reasonable costs incurred as a result of the delay and as a result of taking those steps, and "

3.36.2 Add "and the Consultant" after "Contractor" in subparagraph 9.5.3.4.

3.37 GC 10.1 - TAXES AND DUTIES

3.37.1 Amend paragraph 10.1.2 by adding the following sentence at the end of that paragraph:

"For greater certainty, the *Contractor* shall not be entitled to any mark-up for overhead or profit on any increase in such taxes and duties and the *Owner* shall not be entitled to any credit relating to mark-up for overhead or profit on any decrease in such taxes."

3.37.2 Add new paragraphs 10.1.3, 10.1.4, 10.1.5 and 10.1.6 as follows:

"10.1.3 Where the *Owner* is entitled to an exemption or a recovery of sales taxes, customs duties, excise taxes or *Value Added Taxes* applicable to the *Contract*, the *Contractor* shall, at the request of the *Owner* or the *Owner's* representative, assist with application for any exemption, recovery or refund of all such taxes and duties and all amounts recovered or exemptions obtained shall be for the sole benefit of the *Owner*. The *Contractor* agrees to endorse over to the *Owner* any cheques received from the federal or provincial governments, or any other taxing authority, as may be required to give effect to this paragraph.

10.1.4 The *Contractor* shall maintain accurate records of equipment, material and component costs reflecting the taxes, customs duties, excise taxes and Value Added Taxes paid.

10.1.5 Any refund of taxes including, without limitation, any government sales tax, customs duty, excise tax or Value Added Tax, whether or not paid, which is found to be inapplicable or for which exemption may be obtained, is the sole and exclusive property of the *Owner*. The *Contractor* agrees to cooperate with the *Owner* and to obtain from all *Subcontractor*s and *Suppliers* cooperation with the *Owner* in the application for any refund of any taxes, which cooperation shall include, but not be limited to, making or concurring in the making of an application for any such refund or exemption and providing to the *Owner* copies, or where required, originals of records, invoices, purchase orders and other documentation necessary to support such applications or exemptions or refunds.

All such refunds shall either be paid to the *Owner*, or shall be a credit to the *Owner* against the *Contract Price*, in the *Owner's* discretion.

10.1.6 Customs duties penalties, or any other penalty, fine or assessment levied against the *Contractor* shall not be treated as a tax or customs duty for purposes of this GC 10.1."

3.37.3 Add to the end of paragraph 10.2.4, the following words:

"The *Contractor* shall notify the Chief Building Official or the registered code agency where applicable, of the readiness, substantial completion, and completion of the stages of construction set out in the Ontario Building Code. The *Contractor* shall be present at each site inspection by an inspector or registered code agency as applicable under the Ontario Building Code."

3.37.4 Delete from the first line of paragraph 10.2.5 the word, "The" and substitute the words:

"Subject to paragraph 3.4.1, the".

3.38 INDEMNIFICATION

3.38.1 Delete paragraphs 12.1.1 through 12.1.6 and replace them with the following:

"The *Contractor* shall indemnify and hold harmless the *Owner* and the *Consultant*, their agents and employees from and against all claims, demands, losses, costs, damages, actions, suits, or proceedings (hereinafter called "claims"), by third parties that arise out of, or are attributable to, the *Contractor's* performance of the *Contract* provided such claims are:

.1 attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property, and

.2 caused by negligent acts or omissions of the *Contractor* or anyone for whose acts the *Contractor* may be liable, and

.3 made in writing within a period of 6 years from the date of *Substantial Performance of the Work* as set out in the certificate of *Substantial Performance of the Work*, or within such shorter period as may be prescribed by any limitation statute of the province or territory of the *Place of Work*.

Except as otherwise provided in this Contract, the *Owner* expressly waives the right to indemnity for claims other than those stated above.

3.38.2 The obligation of the *Contractor* to indemnify hereunder shall be limited to $5,000,000 per occurrence from the commencement of the *Work* until *Substantial Performance of the Work* and thereafter to an aggregate limit of $5,000,000.

3.38.3 The *Owner* shall indemnify and hold harmless the *Contractor*, the *Contractor*'s agents and employees from and against claims, demands, losses, costs, damages, actions, suits, or proceedings arising out of the *Contractor's* performance of the *Contract* which are attributable to a lack of or defect in title or an alleged lack of or defect in title to the *Place of Work*."

3.39 GC 12.2 - WAIVER OF CLAIMS

3.39.1 Delete paragraphs 12.2.1 through 12.2.10 and replace them with the following:

"12.2.1 As of the date of the final certificate for payment, the *Owner* expressly waives and releases the *Contractor* from all claims against the *Contractor* including without limitation those that might arise from negligence or breach of contract by the *Contractor* except for one or more of the following:

.1 those made in writing prior to the date of the final certificate for payment and still unsettled;

.2 those arising from the provisions of GC12.1 – INDEMNIFICATION or GC12.3 – WARRANTY;

.3 those arising from GC9.2 – TOXIC AND HAZARDOUS SUBSTANCES AND MATERIALS and arising from the *Contractor* bringing or introducing any toxic or hazardous substances and materials to the *Place of the Work* after the *Contractor* commences the *Work*;

.4 those made by Notice in Writing within a period of six years from the date of *Substantial Performance of the Work* as set out in the certificate of substantial performance, or within such shorter period as may be prescribed in any limitation statute of the province or territory of the *Place of the Work* and arising from any liability of the *Contractor* for damages resulting from the *Contractor's* performance of the *Contract* with respect to substantial defects or deficiencies in the *Work* for which the *Contractor* is proven responsible. As used herein, "substantial defects or deficiencies" means those defects or deficiencies in the *Work* where the reasonable cost of repair of such defects or deficiencies exceeds:

.1 for a *Contract Price* of $2,000,000 or less, the sum of $50,000, before GST;

.2 for a *Contract Price* of $2,000,000 or more, the sum of $100,000, before GST.

12.2.2 As of the date of certificate of *Substantial Performance of the Work*, the *Contractor* expressly waives and releases the *Owner* from all claims which it has or reasonably ought to have knowledge of that could be advanced against the *Owner* including without limitation those that might arise from the negligence or breach of contract by the *Owner* except:

.1 those made in writing prior to the *Contractor's* application for final payment and still unsettled; and

.2 those arising from the provisions of GC9.2 – TOXIC AND HAZARDOUS SUBSTANCES AND MATERIALS or GC10.3 – PATENT FEES."

3.40 GC 12.3 - WARRANTY

3.40.1 Delete paragraph 12.3.1 through 12.3.4 and 12.3.6 and replace them with the following:

"12.3.1 Except for extended warranties as described in paragraph 12.3.6, the warranty period under the *Contract* is two years from the date of *Substantial Performance of the Work*.

12.3.2 Subject to paragraph 3.4.1, the Contractor shall be responsible for the proper performance of

the Work to the extent that the design and Contract Documents permit such performance.

12.3.3 The Owner, through the Consultant, shall promptly give the Contractor Notice in Writing of observed defects and deficiencies which occur during the two year warranty period.

12.3.4 Subject to paragraph 12.3.2, the Contractor shall correct promptly, at the Contractor's expense, defects or deficiencies in the Work which appear prior to and during the two year warranty period.

12.3.6 Any extended warranties required beyond the two year warranty period as described in paragraph 12.3.1, shall be as specified in the Contract Documents. Extended warranties shall be issued by the warrantor to the benefit of the Owner. The Contractor's responsibility with respect to extended warranties shall be limited to obtaining any such extended warranties from the warrantor. The obligations under such extended warranties are solely the responsibilities of the warrantor."

3.41 OTHER PROVISIONS

"Add new PART 13 as follows:

3.42 GC 13.1 - OWNERSHIP OF MATERIALS

13.1.1 Unless otherwise specified, all materials existing at the *Place of the Work* at the time of execution of the *Contract* shall remain the property of the *Owner*. All *Work* and *Products* delivered to the *Place of the Work* by the *Contractor* shall be the property of the *Owner.* The *Contractor* shall remove all surplus or rejected materials as its property when notified in writing to do so by the *Consultant*.

3.43 GC 13.2 - CONSTRUCTION LIENS

13.2.1 In the event that a construction lien is registered against the *Project* by or through a *Subcontractor* or *Supplier* and provided the *Owner* has paid all amounts properly due under the *Contract* and has otherwise complied with its material obligations under the *Contract*, the *Contractor* shall, at its own expense, post the security necessary to vacate or discharge such lien, as the case may be. In the event that a lien action is commenced and a Statement of Claim is issued and served, the *Contractor* shall take all reasonable steps to remove the *Owner* from the main action and to indemnify it and hold it harmless against such action, except where the Statement of Claim makes substantive claims against the *Owner* beyond the recovery of the holdback under the *Act.*

13.2.2 In the event that the *Contractor* fails to comply with the requirements of paragraph 13.2.1, the *Owner* may set off and deduct from any amount owing to the *Contractor*, all costs and associated expenses, including the costs, as applicable, of borrowing the appropriate cash, posting a letter of credit or delivering a bond as security together with all reasonable legal fees and disbursements. If there is no amount owing by the *Owner* to the *Contractor*, then the *Contractor* shall reimburse the *Owner* for all of the said costs and associated expenses.

3.44 GC 13.3 - CONTRACTOR DISCHARGE OF LIABILITIES

13.3.1 In addition to the obligations assumed by the *Contractor* pursuant to GC 3.7, the *Contractor* agrees to discharge all liabilities incurred by it for labour, materials, services, *Subcontractor*s and *Products*, used or reasonably required for use in

the performance of the *Work*, except for amounts withheld by reason of legitimate dispute and which have been identified to the party or parties, from whom payment has been withheld.

13.3.2 Notwithstanding any other provision in this *Contract,* in the event the *Owner* as a result of the *Contractor's* act or omission or breach of contract, incurs damages, costs, fees or expenses, including costs of additional services performed by the *Consultant* and including the *Owner's* reasonable solicitor and own client costs, whether or not such act, omission or breach results in any lien, lien action or other legal proceeding, and whether or not such act, omission or breach results in the *Owner* taking any of the steps provided in ARTICLE 7.1 – THE OWNER'S RIGHT TO PERFORM THE WORK OR TERMINATE THE CONTRACT. All such damages, costs, fees and expenses shall be charged to the *Contractor* and the *Owner* shall be entitled to set off and deduct all such damages, costs, fees and expenses from any amount owing to the *Contractor* and any security or other funds held by the *Owner*. If there is no amount owing by the *Owner* to the *Contractor*, then the *Contractor* shall reimburse the *Owner* for all of the said damages, costs, fees and expenses.

3.45 GC 13.4 - AS-BUILT DRAWINGS

13.4.1 Unless otherwise provided in the *Contract Documents*, the *Contractor* shall prepare as-built *Drawings* and provide them to the *Consultant* for review in accordance with paragraph 5.4.5.

3.46 GC 13.5 - DAILY REPORTS/DAILY LOGS

13.5.1 The *Contractor* shall cause its supervisor, or such competent person as it may delegate, to prepare a daily log or diary reporting on weather conditions, *Work* force of the *Contractor*, *Subcontractor*s, *Suppliers* and any other forces on site and also record the general nature of *Project* activities. Such log or diary shall also include any extraordinary or emergency events which may occur and also the identities of any persons who visit the site who are not part of the day-to-day *Work* force.

13.5.2 The *Contractor* shall also maintain records, either at its head office or at the job site, recording manpower and material resourcing on the *Project*, including records which document the activities of the *Contractor* in connection with GC 3.5, and comparing that resourcing to the resourcing anticipated when the most recent version of the schedule was prepared pursuant to GC 3.5.

13.5.3 The *Contractor* shall make the records, logs and other materials prepared pursuant to this GC13.5 available to the *Owner* and/or the *Consultant* upon reasonable notice. In such event, the *Owner* and/or the *Consultant* may attend at the *Contractor's* premises, review the materials and logs and make such copies as they may require, such copies to be at the expense of the *Owner* and/or the *Consultant*, as the case may be.

3.47 GC 13.6 - NEUTRAL APPOINTING AUTHORITY

13.6.1 For purposes of the Rules the term "neutral appointing authority", shall mean the "Appointing Committee" at ADR Chambers presiding at the time notice of the dispute is given pursuant to the *Contract*."

3.48 GC 13.7 - PUBLIC STATEMENTS

13.7.1 The *Contractor* shall not publish, issue or make any statements or news release, electronic or otherwise, concerning the *Contract*, the *Work*, or the *Project*, without the express written consent of the *Owner*."

END OF SUPPLEMENTARY CONDITIONS

APPENDIX 1

LANGUAGE FOR *OWNER* PERSONNEL OR FOR THIRD PARTY *CONTRACTOR*S ENTERING A PROJECT SITE WHERE THE *CONTRACTOR* HAS ASSUMED OVERALL RESPONSIBILITY – IN *CONTRACT* – FOR OCCUPATIONAL HEALTH AND SAFETY

"The (trade or employee) acknowledges that the *Work* it will perform on behalf of the *Owner* requires it to enter a job site which is under the total control of a *Contractor* which has a *Contract* with____ _____. The (trade or employee) acknowledges that [name of *Contractor*] has assumed overall responsibility for compliance with all aspects of the health and safety legislation of Ontario, including all the responsibilities of the "constructor" under the Occupational Health and Safety Act (Ontario). Further, (trade or employee) acknowledges that [name of *Contractor*] is also responsible to the to co-ordinate and schedule the activities of our *Work* with the *Work* of the *Contractor*.

We agree to comply with [name of *Contractor*] directions and instructions with respect to occupational health and safety and coordination. We acknowledge that it will be cause for termination under our *Contract* with the *Owner* should (I/we) fail or refuse to accept the direction and instruction of the *Contractor* with respect to matters of occupational health and safety or matters related to coordination of *Work*.

We agree to have the *Contractor* named as an additional insured on our comprehensive liability policy."

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APPENDIX 2

Amendment to Rules for Mediation and Arbitration of Construction Disputes (CCDC-40, 1994) (the "Rules")

The Rules assume the use of the Standard Construction Documents CCDC2-2008 for a Stipulated Price *Contract*, including the Agreement, Definitions, General Conditions and any amendments or supplementary conditions, if there are any. This Amendment supersedes, replaces or amends the Rules, as the case may be, as outlined below.

1. RULES FOR MEDIATION OF CCDC 2 CONSTRUCTION DISPUTES

1.1 Interpretation. Amend clause 1.1(a) so that it reads as follows:

> "(a) The "*Contract*" means CCDC2-2008, where such *Contract* document contains an agreement to refer disputes to mediation under these Rules."

1.2 By Agreement. Delete clause 5.1 and replace it with the following:

> "5.1 By Agreement . Where a party desires the appointment of a Project Mediator and gives a *Notice in Writing* to that effect, such notice shall include the names of two qualified individuals who are prepared to act as mediator, ranked in order of preference. Within five *Working Day*s of receiving such a notice, the other party shall deliver a responding notice including the names of two qualified individuals who are prepared to act as mediator, ranked in order of preference. From the names submitted by the parties, the parties shall unanimously appoint a mediator."

1.3 Appointment of Project Mediator. Add a new clause 5.5 which reads as follows:

> "5.5 Formal Agreement. When the Project Mediator has been appointed, whether pursuant to clause 5.1 or clause 5.2, the parties and the mediator shall enter into an agreement in writing pursuant to which the terms and conditions of the engagement of the Project Mediator shall be set out. Such agreement shall include an undertaking by the Project Mediator to carry out the mediation pursuant to these Rules and such agreement shall specifically set out the undertaking of the Project Mediator and the parties as to "Confidentiality" (Section 4) "Costs of the Mediation" (Section 12) and "Privileged Process" (Section 13)."

1.4 Representation. Amend clause 8.1 by deleting the last six words of that clause.

1.5 Right To Withdraw. Amend clause 11.1 by deleting the words "of GC8.2.5" toward the end of line 3.

1.6 Not Compellable. Amend clause 14.2(a) by replacing the word "*Contractor*" with the word "*Contract*".

2. RULES FOR ARBITRATION OF CCDC 2 CONSTRUCTIONS DISPUTES

2.1 Interpretation. Amend clause 1.1(b) so that it reads as follows:

"(b) The "*Contract*" means CCDC2-2008, where such *Contract* document contains an agreement to refer disputes to mediation under these Rules."

2.2 Interpretation. Amend clause 1.1(d) so that, as amended, it reads as follows:

"(d) The parties means the parties to the *Contract* and any other persons who may join in an arbitration involving the *Owner* and the *Contractor* or the Construction Manager and/or a Trade *Contractor*, as the case may be."

2.3 Location of Arbitration. Add the following as a second sentence to clause 5.1:

"Failing agreement by the parties, the arbitrator may select a location for the arbitration within the jurisdiction of the Place of *Work*, which is convenient to both parties".

2.4 Single Arbitrator. Delete clause 8.1 and replace it with the following:

"8.1 The arbitration shall be conducted before a single arbitrator who possesses the qualifications specified in Clause 8.5."

2.5 Appointment Of Arbitrator. Delete Clause 8.2 in its entirety and replace it with the words, "intentionally left blank".

2.6 Appointment of 3 Arbitrators. Delete Clause 8.4 in its entirety and replace it with, "intentionally left blank".

2.7 Appointment of Arbitrator. Add a new clause 8.13 which reads as follows:

"8.13 Where the arbitrator has been appointed pursuant to the Section 8, the parties and the arbitrator shall enter an agreement in writing setting out, at minimum, the name of the arbitrator, the undertaking of the arbitrator and the parties to conduct the arbitration pursuant to these Rules and the terms and conditions of engagement of the arbitrator including the fees to be paid and expenses to be reimbursed and any arrangements required to provide for interim payment of fees and/or expenses to the arbitrator."

2.8 Procedural Meeting. Add the following new sentence to clause 9.2:

"Such written record shall be deemed to be the procedural code for the conduct of the arbitration, subject to any further orders of the arbitrator or of the Court of competent jurisdiction."

2.9 Powers of the Arbitrator. Delete clause 10.1 and substitute the following:

"Subject to these Rules and subject to the written record described in clause 9.2, the arbitrator may conduct the arbitration in such manner as the arbitrator, acting reasonably, considers appropriate provided that in all events each party shall be treated fairly and given a full opportunity to present its case and respond to the case presented by the other party."

2.10 Exchange of Statements. Delete clause 11.3(a) and replace it with the following:

"(a) which are relevant to the issues in dispute, and..".

2.11 Disclosure. Delete clause 12.1 and replace it with the following:

"12.1 Production of Documents - The arbitrator may order one or both parties to prepare an affidavit, within a specified time, in which such party deposes under oath that it has made a full and complete listing of documents pursuant to clause 11.3(a) where the arbitrator has reason to believe that one or both parties may not have made full and complete disclosure of the documents relevant to the issues in the arbitration."

2.12 Add a new clause 12.6 as follows:

"12.6 In the event that a party provides the statement or report of an expert witness pursuant to clause 12.4, the provisions of clauses 15.3 and 15.4 shall apply, with necessary modifications."

2.13 Hearings and Meetings. Amend clause 13.3 by adding the following language to that clause:

"..unless otherwise agreed by both parties or directed by the arbitrator."

2.14 Arbitrator Retained Experts. Add clause 15.3(c) as follows:

"(c) provide the party with a written summary of any other information, beyond that described in clauses 13.2(a) and (b), upon which the expert relied in preparing the expert's report."

2.15 Consolidation. Amend clause 21.1(a) by adding the following wording to that clause:

"...on the same *Project*,..".

END OF SECTION

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1.1 Document Responsibility

.1 Refer to Project Manual, Section 00 01 10 - Table of Contents, for indication of document responsibility (DR). Abbreviations for entity responsible for document preparation are as follows:

.1 A - Denotes documents prepared by Architect.

.2 E - Denotes documents prepared by Electrical Engineer.

.3 H - Denotes documents prepared by Architectural Hardware Consultant.

.4 L - Denotes documents prepared by Landscape Architect.

.5 M - Denotes documents prepared by Mechanical Engineer.

.6 O - Denotes documents prepared by Owner.

.7 O/G Denotes documents prepared by Owner's Geotechnical Consultant.

.8 O/HM - Denotes documents prepared by Owner's Hazardous Materials Consultant.

.9 O/S Denotes documents prepared by Owner's Survey Consultant.

.10 S - Denotes documents prepared by Structural Engineer.

.11 Sc - Denotes documents prepared by Security Consultant.

.2 Professional seals if applied next to company names in the project directory (below) govern only those specification sections and schedules identified by the corresponding document responsibility (DR) abbreviation in Section 00 01 10.

1.2 Project Directory

.1 Owner:

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

Contact: Klaus Padaric

.2 Architect (the *Consultant*):

LGA architectural partners
310 Spadina Avenue, Suite 100B
Toronto, ON, M5T 2E8

.3 Structural Engineer:

WitzelDyce
826 King St North, Unit 20
Waterloo, ON N2J 4G8

.4 Mechanical and Electrical Engineers:

Quasar Consulting Group
250 Rowtree Dairy Road, Unit 2
Woodbridge, ON, L4L 9J7

.5 Civil Engineers:

Strik Baldinelli Moniz
1415 Huron Rd. Unit 225
Kitchener ON, N2R 0L3

END OF SECTION

1.1 Information Available for Review

.1 The following documents are made available for review:

.1 Hazardous Building Material Assessment:

.1 Asbestos Audit, prepared by MTE Consultants Inc. for each facility is available at the main office of the Place of Work.

.2 Existing Drawings:

.1 1966 March Structural Drawing Set, prepared by Snider Huget and March Architects and Engineers.

.2 The accuracy of the information contained in the above listed documents has not been independently verified by the *Consultant*.

END OF SECTION

PART 1 - GENERAL

1.1 Language of the *Contract*

.1 The use of the words “include” or “including”, or variations thereof, within the *Contract Documents* is not limiting.

1.2 The *Contract Documents*

.1 The *Contract Documents* have been arranged into various divisions, sections, drawings, and schedules for the purpose of presenting the *Work* in a logical and organized form and to enable ease of reference and interpretation, and are not intended to be an arrangement of precise and independent *Subcontractors*, or jurisdiction of responsibility for the various parts of the *Work*. The *Contractor* shall be solely responsible for coordinating the execution of the *Work* of this *Contract* in accordance with the requirements of the *Contract Documents*.

.2 As a result, the *Consultant* shall not be required to decide on questions arising with regard to agreements or contracts between the *Contractor* and *Subcontractors* or *Suppliers*, nor to the extent of the parts of the *Work* assigned thereto.

.3 Further, no extra will be allowed as a result of the failure to coordinate and allocate the *Work* such that the *Work* is *Provided* in accordance with the *Contract Documents*.

.4 This section coordinates, relates, and governs the work of other sections of the specifications.

1.3 Divisions 00 and 01

.1 Division 00 Contracting Requirements and Division 01 General Requirements apply to the *Work* of the *Contract Documents*.

.2 Log to acknowledge *Subcontractors* have read Divisions 00 and 01:

.1 Provide confirmation that each *Subcontractor* have read Divisions 00 and 01, in the form of a log, complete with *Subcontractors* required for the Work of the *Contract Documents*, complete with corresponding signature for each *Subcontractor’s* representative.

.2 Submit completed log, updated within 2 weeks of award of contract for all *Subcontractors*

1.4 Existing Services Interruptions

.1 Connection or disconnection of services that will interfere with the operation of the *Owner’s* facilities shall not be done without the prior written acceptance of the *Consultant* in the presence of the *Owner* and during the times designated by the *Owner*. Premium charges associated with such work shall be included in the *Contract Price*.

.2 Provide at least 10 *Working Days*’ prior written notice to the *Consultant* and the *Owner* of requirement or intention to interrupt services, and obtain written permission of the *Consultant* in the presence of the *Owner* prior to commencing such interruption.

.3 In no instance shall interruptions affect the entire existing building.

1.5 Laws, Notices, Permits and Fees

.1 The building code - Ontario Regulation 332/12, including amendments, shall govern the *Work*.

.2 Comply with codes, by-laws, and regulations of authorities having jurisdiction over the *Place of the Work*. Codes and regulations form an integral part of the *Contract Documents*.

.3 *Owner* shall apply and pay for the building permit. The *Contractor* shall pick up building permit from the municipal department having jurisdiction at the *Place of the Work*. Obtain and pay for all other permits, licenses, deposits and certificates of inspection as part of the *Work*.

.4 Arrange for inspection, testing and acceptance of the *Work* required by the authorities having jurisdiction. Be responsible for necessary preparations, provisions and pay costs.

.5 It is the responsibility of the *Contractor* to schedule notifications and inspections required by authorities having jurisdiction such that notifications can be properly received and that inspections can be properly undertaken without causing a delay in the *Work*. The *Contractor*, at no additional cost to the *Owner*, shall be solely responsible for any delay in the *Work* caused by failure to properly schedule required notifications and inspections.

.6 The *Contractor* shall provide to the chief building official or the registered code agency, where a registered code agency is appointed under the Ontario Building Code Act in respect of the construction to which the notice relates, the required notices set out in Division C – Part 1 Sentence 1.3.5.1(2) and Sentence 1.3.5.2 of the Ontario Building Code, O. Reg. 332/12 as amended. The *Contractor* shall be present at each site inspection by an inspector or registered code agency as applicable under Division C – Part 1 Sentence 1.3.5.2 of the building code.

.1 It is the responsibility of the *Contractor* to schedule notifications to the chief building official or the registered code agency such that the inspection pertaining to the notifications can be made within the time frame as required under Division C – Part 1 Sentence 1.3.5.3 of the Ontario Building Code, O. Reg. 332/12 as amended, without causing a delay in the *Work*. The *Contractor*, at no additional cost to the *Owner*, shall be solely responsible for any delay in the *Work* caused by failure to properly schedule required notifications and inspections.

1.6 Examination of the *Place of the Work*, Documents, Surfaces and Conditions

.1 Examine the *Place of the Work* and investigate matters relating to the nature of the *Work*, means of access and egress, obstacles, rights and interests of other parties which may be interfered with during the execution of the *Work*, conditions and limitations including obstructions, existing structures or facilities, local conditions, actual levels, character and nature of the *Work*, and other consideration which may affect performance of the *Work*.

.2 Examine the extent of work to be performed and matters which are referred to in the *Contract Documents* prior to start of the *Work*.

.3 Examine work to which work is to be applied, anchored or connected, and relevant as-built conditions.

.4 Each work operation following on a previous work operation of a differing *Subcontractor*, as in the case of finishing and surfacing work, shall include a thorough examination of the condition of the previous work. Conditions found unacceptable, either for the commencement of the new work or its satisfactory completion, shall be reported in writing to the *Consultant*.

.5 Do not commence work until unsatisfactory conditions are corrected. Commencement of work implies acceptance of surfaces, tolerances, and conditions and existing conditions will not be accepted as a contributing factor to subsequent failure or acceptability of the *Work*.

1.7 Quantity of Items

.1 Where a component, device, item or part of materials or equipment is referred to in the singular number, such reference shall require the provision of as many components, devices, items or parts of material or equipment necessary to complete the *Work*.

1.8 Standards and Codes

.1 *Contract* forms, codes, specifications, standards, manuals and installation, application and maintenance instructions referred to in these specifications, unless otherwise specified, amended or date suffixed, shall be latest published editions at *Contract* date.

1.9 Discrepancies and Clarifications

.1 Advise *Consultant* of discrepancies discovered in requirements of the *Contract Documents* and request clarification in written form.

.2 Advise *Consultant* when clarifications are required pertaining to meaning or intent of requirements of *Contract Documents* and request clarification from *Consultant* in written form.

.3 Do not proceed with related work until written clarification is provided by *Consultant*.

.4 Failure to notify *Consultant* shall result in *Contractor* incurring responsibility for resulting deficiencies and expense at no additional cost to the *Owner*.

.5 Written instructions issued by *Consultant* for the purpose of clarification, implicitly supersede applicable and relevant aspects of the *Contract Documents* irrespective of whether or not these documents are explicitly or specifically cited in clarification requests or clarification instructions.

1.10 Setting out the *Work*

.1 Assume full responsibility for and execute complete layout of the *Work* to required locations, lines and elevations.

.2 Arrange meeting with *Consultant* to discuss critical setting out assumptions for the Work and establish limiting conditions for setting out the *Work*. *Consultant* shall chair meeting and prepare and submit subsequent sketches recording understanding of key setting out principles; *Contractor* shall prepare minutes of the meeting.

.3 Provide devices needed to lay out and construct the *Work*.

1.11 Documents at the *Place of the Work*

.1 Maintain at the *Place of the Work*, one copy of each of following:

.1 *Contract Documents* including drawings, specifications, addenda, and other modifications to the *Contract*.

.2 'Reviewed' or 'Reviewed as Modified' shop drawings.

.3 Construction and submittal schedules.

.4 *Supplemental Instructions*, proposed *Change Orders*, *Change Orders*, and *Change Directives*.

.5 *Consultant's* field review reports and deficiency reports.

.6 Reports by authorities having jurisdiction.

.7 Building and other applicable permits, and related permit documents.

.8 As-built drawings recording as-built conditions, instructions, changes for structure, equipment, wiring, plumbing, and the like, prior to being concealed.

.2 Make above material available to *Consultant* upon request.

1.12 Concealed Services

.1 Conceal wiring, conduit, pipes and ductwork in finished areas, unless otherwise indicated.

1.13 Trademark and Labels

.1 Trademarks and labels, including applied labels, shall not be visible in finished work in finished areas, unless otherwise accepted or indicated by *Consultant*.

.2 The exceptions to this requirement are trademarks and labels which are essential to identify materials, systems, assemblies, and equipment for maintenance and replacement purposes, and for life safety, fire resistance and temperature rise ratings.

1.14 Interferences

.1 Coordinate placement of equipment to ensure that components will be properly accommodated within spaces provided prior to commencement of the *Work*.

.2 Take complete responsibility for remedial work that results from failure to coordinate aspects of work prior to its fabrication/installation.

.3 Ensure that accesses and clearance required by jurisdictional authorities and/or for easy maintenance of equipment are provided in layout of equipment and services; notify *Consultant* if indicated clearances are in conflict.

1.15 Not In Contract Items and Items Supplied by Owner

.1 NIC (Not In *Contract*) shall be used to designate various items of equipment that require coordination for installation although are not *Provided* as part of the *Work*.

.2 SBO (Supplied by *Owner*) shall be used to designate various items of equipment that will be supplied by the *Owner* for installation by the *Contractor* as part of the *Work*.

.1 Install items indicated as supplied by *Owner* (SBO) during the *Work*. Coordinate shipping and delivery with the *Owner*. Store items supplied by *Owner* at the *Place of the Work* and protect from damage. Install completely, and leave in full operating condition, in accordance with manufacturer's directions.

.1 Equipment.

.2 Projector and projector mount.

1.16 Publicity Releases and Photographs

.1 No press or publicity releases will be permitted without prior written approval of the *Owner*.

.2 No photographs of the *Place of the Work* or of any portion of the *Work* will be permitted without written approval of the *Owner*, except as provided by the *Contract Documents*.

1.17 Electronic Files

.1 In the event that the *Contractor* requests copies of AutoCAD files of the drawings prepared for this project from the *Consultant* the procedures and requirements given hereunder shall apply.

.1 *Subcontractors* and *Suppliers* requesting AutoCAD files shall make arrangements with the *Contractor*. The *Consultant* will not provide AutoCAD files to *Subcontractors* or *Suppliers*.

.2 The *Consultant* will require a copyright waiver and/or CAD data disclaimer to be signed by the *Contractor* prior to delivery of such AutoCAD files.

.1 Copies of each of these disclaimers are appended to this section for reference.

.3 The *Consultant* or other consultants/subconsultants may charge a fee for providing the electronic files as indicated in the CAD data disclaimer or otherwise at the *Consultant's* or other consultant's/subconsultant's discretion.

.1 Payment, where required, shall be made directly to the other consultant/subconsultant, and not through the *Consultant*.

1.18 Electronic Submittals

.1 Submit *Contractor* submittal documents electronically by electronic mail.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

PART 1- GENERAL

1.1 Cash Allowances

.1 Expenditures from cash allowance stipulated sum shall be directed by *Consultant* in writing.

.2 Unexpended amounts of cash allowances shall be deducted from the *Contract Price* at completion of *Work*.

.3 Cash allowances include supply and installation unless otherwise indicated.

.4 Supply only cash allowances include:

.1 Net cost of *Products*.

.2 Delivery to the *Place of the Work*.

.3 Applicable taxes and duties (excluding *Value Added Taxes*).

.5 Supply only cash allowances do not include costs for the following (include such costs elsewhere in *Contract Price*):

.1 Storage and handling at the *Place of the Work*.

.2 Installation costs.

.6 Supply and install cash allowances include:

.1 Net cost of *Products*.

.2 Delivery to the *Place of the Work*.

.3 Unloading, storing, handling of *Products* on the *Place of the Work*.

.4 Installation, finishing, and commissioning of *Products*.

.5 Applicable taxes and duties (excluding *Value Added Taxes*).

.7 Inspection and testing cash allowances include:

.1 Net costs of inspection/testing services.

.2 Applicable taxes (excluding *Value Added Taxes*).

.8 List of cash allowance:

.1 The following cash allowances are included in the *Contract Price*:

.1 The total amount is $61,000.00 which covers payment for the following:

.1 Repair to existing masonry at parapet: $5,000.00

.2 Finished Hardware: $7,000.00.

.3 Gymnasium floor repair: $2,000.00

.4 Signage, repair of logo on gymnasium wood floor: $2,000.00.

5 ~~.5 Parapet masonry repair: $5,000.00~~.

.6 Inspection and testing per Section 01 45 00: $40,000.00.

6 .7 Daylighting by Hydrovac or approved equivalent (i.e. hand digging) to confirm service location, inverts/conflicts: $50,000.00

6 .8 Unforeseen abatement which was not already identified in the Asbestos Update that is required to be done in order to complete the work of the project: $40,000.00

.1 *Contractor* will be responsible to hire a third-party in order to inspect the installed door hardware. Costs for the inspection of door hardware to be included in the Cash Allowance.

PART 2- PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 Approved Alternates and Approved Equals

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

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

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

1.2 Substitutions

.1 Submission of substitutions:

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

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

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

.4 Allow minimum 2 weeks review of substitutions. Delay in review of substitutions shall not be basis for a claim.

.5 All claims are waived for additional costs related to the substitutions which may subsequently arise.

.2 Submission requirements:

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

.2 Manufacturer's *Product* data sheets for proposed *Products*.

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

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

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

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

.7 Compliance with the intent of the *Contract Documents*.

.8 Effect on *Contract Time*.

.9 Reasons for the request.

.10 Detailed availability of maintenance services and sources of replacement materials and parts, including associate costs and time frames.

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

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

.5 *Consultant's* decision concerning acceptance or rejection of proposed substitutions is final.

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

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 Request for Interpretation – RFI

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

.2 Submittal procedures:

.1 RFI form:

.1 Submit RFI on "Request for Interpretation" form, appended to this section. The *Consultant* shall not respond to an RFI except as submitted on this form.

.2 Where RFI form does not provide sufficient space for complete information to be provided thereon, attach additional sheets as required.

.3 Submit with RFI form necessary supporting documentation.

.2 RFI log:

.1 Maintain log of RFIs sent to and responses received from the *Consultant,* complete with corresponding dates.

.2 Submit updated log of RFIs with each progress draw submittal.

.3 Submit RFIs 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 this will not be paid by the *Owner*.

.4 RFIs shall be submitted only to the *Consultant*.

.5 RFIs shall be submitted only by *Contractor*. RFIs submitted by *Subcontractors* or *Suppliers* shall not be accepted.

.6 Number RFIs consecutively in one sequence in order submitted.

.7 Submit one distinct RFI per RFI form.

.8 *Consultant* shall review RFIs 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 RFIs. Responses to RFIs received from entities other than the *Consultant* shall not be considered.

.9 Allow 7 *Working Days* for review of each RFI by the *Consultant*.

.1 *Consultant's* review of RFI commences on date of receipt by the *Consultant* of RFI submittal and extends to date RFI returned by *Consultant*.

.2 When the RFI submittal 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*.

.3 If, at any time, the *Contractor* submits a large enough number of RFIs such that the *Consultant* cannot process these RFIs within 7 *Working Days*, the *Consultant*, will confer with the *Contractor* within 1 *Working Day* of receipt of such RFIs, 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 between the RFIs submitted. The *Contractor* shall accommodate such necessary time at no increase in the *Contract Time* and at no additional cost to the *Owner*.

.10 *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.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

Contractor's **Request for Interpretation** ***Consultant's Supplemental Instructions***	**Date**		**# of Pages**	
	To		**From**	
	Co.		**Co.**	
	Phone #		**Phone #**	
	Fax #		**Fax #**	
	Email		**Email**	

Project**:**		**RFI No.:**	
Owner**:**		**Date of Request:**	
To:		***Contractor*****:**	
	(*Consultant's* Representative)		
Project No.:		***Contractor's* Representative:**	
Consultant's **Fax No.:**		**Fax No.:**	

Interpretation Requested: (Description of request for interpretation and references to relevant portions of *Contract Documents*)	
Attachments:	
Requested by:	
Consultant's Supplemental Instruction**:**	
Attachments:	
Reply By:	

The work shall be carried out in accordance with these *Supplemental Instructions* issued in accordance with the *Contract Documents* without change in *Contract Price* or *Contract Time*. Prior to proceeding with these instructions, indicate acceptance of these instructions as being consistent with the *Contract Documents* by returning a signed copy to the *Consultant*.

Supplemental Instruction **Issued:**				***Supplemental Instruction*** **Accepted:**			
By:				**By:**			
Consultant		**Date**			***Contractor***		**Date**
Cc:	☐ ***Owner***	☐ ***Consultant***	☐ **Contractor**	☐ **Field**	☐ **Other:**		

PART 1 - GENERAL

1.1 General

.1 *Provide* the *Work* in accordance with the *Contract Documents* and be responsible for delays or costs resulting from failure to properly inspect or coordinate the *Work*, and for replacement or corrective work required.

1.2 Identification of Systems

.1 *Provide* identification of electrical and mechanical system installations and other automated systems or equipment in compliance with *Contract Documents*.

1.3 Commissioning and Systems Demonstrations

.1 Provide testing, adjusting, balancing and certification and commissioning of mechanical and electrical installations and other automated systems or equipment in accordance with Section 01 77 00.

.2 Instruct *Owner's* designated representatives in operation and maintenance of mechanical and electrical installations and other automated systems or equipment, in accordance with Section 01 77 00.

1.4 Superintendence

.1 Provide superintendent and necessary supporting staff personnel who shall be in attendance at the *Place of the Work* while *Work* is being performed, with proven experience in erecting, supervising, testing and adjusting projects of comparable nature and complexity.

.2 The *Contractor* shall appoint a superintendent at the *Place of the Work* who shall have overall authority at the *Place of the Work* and shall speak for the *Contractor* and represent the *Contractor's* interest and responsibilities at meetings at the *Place of the Work* and in dealings with the *Consultant* and the *Owner*.

1.5 Dimensions

.1 Verify dimensions at the *Place of the Work* before commencing shop drawings. Before fabrication commences report discrepancies to *Consultant* in writing. Incorporate accepted variances on shop drawings and as-built records.

1.6 Coordination

.1 Coordinate and ensure workers, *Subcontractors*, and *Suppliers* cooperate to ensure that the *Work* will be carried out expeditiously and in proper sequence.

.2 Make adjustments to allow adjustable work fit to fixed work.

1.7 Building Dimension, Templates, Built-ins, and Coordination

.1 Take necessary dimensions for the proper execution of the *Work*. Assume complete responsibility for the accuracy and completeness of such dimensions, and for coordination.

.2 *Provide* forms, templates, anchors, sleeves, inserts and accessories required to be fixed to or inserted in the *Work* and set in place or instruct separate *Subcontractors* as to their location.

.3 Supply items to be built in, as and when required together with templates, measurements, shop drawings and other related information and assistance.

.4 Pay the cost of extra work and make up time lost as a result of failure to provide necessary information and items to be built in.

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

.6 Check and verify dimensions referring to interfacing of services. Verify such dimensions with interconnected portions of the *Work*.

.7 Do not scale directly from drawings. Obtain clarification from *Consultant* if there is ambiguity or lack of information.

.8 Details and measurements of any work which is to fit or to conform with work installed shall be taken at the *Place of the Work*.

.9 Advise *Consultant* of discrepancies and omissions in the *Contract Documents*, that affect aesthetics, or that interfere with services, equipment or surfaces. Do not proceed with work affected by such items without clarification from *Consultant*.

.10 Prepare and submit setting drawings, templates and other information necessary for the location and installation of material, holes, sleeves, inserts, anchors, accessories, fastenings, connections and access panels.

.11 *Subcontractors* shall direct related *Subcontractors* on site of specific locations required for sleeves and openings.

PART 2- PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 Administrative

.1 The *Contractor* shall schedule meetings as specified herein.

.1 Such scheduling shall be in consultation both with the *Owner* and with the *Consultant*.

.2 The *Contractor* shall prepare agendas for meetings specified herein.

.1 Agendas shall include, as a minimum, the agenda items specified in the *Contract Documents*.

.3 The *Contractor* shall distribute written notice electronically of each meeting specified herein, complete with meeting agenda, 4 *Working Days* in advance of meeting date to the *Consultant* and the *Owner* and other affected parties.

.4 The *Contractor* shall chair and record the minutes of meetings specified herein.

.1 *Contractor* shall distribute copies of minutes electronically to the *Owner*, the *Consultant*, and all others in attendance within 3 *Working Days* after date of meeting.

.5 Representatives of parties attending meetings shall be authorized to act on behalf of the parties they represent.

.6 *Subcontractors* and *Suppliers* shall not attend meetings unless authorized by the *Consultant* and the *Owner*.

.7 The *Contractor* shall prepare, and distribute electronically to the *Consultant* and the *Owner* 4 days in advance of next progress meeting date, the following:

.1 Monthly progress reports containing updated schedules, shop drawing logs, requests for interpretation logs, submittals and budget.

.8 Meeting minutes shall be recorded in the following manner:

.1 Meetings shall be numbered consecutively.

.2 Items of business shall be identified within the meeting minutes by two numbers:

.1 Meeting number.

.2 Item number as related to that meeting.

.3 Example: ‘10.5’, indicates item number ‘5’, first brought up as new business at meeting number ‘10’. Number shall be retained for future meeting minutes until it is resolved, at which point it is closed and omitted from future meeting minutes.

.3 Whenever possible, identify Consultant, company firms, or individuals who raised the minute items or who made comments related to the minute items.

.4 Minutes shall have an “Action By” column. Consultant or company firm names shall be placed in “Action By” column rather than individuals. If an item is for information only, or is complete and requires no action, it will be noted as “Resolved”.

.5 Minutes shall state the following:

.1 Date and time.

.2 Names of individuals and company firms of those present.

.3 Time of adjournment.

.4 Date, time, and location of the next meeting.

.5 Copies sent to.

1.2 *Contract* Start-Up Meeting

.1 Within 5 days after award of *Contract*, request a meeting of parties in *Contract* to discuss and resolve administrative procedures and responsibilities prior to the commencement of the *Work*.

.2 The *Owner*, the *Consultant*, the *Contractor*, site superintendent(s), and inspection and testing company will be in attendance.

.3 Agenda to include the following:

.1 Code-of-conduct for workers at the *Place of the Work*.

.2 Owner's guidelines and policies.

.3 Appointment of official representative of participants in the *Project*.

.4 Status of permits, fees and requirement of authorities having jurisdiction. Action required.

.5 Establishing a schedule for progress meetings.

.6 Requirements for *Contract* modification and interpretation procedures, including, but not limited to: requests for interpretation, contemplated change orders, *Change Orders*, *Change Directives*, *Supplemental Instructions*, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, and administrative requirements.

.7 Submittal procedures.

.8 Construction schedule and progress scheduling.

.9 Delivery schedule of specified equipment.

.10 Requirements for notification for reviews. Allow a minimum of 48 hours' notice to *Consultant* for review of the *Work*.

.11 Requirements for temporary facilities, signs, offices, storage sheds, utilities, fences.

.12 *Owner* supplied *Products*.

.13 Record drawings.

.14 Maintenance manuals.

.15 Take-over procedures, acceptance, warranties.

.16 Publication to be used for publishing certificate of substantial performance.

.17 Progress claims, administrative procedures, holdbacks.

.18 Insurances, transcripts of policies.

.19 *Contractor's* safety procedures.

.20 Workplace Safety and Insurance Board Certificate.

1.3 Pre-Installation Meetings

.1 During the course of the *Work* prior to *Substantial Performance of the Work*, schedule pre-installation meetings as required by the *Contract Documents* and coordinated with the *Consultant*.

.2 As far as possible, pre-installation meetings shall be scheduled to take place on the same day as regularly scheduled progress meetings.

.3 Agenda to include the following:

.1 Code-of-conduct for workers at the *Place of the Work*.

.2 Owner's guidelines and policies.

.3 Appointment of official representatives of participants in the *Project*.

.4 Review of existing conditions and affected work, and testing thereof as required.

.5 Review of installation procedures and requirements.

.6 Schedule of the applicable portions of the *Work*.

.7 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences.

.8 Requirements for notification for reviews. Allow a minimum of 48 hours' notice to *Consultant* for review of the *Work*.

.9 Requirements for inspections and tests, as applicable. Schedule and undertake inspections and tests.

.10 Delivery schedule of specified equipment.

.11 Special safety requirements and procedures.

.12 Publication to be used for publishing certificate of substantial performance.

.4 The following shall be in attendance:

.1 *Contractor*.

.2 *Subcontractors* affected by the work for which the pre-installation meeting is being conducted.

.3 *Consultant*.

.4 Manufacturer's representatives, as applicable.

1.4 Progress Meetings

.1 During the course of the *Work* prior to *Substantial Performance of the Work*, schedule progress meetings twice monthly.

.2 Attendees at progress meetings shall include the following:

.1 *Contractor*.

.2 *Contractor's* site superintendent(s).

.3 *Consultant*.

.4 *Owner*.

.3 Agenda to include the following:

.1 Code-of-conduct for workers at the *Place of the Work*.

.2 Owner's guidelines and policies.

.3 Review, approval of proceedings of previous meeting.

.4 Review of items arising from proceedings.

.5 Review of progress of the *Work* since previous meeting and *Contractor's* monthly progress report.

.6 Field observations, problems, conflicts.

.7 Update construction schedule.

.8 Problems that impede compliance with construction schedule.

.9 Review of off-site fabrication delivery schedules.

.10 Review material delivery dates/schedule.

.11 Corrective measures and procedures to regain construction schedule.

.12 Revisions to construction schedule.

.13 Progress, schedule, during subsequent period of the *Work*.

.14 Review submittal schedules.

.15 Review status of submittals.

.16 Maintenance of quality standards.

.17 Pending changes and substitutions.

.18 Review of *Contract* modifications and interpretations including, but not limited to: requests for interpretation and log, contemplated change orders, *Change Orders*, *Change Directives*, *Supplemental Instructions*, for effect on construction schedule and on *Contract Time*.

.19 Review of status of as-built documents.

.20 Other business.

1.5 Pre-Takeover Meeting

.1 15 days prior to application for *Substantial Performance of the Work*, schedule a pre-takeover meeting.

.2 Agenda to include the following:

.1 Review, approval of proceedings of previous meeting.

.2 Review of items arising from proceedings.

.3 Review of procedures for *Substantial Performance of the Work*, completion of the Contract, and handover of the *Work*.

.4 Field observations, problems, conflicts.

.5 Review of outstanding *Contract* modifications and interpretations including, but not limited to: requests for interpretation and log, contemplated change orders, *Change Orders*, *Change Directives*, *Supplemental Instructions*, for effect on construction schedule and on *Contract Time*.

.6 Problems which impede *Substantial Performance of the Work*.

.7 Review of procedures for deficiency review. Corrective measures required.

.8 Review of arrangements for hydro, heating, and other services.

.9 Progress, schedule, during succeeding period of the *Work*.

.10 Review submittal requirements for warranties, manuals, and all demonstrations and documentation required for *Substantial Performance of the Work*.

.11 Review of keying and hardware requirements.

.12 Review of status of as-built documents and record drawings.

.13 Status of commissioning and training.

.14 Review *Contractor's* deficiency list and status.

.15 Cleaning for occupancy.

.16 Other business.

1.6 Post-Construction Meeting

.1 Prior to application for completion of *Contract*, schedule a post-construction meeting. Four days prior to date for meeting, *Consultant* shall confirm a date for meeting based on evaluation of completion requirements.

.2 Agenda to include the following:

.1 Review, approval of proceedings of previous meeting.

.2 Confirmation that no business is arising from proceedings.

.3 Confirmation of completion of the *Contract*, and handover of reviewed documentation from the *Consultant* to the *Owner*.

.4 Confirmation of completion of contemplated change orders, *Change Orders*, *Change Directives*, and *Supplemental Instructions*.

.5 Problems that impede *Contract* completion.

.6 Identify unresolved issues or potential warranty problems.

.7 Confirmation of completion of deficiencies.

.8 Corrective measures required.

.9 Confirmation of arrangements for hydro, heating and other services.

.10 Confirm submittal requirements for warranties, manuals, and demonstrations and documentation for *Contract* completion are in order.

.11 Review of procedures for communication during post-construction period.

.12 Handover of reviewed record documents by the *Consultant* to the *Owner*.

.13 Handover of *Contract* completion insurance policy transcripts by *Contractor*.

.14 Submission of final application for payment.

.15 Review and finalize outstanding claims, pricing, and allowance amounts.

.16 Status of commissioning and training.

.17 Demobilization and the *Place of the Work* restoration.

.18 Review of requests for interpretation log.

.19 Other business.

1.7 Special Meetings

.1 *Owner* and/or *Consultant* reserve the right to require special meetings which may be held on short notice (3 days) and at which attendance by *Contractor* and representatives of affected *Subcontractors* and *Suppliers* is mandatory. *Contractor* shall keep detailed and accurate meeting notes and distribute copies promptly to all in attendance and those affected by agreements made at such meetings.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 General

.1 Schedules required:

.1 Construction schedule.

.2 *Product* delivery schedule.

.3 Submittal schedule.

.2 Format:

.1 Construction Schedule shall to be developed utilizing Microsoft Project 2003 (or later version). Include a separate bar for each trade or operation.

.2 Include horizontal time scale identifying the first *Working Day* of each week.

.3 Format for listings: The chronological order of the start of each item or part of the *Work*.

.4 Identification of listings: By systems description.

.5 Upon request by the *Consultant*, submit a digital copy of the construction schedule to the *Consultant*. The electronic copy shall be in a native file type that permits modification of the data. In case of discrepancy between a digital-copy of the construction schedule and the corresponding hard-copy of the construction schedule, the hard-copy of the construction schedule bearing the latest date, and that has been formally submitted and reviewed in accordance with the requirements of Section 01 32 16 shall govern.

.3 Construction schedule:

.1 Include the dates for the commencement and completion of each major element of the *Work* parallel to the sections of the specifications.

.2 Include critical path and a brief narrative where required to clarify the dependencies on the critical path.

.3 Show projected percentage of completion for each item as of the first *Working Day* of each week.

.4 Submit draft schedule for review, and incorporate responses to comments identified by *Consultant* and/or *Owner*.

.5 Submit revised construction schedule with each application for payment.

.6 If requested by the Owner or Consultant, Provide a 3-week lookahead construction schedule for review at the current Site Meeting and those moving forward.

.4 *Product* delivery schedule:

.1 Include dates for delivery of *Products*, equipment, finish items, factory-finished manufactured items. Show last dates for order, shipment, and delivery in order to meet construction schedule.

.2 Submit revised *Product* delivery schedule with each application for payment.

.5 Submittal delivery schedule:

.1 Submit schedule which includes dates for delivery of each set of required shop drawings, *Product* Data, samples, and mock-ups.

.2 Provide submittal delivery schedule with dates for each submission, no more than 2 weeks after construction start-up.

.3 Submit revised submittal delivery schedule with each application for payment.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 General

.1 Provide photographic documentation in digital format and in accordance with procedures and submission requirements specified in this section.

1.2 Digital Photographs

.1 Equipment: Provide photographs using minimum 10 megapixel digital camera.

.2 Submit the required photographs to the *Consultant* and to the *Owner*.

.3 Output: Supply date stamped maximum resolution colour photos to *Consultant* in JPEG format, on universal serial bus drive format.

.4 Number of photos required:

.1 Prior to demolition/construction: Provide necessary number of photographs, as required to document existing conditions and verify damage to adjacent streets and property which may or may not have occurred during construction: Minimum 25 photos.

.2 Each Progress draw: Provide 12 construction photographs each month to accompany each application for progress draw to document the stage of the *Work* from points selected by the *Consultant* showing as much as possible of the *Work* installed during the previous month.

.3 Provide minimum of 4 photographs on each meeting report and for each progress meeting.

.4 Completion: When the *Work* is completed, arrange to take final photographs of the *Work* from a minimum of 8 points of view.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 General Requirements

.1 Submit submittals as requested by the *Contract Documents*, as specified herein, and in accordance with the conditions of the *Contract*.

.2 In addition to submittals specifically requested by the *Contract Documents*, submit other submittals as may be reasonably requested by the *Consultant*, or as are required to coordinate the *Work* and to provide the *Owner* with choices available, within the scope of *Contract Documents*.

.3 Submittals shall not contain MSDS sheets unless specified otherwise in the *Contract Documents*.

.4 Procedures and requirements for *Contract* closeout submittals shall be in accordance with the following sections:

.1 Section 01 77 00 - Contract Closeout Procedures and Submittals.

.2 Section 01 78 36 - Warranties.

.5 *Contractor's* review of submittals:

.1 Review submittals for conformity to *Contract Documents* before submitting to *Consultant*. Submittals shall bear stamp of *Contractor* and signature of a responsible official in *Contractor's* organization indicating in writing that such submittals have been checked and coordinated by *Contractor*. *Contractor's* review shall be performed by qualified personnel who have detailed understanding of those elements being reviewed and of the conditions at the *Place of the Work* proposed for installation.

.2 Check and sign each submittal and make notations considered necessary before submitting to *Consultant* for review. Where submittal is substantially and obviously in conflict with requirements of *Contract Documents*, reject submittal without submitting to *Consultant* and request resubmission. Note limited number of reviews of each submittal covered under *Consultant's* services as specified below.

.3 *Contractor* shall assume sole responsibility for any conflicts occurring in the *Work* that result from lack of comparison and coordination of submittals required for the *Work*.

.4 Submittals that have not been reviewed, checked, and coordinated by *Contractor* prior to submission to *Consultant*, will be rejected.

.5 Notify *Consultant* in writing of changes made on submittals from *Contract Documents*. *Consultant's* review of submittals shall not relieve *Contractor* of responsibility for changes made from *Contract Documents* not covered by written notification to *Consultant*.

.6 *Consultant's* review of submittals:

.1 Review of submittals by *Consultant* is for the sole purpose of ascertaining conformance with the general design concepts and the general intent of the *Contract Documents*. This review shall not mean that *Consultant* approves the detail design inherent in the submittals, responsibility for which shall remain with the *Contractor*. Such review shall not relieve the *Contractor* of responsibility for errors or omissions in the submittals, or responsibility for meeting requirements of *Contract Documents*.

.2 *Contractor* shall be responsible for dimensions to be confirmed and correlated at the *Place of the Work* for information that pertains solely to fabrication processes or to techniques of construction and installation, and for coordination of the *Work*.

.3 As part of their scope of work, *Consultant* shall review shop drawings no more than twice. Should three or more reviews be required due to reasons of *Contractor* omissions causing resubmission requests, then *Contractor* shall reimburse the *Consultant* for time expended in these extra reviews. Time shall be invoiced to the *Owner* (to be deducted from monies due to the *Contractor* and paid to *Consultant* by *Owner*) at rates recommended by *Consultant's* professional association and disbursements shall be invoiced at *Consultant's* cost. The *Contractor* shall cover directly costs and administration associated with courier services and the like for these extra shop drawing reviews.

.4 *Consultant's* review and markings on submittals do not authorize changes in the *Work* or the *Contract Time*, and will be accommodated at no additional cost to the *Owner*. If, in the opinion of the *Contractor*, the *Consultant's* markings on submittals constitute a change in the *Work* or will effect a change in the *Contract Time*, then the *Contractor* shall so notify the *Consultant* in writing and request an interpretation following the procedures for requests for interpretation in accordance with Section 01 26 00. If the *Consultant* finds that the *Consultant's* markings on submittals do constitute a change in the *Work* or will effect a change in the *Contract Time*, then a *Change Order* will be prepared therefore. The time taken to process such a request for interpretation shall not, in and of itself, constitute a change in the *Work* nor increase the *Contract Time*.

.5 Submittals which are not required by the *Contract Documents* or not requested by the *Consultant* will not be reviewed by the *Consultant* and will be marked 'NOT REVIEWED' by the *Consultant* and returned to the *Contractor*.

.7 Make submittals with reasonable promptness and in an orderly sequence so as to cause no delay in the *Work*. Be responsible for delays, make up time lost and pay added costs, at no additional cost to the *Owner*, incurred because of not making submittals in due time to permit proper review by *Consultant*. Organize submissions so that no more than 3 sets of shop drawings are to be reviewed simultaneously at any one time by *Consultant* unless otherwise scheduled ahead and accepted by *Consultant*.

.8 Submittals that contain substitutions will be rejected. Substitutions are permitted only on substitution submittals as specified in Section 01 25 00.

.9 Do not proceed with work affected by a submittal, including ordering of *Products*, until relevant submittal has been reviewed by *Consultant*.

.10 Prepare submittals using SI (metric) units.

.11 *Contractor's* responsibility for errors and omissions in submittals is not relieved by *Consultant's* review of submittals.

.12 *Contractor's* responsibility for deviations in submittal from requirements of *Contract Documents* is not relieved by *Consultant's* review of submittal, unless *Consultant* gives written acceptance of specific deviations.

.13 Engineered submittals:

.1 Submittals for items required to be sealed by professional engineer (engineered) shall be duly prepared, sealed, and signed under the direct control and supervision of a qualified professional engineer registered in the *Place of the Work*, having in force, professional liability insurance with minimum coverage limit of $1,000,000 per claim and annual aggregate.

.2 Include with engineered submittal, proof of insurance identifying insurer, policy number, policy term, and limit of liability, on duly signed letterhead and / or certificates of insurance.

.3 Design includes life safety, sizing of supports, anchors, framing, connections, spans, and as additionally required to meet or exceed requirements of applicable codes, standards, regulations, authorities having jurisdiction, and design requirements of the *Contract Documents*.

.4 Engineered submittals shall include design calculations, complete with references to codes and standards used in such calculations, supporting the proposed design represented by the submittal. Prepare calculations in a clear and comprehensive manner so that they can be properly reviewed.

.5 Professional engineer responsible for the preparation of engineered submittals shall undertake periodic field review, including review of associated mock-ups where applicable, at locations wherever the work as described by the engineered submittal is in progress, during fabrication and installation of such work, and shall submit a field review report after each visit. Field review reports shall be submitted to the *Consultant*, to authorities having jurisdiction as required, and in accordance with the building code.

.6 Field reviews shall be at intervals as necessary and appropriate to the progress of the work described by the submittal to allow the engineer to be familiar with the progress and quality of such work and to determine if the work is proceeding in general conformity with the *Contract Documents*, including reviewed shop drawings and design calculations.

.7 Upon completion of the parts of the *Work* covered by the engineered submittal, the professional engineer responsible for the preparation of the engineered submittal and for undertaking the periodic field reviews described above, shall prepare and submit to the *Consultant* and authorities having jurisdiction, as required, a letter of general conformity for those parts of the *Work*, certifying that they have been *Provided* in accordance with the requirements both of the *Contract Documents* and of the authorities having jurisdiction over the *Place of the Work*.

.14 Keep copies of reviewed submittals at the *Place of the Work* in an organized condition. Only submittals that have been reviewed by the *Consultant* and are marked with *Consultant's* review stamp, as applicable, are permitted at the *Place of the Work*.

.15 The *Work* shall conform to reviewed submittals subject to the requirements of this section. Remove and replace materials or assemblies not matching reviewed submittals at no increase in the *Contract Time* and at no additional cost to the *Owner*.

1.2 Submission Procedures

.1 Coordinate each submittal with requirements of the *Work* and *Contract Documents*. Individual submittals shall include related information.

.2 Distribute copies of submittals to parties whose work is affected by submittals except *Consultant* and *Owner* before final submission for review by *Consultant*.

.3 Accompany submittals with transmittal letter, containing:

.1 Date.

.2 *Project* title and number.

.3 *Contractor's* name and address.

.4 Identification and quantity of each submittal.

.5 Other pertinent data.

.4 Each submittal shall be identified numerically by relevant specification section number with a numeric indicator for multiple submittals by that section followed by revisions number, for example 04 05 19-01-R0.

.5 Make any changes in submittal that *Consultant* may require, consistent with *Contract Documents Contract Documents*, and resubmit as directed by *Consultant*.

.6 Notify *Consultant*, in writing, when resubmitting, of any revisions other than those requested by *Consultant*.

.7 After *Consultant's* review, distribute copies to affected parties.

1.3 *Product* Data Sheets

.1 Submit *Product* data sheets as follows:

.1 1 copy digitally in pdf format to *Consultant* using the *Consultant's* document management system.

.1 Refer to Section 01 10 00 "Electronic Submittals" paragraph.

.2 Submit *Product* data as called-for by the *Contract Documents* or as the *Consultant* may reasonably request where shop drawings will not be prepared due to a standardized manufacture of a *Product*. Manufacturers' catalogue cuts will be acceptable in such cases, and that they indicate choices including sizes, colours, model numbers, options and other pertinent data, including installation instructions. Submissions showing only general information are not acceptable.

.3 Where requirements of *Contract Documents* are more stringent than design proposed on *Product* data sheets, the requirements of the *Contract Documents* take priority.

.4 Upon completion of review by *Consultant*, 1 marked set of *Product* data sheets will be returned to *Contractor* in digital format for reproduction and distribution.

.5 Retain 1 complete set of prints of reviewed *Product* data sheets for issuance to *Owner* immediately prior to *Substantial Performance of the Work*, in an acceptable, bound manner and in accordance with Section 01 77 00.

1.4 Shop Drawings

.1 Submit shop drawings as follows:

.1 1 copy digitally in pdf format to *Consultant* using the *Consultant's* document management system.

.1 Refer to Section 01 10 00 "Electronic Submittals" paragraph.

.2 Lettering on shop drawings shall be not less than 3mm (1/8") high.

.3 Where requirements of *Contract Documents* are more stringent than design proposed on shop drawings, the requirements of the *Contract Documents* take priority.

.4 *Consultant* markings and resulting action required:

.1 Shop drawings requiring no changes will be marked 'REVIEWED', and shall be submitted for as-built drawings purposes.

.2 Shop drawings requiring several changes will be marked 'REVIEWED as NOTED' and shall be revised and submitted for as-built drawings purposes.

.3 Shop drawings requiring substantial changes will be marked 'REVISE AND RE-SUBMIT' and shall be revised and resubmitted until *Consultant* stamps drawings with 'REVIEWED' or 'REVIEWED as NOTED'.

.5 Shop drawing size shall be multiple of 213 mm and 275 mm (8-1/2" and 11") excluding 38 mm (1-1/2") binding margin and not larger than 838 mm x 1117 mm (33" x 44"). Leave minimum 150 mm x100 mm (6" x 4") clear space for *Consultant's* comments.

.6 Upon completion of review by *Consultant*, 1 marked set of shop drawings will be returned to *Contractor* in electronic format for distribution.

.7 Submit copies of reviewed shop drawings to authorities having jurisdiction as required.

.8 Shop drawings shall include:

.1 Fabrication and erection dimensions.

.2 Plans, sections, elevations, arrangements and sufficient full size details which indicate complete construction, components, methods of assembly as well as interconnections with other parts of the *Work*.

.3 Design calculations prepared by professional engineer, as required, substantiating sizes for members and connections based on design loads.

.4 Clear definition of the division of responsibility for the work described thereon. No *Products*, items or equipment, or description of work, shall be indicated to be supplied, or work to be done, "By Others" or "By Purchaser". Shop drawings marked with either of these phrases will be rejected without having been reviewed by the *Consultant*.

.5 Location and type of exposed anchors, attachments and locations and types of fasteners, including concealed reinforcements to accept mounted fasteners.

.6 Adhesives, joinery methods and bonding agents.

.7 Kinds and grades of materials, their characteristics relative to their purpose, detailed description of finishes and other fabrication information.

.8 Configurations, types and sizes required; identify each unit type on drawing and on *Product*.

.9 Descriptive names of equipment and mechanical and electrical characteristics when applicable.

.10 Data verifying that superimposed loads will not affect function, appearance and safety or work shown on shop drawings, as well as other interconnected work.

.11 Assumed design loadings, dimensions of elements and material specifications for load-bearing members.

.12 Proposed chases, sleeves, cuts and holes in structural members.

.13 Wall thicknesses of metals.

.14 Location and types of welds. For structural welds use AWS symbols and clearly show net weld lengths and sizes.

.15 Materials, gauges, and sizes being supplied including connections, attachments, reinforcement, anchorage and locations of exposed fastenings.

.16 Installation instructions and details for *Products* to be installed by separate *Subcontractors*, including function of each part.

.17 A list of *Products* covered by, or included on, the shop drawing. List of *Products* shall be complete and show manufacturer's name, *Product* name, generic description, standard certification where specified, manufacturer's complete installation data and precautions against wrong installation, operation and maintenance.

.18 Refer to individual sections of the specifications for more particular requirements for shop drawings.

.19 Compatibility statement: Include with each shop drawing a statement that each *Product* and material indicated on the shop drawing is compatible with each *Product* and material with which it comes into contact.

1.5 Certificates and Certification Submittals

.1 Certificates and certifications submittals: Provide a statement that includes signature of entity responsible for preparing certification.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 General Procedures

.1 For the purposes of this section:

.1 The words “worker” or “workers” shall mean the *Contractor*, *Contractor’s* staff or employees, *Subcontractors*, *Subcontractor’s* staff or employees, *Suppliers*, *Supplier’s* staff or employees, or anyone engaged for the *Work*, directly or indirectly, by the *Contractor*, unless otherwise indicated.

.2 The words “make good” or “making good” shall mean that, when a finish or material has been altered, the material or finish shall be repaired or replaced, and refinished to match existing quality and appearance to acceptance of *Consultant*, and that repaired or replaced and refinished *Work* shall not be discernible from existing materials or finishes when judged by the *Consultant* from a viewing distance of 1830 mm (6'), and that such work is included in the *Contract Price*.

.2 Operational limitations:

.1 The existing building will remain in full use and occupancy throughout the *Work*.

.2 Comply with requirements of paragraph 1.2 - Work Schedule.

.3 *Contractor’s* use of the *Place of the Work* is limited to permit regular use of existing *Owner’s* facilities to continue with the least amount of interference and disruptions possible.

.4 In consultation with, and to acceptance of, the *Consultant* in the presence of the *Owner*, designate an entrance and a circulation route that workers shall use and that shall not be used by *Owner’s* staff, building occupants, or the public.

.3 Dust tight enclosure and partition doors and entrance doors to the *Place of the Work* shall remain closed.

.4 Areas of the existing building adjacent to the *Place of the Work* or areas affected by the *Work*, including circulation and access routes, shall be maintained in a clean state equivalent to the level of cleanliness maintained in the existing building, and as follows:

.1 Clean and vacuum the *Place of the Work* and areas surrounding the *Place of the Work* daily or more frequently as required.

.2 Wet mop floor areas in vicinity of access doors to the *Place of the Work* daily, or more frequently as required.

.3 Vacuum carpeted areas daily or more frequently as required.

.4 Wet clean carpets in accordance with manufacturer’s recommendations once work in such areas is complete.

.5 Final cleaning shall be in accordance with Section 01 77 00.

.5 Waste protection and removal:

.1 Waste management and disposal shall be in accordance with Section 01 50 00 as supplemented herein.

.2 Transport waste in containers with tightly fitting lids or cover waste with a wet sheet.

.3 Remove waste as it is created. Debris shall be contained and covered if it can not be removed immediately.

.4 Do not transport waste through occupied areas of existing building.

.5 Remove waste at the end of each *Working Day* through construction access routes.

.6 Document condition of the existing building in areas immediately adjacent to the *Place of the Work* by means of construction photographs in accordance with Section 01 32 33.

1.2 Work Schedule

.1 Normal hours of work:

.1 Work to be scheduled/performed after school hours and during holiday/weekends/summer break hours.

.1 School hours: 8:30am-3:45pm.

.2 Holidays/Weekends/summer break (July and August): 7:00am - 11pm.

.2 The maintenance of continuous and uninterrupted operation of the building requires close coordination and scheduling of construction activities. The intent of the contract is that the work be carried out without hindering the normal operation of the building. Safety of the occupants must be maintained at all times. Maintain safe existing at all times for students and staff while Place of Work is occupied.

1.3 Security

.1 *Provide* security for the *Place of the Work* by methods compatible with the security system for the existing building.

.2 *Contractor* shall coordinate the *Work* carefully with the *Consultant* in the presence of the *Owner* in order to ensure no disruption to the existing building's security system.

.3 Where existing building's security system is breached due to *Contractor's* negligence, be responsible for any damage or theft of property, regardless if area where damage or theft occurred is under *Contractor's* control or not.

1.4 Use of Existing Facilities

.1 Restrict access, parking, material deliveries, execution of work, operations and procedures to designated locations and times and do not deviate from designated procedures without prior acceptance by the *Consultant* in the presence of the *Owner*.

.2 Periodically review proposed construction operations with the *Consultant* in the presence of the *Owner* and cooperate as required to ensure that *Owner's* interests and requirements are not unduly compromised with regard to the normal operation and function of occupied areas on the existing building.

.3 Traffic through occupied areas of the existing building shall be kept to a minimum. Travel within occupied areas of the existing building shall be via the most direct route.

.4 Noise, dust and debris, and odours shall be minimized to ensure building occupants in adjacent areas are disturbed as little as possible. Corrective action to cease or limit disagreeable annoyances to building occupants shall be implemented immediately upon notification by the *Consultant* or the *Owner*.

.5 Use of existing containers and garbage bins shall not be permitted.

.6 Existing fire protection equipment:

.1 Existing fire protection equipment shall only be used in an emergency situation.

.2 Do not remove existing fire protection equipment.

.3 If any existing fire protection equipment is used or interfered with in any way, the *Owner's* fire equipment inspector shall be retained to inspect, test, recharge, and otherwise repair such equipment at no additional cost to the *Owner*.

1.5 Parking

.1 Parking for workers shall not be made available by the *Owner, except as agreed to during the project phase, subject to final approval of the Owner. Refer to drawings for proposed phasing.*

.2 Parking will be permitted in public parking areas.

.3 Construction vehicle parking to be co-ordinated with Owner.

.4 Throughout the *Work*, ensure that there is no interference with the operation of the existing premises, and that the existing parking areas and road system remain free and clear of obstructions.

.5 Illegally parked vehicles will be ticketed and/or towed at vehicle owner's expense, and at no additional cost to the *Owner*.

1.6 Existing Services

.1 Service interruptions:

.1 Connection or disconnection of services that will interfere with the operation of the *Owner's* facilities shall not be done without the prior written acceptance of the *Consultant* in the presence of the *Owner* and during the times designated by the *Owner*. Premium charges associated with such work shall be included in the *Contract Price*.

.2 Provide at least 10 *Working Days* prior written notice to the *Consultant* and the *Owner* of requirement or intention to interrupt services, and obtain written permission of the *Consultant* in the presence of the *Owner* prior to commencing such interruption.

.3 In no instance shall interruptions affect the entire existing building.

.4 As far as possible, coordinate interruptions with the *Owner's* regular maintenance of building services and systems.

.5 Areas adversely affected by changes in air flows outside the construction areas as a result of a required shut-down of portions of the existing HVAC system within the construction areas are to be re-balanced to comfortable levels as advised by the *Consultant*.

.2 Should existing services be interrupted in breach of the above, *Make Good* immediately and provide protection against further such disruptions. Costs resulting from such interruptions and for making good shall be the responsibility of the *Contractor* at no additional cost to the *Owner*.

1.7 Protection of the Existing Building

.1 Protection requirements shall be in accordance with Section 01 50 00, as supplemented herein.

.2 Keep *Place of the Work* safe and secure, denying access to unauthorized personnel.

.3 Protect existing work from damage. *Make Good* any damage caused. The onus is on the *Contractor* to substantiate that damage existed prior to commencement of the *Work*.

.4 Do not overload the existing structure due to the *Work*.

.5 Take special measures to protect existing work from damage when moving heavy loads or equipment. Protect areas used as passageways or through which materials are moved. Use resilient tired conveyances only when moving materials and equipment inside building. *Provide* coverings as required to protect existing work from damage.

.6 Separate exterior access, work and storage areas from *Owner* occupied existing areas, with fencing and hoarding as specified in Section 01 56 23. Rearrange fencing/hoarding as *Work* progresses to suit extent and configuration of the *Work*.

.7 *Provide* guards, barricades and other temporary protection to prevent injury to persons.

.8 Protect existing building components and contents from damage by weather, when executing *Work* affecting integrity of the building envelope. *Provide* temporary insulated and air tight weatherproof closures to protect openings made in existing building envelope. *Make Good* existing building components and contents damaged by weather resulting from inadequate temporary protection measures.

.9 *Provide* temporary fire resistant closures at existing areas openings exposed to construction areas for the *Work* to maintain fire and life safety of existing building.

.10 Protection of existing occupied areas:

.1 Existing exterior walls with windows of plain glazing, when exposed to the *Work*, shall be protected with 16 mm (5/8”) gypsum board for interior surfaces and 9.5 mm (3/8”) exterior grade plywood for exterior surfaces, mounted on suitable framing.

.2 Maintain such protection throughout the *Work*.

.3 Other openings in the existing exterior walls, such as doors and louvres, shall be similarly protected or replaced with doors of solid core wood or hollow steel construction.

1.8 Emergency and Fire Protection

.1 *Provide* and maintain ready access to fire protection equipment, in accordance with Section 01 50 00.

.2 *Provide* temporary fire resistant closures at existing building openings exposed to construction areas.

.3 *Contractor* shall coordinate the work carefully with the *Owner* in order to ensure no disruption to the existing fire detection and annunciation systems. Failure to provide such coordination shall result in the *Contractor* incurring the responsibilities and expenses associated with disruption to the existing fire detection and annunciation systems at no additional cost to the *Owner*.

.1 Provide fire watch when existing fire detection and annunciation systems are not operational or on bypass.

.2 Whenever a changeover time occurs, which is an outage time of at least a portion of the fire alarm system, the municipal fire department shall be notified of the temporary shutdown and alternative measures shall be devised.

.4 *Contractor* shall coordinate the work carefully with the *Consultant* in the presence of the *Owner* in order to prevent unapproved disruptions to the existing sprinkler system, standpipe system, or other fire protection systems.

.1 Where temporary shut-down is necessitated, such shut down shall be in accordance with the requirements of authorities having jurisdiction and the building code.

.5 Obtain 'Hot Work Permit' from *Owner* and *Consultant* prior to hot work operation, which may cause the building's fire alarm system to be activated or create an unwarranted fire risk condition. The prevention of fires and false fire alarms caused by hot work operations is the primary goal of this procedure. Gas hoses, backflow preventers, fire resistive tarpaulins, curtains and other cutting and welding equipment must be in good repair before the permit is issued.

.1 'Hot Work' is defined as work using open flames or sources of heat that could ignite materials in the work area.

.6 Fire separations:

.1 Maintain the integrity of fire separations, fire protection systems , and fire rated assemblies.

.2 *Make Good* fire separations, fire protection, and fire rated assemblies compromised as a result of the *Work*.

.7 Temporary fire separations:

.1 *Provide* temporary fire separations between existing occupied floor areas and new areas under construction.

.2 Construct temporary fire separations out of steel studs and gypsum board to provide a construction equivalent to a minimum of 1 hour fire resistance rating, unless otherwise indicated.

.3 Where access is required, the doorway shall be protected by a door of solid core wood or hollow steel construction.

.4 Finish hardware equivalent to a minimum of 1 hour fire resistance rating, unless otherwise indicated.

.8 Maintaining existing building exit facilities:

.1 Maintain exit facilities serving the existing building.

.2 Where an exit is blocked-off or deleted as a result of the *Work*, an alternative exit shall be *Provided* that is acceptable to the *Consultant*, the *Owner*, and authorities having jurisdiction.

.3 Where it is necessary for access to be gained to an exit through the *Place of the Work*, the access shall be clearly defined and protected so that it is separated from construction areas by a smoke tight fire separation equivalent to a minimum of 1 hour fire resistance rating, unless otherwise indicated.

.9 Fire department access:

.1 Do not obstruct access route designated for fire department equipment.

.2 If it is necessary that existing access routes be obstructed or deleted, alternative access routes acceptable to the fire department and in accordance with the requirements of the *Contract Documents* and authorities having jurisdiction shall be *Provided* prior to commencement of work that will obstruct or delete existing access.

.10 Combustible materials:

.1 Stockpiling of combustible materials adjacent to or inside the existing building shall not be acceptable.

.11 Temporary protection of openings in fire separations:

.1 Openings in existing floor assemblies and vertical fire rated assemblies required by the *Work*, shall be temporarily protected with materials as required to maintain continuity of the required fire resistance rating for existing fire rated assembly.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 Section Includes

.1 General administrative and procedural requirements for quality assurance and quality control as specified elsewhere in the *Contract Documents*.

1.2 Related Requirements

.1 Pre-installation meetings: in accordance with Section 01 31 19.

.2 Materials and workmanship quality assurance and reference standards: in accordance with Section 01 60 00.

.3 Balancing and testing of systems - under Mechanical and Electrical Divisions.

1.3 *Contractor's* Quality Assurance Program

.1 Submit to the *Owner* and the *Consultant* for their information, a quality assurance program (the "Quality Assurance Program").

.2 The Quality Assurance Program shall meet the requirements of Canadian Standards Association CSA Z299.3 or such other requirements as set out in the *Contract Documents*.

.1 The Quality Assurance Program shall be designed so that quality requirements are obtained by progressive implementation of the controls and inspection functions stated in the Quality Assurance Program.

.2 The *Contractor* shall make any modifications to the Quality Assurance Program as reasonably requested by the *Owner* and/or the *Consultant*.

.3 The Quality Assurance Program shall include, but shall not be limited to, the following:

.1 A system by which changes to the *Contract Documents* and correspondence with *Subcontractor* and other correspondence is handled in a controlled manner.

.2 A system for purchased or manufactured materials to be identified, inspected to the specified standard, and covered by a material test report.

.3 A system by which measuring and testing equipment is properly stored, handled, and calibrated to a known standard.

.4 A system by which incoming materials are: inspected to the specified standard; accepted; allocated safe storage; and properly recorded.

.5 A system by which process inspection requirements shall be clearly stated for operations and carried out by qualified personnel.

.6 A system by which final inspections will be carried out and accepted by authorized personnel prior to release for shipping or major assembly.

.7 A system by which non-conformance to requirements of the *Contract Documents* shall be recorded and solutions proposed by the *Owner* or the *Consultant* are also recorded.

.8 A system by which instructions for handling and storage of equipment shall be given.

.9 A system by which a record of quality inspections, tests, and actions shall be kept.

.10 A system by which the *Owner* and the *Consultant* shall be afforded access to manufacturing areas and quality records and issued with copies of pertinent drawings and manufacturing schedules.

.3 The *Contractor* shall provide the *Owner* and the *Consultant* with regular Quality Assurance Reports for their information according to an agreed schedule.

1.4 *Contractor's* Field Quality Control

.1 The *Contractor* is responsible for field quality control of the *Work* including quality control of *Subcontractors* and material *Suppliers*.

.2 Ensure that the only specified or approved *Products* and materials are used.

.3 Provide and maintain an effective quality control program, in accordance with the Quality Assurance Program, and perform sufficient inspections and tests of all items of work, including those of *Subcontractors*, to ensure compliance with *Contract Documents*.

.4 Furnish appropriate facilities, instruments, and testing devices required for performance of the quality control function.

.5 Required certificates of inspection testing or approval shall be secured by the *Contractor* and delivered to the *Owner* in such time as not to delay progress of the *Work*.

.6 The *Contractor* shall develop a field quality control manual covering both factory and field installation. The form of the manual shall be reviewed and accepted by the *Consultant*. This manual will document quality control practices of the *Contractor*, *Subcontractors*, and major *Suppliers*. The manual shall include, but not be limited to, specific criteria related to:

.1 Surface preparation.

.2 Fastener and anchor installation.

.3 Air barrier continuity: identify continuity of air barrier systems, including joints and overlapping of dissimilar systems.

.4 Air barrier, adhesion testing.

.5 Sealant mixing, tack time, set time.

.6 Sealant staining of porous substrate testing.

.7 Sealant adhesion testing, including butterfly tests where applicable.

.8 Painting, verification and adhesion testing where required.

.9 Material compatibility testing.

.10 Shipping.

.11 Field installation.

.12 Field inspection and testing (by *Contractor*).

.13 Field inspection and testing (independent).

.7 Inspection and testing shall be performed by company qualified to perform the inspections or tests specified or required.

.8 The *Contractor* is to maintain a logbook (copies to be provided to the *Consultant* at completion of fabrication) documenting date, time, results, and significance of in-plant testing carried out, where applicable, linked to daily production. The form of this logbook shall be reviewed and accepted by the *Consultant*.

1.5 Independent Inspection and Testing – *Owner's* Quality Assurance

.1 Independent inspection and testing services will be used to verify compliance with requirements of the *Contract Documents*. These services do not relieve the *Contractor* of responsibility for compliance with the *Contract Documents*.

.1 Specified tests, inspections, and related actions do not limit the *Contractor's* other quality assurance and control procedures that facilitate compliance with the *Contract Documents* requirements.

.2 Requirements for the *Contractor* to provide quality control services required by *Consultant*, *Owner*, or authorities having jurisdiction are not limited by provisions of this section.

.3 Inspections and tests specified or required that are not specified as independent inspection and testing are the responsibility of the *Contractor* and are not covered under the *Owner's* quality assurance requirements.

.2 The *Consultant* will, on behalf of *Owner*, appoint independent inspection and testing agencies, representing, reporting and responsible to the *Owner* through the *Consultant*.

.1 Cost of independent inspection and testing company services will be authorized as a disbursement from Cash Allowance as specified in Section 01 21 00. Independent inspection and testing company shall submit monthly invoice original to *Contractor* for review, relating invoices to tests and inspection reports. Provide original receipts for disbursements. Invoices for independent inspection and testing services shall be forwarded by *Contractor* to *Consultant* for inclusion in progress payment application.

.3 Additional testing services required because of changes in materials, proportions of mixes requested by *Contractor* or *Subcontractors* as well as additional testing services for materials occasioned by lack of identification or by failure of such materials being replaced to meet requirements of the *Contract Documents* or testing of structure or elements including load testing, shall be carried out at no additional cost to the *Owner*.

.4 Inspection and testing required by codes or ordinances, or by an authority having jurisdiction, and made by a legally constituted authority, shall be the responsibility of the *Contractor* and shall be paid for by the *Contractor* and not be paid by *Owner*, unless otherwise specified in the *Contract Documents*.

.5 Independent inspection or testing performed exclusively for *Contractor's* convenience shall be sole responsibility of *Contractor*, and will not be paid by *Owner*.

.6 Inspection and testing 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.

.7 Requirements of regulatory agencies:

.1 Testing shall be conducted in accordance with requirements of the building code.

.2 Obtain certification where required by the building code and standards.

.8 Cooperation with Independent inspection and testing agencies:

.1 Provide Independent inspection and testing agencies with materials and installation information as required and /or requested.

.2 Provide access to the *Work* for representatives of inspection and testing agencies.

.3 Cooperate with independent inspection and testing agencies and give adequate notification of any changes in source of supply, additional work shifts and other proposed changes.

.4 Permit access to the *Work* for independent inspection and testing agencies wherever the *Work* is in progress, or wherever *Products*, materials, or equipment are stored prior to shipping.

.5 Supply labour required to assist independent inspection and testing agencies in sampling and making tests.

.6 Repair work damaged as a result of inspection and testing work.

.7 Independent Inspection and testing company services do not relieve the *Contractor* of responsibility for normal shop and site inspection, and quality control of manufacturing and installation.

.9 Where evidence exists that defective workmanship may have occurred, or that the *Work* may have been carried out incorporating defective materials, or tests demonstrate that installed conditions do not comply with the requirements of the *Contract Documents*, the *Consultant* reserves the right to have appropriate inspections, tests, and 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. Inspections, tests, and surveys carried out under these circumstances will be made at the *Contractor's* expense, and will not be paid by *Owner*, unless the results indicate that the work so tested, inspected or surveyed is not defective or that, in *Consultant's* opinion, the work so tested, inspected, or surveyed may be accepted, in which case tests, inspections or surveys will be paid by *Owner*.

.10 Prepare schedule for independent inspection and testing company services in accordance with Section 01 33 00 and as follows:

.1 Establishing schedule:

.1 By advance discussion with the selected independent inspection or testing company, determine the appropriate time necessary to perform the required services and to issue related reports.

.2 Allow for required time within construction schedule.

.2 Adherence to schedule:

.1 *Contractor* shall advise independent inspection and testing agencies in advance when inspection and testing of the *Work* is required.

.1 Amount of advance notice shall be as required by the inspection and testing company, but shall be no less than 2 *Working Days*.

.2 When independent inspection and testing company is ready to perform inspection and testing according to predetermined schedule, but is prevented from inspection and testing or taking specimens due to incompleteness of the parts of the *Work* scheduled for inspection and testing, extra costs for inspection and testing attributable to the delay may be back-charged to *Contractor* at no additional cost to the *Owner*.

.3 Notify independent inspection and testing 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 1 *Working Day* before the work starts with the following present:

.1 The *Contractor*, and the *Subcontractor* responsible for the work to inspected and/or tested, the inspection and testing company representatives, the product manufacturer's representative when required, and the *Consultant*.

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

.11 Reports and documents

.1 Independent inspection and testing agencies shall submit shop inspection and site inspection reports within 5 *Working Days* of each inspection.

.2 Distribute reports electronically in PDF format to the following parties:

.1 *Owner*.

.2 *Consultant*.

.3 *Contractor*.

.4 Consulting engineers, as applicable.

.3 Independent inspection and testing agencies shall submit a written report for 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, testing methodology, procedures, and descriptions, site instructions given, recommendations and/or any other information required by standard applicable to reporting of tests and inspections.

.1 Report shall clearly indicate failure of *Product* or procedures to meet applicable standards, give recommendations for retesting or correction. Inspector shall contact *Contractor* and *Consultant* immediately when *Product* or *Product* assembly fails to meet requirements of the *Contract Documents*.

.4 Upon completion of portions of the *Work* subject to independent inspection and testing, submit to the *Consultant* duplicate certificates of acceptance of the installation issued by the independent inspection and testing company.

.12 Inspection and test specimens

.1 Inspection and testing 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 independent inspection and testing company; sampling equipment and personnel will be provided by the independent inspection and testing company; and deliveries of specimens and samples to the testing company will be performed by the testing company unless otherwise specified.

.3 Independent inspection and testing company shall take samples necessary to verify quality as specified. Taking of samples shall not endanger the structure or life safety, and shall be taken so as to best represent the *Work* as a whole.

.4 Samples shall be handled, packaged, stored and delivered in accordance with specified tests. Sample handling where required shall duplicate conditions at the *Place of the Work* (such as site-cured concrete cylinders).

1.6 Mock-Ups

.1 *Provide* field or shop erected example of work complete with specified materials and workmanship.

.2 Erect mock-ups at locations as specified and as acceptable to *Consultant*. Do not proceed with work for which mock-ups are required prior to *Consultant's* review of mock-ups.

.3 Protect and maintain mock-ups until directed to be removed. Commence work demonstrated in mock-up only after review and acceptance of workmanship. If possible, mock-up may become part of finished work, at sole discretion, and with prior written acceptance of *Consultant*.

.4 Reviewed and accepted mock-ups will become standards of workmanship and material against which installed work will be compared.

.5 Remove and replace materials or assemblies not matching reviewed mock-ups.

.6 Resubmit mock-ups until written acceptance is obtained from *Consultant*.

.7 Provide line item in breakdown of construction costs identifying full costs for mock-ups.

1.7 Manufacturer's Field Review

.1 Where manufacturer's field review is specified, manufacturer's representative shall review the relevant parts of the work at the *Place of the Work*, or wherever such affected work is in progress, to ensure that work is being executed in accordance with manufacturer's written recommendations and verify its product to be fit-for-purpose intended.

.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 Unless otherwise indicated, manufacturer's representative shall undertake a minimum of 1 field review, with additional reviews as deemed necessary by the manufacturer, to determine that the work of such sections is in accordance with the manufacturer's written recommendations.

.4 Manufacturer's representative shall submit a type-written report on manufacturer's letterhead in PDF format 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 shall be prepared and distributed following the procedures specified for preparation and submittal of inspection and testing reports given above.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 General Instructions

.1 Temporary facilities and controls specified in this section shall be supplemented as applicable in accordance with Section 01 35 13.

.2 Arrange, obtain and pay cost for permits required for temporary facilities and controls.

.3 *Provide* and maintain temporary facilities and controls for the *Work* and remove them from the *Work* upon issuance of certificate of *Substantial Performance of the Work*.

.4 Arrange and pay for required temporary services, unless otherwise indicated by *Consultant*.

.5 Protect and maintain without interruption, existing water, heating, drainage, telephone and other services within the *Place of the Work* to existing buildings not within the scope of the *Work* of this *Contract*. Obtain written permission of the *Owner* for services required to be temporarily shut off, at least 2 full *Working Days* in advance.

.6 Do not use permanent conveying, mechanical, or electrical systems, except standpipe for firefighting, during the course of the *Work* unless specific written permission is provided by the *Consultant*. Use of permanent facilities or services for temporary construction service shall not prejudice warranties.

.7 *Provide* connection and disconnection of temporary services and facilities required in the *Work*, including connection to existing services made available by the *Owner*.

1.2 Temporary Electrical Services

.1 *Provide* and maintain an adequate temporary electrical service for performance of the *Work* including, but not limited to, operation of electric pumps, motors, vibrators and other power tools, hoisting and related construction and general illumination during the *Work*.

.2 *Provide* and maintain any components and equipment necessary to transform supply power to necessary temporary power voltage.

1.3 Temporary Water Supply

.1 *Provide* and maintain a temporary supply of water for use in the *Work*.

.2 Extend supply pipe or pipes from nearest available sources and maintain in good condition until permanent system is installed and ready for use.

1.4 Temporary Sanitary Facilities

.1 *Provide* and maintain temporary sanitary facilities for use by workers.

.2 Use of building's sanitary facilities by workers is prohibited.

1.5 Temporary Heating and Ventilation

.1 *Provide* and pay for temporary heating, cooling and ventilating required for the *Work*, including attendance, maintenance and fuel.

.2 *Provide* temporary heat and ventilation as required to:

.1 Facilitate continuous uninterrupted progress of the *Work*.

.2 Protect the *Work* and *Products* against damage and defacement caused by weather, harmful levels of temperature, humidity, and moisture.

.3 Provide ambient temperatures and humidity levels for proper storage, installation and curing of materials, in accordance with specified standards and manufacturer's requirements.

.4 Provide adequate ventilation to meet health regulations for safe working environment.

.3 Solid fuel salamanders will not be permitted.

.4 Furnish other temporary heating as required by various sections of the specifications or by *Product* manufacturers.

.5 Ventilate to the exterior of the building work areas as required when toxic materials are being utilized or cured.

.6 Replace with new, any work damaged due to failure to provide adequate heat at no cost to *Owner*.

1.6 Temporary Enclosures and Protection

.1 *Provide* temporary enclosures and protection of adequate construction to prevent dispersion of dust and dirt into other areas of existing building and to prevent dispersion of dust and dirt beyond the *Place of the Work*.

.2 Temporary enclosure and protection shall be of finished appearance and painted to colour approved by *Owner*.

.3 Provide dust seal and sound resistant enclosures to protect existing building and operations as indicated. Include temporary doors, fastenings and keys.

.4 Supplement these requirements in accordance with Section 01 35 13.

1.7 Plant, Machinery and Scaffolding

.1 *Provide* formwork, scaffolding, equipment, tools, machinery and incidental appurtenances necessary for the proper execution of the *Work*.

.2 Erect plant, machinery and scaffolding to permit access to building and the *Work*.

.3 Use scaffolds in such manner as to interfere as little as possible with other trades' operations.

.4 Support scaffolds from finished surfaces only after taking precautions to prevent damage. No supports, clips, brackets, or similar devices shall be welded, bolted, or otherwise affixed to any finished member or surface without prior permission.

1.8 Site Storage

.1 Handle and store materials so as to prevent damage or defacement to the *Work* and surrounding property.

.2 *Owner* is not responsible for securing *Products* or materials at the *Place of the Work*.

1.9 Protection of the Public

.1 *Provide* fencing, barricades, hoarding, notices and warning boards and maintain lights and signals for protection of workers engaged on the *Work*, for protection of adjoining property and for protection of the public.

.1 Refer also to Section 01 56 23 – Hoarding.

.2 Such protective measures shall be finish painted to *Owner's* approved colour, when visible to the public.

.3 Where any special hazard exists from which it is not possible to protect the public safety by other means, watchpersons shall be employed to preserve public safety until the area of special hazard no longer poses a risk to public safety.

1.10 Protection of the *Work*

.1 Protect the *Work* from damage, discolouring, and defacement. Maintain protection until the *Work* is complete.

.2 Protect completed work from soiling, abrasion, punctures, damage, and defacement, and maintain protection until the surrounding or overhead work is complete.

.3 Keep surfaces free of oils, grease or other materials that may damage or deface them or affect bond of applied *Products*.

.4 Remove and replace materials damaged or defaced as a result of failure to provide adequate protection.

.5 Have damaged or defaced work corrected by workers meeting qualification requirements of the *Contract Documents*.

1.11 Waste Management

.1 Do not bury rubbish and waste materials at the *Place of the Work*.

.2 Do not dispose of waste into waterways or storm or sanitary sewers.

.3 Do not burn waste materials at the *Place of the Work*.

.4 Comply with waste disposal requirements of authorities having jurisdiction.

.5 Remove waste material from the *Place of the Work* daily. If waste is collected in bins, bins to be removed from site once full.

.6 Locations identified as approved locations for placement of *Contractor*'s waste bins may have noise and time of access restrictions imposed on them by any of the *Owner*, the landlord, adjacent property owners and/or landlords. The *Contractor* shall schedule collection of waste bins or of waste from bins with such entities.

.7 Arrange and pay for removal of debris and waste from the *Place of the Work*.

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

1.12 Control of Dust, Debris and Noise

.1 Control dust and dirt produced during the *Work* to prevent dispersion beyond the immediate work areas.

.2 Prevent materials from contaminating air beyond application area, by providing temporary enclosures and ventilation/filtration.

.3 Limit noise levels in accordance with requirements of authorities having jurisdiction and the *Owner*.

.4 Supplement these requirements in accordance with Section 01 35 13.

1.13 Design and Safety Requirements for Temporary Facilities

.1 Be responsible for design, erection, operation, maintenance and removal of temporary structural and other temporary facilities. Engage and pay for registered professional engineering personnel skilled in the appropriate disciplines to perform these functions where required by law or by the *Contract Documents*; and in cases where such temporary facilities and their method of construction are of such a nature that professional engineering skill is required to produce safe and satisfactory results.

.2 Engage and pay for professional engineer(s) registered in *Place of the Work* to design and supervise construction and maintenance of hoardings, covered ways, protective canopies and project sign(s). Designs provided by *Consultant* or *Owner* for such work cover general appearance only.

1.14 Security

.1 The *Contractor* shall be solely responsible for securing the *Place of the Work* and the *Work*, and for securing areas used for the storage of *Products* or construction machinery and equipment. The *Owner* shall have no responsibility in this regard.

.2 *Provide* and maintain temporary locks. Premises to be locked after working hours.

PART 2- PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 Permits

.1 Arrange and pay for necessary permits for proper execution and completion of the work of this section.

1.2 Design

.1 Design hoarding to meet bylaws and regulations of authorities having jurisdiction and obtain approvals from authorities having jurisdiction.

.2 Hoarding shall be of post and chainlink construction unless otherwise indicated.

PART 2- PRODUCTS

2.1 Materials

.1 *Provide* prefabricated panelized chainlink and post galvanized metal hoarding system:

.1 Fence shall be used but to be covered in cloth for dust collection.

.2 Areas to be visibly open in the cloth to allow for students to see the construction site on the north side of the construction zone only; Provide translucent fabric rather than opaque cloth with open areas on the north side of the construction zone.

.2 Signage: *Provide* suitable sized notice signs at entrance to the *Place of the Work* with contrasting text "RESTRICTED ACCESS - CONSTRUCTION SITE" complete with the name of *Contractor*.

PART 3 - EXECUTION

3.1 Erection

.1 Erect framing members and install hoarding at the perimeter of the *Place of the Work* as indicated or required by authorities having jurisdiction to fully enclose the *Place of the Work* and as follows, unless otherwise indicated or required by authorities having jurisdiction:

.1 Height of hoarding: 2400 mm (8') minimum, unless otherwise indicated, above grade at any point.

.2 Vertical posts spaced 2400 mm (8’) on centre, maximum.

.3 Horizontal rails securely nailed or screwed to vertical posts at top, bottom, and intermediate locations at 600 mm on centre.

.4 Erect panels around objects as required.

.5 Hoarding shall contain no opening more than 150 mm wide or less than 900 mm above the bottom of the fence except where required for access to and from the *Place of the Work*.

.6 *Provide* no rails, other horizontal or diagonal bracing, attachments, or pattern of openings on the outside that would facilitate climbing.

.7 At access openings: *Provide* gates that provide performance and safety at least equivalent to hoarding and contain wire mesh of sufficient openness to provide visibility for traffic entering or exiting the *Place of the Work*.

.2 *Provide* overhead protection hoarding where public access is required.

.3 *Provide* hoarding, access gates, access doors, in conformance with the *Contract Documents* and authorities having jurisdiction.

3.2 Hardware

.1 *Provide* rough and finish hardware as required to meet *Owner's* security requirements.

END OF SECTION

PART 1 - GENERAL

1.1 Availability of Products

.1 In the event of delays in supply of *Products*, and should it subsequently appear that the *Work* may be delayed for such reason, *Consultant* reserves the right to substitute more readily available *Products* of similar character, at no additional cost to the *Owner*.

1.2 *Product* Handling

.1 Handle and store *Products* in a manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturers' and *Supplier's* recommendations and so as to ensure preservation of their quality and fitness for the *Work*, and protect from vandalism and theft.

.2 Store packaged or bundled *Products* in original and undamaged condition with manufacturer's seals and labels intact, facing to outside. Do not remove from packaging or bundling until required in the *Work*.

.3 Handle materials to preclude damaging existing surfaces and work of others.

.4 Remove damaged *Products* and replace with new undamaged *Products*.

.5 Transportation:

.1 Pay cost of transportation of *Products* required in performance of *Work*.

.2 Transportation cost of *Products* supplied by *Owner* will be paid for by *Owner*. Unload, handle and store such *Products* at the *Place of the Work*.

.3 Reject *Products* damaged during transport.

.4 Transportation of *Products* must be undertaken to suit construction schedule. *Contractor* is responsible for determining mode of transport to ensure delivery, obtaining shop drawings, placement of orders, and on-time premium costs, air freight, and the like.

PART 2 - PRODUCTS

2.1 Product Requirements and Quality

.1 *Products* used for temporary facilities may have been previously used, providing they are sound in structural qualities.

.2 *Products* and *Product* installation shall be in compliance with building code, regulations and requirements of authorities having jurisdiction.

.3 Specified options: The *Work* is based on materials, *Products* and systems specified by manufacturer's catalogued trade names, references to standards, by prescriptive specifications and by performance specifications.

.1 Where only one manufacturer's trade name is specified for a *Product*, the *Product* is single sourced and shall be supplied by the specified manufacturer.

.2 Where more than one manufacturer's trade name is specified for a *Product*, supply one *Product* from list of *Products* specified.

.3 When a *Product* is specified by reference to a standard, select one *Product* from manufacturer that meets or exceeds the requirements of the standard and manufacturer's written application directions.

.4 When a *Product* or system is specified by prescriptive or performance specifications, *Provide* one *Product* or system which meets or exceeds the requirements of the prescriptive or performance specifications and manufacturer's written application directions.

.5 The onus is on the *Contractor* to prove compliance with governing published standards, prescriptive specifications and with performance specifications.

.6 Visual selection specification:

.1 Where specifications include the phrase "as selected by *Consultant* from manufacturer's full range" or similar phrase, select a product that complies with requirements. *Consultant* will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

.7 Visual matching specification:

.1 Where specifications require "match *Consultant's* sample", provide a product that complies with requirements and matches *Consultant's* sample. *Consultant's* decision will be final on whether a proposed product matches.

.4 *Products*, materials, equipment and articles (referred to as *Products* throughout the *Contract Documents*) incorporated in the *Work* shall be new, not damaged or defective, and of the quality standards specified, for the purpose intended. If requested, furnish evidence as to type, source and quality of *Products Provided*.

.5 Where *Contract Documents* list Basis of Design or acceptable manufacturers, or list of products, select as applicable, one *Product* meeting performance of specifications and manufacturer's written application directions.

.6 Where *Contract Documents* list acceptable *Products* or acceptable manufacturers, select as applicable, one *Product* meeting performance of specifications and manufacturer's written application directions.

.7 Where *Contract Documents* require design of a *Product* or system, and minimum material requirements are specified, the design of such *Product* or system shall employ materials specified within applicable section. Where secondary materials or components are not specified, augment with materials meeting applicable code limitations, and incorporating compatibility criteria with adjacent work.

.8 Defective *Products*, whenever identified prior to completion of the *Work*, will be rejected, regardless of previous reviews. Review of the *Work* by the *Consultant* or inspection and testing companies does not relieve the *Contractor* of the responsibility for executing the *Work* in accordance with the requirements of the *Contract Documents*, but is a precaution against oversight or error.

.9 Should dispute arise as to quality or fitness of *Products*, the decision rests strictly with *Consultant* based upon the requirements of the *Contract Documents*.

.10 Unless otherwise indicated in the *Contract Documents*, maintain uniformity of *Product* and manufacturer for any like item, material, equipment or assembly for the duration of the *Work*.

.11 *Products* exposed in the finished work shall be uniform in colour, texture, range, and quality, and be from one production run or batch, unless otherwise indicated.

.12 Permanent labels, trademarks and nameplates on *Products* are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical, electrical, machinery or like rooms.

.13 *Owner* retains right to select from choices available within specified *Products* for colours, patterns, finishes or other options normally made available. Submit full range of *Product* options in accordance with 01 33 00 for such selection.

.14 Quality control:

.1 Implement a system of quality control to ensure compliance with *Contract Documents*.

.2 Notify *Consultant* of defects in the *Work* or departures from intent of *Contract Documents* that may occur during construction. *Consultant* will recommend appropriate corrective action in accordance with requirements of the *Contract*.

.15 Exposed to weather: *Products* and materials in environments not protected by the building's HVAC and/or climate control systems shall be considered exposed to weather.

2.2 Inserts, Anchors, and Fasteners

.1 Use only factory made, threaded or toggle type inserts as required for supports and anchors, properly sized for load to be carried.

.2 Where inserts cannot be placed, use factory made expansion shields for light weights only.

.3 Supply and locate inserts, holes, anchor bolts and sleeves during placement or fabrication of structural elements.

.4 Fasteners stressed in withdrawal are not acceptable, except where otherwise indicated.

.5 Metal fastenings shall be uniform to metals materials and components being anchored or of a metal which will not set up a galvanic action causing damage to the fastening or metal component under moist conditions.

.6 Fastenings for prefinished materials shall be of concealed type unless otherwise indicated, and when exposed finish is required, of matching prefinishing materials.

.7 Metal fastenings and accessories shall be same texture, colour and finish as material on which they occur, as selected by *Consultant*.

.8 Power actuated fasteners:

.1 Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E1190-11(2018) conducted by a qualified independent testing agency.

.2 Do not use power actuated fasteners which are stressed in withdrawal in finished work.

.3 Do not use power actuated fasteners within 100 mm (4") of the edge of concrete or masonry, unless otherwise accepted in writing by *Consultant*.

.4 Do not use power actuated fasteners in post-tensioned concrete.

PART 3 - EXECUTION

3.1 Manufacturer's Instructions

.1 Unless otherwise indicated in the *Contract Documents*, install or erect *Products* in accordance with manufacturer's printed instructions. Do not rely on labels or enclosures supplied with *Products*. Obtain printed instructions directly from manufacturers.

.2 Notify *Consultant* in writing, of conflicts between the *Contract Documents* and manufacturer's instructions.

.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 additional cost to the *Owner*.

.4 Manufacturers' representatives shall have access to the *Work* at all times. *Contractor* shall render assistance and facilities for such access in order that the manufacturers' representatives may properly perform their function.

3.2 Overloading

.1 Protect the existing building from loads which may cause permanent deformation.

.2 Protect the *Work* from loads which may cause permanent deformation.

3.3 Galvanic/Dissimilar Metal Corrosion

.1 Insulate dissimilar metals from each other by suitable plastic strips, washers or sleeves to prevent galvanic corrosion where conductive liquid or electrolyte (rainwater or condensation) exists.

3.4 Penetrations

.1 Holes or voids created in assemblies or partitions for penetrating mechanical, electrical, or sprinkler service items, shall be of sufficient size to accommodate the penetrating item as well as additional required fill materials, such as sealants, firestopping and smoke sealants, insulation, and the like, without exceeding the maximum opening allowable by the manufacturer of the additional required fill material.

3.5 Workmanship

.1 General:

.1 Execute the *Work* using workers experienced and skilled in the respective duties for which they are employed.

.2 Do not employ an unfit person or anyone unskilled in their required duties.

.3 Decisions as to the quality or fitness of workmanship in cases of dispute rest solely with *Consultant*, whose decision is final.

.4 Remove *Products* or materials that have been broken, chipped, cracked, discoloured, abraded, or damaged during construction period and *Provide* undamaged *Products* or materials meeting the requirements of the *Contract Documents*.

.2 Coordination:

.1 Ensure cooperation of workers in layout of the *Work*. Maintain efficient and continuous supervision.

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

.3 Backer plates:

.1 Provide backer plates to support and provide anchorage base to carry loads from surface or recessed applied materials.

.4 Concealment:

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

.2 Before installation, inform *Consultant* of any contradictory situation. Install as directed by *Consultant*.

.5 Cutting and remedial work:

.1 Perform cutting and remedial work required to make parts of the *Work* come together. Coordinate the *Work* to ensure this requirement is maintained. Obtain permission from *Consultant* before commencing any cutting. Refer also to requirements of Section 01 73 29.

.6 Location of fixtures:

.1 Consider location of fixtures, access panels, outlets and mechanical and electrical items indicated as approximate only. Locate fixtures, and the like approximately; Architectural drawings will relate these items to known dimensions, such as ceiling tile grid or wall locations and the like.

.2 Obtain *Consultant's* acceptance for precise locations of fixtures, access panels, outlets, mechanical, and electrical items.

.3 *Consultant* reserves the right to relocate electrical outlets and mechanical fixtures at a later date, but prior to installation, without cost, provided that the relocation per outlet does not exceed 3050 mm (10') from the original location.

.4 Inform *Consultant* of conflicting installations. Install only as directed by *Consultant*.

.7 Protection of work in progress:

.1 Take reasonable and necessary measures, including those required by authorities having jurisdiction, to *Provide* protection.

.2 Adequately protect parts of the *Work* completed or in progress. Parts of the *Work* damaged or defaced due to failure in providing such protection is to be removed and replaced, or repaired, as directed by the *Consultant*, at no additional cost to the *Owner*.

.3 Prevent overloading of any part of the building. Do not cut, drill or sleeve any load bearing structural member without written permission of *Consultant*, unless specifically indicated. Refer also to Section 01 73 29.

.4 Adequately protect finished flooring from damage. Take special measures when moving heavy loads or equipment on them.

.5 Keep floors free of oils, grease or other materials likely to discolour them or affect bond of applied surfaces.

.6 Protect work of other *Subcontractors* from damage while doing subsequent work. Damaged work shall be made good by appropriate *Subcontractors* but at expense of those causing damage.

.7 Protect existing buildings, curbs, roads and lanes. If, during the *Work*, any buildings, curbs, roads or lanes are damaged, bear costs for repairs.

.8 Existing utilities:

.1 When breaking into or connecting to existing services or utilities, execute the *Work* at times approved by *Owner*, with a minimum of disturbance to *Owner's* ongoing operations, the *Work*, and traffic.

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

.9 Protection of mechanical and electrical *Products* or materials:

.1 Wrap in protective plastic and seal mechanical and electrical items of mechanical and electrical equipment prior to and during for shipment, storage at the *Place of the Work* and after installation.

.2 Remove protective coverings only to the extent required for installation of the items. Re-install protection immediately following installation.

.3 Remove protective coverings in stages, as work areas are completed, or when directed by *Consultant*.

.10 Operational requirements:

.1 Operable *Products* shall be *Provided* fully operational and ready for intended use.

.2 Adjust operating hardware and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts for smooth squeak-free function, in accordance with manufacturer's instructions.

.11 Alterations:

.1 Restore new or existing work which is altered by new work and make good. Materials and workmanship shall be match existing materials and workmanship. Exposed materials shall match and blend in with the appearance of the existing undamaged surfaces in all respects, including, colours, textures, layout, jointing, and material types so as to not vary in appearance when compared to adjacent materials from a distance of 1830 mm (6').

END OF SECTION

PART 1 - GENERAL

1.1 Cutting, Patching and Remedial Work

.1 Submittal Items:

.1 Comply with administrative requirements of Section 01 33 00.

.2 Submit written request in advance of cutting, coring, and alteration that affects:

.1 Structural integrity of any element of *Work*.

.2 Integrity of weather-exposed or moisture-resistant elements.

.3 Efficiency, maintenance, or safety of any operational element.

.4 Visual qualities of sight-exposed elements.

.5 *Owner* or work of other contractors.

.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 *Owner* or work of other contractors.

.7 Written permission of affected separate contractor.

.8 Date and time work will be performed.

.9 Non-destructive structural survey: Radiography (X-ray) imaging of work to be cut or cored.

.4 Do not commence cutting, patching, or remedial work until request has been reviewed by *Consultant*.

.2 Preparation:

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

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

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

.4 *Provide* supports to assure structural integrity of surroundings; devices and methods to protect other portions of the *Work* from damage.

.5 *Provide* protection from elements for areas which may be exposed by uncovering work.

.6 Where uncovering of area exposes local deterioration, cracking, evidence of water infiltration, structural settlement, previous modifications, or other unexpected conditions, advise *Consultant* immediately in writing and leave conditions exposed until receipt of *Consultant's* written instructions. If area is exposed to the exterior, *Provide* temporary protection from inclement weather.

.3 Execution:

.1 Execute cutting, fitting, and patching to complete the *Work*. Under no circumstances will overcutting of corners of opening be accepted. Ensure corners of openings to be cut are predrilled or sawed.

.2 Remove and replace defective and non-conforming work.

.3 Remove samples of installed work for testing if directed by *Consultant*.

.4 Shop drawings identifying precise locations and size of openings to be cored and cut are to be submitted for review by *Consultant*. *Provide* non-destructive structural survey of structural concrete to be cored or cut, for *Consultant* review. Coring and cutting work locations shall be reviewed by *Consultant* for acceptance before proceeding.

.5 *Provide* openings in non-structural elements of the *Work* for penetrations of mechanical and electrical work

.6 Perform work by methods to avoid damage to other work, and which will *Provide* proper surfaces to receive patching and finishing.

.7 Employ qualified installer relevant experience to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.

.8 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed to be used anywhere within existing buildings unless approved by *Consultant*.

.9 Restore work with new *Products* in accordance with requirements of *Contract Documents*.

.10 Fit work to pipes, sleeves, ducts, conduit, and other penetrations through surfaces and with suitable allowance for deflection, expansion, contraction, and firestopping.

.11 Enclose pipes, ducts, conduit and wires passing through floors at areas where faucets occur in a 100 mm (4") high metal sleeve and make air and watertight with water resistant firestopping.

.12 Completely seal voids of penetrations of fire rated wall, ceiling, and floor constructions with firestopping and smoke seals.

.13 Refinish surfaces to match adjacent finishes. Refinish continuous surfaces to nearest intersection. Refinish entire assembly units.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 Environmental Controls

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

.2 Store volatile wastes in covered metal containers, and remove from *Place of the Work* daily.

.3 Prevent accumulation of wastes which create hazardous conditions.

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

1.2 Materials

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

1.3 Cleaning During Construction

.1 Clean-up the *Place of the Work* daily. Maintain clean and clear egress routes at all times.

.2 Maintain *Place of the Work*, grounds and public properties free from accumulations of waste materials and rubbish.

.3 *Provide* containers at the *Place of the Work* for collection of waste materials and rubbish. Remove waste materials and rubbish from the *Place of the Work* when containers become full.

.4 Vacuum and clean interior building areas when ready to receive finish painting, and continue vacuum cleaning on an as-needed basis until *Substantial Performance of the Work*.

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

.6 Promptly as the *Work* proceeds, on a daily basis and upon completion, clean up and remove rubbish, surplus materials and equipment.

.7 Remove as the work of this section progresses, corrosive and foreign materials which may set or become difficult to remove at time of final cleaning or which may damage members.

.8 Wash exposed surfaces with a cleaning solution approved by *Product* manufacturers.

.9 Debris and waste not permitted within cavities of *Work*.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 General Instructions

.1 The procedures for completing *Contract* and acceptance by the *Owner* shall be in accordance with the methods described in OAA/OGCA Document 100 (July 1, 2018, and reissued January 8, 2019) and any additional requirements described below.

.2 Stages will be reviewed at the *Contract* start-up meeting to ensure that parties understand their responsibilities. Refer to Section 01 31 19 for procedures and requirements for *Contract* start-up meeting.

.3 Within 4 weeks of commencement of the *Work*, submit to the *Consultant* a list of closeout submittals required by the *Contract Documents.*

1.2 Final Cleaning

.1 Environmental controls:

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

.2 Store volatile wastes in covered metal containers, and remove from *Place of the Work* daily.

.3 Prevent accumulation of wastes which create hazardous conditions.

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

.2 Materials:

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

.3 Final cleaning:

.1 Immediately prior to *Consultant's* review to determine if *Substantial Performance of the Work* has been achieved, remove surplus *Products* and construction machinery and equipment not required for the performance of the remaining *Work*.

.2 Remove waste *Products* and debris other than that caused by the *Owner*, and leave the *Work* clean and suitable for occupancy by *Owner*.

.3 When the *Contract* is completed, remove surplus *Products*, tools, construction machinery and equipment.

.4 Clean glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, prefinished surfaces, and fixtures.

.5 Remove stains, spots, marks and dirt from decorative parts of the *Work*, electrical and mechanical fixtures, furniture fittings, walls, and floors.

.6 Vacuum clean and remove dust from building interiors, behind grilles, louvres, and screens. Vacuum clean interior of electrical equipment.

.7 Clean floor finishes to recommendations of manufacturer.

.8 Remove non-permanent labels.

.9 Remove dirt and residue from surfaces.

.10 Inspect finishes, fittings and equipment and ensure specified workmanship and operation.

.11 At completion of the *Work*, remove protective coatings, clean surfaces and remove excess compounds and sealant materials. Make good defective, scratched or damaged work.

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

.13 Remove seal wrap on mechanical and electrical *Products* and materials and clean as required.

.14 Clean and/or replace lamps, light fixtures, lenses and grilles.

.15 Remove protective covering and labels from lamps, hardware, and speciality items.

.16 Under the direction of the *Consultant*, aim adjustable luminaires

.17 Clean architectural metal surfaces to remove surface discolouration and rust staining.

1.3 Closeout Submittals

.1 Collect reviewed submittals, and assemble required closeout submittals executed by *Subcontractors*, *Suppliers*, and manufacturers. Prior to submitting closeout submittals to the *Consultant*, undertake the following:

.1 Review maintenance manual contents (operating, maintenance instructions, as-built drawings, materials) for completeness.

.2 Review supply and completeness of spare parts required by *Contract Documents* and manufacturers.

.3 Review in relation to *Contract Price*, *Change Orders*, *Change Directives*, holdbacks and other adjustments to the *Contract Price*.

.4 Execute transition of performance bond and labour and materials payment bond to warranty period requirements.

.5 Submit a final statement of accounting giving total adjusted *Contract Price*, previous payments, and monies remaining at time of application for completion of the *Contract*. *Consultant* will issue a final change order reflecting approved adjustments to *Contract Price* not previously made.

.2 No later than 10 *Working Days* prior to submitting request for *Consultant's* review to determine if *Substantial Performance of the Work* has been achieved, submit to the *Consultant* the closeout submittals specified in this section, including, but not limited to, reviewed shop drawings, *Product* data sheets, samples, operating instructions, as-built records, fully executed warranties and guarantees, reports recording demonstration and instruction provided to *Owner* for operation and maintenance of building systems, software required for operation and maintenance of building systems, maintenance materials, and keys.

.1 Submit close-out document submittals in electronic (PDF and CAD) format. If originals are hardcopies, they shall be scanned and submitted electronically along with submitting the original hardcopies. Electronic documents shall be submitted via FTP website or on a CD/DVD, in duplicate.

.3 For equipment put into use with *Owner's* permission during the *Work*, submit required closeout submittals within 10 *Working Days* after start-up.

.4 For items of the *Work* delayed materially beyond date of *Substantial Performance of the Work*, provide updated closeout submittals within 10 *Working Days* after acceptance, listing date of acceptance as start of warranty period.

.5 Neither the *Consultant's* review to determine if *Substantial Performance of the Work* has been achieved, nor acceptance of the *Work,* will take place until receipt, by the *Consultant*, of acceptable copies of the closeout submittals required herein and by the *Contract Documents*.

.6 As-built documents:

.1 *Owner* will provide 1 set of *Contract Documents* to the *Contractor* for as-built documentation purposes.

.2 Accurately record as-built conditions and deviations from *Contract Documents* as the *Work* progresses.

.3 Mark changes in red ink.

.4 Record, without being limited to, the following:

.1 Field changes of dimensions/details.

.2 Changes by *Change Orders*, *Change Directives*, and *Supplemental Instructions*.

.3 Locations of interior mechanical and electrical equipment and distribution.

.4 Specification as-builts: Record as-built *Products*, including manufacturer, manufacturer's model or system number.

.5 As-built documentation:

.1 Submit close-out document submittals in electronic (PDF and CAD) format. If originals are hardcopies, they shall be scanned and submitted electronically along with submitting the original hardcopies. Electronic documents shall be submitted on FTP website or CD/DVD flash drives, in duplicate.

.7 Operation and maintenance manuals:

.1 Submit operation and maintenance manuals, consisting of the following general components:

.1 Operation and maintenance book.

.2 Shop drawing book.

.3 Warranty book.

.4 *Project* data book.

.2 Operation and maintenance books shall contain operating and maintenance data and information specified below for supplied *Products*, in English, and shall be made up as follows:

.1 Charts, diagrams and reports identified in Mechanical and Electrical Division specifications.

.2 Description, operation and maintenance instructions for equipment and parts list. Indicate nameplate information such as make, size, capacity, serial number.

.3 Enclose title sheet, labelled as applicable, with project name, date and list of contents.

.4 Organize contents into applicable sections of work to parallel project specifications break-down. Mark each section by labelled tabs protected with celluloid covers fastened to hard paper dividing sheets.

.5 Neatly type lists and notes. Use clear drawings, diagrams of manufacturers' literature.

.6 Submit close-out document submittals in electronic (PDF and CAD) format. If originals are hardcopies, they shall be scanned and submitted electronically along with submitting the original hardcopies. Electronic documents shall be submitted via FTP website or on a CD/DVD, in duplicate.

.3 Shop drawing book:

.1 Submit one copy of each final accepted shop drawing issued for the *Work* on which have been recorded changes made during fabrication and installation caused by unforeseen conditions.

.2 Engineered shop drawings shall include copies of the certificate of insurance, the engineer’s field review reports, and the engineer’s letters of general conformity that were provided as part of the engineered submittal in accordance with Section 01 33 00 appended to the pertinent engineered shop drawing in the shop drawing manual.

.3 Submit close-out document submittals in electronic (PDF and CAD) format. If originals are hardcopies, they shall be scanned and submitted electronically along with submitting the original hardcopies. Electronic documents shall be submitted via FTP website or on a CD/DVD, in duplicate.

.4 Warranty book:

.1 Submit copies of bonds, guarantees, warranties and extended warranties together in one report binder, complete with an indexed summary list of warranties and expiration dates. Warranties to be in accordance with Section 01 78 36.

.2 Submit close-out document submittals in electronic (PDF and CAD) format. If originals are hardcopies, they shall be scanned and submitted electronically along with submitting the original hardcopies. Electronic documents shall be submitted via FTP website or on a CD/DVD, in duplicate.

.5 *Project* data book: shall include the following information supplemented by additional required data specified elsewhere in the *Contract Documents*:

.1 Maintenance instructions for finished surfaces and materials.

.2 Copy of hardware and paint schedules.

.3 Names, addresses and phone numbers of *Subcontractors* and *Suppliers*, as applicable.

.4 Additional material used in the *Work* listed under various sections showing name of manufacturer and source of supply.

.5 Report recording demonstration and instruction provided to *Owner* for operation and maintenance of building systems as described below in this section.

.6 Key construction photos.

.7 Permits and forms:

.1 Workplace Safety & Insurance Board certificate of clearance.

.2 Certificates of approval of the *Work* by local building department (if available).

.3 Electrical authority certificate of inspection.

.8 Submit close-out document submittals in electronic (PDF and CAD) format. If originals are hardcopies, they shall be scanned and submitted electronically along with submitting the original hardcopies. Electronic documents shall be submitted via FTP website or on a CD/DVD, in duplicate.

.8 Posted operating instructions

.1 Prepare operating instructions in English for posting near equipment and systems. Posted instructions to be glass covered, framed and mounted.

.2 Posted instructions to consist of simplified, consolidated equipment, control and power diagrams graphically representing the entire system, including concise instructions on how to start and stop systems, what settings and conditions are to be observed by the operators, and what control adjustments are to be made or maintained by the operator.

.3 Posted instructions shall include control diagrams with added specific operating instructions, controls, interlocks, and the like.

.4 Posted instructions shall include:

.1 HVAC controls for each system;

.2 One line schematic diagrams of water supply;

.3 One line isometric diagrams of sanitary drainage;

.4 One line diagrams of steam distribution, hot and cold water systems, including risers, valves, control devices, etc.

.5 Submit close-out document submittals in electronic (PDF and CAD) format. If originals are hardcopies, they shall be scanned and submitted electronically along with submitting the original hardcopies. Electronic documents shall be submitted via FTP website or on a CD/DVD, in duplicate.

.9 Maintenance materials:

.1 Provide overage, extra stock, and maintenance materials. For required materials, see individual sections of specifications. Deliver to a location and at a time specified by the *Owner*, and as follows:

.1 Use unbroken cartons, or if not supplied in cartons, material shall be strongly packaged.

.2 Clearly mark cartons or packaging as to contents, project name, and *Supplier*.

.3 If applicable give colour and finish, room number or area where material is used.

.2 Replace incorrect or damaged maintenance materials delivered to *Owner*, including damage through shipment.

.3 Provide a typed inventory list of maintenance materials prior to *Substantial Performance of the Work* application. List all items, complete with quantities, and storage locations.

.4 Establish a master list identifying maintenance materials and maintain a log of when materials are turned over to *Owner* and signing authority for acceptance of materials on behalf of *Owner*.

.5 Submit close-out document submittals in electronic (PDF and CAD) format. If originals are hardcopies, they shall be scanned and submitted electronically along with submitting the original hardcopies. Electronic documents shall be submitted on via FTP website or on a CD/DVD, in duplicate.

1.4 System Demonstration and Project Commissioning

.1 Refer also to requirements of Mechanical and Electrical Division specifications with respect to commissioning for control systems, mechanical / electrical systems.

.2 Perform system demonstration and commissioning work no later than 10 *Working Days* prior to submitting request for *Consultant*'s review to determine if *Substantial Performance of the Work* has been achieved.

.3 Submit required certificates of approval or acceptance from authorities having jurisdiction.

.4 Meet with other consultants; mechanical, electrical, to coordinate demonstration, instruction, commissioning and completion.

.5 When partial occupancy of uncompleted project is required by *Owner*, coordinate *Owner's* uses, requirements, access, and the like, with *Contractor*'s requirements to complete the *Work*.

.6 Demonstration and instruction:

.1 Demonstrate operation of each system to *Owner* and *Consultant*.

.2 Instruct *Owner's* personnel in operation, adjustment and maintenance of equipment and systems, using operation and maintenance data provided as the basis for instructions. Arrange and coordinate instruction of *Owner's* staff in care, maintenance and operation of building systems and finishes

.3 *Contractor*, manufacturer's representatives, and responsible personnel from *Subcontractors* whose work is being demonstrated shall be present at these demonstrations.

.4 Instruct *Owner's* representative on use of software required for operation and maintenance of building systems and provide a toll-free telephone number or website address for further assistance to the *Owner*.

.5 Prepare and insert additional data in the operation and maintenance data manuals when the need for additional data becomes apparent during demonstration or instruction.

.6 Demonstration and instruction report: Submit a written report of such demonstration, instruction, and commissioning to the *Consultant* as part of the contract closeout submittals described earlier in this section. Report shall include time and date of each demonstration, instruction, and commissioning activity, complete with a list of persons present.

.7 Correct deficiencies and defects identified during demonstration, instruction, or commissioning.

.8 Attend 'end-of-work' testing and break-in or start-up demonstration.

1.5 *Substantial Performance of the Work*

.1 Deficiency review:

.1 Neither *Owner* nor *Consultant* will be responsible for preparation or issuance of extensive lists of deficiencies. *Contractor* assumes prime responsibility for ensuring that items shown and described in the *Contract Documents* are complete. Any reviews to approve the certificate of *Substantial Performance of the Work* will be immediately cancelled if it becomes obvious to the *Consultant* that extensive deficiencies are outstanding.

.2 The *Contractor* shall conduct an inspection of the *Work* to identify deficiencies and defects, which shall be repaired. When the *Contractor* considers that the *Work* is substantially performed, the *Contractor* shall prepare and submit to the *Consultant* a comprehensive list of items to be completed or corrected and apply for a review of the *Work* by the *Consultant* to determine if *Substantial Performance of the Work* has been achieved.

.3 The *Contractor's* request described above shall include a statement by *Contractor* that the *Work* to be reviewed by *Consultant* for deficiencies is, to the best of the *Contractor's* knowledge, in compliance with *Contract Documents*, reviewed shop drawings, and samples, and that deficiencies and defects previously noted by *Consultant* have been repaired.

.4 No later than 10 *Working Days* after the receipt of the *Contractor's* request described above, but contingent upon the prior receipt, by the *Consultant*, of the closeout submittals in the manner and form specified in this section, the *Consultant* and the *Contractor* will review the *Work* to identify any defects or deficiencies. If necessary, the *Contractor* shall tabulate a list of deficiencies to be corrected prior to *Substantial Performance of the Work* being certified by the *Consultant*. During review, the *Consultant* and the *Contractor* will decide which deficiencies or defects must be rectified before *Substantial Performance of the Work* can be certified, and which defects are to be treated as warranty items.

.5 Provide a schedule of planned deficiency review having regard to the foregoing.

.2 Certification of *Substantial Performance of the Work*:

.1 When the *Consultant* considers that the deficiencies and defects have been completed and that it appears that the requirements of the *Contract Documents* have been substantially performed, the *Consultant* shall issue a certificate of *Substantial Performance of the Work* to the *Contractor*, stating the date of *Substantial Performance of the Work*.

.1 Inform *Owner*, *Consultant*, *Subcontractors*, and *Suppliers* which publication is to be used for publishing certificate of substantial performance in accordance with Section 01 31 19.

.2 The certificate of *Substantial Performance of the Work* shall be prepared and issued in accordance with the Construction Act.

.3 Final Inspection for completion of the *Contract*:

.1 Deficiencies and defects shall be made good before the *Contractor* submits a written request for final review of the *Work* and before the *Contract* is considered complete.

.2 When *Contractor* is satisfied that the *Work* is complete, and after the *Contractor* has reviewed the *Work* to verify its completion in accordance with the requirements of the *Contract Documents*, the *Contractor* shall submit a written request for a final review by the *Consultant*, who in turn will notify the *Owner*.

.3 If there are any deficiencies identified as a result of this review, they shall be listed by the *Consultant* and submitted to the *Contractor*. This list shall be recognized as the final deficiency list for purposes of acceptance of the *Work* under the *Contract*.

.4 Such deficiencies shall be corrected by a date mutually agreed upon between *Consultant* and the *Contractor*, unless a specific date is required by *Contract*, and a further review by the *Consultant* shall be called for by the *Contractor* following his own review to take place within 7 days from date of request.

.5 *Contractor* shall thereafter submit invoice for final payment.

.6 Money shall be withheld for deficiency work and will be released only when all deficiencies have been completed. No partial payment to be recognized until all work is completed.

1.6 Warranty Period

.1 Provide on-going review and attendance to building call-back, maintenance and repair problems during the warranty periods.

.2 At the beginning of the 24th month after *Substantial Performance of the Work*, the *Owner*, *Contractor* and *Consultant*, along with key *Subcontractors* as designated, shall carry out a complete review of building and its systems to determine which deficiencies are to be rectified under the warranty. *Contractor* shall be responsible for timely written notification of *Owner*, and *Consultant* prior to such end of warranty period inspection and any delay in such notification shall extend such warranty period until proper notification is received by *Owner*, and *Consultant*.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 Extended Warranties

.1 Where specifically identified in the *Contract Documents*, extended warranties shall be furnished by individual manufacturer for particular product/system/assembly or by *Subcontractor* for a particular product/system/assembly/section of the specifications.

.2 Extended warranties shall include for proper performance of the portion of the *Work* as defined by the scope of the applicable specification section to the extent that the design and *Contract Documents* permit such performance.

.3 Extended warranties shall be provided by *Subcontractor* unless warranty is specified to be provided by product manufacturer.

.4 The *Owner* shall promptly give the warrantor notice in writing of observed defects and deficiencies which occur during the warranty period.

.5 Extended warranties shall commence at date of *Substantial Performance of the Work*.

.6 Extended warranties specified shall be in addition to, and run concurrent with, other warranties required by the *Contract Documents*. Manufacturer's disclaimers and limitations on product warranty do not relieve *Contractor* of obligations under requirements of the *Contract Documents*.

.7 Submit extended warranty on warrantor’s standard form specifically endorsed by the warrantor to the *Owner* and shall include the following information:

.1 Name and address of *Project*.

.2 Warranty commencement date (date of *Substantial Performance of the Work*).

.3 Warranty period.

.4 Specific warranty terms as required in applicable portion of *Contract Documents*.

.5 Name and title of authorized signing officer and seal of warrantor.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

PART 1- GENERAL

1.1 Summary

.1 Section includes:

.1 Demolition and removal of selected non-structural portions of building.

.2 Salvage:

.1 Salvaging of designated items for reuse by *Owner*.

.3 Removal of surplus materials from the *Place of the Work*.

.4 Related mechanical and electrical work and demolition requirements are covered under Mechanical and Electrical Divisions.

1.2 Administrative Requirements

.1 Pre-demolition meeting:

.1 Schedule a pre-demolition meeting following the procedures specified for pre-installation meetings in accordance with Section 01 31 19.

.2 Review existing conditions at the *Place of the Work* thoroughly to establish full extent of items to be removed, including footings, foundations, slabs, toppings, secondary floor finishes, and structures and items to remain. Commencement of demolition work will be considered to be acceptance of existing conditions at the *Place of the Work* and removal of such items.

.3 Examine adjacent properties to determine extent of protection required.

1.3 Submittals

.1 Submit required submittals in accordance with Section 01 33 00.

.2 Special procedures submittals:

.1 Existing conditions documentation:

.1 Document existing conditions of adjoining construction and site improvements, including pre-existing damage to finish surfaces that might be misconstrued as damage caused by demolition operations.

.2 Comply with Section 01 32 33.

.3 Submit existing conditions documentation before demolition work begins.

1.4 Quality Assurance

.1 Qualifications:

.1 Installers / applicators / erectors: the work of this section shall be executed by a *Subcontractor* able to deploy adequate equipment and skilled personnel to complete work expediently in an efficient and orderly manner.

.2 Soil Removal (Hydrovac)

.1 Daylighting by Hydrovac or approved equivalent (i.e. hand digging) to confirm service location, inverts/conflicts. Unit price to include fee for mobilization, demobilization and excess material disposal fee.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

3.1 Examination

.1 Verify that utilities have been disconnected and capped.

.2 Observe existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

.3 When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to *Consultant*.

.4 Survey of existing conditions: Record existing conditions by use of photographs in accordance with Section 01 32 33.

3.2 Utility Services and Mechanical / Electrical Systems

.1 Refer to Mechanical and Electrical Divisions.

3.3 Selective Demolition, General

.1 Demolish and remove existing construction only to the extent required by new construction, and as otherwise indicated. Use methods required to complete the work within limitations of governing regulations and as follows:

.1 Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.

.2 Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.

.3 Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.

.4 Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.

.5 Maintain adequate ventilation when using cutting torches.

.6 Remove decayed, infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.

.7 Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

.8 Dispose of demolished items and materials promptly.

.2 Dispose of demolished materials from *Project* site except where noted otherwise and in accordance with authorities having jurisdiction. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

.3 Do not sell demolished material at the *Place of the Work*.

.4 Clean existing surfaces specified to receive new applied finishes to assure proper adherence.

3.4 Salvage

.1 Remove and store items indicated or directed for salvage. Remove, handle and transport such items to storage area designated, to an area within the *Place of the Work* designated by *Consultant*, or to an area away from the *Place of the Work* as directed by the *Consultant*. Perform such work to prevent damage to the items during removal and in storage.

.2 Remove and store indicated items for future use by *Owner*. Remove, handle and transport such items to storage area indicated in the *Contract Documents* or to an area within the *Place of the Work* designated by *Consultant*. Perform such work carefully and with diligence to prevent any damage to the items during removal and in storage.

3.5 Protection

.1 *Provide* temporary weather enclosures.

.2 Prevent debris from obstructing active services and drainage systems.

.3 Protect work to remain against damage. Repair or replace damaged work at no additional cost to the *Owner*.

END OF SECTION

PART 1 - GENERAL

1.1 Summary

.1 Section includes:

.1 Work of this section includes service grade metal fabrications and related metals including, but not limited to, the following:

.1 Loose steel lintels: Interior lintels shall be primed. Exterior lintels shall be hot dip galvanized.

.2 Architectural woodwork supports.

.3 Mechanical requirements in accordance with Mechanical Drawings and Specifications.

.2 Section excludes:

.1 Finish painting coats shall be provided in accordance with Section 09 91 00.

1.2 Administrative Requirements

.1 Conduct a pre-installation meeting in accordance with Section 01 31 19.

1.3 Submittals

.1 Submit required submittals in accordance with Section 01 33 00.

.2 Submit list of fabrications to be *Provided* as part of the work of this section.

.3 *Product* data sheets:

.1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this section.

.4 Shop drawings:

.1 Submit engineered shop drawings.

.2 Include plans, sections and large scale details, and shall indicate components and methods of assembly, materials and their characteristics, fastenings, metal finishes, welds, and their structural characteristics relative to their purpose, and other fabrication information required.

.3 Indicate proposed *Place of the Work* connections and methods.

.4 Submit coordination drawings indicating locations of concealed grounds, cutouts, plates, and other required fabrications.

.5 Show relation to adjoining construction, details of outside and inside corners and door openings.

1.4 Quality Assurance

.1 Qualifications:

.1 Installers / applicators / erectors: work of this section to be executed only by a *Subcontractor* who has adequate plant, equipment, and skilled tradespersons to perform work expeditiously, and is known to have been responsible for satisfactory installations similar to that required in the *Work*.

.2 Aspects of the work of this section are required to be prepared by a professional engineer. Refer to Section 01 33 00 for specific details and requirements in this regard.

.2 Requirements of regulatory agencies: the work of this section that functions to resist forces imposed by dead and live loads shall conform to requirements of jurisdictional authorities.

1.5 Delivery, Storage, and Handling

.1 Label, tag or otherwise mark metal fabrications supplied for installation by other sections to indicate its function, location in building and shop drawing designation.

.2 Protect work from damage during delivery, storage and handling.

.3 Deliver work to location at the *Place of the Work* designated by *Contractor* and to meet requirements of construction schedule.

PART 2 - PRODUCTS

2.1 Performance/Design Requirements

.1 Design, fabricate, and install work of this section in accordance with the building code and requirements of all other governing authorities.

.2 Welding:

.1 Weld structural components in steel to conform to requirements of CSA W59-13, and by a fabricator fully certified by the Canadian Welding Bureau to conditions of CSA W47.1-09(R2014) and CSA W55.3-08 (R2013) as applicable.

.3 Design assemblies and connections to withstand own dead load, live loads, super-imposed dead loads, and fabrication forces, without permanent distortions or deformation, to maximum allowable deflection of L/360, within the following construction tolerances:

.1 Maximum variation from plumb in vertical lines:

.1 3.2 mm (1/8") in 3 m (10’-0”).

.2 Maximum variation from level:

.1 3.2 mm (1/8") in 9 m (30’-0”).

.3 Maximum variation from straight:

.1 3.2 mm (1/8") in 3 m (10’-0”) under a 3 m (10’-0”) straight edge.

.4 Maximum variation from angle indicated:

.1 10 seconds.

.5 Tolerances shall be non-cumulative.

2.2 Materials

.1 General:

.1 Unless detailed or specified otherwise, standard *Products* will be acceptable if construction details and installation meet intent of the *Contract Documents*.

.2 Include materials, *Products*, accessories, and supplementary parts necessary to complete assembly and installation of work of this section.

.3 Incorporate only metals that are free from defects that are visible, or that impair strength or durability. Install only new metals of best quality, and free from rust or waves and buckles, and that are clean, straight, and with sharply defined profiles.

.4 The engineer responsible for the production of the shop drawings is responsible for structural design, member sizes, arrangement, connections and anchoring of work of this section. Coordinate and maintain materials, dimensions, layout and appearance to meet intent of the *Contract Documents*.

.2 Metals:

.1 Steel:

.1 Structural shapes, plate, bars: hot-rolled, CSA G40.21-04, Grade 300W.

.2 Hollow structural sections: hot-formed, seamless, CSA G40.21-04, Grade 350W, Class H.

.3 Mild sheet and strip, hot rolled, ASTM A1011/A1011M-10.

.4 Cold rolled sheet, stretcher levelled, fully pickled, ASTM A1008/A1008M-11, Grade CS Type A exposed, matte finish, dry, unless otherwise indicated.

.5 Steel pipe to ASTM A53 / A53M - 10, Type E or S, Grade A or B, standard weight, Schedule 40 seamless black or AISI MT 1010/1015, or acceptable alternative.

2.3 Accessories

.1 Fasteners:

.1 Fasteners: Exposed fasteners to match the material surface on which they occur.

.2 Bolts and anchor bolts: to ASTM A307-14e1.

.3 High strength bolts: to ASTM A325-14.

.4 Use embedded epoxy set anchors for anchorage to concrete at exterior locations exposed to weather, unless otherwise indicated; installation and embedment depth shall be as per manufacturer’s requirements, embedment depth shall not be greater than 80% of concrete thickness.

.5 Other types of fasteners as appropriate to meet design requirements.

.2 Welding materials:

.1 Steel: to CSA W59-13.

.3 Grout:

.1 Epoxy grout; non-shrink, non-expanding:

.1 Hilti ‘HY-200’.

.2 Sika 'Sika AnchorFix 3001'.

.3 W.R. Meadows ‘REZI-WELD 3/2 EPOXY GROUT/PATCH’.

.2 Cementitious grout: non-shrink, non-expanding to ASTM C1107/C1107M-17:

.1 Sika 'Sika Grout 212' or ‘Sika M-Bed Standard’.

.2 W.R. Meadows 'Sealtight CG-86 Construction Grout'.

.4 Dielectric separator: Best grade, quick drying non-staining alkali resistant bituminous paint to CAN/CGSB 1.108-M89, or membrane type to acceptance of *Consultant*.

.5 Pre-fabricated ship’s ladder:

.1 Acceptable product:

.1 Skyline Group ‘Ships ladder’

.1 Product to meet the requirements of OHSA.

2.4 Finishes

.1 Shop primer; steel: CISC/CPMA 2-75 or SSPC-Paint 20, Paint Specification No. 20: Zinc-Rich Primers (Type I "Inorganic" and Type II "Organic").

.2 Zinc rich paint; steel: Two-component zinc-rich coating, zinc powder to ASTM D520-00(2011) Type III ,SSPC-Paint 20, Type 1 Inorganic or single-component zinc-rich coating to SSPC-Paint, Type 2 Organic, CAN/CGSB 1.181-M99, VOC content <100 g/l to ASTM-D1475.

.1 Acceptable *Products*:

.1 Aervoe Industries, Inc. ‘Low VOC Cold Galvanize Coating 93% Zinc’.

.2 ZRC Worldwide ‘ZRC Zero-VOC Galvanizing Compound’.

.3 Hot dip galvanizing: conforming to ASTM A123/A123M-09, minimum zinc coating of 600 g/m². Use air cooling method (no water or chromate dipping treatment permitted).

2.5 Fabrication

.1 General:

.1 Fabricate metal fabrications with machinery and tools specifically designed for the intended manufacturing processes and by skilled tradesmen.

.2 Fit and assemble metal fabrications in shop. When this is not possible, make a trial shop assembly.

.3 Incorporate anchors at 610 mm (24") on centre or as otherwise required for secure attachment for metal fabrications located in cast-in-place concrete and concrete masonry units.

.4 Incorporate means for fastenings of other work secured to work of this section.

.5 Do welding work in accordance with CSA W59-13, as applicable, unless specified otherwise.

.2 Construction:

.1 Fabricate with materials, component sizes, metal gauges, reinforcing, anchors, and fasteners of adequate strength to withstand intended use, and within allowable design factors imposed by jurisdictional authorities. Fabricate items from steel unless otherwise noted.

.2 Ensure that metal fabrications will remain free of warping, buckling, opening of joints and seams, distortion, and permanent deformation.

.3 Construct items that are part of floor construction, such as gratings and trench covers, to support the same live loads for which surrounding construction is designed.

.4 *Provide* drainage holes at exterior exposed tubular fabrications to permit drainage of moisture to exterior of metal fabrications.

.3 Assembly:

.1 Accurately cut, machine and fit joints, corners, copes and mitres so that junctions between components fit together tightly and in true planes.

.2 Provide smooth welds with splatter removed where exposed to view.

.3 Allow for differential movements within assemblies and at junctions of assemblies with surrounding *Work*.

.4 Field welding of hot dipped galvanized members permitted only when other fastening methods are not possible. Locations of field welds to be clearly identified on reviewed shop drawings.

.5 Incorporate holes and connections for work installed under other sections.

.6 Cleanly and smoothly finish exposed edges of materials including holes.

.7 Cap open ends of sections exposed to view, such as pipes, channels, angles, and other similar work.

.4 Shop prime painting:

.1 Shop primer: Sherwin Williams 'Pro Industrial Pro-Cryl Universal Primer', 0.0076 mm (3 mils) DFT.

.2 Clean loose mill scale, rust, dirt, weld flux and spatter from work after fabrication.

.3 Clean and prepare surfaces to meet specified requirements of SSPC SP-6 and paint manufacturer's installation requirements.

.4 Apply primer in accordance with paint manufacturer's installation requirements.

.5 Galvanizing:

.1 Galvanize metal fabrications following fabrication.

.2 Paint damage galvanized surfaces with zinc rich paint, immediately following damage to galvanized protection. Prepare substrate to remove oil and grease to SSPC-SP1-82(R2004), rust scale to SSPC-SP3-82 (R2004), mill scale to SSPC-SP6.

.3 Fill vent and drain holes that are exposed in the finished *Work*, unless indicated to remain as weep holes in exterior fabrications, by plugging with zinc solder and filing off smooth.

PART 3 - EXECUTION

3.1 Examination

.1 Take measurements at the *Place of the Work* to ensure that metal fabrications are fabricated to fit surrounding construction, around obstructions and projections in place, or as indicated, and to suit service locations.

3.2 Installation

.1 Install metal fabrications plumb, true, square, straight, level, and accurately and tightly fitted together and to surrounding work.

.2 Include in work of this section anchor bolts, high tensile bolts, washers and nuts, expansion bolts, toggles, straps, sleeves, brackets, clips, and other items necessary for secure installation as required by loading and jurisdictional authorities.

.3 Attach metal fabrications to interior concrete and masonry with corrosion resistant expansion bolts to support load with a safety factor of 3.

.4 Attach metal fabrications to exterior concrete and masonry with non-shrink epoxy cement to support load with a safety factor of 3.

.5 Insulate between dissimilar metals or between metal, and masonry or concrete with bituminous paint to prevent electrolytic action.

.6 Where indicated, grout metal posts, pickets, balusters, and the like, in metal sleeves cast into concrete, with non-shrink quick setting epoxy anchor cement, unless detailed otherwise. Fabricate sleeves of 75 mm (3") minimum in depth.

.7 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.

.8 Install roof ladders to suit locations indicated complete with safety cages where required. Galvanized finish. Reinforce walls as required to receive roof ladders.

.9 Through bolt or cast-in ladder anchorage assemblies unless otherwise approved by authorities having jurisdiction.

3.3 Adjusting and Cleaning

.1 After erection, touch up primed surfaces that are burned, scratched or otherwise damaged with prime paint to match shop paint.

.2 Clean and repair areas of bare metal and welds on galvanized surfaces with zinc rich paint. Welded area of members to be masked to minimize overpainting of adjacent undamaged surfaces. Prepare substrate to remove oil and grease to SSPC-SP1-82(R2004), rust scale to SSPC-SP3-82 (R2004), mill scale to SSPC-SP6.

.3 Remove damaged, dented, defaced, defectively finished, or tool marked components and replace with new.

3.4 Protection

.1 Protect finished surfaces from damage from time of installation until final finishes are applied or to final cleanup.

END OF SECTION

PART 1- GENERAL

1.1 Summary

.1 Work of this section includes architectural woodwork including, but not limited to, the following:

.1 Window sill

.1 Plastic laminate

.2 Solid surfacing

.3 Oak trim

.2 Factory and site finishing of architectural woodwork.

1.2 Administrative Requirements

.1 Coordination:

.1 Coordinate with other work for satisfactory and expeditious completion of the work of this section. Coordinate with partition accessories, electrical, communications, and finish components to ensure that proper provisions are made for the installation of the work of this section and for work by others.

.2 Where woodwork is to be fitted to other construction, check actual dimension of other construction by accurate field measurements before manufacturing woodwork; show recorded measurements on final shop drawings. Coordinate manufacturing schedule with construction progress to avoid delays in the *Work*.

.3 *Provide* forms, templates, anchors, sleeves, inserts and accessories required to be fixed to or inserted in the work of this section and set in place. Instruct applicable *Subcontractors* as to their locations.

.4 *Provide* cut-outs for raceways, sleeves, grommets and other manufactured accessories which are required for the work of this section and for work by others.

.2 Conduct a pre-fabrication meeting in accordance with Section 01 31 19.

1.3 Submittals

.1 Submit required submittals in accordance with Section 01 33 00.

.2 *Product* data sheets:

.1 Submit manufacturer's *Product* data for each type of *Product* and process proposed for use in the work of this section and incorporated into items of architectural woodwork.

.3 Shop drawings:

.1 Submit shop drawings for the work of this section complying with the North American Architectural Woodwork Standards 3.1 requirements.

.2 Indicate quality standards and grades.

.3 Include full scale drawings of all exposed-to-view edge conditions.

.4 Include plans, sections and large scale details, and indicate components and methods of assembly, fastenings, and other fabrication information required for the work of this section. Indicate assembly joint lines.

.5 Include materials and their characteristics and finishes as applicable including the following:

.1 Material types, thicknesses, compliance with specified standards, special treatments.

.2 Adhesive types to be used and locations.

.3 Finishing requirements including North American Architectural Woodwork Standards 3.1finish system number, sheen, and required application steps.

.6 Submit coordination drawings indicating locations of concealed grounds, cut-outs, plates, and other required fabrications.

.7 Show relation to adjoining construction, details of outside and inside corners and door openings.

.8 Provide flame spread ratings of walls and ceiling finishes to meet building code requirements, tested and listed by accredited listing agency.

.4 Selection samples:

.1 Submit 3 sets of samples for initial selection purposes of actual veneers showing full range of grain variation, colour and matching, natural characteristics reflecting wood cut and species, manufacturing characteristics, and for each wood species specified. Submit samples as many times as required until approved by *Consultant*. First submission to include one set of samples per *Consultant* request plus one set lighter in tone and one set darker in tone.

.1 150 mm (6") widths, for each colour and finish and installed condition, finished on one side and one edge, complete with plastic laminated end as applicable.

.2 No less than one-half hide for leather upholstery and related attachment and seaming materials.

.5 Verification samples:

.1 Submit samples for purpose of verification of compliance with specified requirements.

.2 Submit 3 sets of 200 mm x 200 mm (8” x 8”) samples, or 200 mm (8”) long as applicable, of each specified *Product*, material and finish, including but not limited to the following:

.1 Shop finished materials, showing each type of finish and colour.

.2 Samples of each specified *Product*, in each specified colour and finish.

.3 Plastic laminates, in each specified colour and finish.

1.4 Closeout Submittals

.1 Submit closeout submittals in accordance with Section 01 77 00.

.2 Operation and maintenance data:

.1 Submit maintenance and cleaning instructions for finishes requiring specific care, noting particularly those procedures or materials which will cause damage to finished surfaces to be included in maintenance manuals.

1.5 Quality Assurance

.1 Qualifications:

.1 Manufacturers:

.1 Fabricator solid surfacing: Fabrication to be performed by a solid surface manufacturer's certified fabricator Submit certification letter prepared by the solid surfacing manufacturer.

.2 Quality standard:

.1 Work shall be in accordance with the North American Architectural Woodwork Standards 3.1, Custom Grade, or the highest grade available for performance and appearance characteristics of materials in Sections 3 – 5 used that apply to *Product* fabrication and installation requirements governed by Sections 6 – 12.

.3 Requirements of regulatory agencies: the work of this section that functions to resist forces imposed by dead and live loads shall conform to requirements of jurisdictional authorities.

1.6 Delivery, Storage, and Handling

.1 Protect architectural woodwork during transit, delivery, storage and handling to prevent damage, spoilage, and deterioration.

.2 Do not deliver woodwork until painting, wet work, grinding, and similar operations that could damage, soil, or deteriorate architectural woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas whose environmental conditions meet requirements specified under paragraph 1.7 Field Conditions.

.3 The architectural woodwork manufacturer and the *Contractor* shall be jointly responsible to make certain that architectural woodwork is not delivered until the building and storage areas are sufficiently dry so that the architectural woodwork will not be damaged by excessive changes in moisture content.

1.7 Field Conditions

.1 Environmental conditions:

.1 During storage and installation: Obtain and comply with North American Architectural Woodwork Standards 3.1 for optimum temperature and relative humidity conditions for woodwork during its storage and installation. Do not install woodwork until these conditions have been attained. Woodwork shall be acclimatized for a minimum of 72 hours prior to commencing woodwork installation.

.2 During finishing: Comply with Architectural Woodwork Standard’s temperature and humidity requirements before, during, and after application of finishes.

.3 During service life of woodwork: Obtain and comply with woodwork manufacturer's advice for optimum temperature and humidity conditions. Note that building humidity control is not in operation 24 hours per day or 365 days per year and system is intermittent during winter and summer months. As a result, fabrication of wood components should anticipate major changes in humidity levels.

1.8 Extended Warranty

.1 Warrant work of this section in accordance with Section 01 78 36 for a period of 2 years.

PART 2 - PRODUCTS

2.1 Performance/Design Requirements

.1 Casework integrity shall meet the minimum acceptance levels in accordance with SEFA 8-1999 as outlined in the North American Architectural Woodwork Standards 3.1 and additional or greater loading capacities as specified throughout the North American Architectural Woodwork Standards 3.1.

.2 Maximum allowable adjustable shelf lengths shall comply with shelves assembly rules per the North American Architectural Woodwork Standards 3.1 based on shelf thickness indicated or scheduled.

2.2 General

.1 Single-source manufacturing and Installation responsibility: Engage a qualified Manufacturer to assume undivided responsibility for woodwork specified in this section, including fabrication, finishing, and installation.

2.3 Wood Materials

.1 Lumber:

.1 Hardwood for concealed blocking and framing: Economy grade, any species that, when painted, will not show any defects.

.2 Hardwood for exposed blocking: species and grade to match panel veneer.

.3 Moisture content: *Provide* kiln-dried (KD) lumber with moisture content range between 6% to 12% for interior architectural woodwork. Maintain temperature and relative humidity during fabrication, storage and finishing operations so that moisture content values for woodwork at time of installation do not exceed 5% to 10%.

.4 Solid hardwood for transparent finish.

.1 Species:

.1 White oak.

.2 Cut:

.1 Quarter sawn.

.2 Wood veneers:

.1 Allowable wood veneer face grade characteristics shall comply with North American Architectural Woodwork Standards 3.1 referenced grade and referenced standards.

.2 Hardwood veneer; for transparent finish:

.1 Species:

.1 White oak.

.2 Veneer thickness: Minimum 1.02 mm (0.040") thick after sanding.

.3 Veneer cut:

.1 Quarter sawn.

.4 Veneer leaf matching:

.1 Book.

.5 Veneer assembly matching:

.1 Balance.

2.4 Panel Materials

.1 Panel material schedule; except where indicated otherwise:

.1 Thickness: 19 mm (3/4") minimum.

.2 Core panels:

.1 At veneered work: Particleboard, except at shelving use veneer core plywood.

.2 At plastic laminate and melamine work: Particle board.

.3 Plywood backing; countertops, backsplashes, and where indicated: Exterior grade plywood with no added urea-formaldehyde used in composition.

.3 Maximum moisture content at time of installation: 10% to 12%.

.2 Low pressure decorative laminate; melamine particleboard panels:

.1 Particleboard conforming to ANSI A208.1-2009, grade M3i, board consisting of 100% pre-consumer wood fibre containing no added urea-formaldehyde resins, 16 mm (5/8") 19 mm (3/4") minimum thickness with thermally fused melamine resin impregnated decorative paper facing to ANSI/NEMA LD 3-2005, complete with matching non-yellowing edge trim, unless otherwise noted.

.2 Colours: as selected by *Consultant*.

.3 High pressure decorative laminate:

.1 General purpose grade: ANSI/NEMA LD 3-2005, Horizontal General Purpose Grade (HGS).

.2 Colours, finishes, and patterns: To later selection by Consultant.

.4 Solid surfacing sheet:

.1 Homogenous (not coated, laminated or composite construction), solid colour reinforced composite material, composed of dyes, organic fibrous material, and polycarbonate/phenolic resins.

.1 Nominal sheet thickness: 12.7 mm (1/2") minimum, unless otherwise indicated.

.2 Colour: To later selection by Consultant.

2.5 Fasteners and Adhesives

.1 Fasteners shall comply with North American Architectural Woodwork Standards 3.1

.2 Upholstery staples: Type, size, to provide sufficient strength to hold upholstered fabric taut and in place without sagging and not visible in finished work.

.3 Concealed panel hanging strips: extruded aluminum interlocking strips. Strips and fasteners/anchors to be capable of supporting 2.5 times dead load of panels in both vertical and horizontal panel applications.

.4 Adhesives: Shall be used for intended purpose and manufacturer materials applications and installation, applied in accordance with manufacturer's written requirements and shall comply with the "adhesive usage guidelines" recommendations of North American Architectural Woodwork Standards 3.1

2.6 Finishes - Interior Architectural Woodwork

.1 General: The entire finish of interior architectural woodwork is specified in this section, regardless of whether factory applied or applied after installation.

.2 Preparations for finishing:

.1 Prior to finishing, exposed portions of woodwork shall have handling marks or effects of exposure to moisture removed with a thorough final sanding over surfaces of the exposed portions, using appropriate grit sandpaper, and shall be cleaned prior to applying sealer or finish. Sanding shall be completed just prior to stain or finishing application.

.2 Concealed surfaces of woodwork that might be exposed to moisture, such as those adjacent to exterior concrete or masonry walls, shall be back-primed.

.3 Comply with referenced quality standard in Part 1 for sanding, filling countersunk fasteners, sealing concealed surfaces and similar preparations for finishing of architectural woodwork, as applicable to each unit of work.

.3 Finish for wood veneer and solid wood :

.1 Comply with requirements indicated below for finish system, staining, and sheen.

.1 Sheen: Satin Sheen range measurements in accordance with North American Architectural Woodwork Standards 3.1.

.2 Factory finish with transparent, Post Catalyzed Lacquer in accordance with the North American Architectural Woodwork Standards 3.1, Section 5.

.1 Opaque finish: Paint or pigmented stain colour to later selection by the *Consultant*.

.2 Transparent finish:

.1 Clear (natural).

2.7 Fabrication

.1 Fabricate woodwork to dimensions, profiles, and details indicated with openings and mortises pre-cut, where possible, to receive hardware and other items of work.

.2 Complete fabrication, assembly, finishing, hardware application, and other work before shipment to maximum extent possible. Trial fit in shop and disassemble components only as necessary for shipment and installation. Where necessary, provide ample allowance for scribing, trimming, and fitting. Reassemble with concealed fasteners.

.3 *Provide* woodwork, solid tops and other indicated materials with pre-cut openings, where possible, for hardware, appliances, plumbing fixtures, electrical work, telephone cut-outs and similar items. Locate openings accurately and *Provide* proper size and shape. Smooth edges of cut-outs and, where located in countertops, seal edges of cut-outs with a water-resistant coating.

.4 *Provide* framing for architectural woodwork, complete with all bracing and fastening devices as required for a rigid installation, and as required to sustain the imposed loads.

.5 Reinforcing shown is minimum. *Provide* additional reinforcing as required to ensure a rigid assembly. Take responsibility for the stability of furniture and fitments.

.6 *Provide* balancing sheets as required, and specified, complying with the North American Architectural Woodwork Standards 3.1.

.7 *Provide* surface mount blocking & strapping necessary to support the work of this section. Such blocking shall not be exposed upon completion of work.

.8 Prefinish work at the factory, except where specified or indicated otherwise.

.9 Solid wood edging: No end grain shall be visible; mitre external corners; house internal corners.

PART 3 - EXECUTION

3.1 Preparation

.1 Condition woodwork to field conditions in installation areas before installing. Ensure that field conditions have been provided as requested and specified.

.2 Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including back priming and removal of packing.

.3 *Provide* all grounds, nailers and other required fabrications which are to be built into other work when required.

.4 Ensure that wall and ceiling variations are not in excess of 6.4 mm (1/4") in 3658 mm (144") and that floors are not in excess of 12.7 mm (1/2") in 3658 mm (144") of being plumb, level, flat, straight, square, of the correct size. Variations shall be corrected prior to installation of work of this section.

.5 Report conditions contrary to requirements preventing proper installation. Do not proceed with the installation until unsatisfactory conditions have been corrected.

3.2 Installation

.1 Install woodwork to comply with North American Architectural Woodwork Standards 3.1 for same grade specified in Part 1 of this section for type of woodwork involved.

.2 Install woodwork plumb, level, true, and straight with no distortions.

.3 Scribe and cut woodwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.

.4 Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where prefinished matching fastener heads are required, use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork and matching final finish where transparent finish is indicated.

.5 Complete the finishing work specified in this section to whatever extent not completed at shop or before installation of woodwork.

3.3 Installation - Tolerances

.1 Install to a tolerance of 3 mm in 2400 mm (1/8" in 8’-0”) for plumb and level (including tops) and with no variations in flushness of adjoining surfaces unless otherwise acceptable in accordance with the North American Architectural Woodwork Standards 3.1.

3.4 Adjusting and Cleaning

.1 Repair damaged and defective woodwork where possible to eliminate defects functionally and visually; where not possible to repair, replace woodwork.

.2 Clean, lubricate, and adjust hardware.

.3 Clean woodwork on exposed and semi-exposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

3.5 Protection

.1 Protect architectural woodwork during remainder of construction period to ensure that work will be without damage or deterioration at time of acceptance.

.2 *Provide* final protection and maintain conditions, in a manner acceptable to manufacturer and installer, that ensure that woodwork is without damage or deterioration at time of *Substantial Performance of the Work*.

END OF SECTION

PART 1 - GENERAL

1.1 Summary

.1 Section includes 3 Ply PowerPly cold-applied SBS-modified bituminous roofing system.

.2 Complete Roof Replacement of Roof Areas R-E, R-F, R-I, R-J, R-T & R-U.

.3 Localised roof repair at:

.1 New access hatch,

.2 Existing access hatch to be removed,

.3 New penetrations in existing roof areas that are part of the Mechanical scope.

1.2 Administrative Requirements

.1 Coordination: Conduct pre-installation meeting as specified.

.2 Pre-installation Conference: Prior to commencing Work, conduct at Project site.

.1 Meet with Owner, Consultant, roofing Installer, roofing manufacturer's representative, and installers of related work.

.2 Review installation methods and procedures, including manufacturer's written instructions and requirements of referenced standards.

.3 Review and finalize construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

.4 Review structural loading limitations of roof deck during roofing operations.

.5 Review base flashings, edge conditions and terminations, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing.

.6 Review requirements of authorities having jurisdiction and requirements for insurance and certificates if applicable.

.7 Review temporary protection requirements for roofing.

.8 Review roof observation, inspection, and repair procedures.

.9 Examine deck substrate conditions and finishes for compliance with requirements.

.3 Sequencing and Scheduling: as specified or required.

1.3 Action Submittals

.1 Product Data: For each specified product.

.2 Shop Drawings: Show orientation and types of roof deck, orientation of membrane roofing, and fastener spacing and patterns. Indicate details meet requirements of CRCA standards required by this Section:

.1 Base flashings and terminations.

.2 Tapered insulation, crickets, saddles, and tapered edge strips, including slopes.

1.4 Closeout Submittals

.1 Manufacturer's and Installer's executed warranty documents. Submit prior to acceptance of Work.

1.5 Quality Assurance

.1 Regulatory Requirements: [Insert special Project regulatory requirements].

.2 Quality Standards: Perform Work of this Section in accordance with the following:

.1 Canadian Roofing Contractors Association (CRCA) Roofing Specifications Manual.

.2 National Roofing Contractors Association (NRCA) Roofing Manual.

.3 Installer Qualifications: A manufacturer-approved firm with experience in installation of specified products in successful use on similar projects, employing workers trained by manufacturer, including a full-time on-site supervisor with experience installing similar work, able to communicate verbally with Contractor, Consultant, and employees, and qualified by the manufacturer to furnish warranty of type specified.

.4 Design Professional Qualifications: A professional engineer licensed in the Place of Work and qualified to prepare and seal design calculations serving as the basis for shop drawings.

.5 Roofing Inspector Qualifications: A technical representative of manufacturer not engaged in the sale of products and experienced in the installation and maintenance of the specified roofing system, qualified to perform roofing observation and inspection specified in Field Quality Control Article, to determine Installer’s compliance with the requirements of this Project, and approved by the manufacturer to issue warranty certification. The Roofing Inspector shall be one of the following:

.1 An authorized full-time technical employee of the manufacturer.

1.6 Delivery, Storage, and Handling

.1 Deliver products in manufacturer's original containers, dry, undamaged, with manufacturer's seals and labels intact.

.2 Store products in weather protected environment, clear of ground and moisture. Protect foam insulation from direct exposure to sunlight.

.3 Handle and store roofing materials and place equipment in a manner that does exceed structural capacity or result in permanent deflection of roof deck.

.4 Construction Waste: Store and dispose of packaging materials and construction waste.

1.7 Project Conditions

.1 Weather Limitations: Comply with manufacturer's written instructions for each product specified.

.2 Do not apply roofing membrane to damp or frozen deck surface or when precipitation is occurring.

.3 Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

1.8 Warranty

.1 Installer's Warranty: Roofing system Installer's warranty, on warranty form at end of this Section signed by Installer, covering the Work of this Section and related Sections listed in "Roof System Warranty" Paragraph above, including all components of roofing such as roofing membrane, base flashing, roof insulation, fasteners, cover boards, Thermal Barrier (Underlay Board), vapour barriers, roof pavers, and walkway products, for the following warranty period:

.2 Warranty Period: Two years from date of Substantial Completion.

1.9 Manufacturer’s Warranty and Maintenance

.1 The Manufacturer shall issue a non-prorated warranty for a period of Twenty Years. All components including the vapour barrier, insulation, cover board, membrane, flood coat, perimeter flashings including metal shall be covered under this warranty.

.2 Warranty shall include inspections in years 2 and 5, 10 and 15 of the warranty. The following duties shall be carried out at no extra cost to the Owner as required, by the Manufacturer.

- .1 Sealing of flashing seams
- .2 Filling of pitch pockets
- .3 Repairs to blisters and ridges
- .4 Caulking at metal details as required
- .5 Written inspection report
- .6 Removal of light debris from the roof and premises
- .7 Cleaning of drain screens

.3 Upon satisfactory completion, the warranty and all construction information regarding the roof installation shall be placed on an Online Roof Management Program at no additional cost to the Owner.

.4 Prior to the 2-year expiration of the warranty, the manufacturer shall carry out an Infra Red Roof Analysis of the replaced roof areas.

.5 The manufacturer shall provide to the owner access to an Online Data Base. All pertinent details regarding this project shall be entered on the data base such as:

- .1 Construction of the entire roof system
- .2 Warranty documentation
- .3 Scale roof drawing.
- .4 Inspection schedule (warranty requirements)
- .5 Photographs of the roof system
- .6 Substantial completion date.

PART 2- PRODUCTS

2.1 System Description

.1 Cold Applied POWERply Modified Bitumen Roofing System: Assembly of components including three ply membrane system, bitumen adhered system on deck, and including but not limited to:

.1 Thermal Barrier Underlay Board (Optional) ½" cellulosic-fiber-reinforced gypsum panel mechanically fastened or adhered to substrate as required.

.2 Vapour Barrier AVC Membrane air and vapour control membrane in primer adhesive.

.3 Roof Insulation Polyisocyanurate, two layers of 3" fully adhered.

.4 Tapered Back Slope and Sumps, Polyisocyanurate Insulation as indicated on drawings in adhesive.

.5 Cover Board 0.5" thick asphalt coated fiberboard insulation in adhesive.

.6 3 Ply Modified Bitumen roof membrane consisting of a 2 Ply Composite Ply HT and POWERply Endure 200 FR cap sheet, adhered in Cold-Applied Rubberized Adhesive.

.2 Flashings and Fastening: Comply with requirements of Division 07 Sections "Sheet Metal Flashing and Trim" and "Roof Specialties." Provide base flashings, perimeter flashings, detail flashings and component materials and installation techniques that comply with requirements and recommendations of the following:

.1 CRCA Roofing Manual for construction details and recommendations.

.2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) Architectural Sheet Metal Manual for construction details.

2.2 Manufacturers

.1 Acceptable Manufacturer:

.1 Tremco Canada.

.2 No substitution.

2.3 Performance Requirements

.1 General Roofing System Performance: Remain weathertight and withstand thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, or installation.

.2 Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

.3 Exterior Fire-Test Exposure: CAN/ULC-S107, Class A.

.4 Fire-Resistance Ratings: Provide fire-resistance-rated roof assemblies per CAN/ULC-S126.

2.4 Base-Sheets

.1 Base Sheet: ASTM D4601, Type II, nonperforated, asphalt-coated, fiberglass/fiberglass/polyester reinforced sheet dusted with fine mineral surfacing on both sides.

.1 Basis of design product: Tremco, BURmastic Composite Ply HT.

.2 Tensile Strength, minimum, ASTM D5147: machine direction, 28.9 kN/m (165 lbf/in); cross machine direction, 26.3 kN/m (150 lbf/in).

.3 Tear Strength, minimum, ASTM D5147: machine direction, 0.9 kN (210 lbf); cross machine direction, 0.8 kN (185 lbf).

.4 Elongation at 25 deg. C (77 deg. F), minimum, ASTM D5147: machine direction, 6 percent; cross machine direction, 6 percent.

.5 Thickness, minimum, ASTM D146: 1.4 mm (0.055 inch).

2.5 Cap Sheet

.1 Roofing Membrane Cap Sheet: ASTM D6164, Grade G, Type I, polyester reinforced, SBS-modified asphalt sheet; granular surfaced.

.1 Basis of design product: Tremco, POWERply Endure 200 FR.

.2 Exterior Fire-Test Exposure, ASTM E 108: Class A.

.3 Tensile Strength at 73 deg. F (23 deg. C), minimum, ASTM D 5147: machine direction 170 lbf/in (28.0 kN/m); cross machine direction 90 lbf/in (15.0 kN/m).

.4 Tear Strength at 73 deg. F (23 deg. C), minimum, ASTM D 5147: machine direction, 170 lbf (750 N); cross machine direction 110 lbf (480 N).

.5 Elongation at 73 deg. F (23 deg. C), minimum, ASTM D 5147: machine direction 60 percent; cross machine direction 70 percent.

.6 Low Temperature Flex, maximum, ASTM D 5147: -15 deg. F (-26 deg. C).

.7 Thickness, minimum, ASTM D 5147: 0.160 inch (4 mm).

2.6 Flashing Sheets

.1 Backer Sheet: ASTM D4601, Type II, nonperforated, asphalt-coated, fiberglass/fiberglass/polyester reinforced sheet dusted with fine mineral surfacing on both sides.

.1 Basis of design product: Tremco, BURmastic Composite Ply HT.

.2 Tensile Strength, minimum, ASTM D5147: machine direction, 28.9 kN/m (165 lbf/in); cross machine direction, 26.3 kN/m (150 lbf/in).

.3 Tear Strength, minimum, ASTM D5147: machine direction, 0.9 kN (210 lbf); cross machine direction, 0.8 kN (185 lbf).

.4 Elongation at 25 deg. C (77 deg. F), minimum, ASTM D5147: machine direction, 6 percent; cross machine direction, 6 percent.

.5 Thickness, minimum, ASTM D146: 1.4 mm (0.055 inch).

.2 Flashing Sheet: ASTM D6164, Grade G, Type I, polyester reinforced, SBS-modified asphalt sheet; granular surfaced.

.1 Basis of design product: Tremco, POWERply Endure 200 FR.

.2 Exterior Fire-Test Exposure, ASTM E 108: Class A.

.3 Tensile Strength at 73 deg. F (23 deg. C), minimum, ASTM D 5147: machine direction 170 lbf/in (28.0 kN/m); cross machine direction 90 lbf/in (15.0 kN/m).

.4 Tear Strength at 73 deg. F (23 deg. C), minimum, ASTM D 5147: machine direction, 170 lbf (750 N); cross machine direction 110 lbf (480 N).

.5 Elongation at 73 deg. F (23 deg. C), minimum, ASTM D 5147: machine direction 60 percent; cross machine direction 70 percent.

.6 Low Temperature Flex, maximum, ASTM D 5147: -15 deg. F (-26 deg. C).

.7 Thickness, minimum, ASTM D 5147: 0.160 inch (4 mm).

2.7 Cold-Applied Adhesive Materials

.1 General: Adhesive and sealant materials recommended by roofing manufacturer for intended use and compatible with built-up roofing.

.1 Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

.2 Asphalt Primer, Water-Based: Water-based, polymer modified, asphalt primer.

.1 Basis of design product: Tremco, TREMprime WB.

.2 Asbestos Content, EPA 600/R13/116: None.

.3 Non-Volatile Content, minimum, ASTM D2823: 30 percent.

.4 Volatile Organic Compounds (VOC), maximum, ASTM D3960: 2 g/L.

.3 Insulation Adhesive: Two-component, solvent-free, low odor, elastomeric urethane adhesive formulated to adhere roof insulation to substrate.

.1 Basis of design product: Tremco, Low Rise Foam Insulation Adhesive.

.2 Flame Spread Index, ASTM E84: 10.

.3 Smoke Developed Index, ASTM E84: 30.

.4 Asbestos Content, EPA 600/R13/116: None.

.5 Volatile Organic Compounds (VOC), maximum, ASTM D3960: 0 g/L.

.6 Tensile Strength, minimum, ASTM D412: 1724 kPa (250 psi).

.7 Peel Adhesion, minimum, ASTM D903: 2.98 kN/m (17 lbf/in).

.8 Flexibility, 39 deg. C (70 deg. F), ASTM D816: Pass.

.4 Base Sheet Adhesive: Cold-Applied, Rubberized Adhesive: One-part, asbestos-free, SEBS-modified, cold-applied adhesive specially formulated for compatibility and use with specified roofing membranes and flashings.

.1 Basis of design product: Tremco, POWERply Rubberized Cold Adhesive.

.2 Asbestos Content, EPA 600 R-93/116: None.

.3 Volatile Organic Compounds (VOC), maximum, ASTM D6511: 250 g/L.

.4 Nonvolatile Content, minimum, ASTM D6511: 70 percent.

.5 Flash Point, minimum, ASTM D93: 38 deg. C (100 deg. F).

.5 Cap Sheet Adhesive: Cold-Applied, Rubberized Adhesive: One-part, asbestos-free, SEBS-modified, cold-applied adhesive specially formulated for compatibility and use with specified roofing membranes and flashings.

.1 Basis of design product: Tremco, POWERply Rubberized Cold Adhesive.

.2 Asbestos Content, EPA 600 R-93/116: None.

.3 Volatile Organic Compounds (VOC), maximum, ASTM D6511: 250 g/L.

.4 Nonvolatile Content, minimum, ASTM D6511: 70 percent.

.5 Flash Point, minimum, ASTM D93: 38 deg. C (100 deg. F).

.6 Flashing Sheet Adhesive: Elastomeric Flashing Adhesive, Butyl Rubber-Based One-part, asbestos-free, cold-applied, elastomeric trowel-grade adhesive specially formulated for compatibility and use with specified roofing membranes and flashings.

.1 Basis of design product: Tremco, Sheeting Bond.

.2 Asbestos Content: ASTM D276: None.

.3 Volatile Organic Compounds (VOC), maximum, ASTM D3960: 250 g/L.

.4 Adhesion in Peel, minimum, ASTM D1876: 0.5 N/mm (3 lbf/in).

.5 Lap Shear Adhesion, minimum, ASTM D816: 124 kPa (18 psi).

2.8 Auxiliary Built-Up Roofing Materials

.1 General: Auxiliary materials recommended by roofing manufacturer for intended use and compatible with roofing.

.2 Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required by roofing manufacturer for application.

.3 Mastic Sealant: Polyisobutylene, plain or modified bitumen, non-hardening, non-migrating, non-skinning, and nondrying.

.4 Fasteners: Factory-coated steel fasteners and metal or plastic plates designed for fastening roofing components to substrate, tested by manufacturer for required pullout strength, and acceptable to roofing manufacturer, if required.

.5 Termination Bar: 1 mm (0.040 inch) aluminum, with pre-punched holes at 406 mm (16 inches) o.c., metal snap on cover, and sealant cup. Finish: Mill finish.

.6 Metal Flashing Sheet: Metal flashing sheet is specified in Division 07 Section "Sheet Metal Flashing and Trim."

.7 Miscellaneous Accessories: Provide miscellaneous accessories recommended by roofing manufacturer.

2.9 Thermal Barrier (Underlay Board)

.1 Thermal Barrier (Underlay Board): ASTM C1177/C1177M, glass-mat, water-resistant gypsum substrate, 13 mm (1/2 inch) thick.

.1 Basis of design product: USG Corporation; Securock. (CGC Securock Gypsum-Fiber Roof Board)

.2 Adhesive: Low-Rise Foam, Low VOC, adhesive; meeting UL and tested by Factory Mutual; Tremco Low-Rise Foam Adhesive by Tremco Canada.

2.10 Vapour /Air Barrier

.1 Vapour Barrier: 1.0-mm- (40-mil-) thick, self-adhered air and vapour control membrane consisting of SBS rubberized asphalt laminated to slip-resistant, cross-laminated polyethylene surface film, with release-paper backing. Provide substrate primer when recommended by vapour barrier manufacturer.

.1 Basis of design product: Tremco, AVC Membrane.

.2 Permeance, ASTM E96: 0.5 perm.

.3 Tensile Strength at 0 deg. F (-18 deg. C), minimum, ASTM D2523: 25 lbf/in (43 kN/m).

.4 Adhesion (to plywood), minimum, ASTM D903: 6 lbf/in (1000N/m).

.5 Elongation, ASTM D412: 250 percent.

.2 Vapour Barrier Primer: AVC Primer WB by Tremco Canada.

2.11 Roof Insulation

.1 General: Preformed roof insulation boards manufactured or approved by roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.

.2 Polyisocyanurate Board Insulation: CAN/ULC-S704, ASTM C1289, Type II, Class 1 approved and listed by FM Global for windstorm and fire characteristics specified, HCFC-free, integrally laminated to heavy non-asphaltic fiber-reinforced felt facers; FM 1-90 wind classification. CCMC listed.

.1 Basis of design product: Tremco Trisotech Polyisocyanurate

.2 Compressive Strength, ASTM C1621: Grade 3: 172 kPa (25 psi).

.3 Conditioned Thermal Resistance at 24 deg. C (75 deg. F): 12.1 at 50.8 mm (2.0 inches) thick.

.4 Thickness: Two layers of 3 inch

.3 Tapered Insulation and Sumps: Provide factory-tapered back slope insulation boards of same material as roof insulation, fabricated to slope of [1:48 (1/4 inch per 12 inches)] unless otherwise indicated.

.1 Basis of design product: ModulR Polyisocyanurate

.2 Sumps: Minimum 12’

.4 Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.12 Insulation Accessories

.1 General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with roofing.

.2 Insulation Cant Strips: ASTM C208, Type II, Grade 1, cellulosic-fiber insulation board.

.3 Wood Cant Strips: Comply with requirements in Division 06 Section Rough Carpentry.

.4 Tapered Edge Strips: ASTM C208, Type II, Grade 1, cellulosic-fiber insulation board.

.5 Cover Board: 0.5” Cellulosic-Fiber Board Insulation Type II, Grade 2, cellulosic-fiber and water-resistant binders, asphalt coated on six sides and chemically treated for deterioration. (0.5 In

2.13 Walkway Materials

.1 Provide pavers walkways as indicated on drawings.

.2 Pavers: 610 x 610 mm size, 50 mm thick, precast concrete paver units; diamond pattern; colour as selected by Consultant.

.3 Paver Pedestals: site fabricated, approximately 460 x 460 mm size rigid extruded polystyrene pads, 50 mm thick; having a minimum compressive strength of 210 KPA.

2.14 Flashings

.1 Fabricated Roof Specialties: Copings, Roof-edge flashings, Roof-edge drainage systems, Reglets and counter flashings, Penetration Flashings: Refer to Section 07 71 00 "Roof Specialties."

PART 3- EXECUTION

3.1 Examination

.1 Examine surfaces and site conditions, with Installer, for compliance with requirements, prior to commencing work.

.1 Verify surfaces and site conditions are ready to receive work.

.2 Verify deck is supported and secure.

.3 Verify that roof openings and penetrations are in place, curbs are set and braced, blocking, curbs, wood cants, and nailer are anchored to roof deck at penetrations and terminations, that wood nailer match insulation thickness, and roof drain bodies are properly installed.

.4 Verify deck surfaces are clean, dry, and free of snow or ice.

.2 Steel Decking Substrate:

.1 Verify installation complies with requirements in Division 05 Section "Steel Decking" for support, fastening, and surface plane flatness.

.3 Wood Substrate:

.1 Confirm moisture content measured by moisture meter is acceptable to roofing manufacturer.

.2 Verify that deck is securely fastened with no projecting fasteners and with adjacent units aligned and knot holes filled.

.4 Existing Roofing or Roofing Insulation Substrate:

.1 Refer to requirements of Section 07 01 50 "Preparation for Re-roofing.

.2 Verify that existing insulation and substrate are sound and dry.

.5 Report: Provide written report to Consultant indicating conditions that do not meet requirements.

.6 Proceed with installation once non-complying conditions have been corrected.

3.2 Preparation

.1 Clean substrate of substances and projections detrimental to roofing installation according to roofing manufacturer's written instructions.

.2 Prevent materials from entering roof drains and conductors and from contacting surfaces of other construction.

.3 Substrate-Joint Penetrations: Prepare joints as required to prevent asphalt and adhesives from penetrating joints, entering building, or damaging roofing components or other construction.

3.3 Installation, General

.1 Wood Components: Install wood blocking, curbs, and nailer in accordance with requirements of Division 06 Section "Rough Carpentry."

.2 Install roofing membrane system components according to roofing manufacturer's written instructions, applicable referenced roofing system approval, and approved shop drawings.

.3 Cooperate with testing agencies and personnel performing services for installing roofing.

3.4 Thermal Barrier (Underlay Board) Installation

.1 Roof Areas R-E, R-F & R-J: Install Thermal Barrier (Underlay Board) in straight lines, perpendicular to slopes with end joints staggered. Butt Thermal Barrier (Underlay Board) together.

.1 Adhesive-Fastened Substrate Board: Set substrate board in ribbons of low-rise foam adhesive.

.2 Firmly butt each board to surrounding boards. Do not jam or deform boards.

.3 Cut and fit boards where roof deck intersects vertical surfaces.

.4 Provide filler boards every 450 mm in both directions [and secure with minimum two fasteners per board.

.5 Tape joints of thermal barrier underlay board with 50 mm wide tape

.2 Roof Areas R-I, R-T & R-U: Existing thermal underlay board to remain in place. Isolated replacement to be carried out should underlay board is found to be damaged.

.1 Re-secure existing underlay board if required.

3.5 Vapour /Air Barrier Installation

.1 Self-Adhering Sheet Vapour /Air Barrier: Prime substrate if required by manufacturer. Install with side and end laps minimum 90 mm and 150 mm (3-1/2 inches and 6 inches), respectively.

.1 Adhesive: Set each layer in a uniform coverage of primed substrate.

.2 Seal vapour /air barrier at terminations, obstructions, and penetrations to prevent air movement into roofing.

.3 Provide perimeter termination configured to coordinate with interface with adjacent air barrier system, compatible with adjacent materials.

3.6 Insulation Installation

.1 Install insulation boards to maintain continuity of thermal envelope.

.2 Minimize joints, adhere base layer of roof insulation to vapour aarrier with approved low-rise foam adhesive at manufacturer’s recommended rate.

.3 Adhere top layer of roof insulation to base layer of roof insulation with approved low-rise foam adhesive at manufacturer’s recommended rate.

.4 Adhere tapered sumps and back slope insulation where indicated and in accordance with approved Shop Drawings.

.5 Fit insulation tight to roof penetrations.

.6 Firmly butt insulation boards. Do not jam or deform boards.

.7 Minimize lipping between adjacent boards.

.8 Stagger joints minimum 300 mm.

.9 Cover Boards: Install cover boards over insulation in straight lines with joints staggered and edges loosely butted.

.1 Adhesive: Set cover board with approved low-rise foam adhesive at manufacturer’s recommended rate.

3.7 Roofing Membrane Installation

.1 General: Install roofing membrane system according to roofing system manufacturer's written instructions and applicable recommendations in ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing."

.2 Start installation of built-up roofing in presence of manufacturer's technical personnel.

.3 Cooperate with testing agencies and personnel engaged or required to perform services for installing roofing.

.4 Coordinate installation of roofing to protect roofing system components and structure from exposure to precipitation.

.5 Substrate Primer: Prime substrates with asphalt primer if required.

3.8 Base-Sheet Installation

.1 Base Sheet: Install lapped base sheet course, extending sheet over and terminating beyond cants.

.1 Embed base sheet in a uniform coverage of cold-applied adhesive.

3.9 Sbs-Modified Bituminous Membrane Installation

.1 A. Install modified bituminous roofing membrane sheet and cap sheet according to roofing manufacturer's written instructions, starting at low point of roofing system. Extend roofing membrane sheets over and terminate beyond cants, installing as follows:

.2 B. Base Sheet

.1 Embed membrane ply sheet(s) in a uniform coverage of cold-applied adhesive.

.3 Laps: Accurately align roofing membrane sheets, without stretching, and maintain uniform side and end laps. Stagger end laps. Install roofing membrane sheets so side and end laps shed water. Completely bond and seal laps, leaving no voids.

.1 Repair tears and voids in laps and lapped seams not completely sealed.

.4 Cap Sheet: Install lapped cap sheet starting at low point. Offset laps from laps of preceding ply sheets. Weather lap cap sheet. Extend cap sheet over and terminate beyond cants.

.1 Embed cap sheet in a uniform coverage of cold-applied adhesive.

.2 Unroll roofing membrane sheets, cut to maximum lengths (18 feet) recommended by manufacturer, and allow them to relax for minimum time period (1 hour) required by manufacturer.

.3 All seams are to be hot air welded.

3.10 Flashing and Stripping Installation

.1 Base Flashing: Install base flashing at roof edges and at penetrations through roof. Secure to substrates according to roofing manufacturer's written instructions.

.1 Prime substrates with asphalt primer if required.

.2 Backer Sheet Application:

.1 Embed backer sheet in a uniform coverage of cold-applied adhesive.

.3 Flashing Sheet Application:

.1 Embed backer sheet in a uniform coverage of cold-applied adhesive.

.4 Extend base flashing up walls or parapets a minimum of 305 mm (12 inches) above roofing and 150 mm (6 inches) onto field of roofing.

.5 Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.

.6 Seal top termination of base flashing with a metal termination bar.

.2 Stripping: Install stripping where metal flanges and edgings are set on roofing. Install flashing-sheet stripping in a continuous coating of cold-applied adhesive and extend onto roofing membrane.

3.11 Accessories

.1 Roof Drains: Set metal roof drain flashing in bed of asphalt roofing cement over roofing. Cover metal flashing with roofing cap-sheet stripping and extend onto field of roofing. Clamp roofing, metal flashing, and stripping into roof-drain clamping ring.

.2 Expansion and Control Joints: Provide roofing expansion joints to isolate roof into areas as indicated.

3.12 Walkway Installation

.1 Roof-Paver Walkways: Install walkway roof pavers according to manufacturer's written instructions in locations indicated, to form walkways. Leave 150 mm (6 inches) of space between adjacent roof pavers insulation.

3.13 Field Quality Control

.1 Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion. Notify Consultant and Owner 48 hours in advance of date and time of inspection.

.2 Repair or remove and replace non-complying components of roofing. Retest to demonstrate compliance.

3.14 Protecting and Cleaning

.1 Protect roofing from damage and wear during construction according to manufacturer's instructions.

.2 Correct deficiencies in or remove roofing that does not comply with requirements, repair substrates, and repair or reinstall roofing to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

.3 Clean overspray and spillage from adjacent construction.

END OF SECTION

PART 1- GENERAL

1.1 Summary

.1 Section includes:

.1 Supply and installation of prefinished metal (steel) flashings.

.2 Supply and installation of gravel stops.

1.2 Administrative Requirements

.1 Conduct a pre-installation meeting in accordance with Section 01 31 19.

1.3 Submittals

.1 Submit required submittals in accordance with Section 01 33 00.

.2 Shop drawings:

.1 Submit shop drawings including the following:

.1 Plans, elevations, sections, and attachment details.

.2 Detail fabrication and installation layouts, expansion-joint locations, and key details. Distinguish between shop and field assembled work.

.3 Include identification of material, thickness, weight, and finish for each item and location in the work.

.4 Include details for forming, including profiles, shapes, seams, and dimensions.

.5 Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.

.6 Include details of termination points and assemblies.

.7 Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contracting from fixed points.

.8 Include details of roof penetrations flashing.

.9 Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counter flashings as applicable.

.10 Include details of special conditions.

.11 Include details of connections to adjoining work.

.3 Samples:

.1 Submit full-size samples of each specified flashing material formed to detailed profile including corner, curb, cap, and parapet flashing, and coping including lock-joints and hold-down clips.

.2 Submit 2 - 50 mm x 50 mm (2" x 2") samples of each type of sheet metal material, colour and finish.

1.4 Quality Assurance

.1 Qualifications:

.1 Installers / applicators / erectors: *Provide* work of this section, executed by competent installers with record of successful install in application of *Products*, systems and assemblies specified and with approval of *Product* manufacturers.

.1 Sealant shall be applied by a *Subcontractor* with proven experience in this type of work, and who has the necessary equipment and skilled mechanics to carry out the work of this section satisfactorily and can substantiate this to satisfaction of *Consultant*.

.2 Quality standards:

.1 Quality of fabrication and installation of sheet metal work shall comply with recommendations published by Revere Copper Products, Inc.,

.2 Quality of fabrication and installation of sheet metal work shall comply with recommendations published by National Slate Association.

.3 Quality of fabrication and installation of sheet metal work shall comply with recommendations published by National Roofing Contractors Association.

1.5 Delivery, Storage, and Handling

.1 Comply with AAMA CW-10 – Care and Handling of Architectural Aluminum from Shop to Site.

.2 Keep materials and equipment free from debris, ice, snow and contaminants. Allow air to circulate around metal components, sheets and break shapes.

.3 Protect holes, and reglets from water and ice during freezing weather.

1.6 Extended Warranty

.1 Warrant work of this section in accordance with Section 01 78 36 for a period of 2 years.

PART 2 - PRODUCTS

2.1 Performance/Design Requirements

.1 Design members to withstand wind loads as calculated in accordance with the building code and to cladding design wind loads indicated in wind study report, to maximum allowable deflection without permanent deformation.

2.2 Prefinished Steel Flashing

.1 Sheet steel: Commercial quality to ASTM A653/A653M-13 with Z275 designation zinc coating.

.1 Minimum thickness:

.1 0.61 mm (0.0239”) (24 gauge).

2.3 Prefinished Metal Finishes

.1 Provide the following finish to exposed prefinished steel:

.1 Finish: factory prefinished CSSBI 10000 Series.

.1 10000 Series (Polyvinylidene Fluoride - PVDF) will not visibly (within 10 metres to the unaided naked eye) crack, chip, or peel (lose adhesion) for thirty-five (35) years from date of application. This does not include minute fracturing that may occur during the normal fabrication process. 10000 Series (Polyvinylidene Fluoride - PVDF) will not chalk in excess of a number eight (8) rating, in accordance with ASTM D4214-07(2015) method D659 at any time for thirty (30) years; will not change colour more than five (5.0) Hunter ΔE units as determined by ASTM D2244-16 at any time for thirty (30) years.

.2 Colour to later selection by *Consultant* from manufacturer's full range.

2.4 Accessories

.1 Isolation coating: to CAN/CGSB-1.108, bituminous type.

.2 Sealants:

.1 Exposed sealants: Silicone in accordance with Section 07 92 00, colour as selected by *Consultant* from manufacturer's full range.

.2 Concealed flashing sealants; hooked-type expansion joints with limited movement: Butyl sealant to ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied.

.3 Cleats: of matching metal to flashing material, continuous, and of greater thickness than flashing material. Offset joints in cleats 305 mm (12”) with joints in perimeter edge metal. Allow a 12.7 mm (1/2") gap between pieces.

.4 Fasteners:

.1 Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.

.2 General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head:

.1 Exposed screws: 38 mm (1-1/2") long minimum at 450 mm (18") on centre maximum. Heads matching colour of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM washer under heads of exposed fasteners.

.2 Blind fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.

.3 Cleat fasteners: Corrosion-resistant barbed angular ring or screw shank nail; length to achieve approximately 32 mm (1-1/4") penetration into nailer.

.3 Fasteners for prefinished galvanized steel sheet: hot dip galvanized steel to ASTM A153/A153M-09 and ASTM A653/A653M-13 Class G185.

.4 Fasteners for galvanized steel sheet: hot dip galvanized steel to ASTM A153/A153M-09 and ASTM A653/A653M-13 Class G185.

.5 Fasteners and plates to meet the requirements of FM 4470-12 for wind uplift and corrosion resistance.

.5 Flexible flashing membrane; high temperature grade for use at locations where membrane is not protected by insulation:

.1 Description:

.1 Thickness: 0.76 mm (30 mils) minimum.

.2 Self-adhesive grade rubberized membrane backed by high density polyethylene.

.3 Primer for substrate.

.4 High temperature grade to resist softening at 105°C minimum.

.2 Acceptable *Products*:

.1 Henry 'Blueskin PE 200 HT'.

.2 Firestone ‘Clad-Gard SA’.

.3 GCP Applied Technologies ‘Ultra’.

.4 Soprema 'LASTOBOND SHIELD HT’.

.6 Flexible flashing membrane; standard temperature grade for use at locations where membrane is protected by material with insulating properties:

.1 Description:

.1 Thickness: 1 mm (40 mils) minimum.

.2 Self-adhesive grade rubberized membrane backed by high density polyethylene.

.3 Primer for substrate.

.2 Acceptable *Products*:

.1 Henry 'Blueskin Roof RF200'.

.2 GCP Applied Technologies ‘Ice & Water Shield’.

.3 Soprema 'LASTOBOND SHIELD’.

2.5 Fabrication

.1 Fabricate metal flashings and other sheet metal work in accordance with applicable NRCA Roofing Manual: Membrane Roof Systems 2011, details and as indicated.

.2 Fabricate metal flashings and other sheet metal work in accordance with applicable SMACNA "Architectural Sheet Metal Manual (Seventh Edition) details and as indicated.

.3 Form pieces in 3048 mm (10 ft) maximum lengths. Make allowance for expansion at joints.

.4 Sealed joints: Form non-expansion but movable joints in metal to accommodate sealant.

.5 Expansion provisions: Form expansion joints of intermeshing hooked flanges, not less than 25.4 mm (1") deep, filled with butyl sealant concealed within joints.

.1 Joints that provide expansion and contraction capabilities should be located near the corners within approximately 610 mm (24") from each direction of the corner measured from the interior side.

.6 Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" and by FMG Loss Prevention Data Sheet 1-49 for application, and of greater thickness of metal being secured.

.7 Hem exposed edges on underside 12.7 mm (1/2"). Mitre and seal corners with butyl sealant.

.8 At parapets, provide 25.4 mm (1") minimum overlap between bottom of wood blocking or flashing anchorage support and edge of drip or termination of flashing.

.9 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.10 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.

.11 Provide 25.4 mm (1") minimum overlap between bottom of wood blocking or flashing anchorage support and edge of drip or termination of flashing.

.12 Shop fabricate inside and outside corners.

PART 3- EXECUTION

3.1 Flexible Flashing Underlayment Installation

.1 Apply primer to concrete masonry and precast concrete substrates.

.2 Install in a consecutive weatherboard method starting at bottom or base of wall and working up.

.3 *Provide* minimum of 50 mm (2") side laps and 75 mm (3") end laps.

.4 Cut to manageable lengths, position membrane for alignment, remove protective poly-film and firmly apply pressure to assure adhesion.

.5 Eliminate wrinkles or gaps, roll entire membrane surface (including seams) with a counter top or “J-roller” to ensure full contact and adhesion.

.6 Seal membrane terminations, heads of mechanical fasteners, masonry tie fasteners, around penetrations, duct work, electrical and other apparatus extending through the air barrier membrane and around the perimeter edge of membrane terminations.

.7 Flashing membrane shall be applied in weatherboard fashion starting at bottom of base of wall and working up, in and around the full perimeter of openings, to provide water tight protection and according to the following procedures:

.1 Apply the first strip horizontally immediately below the sill, cut it sufficiently long to extend past each side of the window, so that it projects even with the vertical jamb flashing to be applied later. Turn sill flashing up 50 mm (2") at ends of sill.

.2 Sill flashing shall overlap wall membrane. Overlap jamb at head flashing membrane in the same manner.

3.2 Roof Flashing Installation

.1 Install sheet metal work in accordance with applicable NRCA Roofing Manual: Membrane Roof Systems 2011, details and as indicated.

.2 Install sheet metal work in accordance with SMACNA Architectural Sheet Metal Manual - Seventh Edition - 2012.

.3 *Provide* minimum 10% slope for drainage towards roof at parapet locations, with minimum 2% sloped to drain at remaining flashing locations.

.4 Provide continuous cleats for attachment of flashings at exterior face of wall and fasten at 150 mm (6") spacing and not less than 2 fasteners per cleat.

.5 Provide radius (3-piece) copings for curved wall condition unless otherwise indicated.

.6 Prefabricate corner copings in 610 mm (24") x 610 mm (24") shop fabricated and connected one pieces sections.

.7 Concealed fastenings and cleats, from view except where exposed flashings are accepted by *Consultant* prior to installation.

.1 Roof side fastening of copings shall be accomplished using either cleats or exposed colour matched screws with EDPM backed metal washers fastened through oversized holes in coping to allow for thermally induced movement and spaced at maximum spacing of 610 mm (24") centre to centre and not less than 2 fasteners per section of coping.

.8 Flash joints using S-lock forming tight fit over hook strips/cleats; unless otherwise indicated.

.9 Install surface mounted flared joint true and level, and caulk top of reglet with sealant at reglets.

.10 Insert metal flashings to other materials and flashings to form weather-tight junction.

.11 *Provide* prefinished metal flashing over equipment curbs which are covered with roofing membrane.

.12 Expansion provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 3048 mm (10 ft) and provide uniform joint spacing with no joints allowed within 610 mm (24") of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 25.4 mm (1") deep, filled with butyl sealant concealed within joints.

.13 Install flexible flashing membrane in accordance with manufacturer's written installation requirements.

3.3 Wall Flashing Installation

.1 General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

3.4 Roof Drainage System Installation

.1 General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

.2 Splash pans: Install precast concrete pads set onto rigid extruded polystyrene pads where downspouts discharge on low slope roofing.

.3 Scuppers for parapets: Install scuppers where indicated through parapet. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and tie into roofing membrane.

3.5 Installation of Roof Accessories

.1 Incorporate devices to which roofing and flashing may be secured.

.2 Install work to ensure that roofing and flashings will be properly applied to maintain building envelope weather-tight.

3.6 Installation Tolerances

.1 Shim and align sheet metal flashing and trim within installed tolerance of 6 mm in 6 m (1/4 inch in 20 feet) on slope and location lines as indicated and within 3.2 mm (1/8") offset of adjoining faces and of alignment of matching profiles.

.2 Shim and align sheet metal flashing and trim within installed tolerances specified in Metal Construction Association (MCA) "Guide Specification for Residential Metal Roofing."

3.7 Field Quality Control

.1 Conduct quality control in accordance with Section 01 45 00.

.1 Independent inspection and testing company shall perform inspection of completed work.

.2 The work of this section will be inspected and tested in conjunction with inspection and testing of roofing work.

3.8 Adjusting and Cleaning

.1 Remove deposits, stains or protections and wash metals left unpainted and exposed to view as recommended by manufacturer of metal or paint finish.

.2 Clean exposed copper surfaces, removing substances that might cause discoloration of metal.

3.9 Protection

.1 Advise *Contractor* of required procedures for surveillance and protection of flashings and sheet metal work during construction to ensure that work will be without damage or deterioration other than natural weathering.

END OF SECTION

PART 1 - GENERAL

1.1 Summary

.1 Section includes:

.1 Roof hatches.

.2 Roof Hatch guardrail system

1.2 Submittals

.1 Submit required submittals in accordance with Section 01 33 00.

.2 *Product* data sheets:

.1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this section.

.3 Shop drawings:

.1 Show profiles, accessories, locations, and dimensions.

.2 Include details of interface with work of other sections.

1.3 Delivery, Storage, and Handling

.1 Package and brace products to prevent damage in shipment and handling. Protect finish surfaces by sturdy wrappings, or covering.

1.4 Extended Warranty

.1 Warrant work of this section in accordance with Section 01 78 36 for a period of 2 years.

PART 2 - PRODUCTS

2.1 Roof Hatches; Ladder Access

.1 Description: Preassembled, insulated cover and insulated metal curb, welded corner construction, c/w padlock latch, hinge, handle, and other hardware as required.

.2 Cover: Break formed, hollow-metal design with concealed insulation, overlapping flange, and internally reinforced live load to meet building code.

.1 Aluminum: Cover and frame; 2.3 mm (0.09") (11 gauge) aluminum.

.3 Gasket: Extruded EPDM rubber gasket permanently adhered to cover.

.4 Hinges: Heavy-duty pintle hinges with 9.5 mm (3/8") type 316 stainless steel hinge pins.

.5 Latch: Slam latch with interior and exterior turn handles and padlock hasps.

.6 Lift Assistance: Compression spring operators enclosed in telescopic tubes. Automatic hold-open arm with grip handle release.

.7 Hardware:

.1 Aluminum: Engineered composite compression spring tubes. Steel compression springs with electrocoated acrylic finish. Type 316 Stainless steel hinges. All other hardware is zinc plated/chromate sealed.

.8 Size:

.1 914 mm x 914 mm (36" x 36") size, unless otherwise indicated.

.9 Include safety bar/post for access.

.10 Safety railing system; safety yellow colour, self-closing gate with latch, model size to fit hatch:

.1 FixFast USA ‘Surround – Roof hatch guardrail system’.

.1 Comply with the requirements of OSHA requirements for roof top openings.

.11 Finish:

.1 Aluminum: Mill Finish.

.12 Acceptable *Products*:

.1 Bilco model 'Type NB-50 TB' complete with 'LadderUP Safety Post'.

2.2 Fabrication

.1 Fit joints and junctions between components tightly, to prevent entry of water into component voids and interior of building. Cap open ends of sections exposed to view.

.2 Fabricate work with materials and component sizes, complete with metal gauges, reinforcing, anchors, and fastenings of adequate strength to ensure that it will remain free of warping, buckling, opening of joints and seams, and distortion within limits of intended and specified use. Conceal and weld connections wherever possible.

PART 3 - EXECUTION

3.1 Installation

.1 Install in accordance with manufacturer's written installation requirements.

.2 Incorporate devices to which roofing and flashing may be secured, and, install work to ensure that roofing and flashings will be properly installed to maintain weather-tight building.

.3 Verify under work of this section that installed products function properly.

.4 Adjust hardware to function smoothly and without binding and to ensure that components fit in a weather-tight fashion.

END OF SECTION

PART 1 - GENERAL

1.1 Summary

.1 Section includes:

.1 Materials installed in joints to restrict the spread of fire and smoke.

.1 Joints in or between fire-resistance-rated constructions.

.2 Perimeter fire barrier systems between fire-rated floor/roof and non-rated exterior wall assembly.

.1 Coordinate perimeter fire barrier system installation requirements with work of curtain wall assemblies.

.2 Section excludes:

.1 Firestopping and smoke seals, for mechanical, electrical and communications penetrations of fire resistant assemblies, and firestopping and smoke seals within their respective assemblies. Refer to Divisions 21, 22, and 23 and Divisions 26, 27, and 28.

1.2 Administrative Requirements

.1 Coordination:

.1 Coordinate joint firestopping and smoke seal work with Section 01 33 00, paragraph 1.8 Project Firestopping Manual and Coordination.

.2 Coordinate with other sections to assure that pipes, conduit, cable, and other items that penetrate fire rated construction, have been permanently installed prior to installation of firestop assemblies.

.3 Schedule the *Work* to assure that penetrations and other construction that conceals penetrations are not erected prior to the installation of firestop and smoke seals.

.2 Conduct a pre-installation meeting in accordance with Section 01 31 19.

.1 Representatives for mechanical and electrical work and independent inspection and testing company shall attend pre-installation meeting.

1.3 Submittals

.1 Submit required submittals in accordance with Section 01 33 00.

.2 *Product* data sheets: Submit data and installation instructions for *Products* providing descriptions sufficient for identification at the *Place of the Work*.

.1 Materials list of *Products* proposed for use in the work of this section; complying with listed systems designs.

.2 Listing agency's detailed drawing showing joint assemblies and firestopping materials, identified with listing agency's name and number or designation, fire rating achieved, and date of listing.

.3 Certificates:

.1 Submit the following certification documents with closeout submittals:

.1 Manufacturer's certification: Submit manufacturer's certification that installed firestopping and smoke seal *Products* are suitable for the use indicated and comply with specified requirements.

.2 Installation certification: Installer shall submit certification that all joint firestopping system installations are completed and that installations comply with listed systems designs.

.4 Submit fire resistance rating test listings for firestopping and smoke seal systems.

.3 Shop drawings:

.1 Submit drawings indicating fire resistance rated assembly number, required temperature, hose stream, and flame rating, material thicknesses, installation methods and materials of firestopping and smoke seals, primers, supports, damming materials as applicable, reinforcements, anchorages, fastenings and methods of installation for each condition to be encountered.

.2 Designate on shop drawings static and dynamic joint systems, relative positions, expansion and control joints in rated slabs and walls, and firestopping details.

.3 Engineered shop drawings; for engineering judgements:

.1 Where *Project* conditions require modification to an accredited third party testing agency's listed system design to address a particular firestopping condition that is not covered by a listed system, submit engineered shop drawings detailing the modifications to the listed system design as an engineering judgment or equivalent fire-resistance-rated assembly, for each *Project* location and condition.

.2 Submit the manufacturer's engineering judgment identification number and shop drawing details prepared by a professional engineer. The engineering judgment submittal shall include both *Project* name, *Project* location, and *Subcontractor*'s name who will install firestop system as described in engineering judgement shop drawings.

.3 Provide complete details of specific application of listed system and its modifications upon which the engineered judgement is based upon.

.4 For perimeter fire barrier systems:

.1 Submit engineered shop drawings for engineering judgements covering perimeter fire barrier systems. Identify each cladding assembly type in contact with each perimeter fire barrier system.

.4 Manufacturers' instructions:

.1 Manufacturer of *Products* proposed for use in work of this section shall prepare firestopping manual scheduling products to be used for each assembly and installation required in the *Work*.

.1 Coordinate with project firestopping manual specified under Section 01 33 00.

.2 Manual shall include manufacturer's *Product* data sheets as specified under paragraph 1.3.2.

.3 Firestopping manual shall be submitted within 4 weeks of *Contract* award.

1.4 Quality Assurance

.1 Qualifications:

.1 *Provide* work of this section, executed by installers with experience in application of *Products*, systems and assemblies specified and with approval, training and certification of *Product* manufacturers.

.1 Submit proof of manufacturer's installer certification for each installer of firestopping and smoke sealant systems.

.1 Manufacturer's willingness to sell its firestopping *Products* to the *Contractor* or to an installer engaged by the *Contractor* does not in itself confer qualification on the buyer.

.2 Applicator shall designate a single individual as *Project* foreperson who shall be present at the *Place of the Work* at all times throughout the work of this section when the work of this section is being performed.

.3 Aspects of the work of this section are required to be prepared by a professional engineer. Refer to Section 01 33 00 for specific details and requirements in this regard.

1.5 Delivery Storage, and Handling

.1 Deliver materials to *Place of the Work* in manufacturer's unopened containers, containing classification label, with labels intact and legible at time of use.

.2 Store materials in accordance with manufacturer's recommendations with proper precautions to ensure fitness of material when installed.

.3 Do not use damaged or adulterated materials and materials exceeding their expiry date.

1.6 Field Conditions

.1 Comply with manufacturer's requirements relative to temperature and humidity conditions, before, during and after installation.

PART 2- PRODUCTS

2.1 Manufacturers

.1 General: Manufacturers of firestopping and smoke seal system *Products* and installation specialists for the work of this section are limited to applicable assemblies as required for the *Work* and having listing mark on packaging.

.2 Subject to compliance with requirements, provide products by one of the following:

.1 3M Canada Inc.

.2 Hilti Canada Corp.

.3 NUCO Inc.

.4 STI Firestop.

.5 Tremco Commercial Sealants & Waterproofing.

2.2 Performance/Design Requirements

.1 Firestop and smoke sealant systems shall consist of material, or combination of materials installed to retain integrity of fire-rated construction by effectively impeding spread of flame, smoke, and/or hot gasses through perimeter joint or gaps, construction joints, or at perimeter fire containment in or adjacent to fire-rated barriers.

.2 Smoke sealants applied over firestopping materials or combination smoke seal/firestop seal material shall form air tight barriers to prevent passage of gas and smoke.

.3 Fire-resistance rating of firestopping system shall be equivalent to rating of adjacent floor, wall or other fire separation assembly.

.4 Firestopping system at fire rated assemblies with assembly STC rating requirements, shall provide STC rating equal to STC rating of fire rated assembly.

.5 Confirm locations of exposed/non-exposed firestopping/smoke seal surfaces with *Consultant* prior to application.

.6 *Provide* movement capability at movement joints in accordance with design requirements for movement joint.

.7 Head-of-wall joints; with dynamic designation:

.1 Joint assemblies to allow for vertical movement, allowing wall to move independent of structure, due to forces such as live loads, dead loads, thermal expansion/contraction, wind sway, without damaging the wall assembly or its fire protection components.

.1 Provide head-of-wall joints with dynamic designation.

.8 Regulatory requirements:

.1 Joint firestop systems shall be listed in accordance with CAN/ULC-S115-11 and shall achieve required fire resistance rating in accordance with building code.

.2 Proposed firestopping and smoke seal materials and methods shall conform to applicable governing codes having local jurisdiction.

2.3 Materials

.1 Single source responsibility for firestopping and smoke seal materials:

.1 Obtain firestopping and smoke seal materials from single manufacturer for each different *Product* required.

.2 Manufacturer shall instruct applicator in procedures for each material.

.2 Firestopping and smoke seal systems shall conform to the following:

.1 Asbestos-free materials and systems capable of maintaining an effective barrier against flame, smoke and gasses in compliance with requirements of CAN/ULC-S115-11 and not to exceed opening sizes for which they are intended.

.2 *Provide* firestopping materials and systems with fire-resistance rating not less than the fire-resistance rating of applicable adjacent assembly.

.3 Listed in accordance with CAN/ULC-S115-11.

.4 Use only joint firestop systems that have been tested by an accredited third party testing agency for specific fire-rated construction conditions conforming to construction assembly type, joint type and fire-rating requirements for each separate instance.

.1 Where there is no specific third party tested and classified firestop system for a particular firestop configuration, submit engineered shop drawings.

.5 For joints in fire-separations, provide listed systems designs for the joint firestop and smoke seal systems as required by building code to maintain the integrity of the fire separations.

.6 *Products* shall be compatible with abutting dissimilar membranes, architectural coatings, finishes at floors, walls and ceilings. Check with requirements of *Contract Documents* and manufacturer of selected materials being installed.

.3 Smoke sealants for overhead and vertical joints shall be non-sagging; sealants for floors shall be self-levelling.

PART 3A. - EXECUTION

3.1 Preparation

.1 Examine sizes, anticipated movement and conditions to establish correct thickness and installation of back-up materials.

.2 Prepare surfaces in accordance with manufacturer's written specifications and to requirements of listed system designs.

3.2 Installation

.1 Install joint firestopping and smoke seal systems in accordance with manufacturer’s written requirements and in compliance with listed system designs. Products and installation requirements must comply with listed system designs.

.2 For materials that will remain exposed after completing the *Work*, finish to achieve smooth, uniform surfaces. Tool or trowel exposed surfaces.

.3 Notify *Consultant* when random completed installations are ready for review, as directed by *Consultant*, prior to concealing or enclosing firestopping and as applicable, smoke seals.

.4 Protect materials from damage on surfaces subjected to traffic.

3.3 Identification and Documentation

.1 Provide documentation for each joint firestop system application addressed. This documentation is to identify each joint location on the entire Project.

.2 Documentation for installed joint firestop systems is to include:

.1 Sequential location number.

.2 Project name.

.3 Date of installation.

.4 Detailed description of joint firestop system location.

.5 Listed firestop system design number or engineered judgment number.

.6 Type of joint.

.7 Width of joint.

.8 Overall length of joint.

.9 Number of sides addressed.

.10 Hourly rating of firestop joint system to be achieved.

.11 Installers name.

3.4 Field Quality Control

.1 Conduct quality control to be in accordance with Section 01 45 00.

.1 Field tests and inspections:

.1 Examine completed firestop joint installations to ensure proper installation before concealing or enclosing areas. Keep areas of work accessible until inspections are completed.

.2 Inspection consultant to review installation of the work of this section and to perform random tests to verify its completion in accordance with the requirements of the *Contract Documents*.

.3 Give at least 48 hours notice before operations commence, and arrange for a pre-job conference with *Contractor*, installer, independent inspection and testing company, manufacturer, and *Consultant* present.

.4 Independent inspection and testing company shall examine installed firestopping in accordance with ASTM E2393-20. Independent inspection and testing company shall examine firestopping and shall determine, in general, that firestopping has been installed in accordance with requirements of the *Contract Documents* and in compliance with each listed firestop system design.

.5 Representatives of the manufacturer(s) shall have access to the *Work*. *Contractor* shall provide assistance and facilities for such access in order that the manufacturer(s) representative(s) may properly perform its function.

.2 Manufacturer’s field review to be in accordance with Section 01 45 00.

END OF SECTION

PART 1 - GENERAL

1.1 Summary

.1 Section includes:

.1 Exterior building sealants.

.2 Interior building sealants.

.2 Section excludes:

.1 Tiling control joint sealants.

.2 Glazing sealants.

.3 Mechanical and electrical sealant work.

1.2 Administrative Requirements

.1 Coordination:

.1 Coordinate cleaning, priming and installation to avoid contamination of wet, freshly coated or adjacent finished surfaces.

.2 Conduct a pre-installation meeting in accordance with Section 01 31 19.

.1 The following items shall be addressed at the pre-installation meeting:

.1 Analysis of the work and weather conditions.

.2 Shape factor of the joint.

.3 Recommendations for priming joints.

.4 Inspection of surfaces and joints.

.5 Compatibility of materials.

.6 Backing materials.

1.3 Submittals

.1 Submit required submittals in accordance with Section 01 33 00.

.2 *Product* data sheets:

.1 Submit manufacturer’s *Product* data sheets for *Products* proposed for use in the work of this section.

.2 Submit manufacturer's and *Product* name for each sealant which will be used in the *Work* prior to commencing the *Work*.

.3 For *Products* specified to comply with SWR Institute Sealant Validation Program, provide written confirmation from SWRI of *Product* compliance.

.3 Samples:

.1 Submit "wet sample" sealant colour samples for each sealant *Product* and colour.

.4 Test and evaluation reports:

.1 Test sealant in contact with samples of materials to be sealed to verify adhesion will be achieved in accordance with Field Quality Control paragraphs in this section, and no staining of the material will result. Prepare sample joints at the *Place of the Work* of each type of sealant for each joint condition.

.1 Submit test results to *Consultant* prior to application of sealants.

.2 Test sealant in contact with samples of porous materials to be sealed to ensure that no staining of the material will result in accordance with ASTM C1248-18.

.1 Submit test results to *Consultant* prior to application of sealants.

1.4 Quality Assurance

.1 Qualifications:

.1 Installers / applicators: Execute the work of this section only by a Subcontractor with approval and training of *Product* manufacturers. Installer to comply with quality assurance articles referenced in ASTM C1193-16 for installation of joint sealants.

.2 Mock-up:

.1 Submit 2440 mm (96") long sealant joint mock-up.

1.5 Field Conditions

.1 Conform to sealant manufacturer's specifications and recommendations.

.2 Verify substrates and ambient air temperature at the *Place of the Work* before, during and after application.

.3 Weather conditions: Do not apply silicone joint sealants in snow, rain, fog or mist, or when such conditions are expected.

1.6 Extended Warranty

.1 Warrant work of this section in accordance with Section 01 78 36 for a period of 2 years.

.2 Repair or replace joint sealants which fail to perform as air tight and water-tight joints; or fail in joint adhesion, cohesion, abrasion resistance, weather resistance, or general durability; or appear to deteriorate or become unserviceable or causing an objectionable appearance resulting from either defective or non-conforming materials and workmanship or in any other manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated.

.1 Defects shall include, but are not limited to:

.1 Staining from abutting materials or filler.

.2 Migrating, bleeding into, or staining abutting materials.

.3 Unsightly surface deformation.

.4 Excessive colour change, chalking, or dust pick-up.

.5 Failing adhesively or cohesively where maximum elongation is less than 25% of designed width of exposed joints.

.6 Hardening to more than 25% over specified hardness.

PART 2- PRODUCTS

2.1 Sealants

.1 General:

.1 Colours: Sealant colours shall match colours of adjacent materials, as selected and approved by *Consultant*.

.1 Colours shall be selected from manufacturer's full range of colours.

.2 Comply with ASTM C920-14 and other requirements indicated for each liquid-applied chemically curing sealant, including those referencing ASTM C920-14 classifications for type, grade, class, and uses.

.3 For sealants to be applied to porous substrates: Provide products that have undergone testing according to ASTM C1248-18 and have not stained porous joint substrates indicated for *Work*.

.4 Sealant supplied shall not exude any material(s) which travels into adjacent materials, or travels onto surfaces of adjacent materials; causing damage, or attracting soiling, which becomes apparent during the service life of the building.

.2 Exterior sealants; joints in vertical surfaces:

.1 Sealant: single-component, non-sag, low to medium modulus non-bleed, high-performance silicone joint sealant, in accordance with the following:

.1 Comply with:

.1 ASTM C920-14, Type S, Grade NS, Class 50 or greater.

.2 CAN/CGSB 19.13-M87.

.3 SWR Institute Sealant Validation Program.

.2 Acceptable *Products*:

.1 DOWSIL '790'.

.2 DOWSIL '795'.

.3 Momentive 'SCS2700 Silpruf LM or SCS 2000 Silpruf'.

.4 Sika 'Sikasil WS-290'.

.5 Sika 'Sikasil WS-295'.

.6 Tremco, Inc. 'Spectrem 1'.

.3 Exterior general sealants; horizontal trafficable joints:

.1 Sealants: silicone low modulus pour grade traffic sealant in accordance with the following:

.1 Comply with:

.1 ASTM C920-14, Type S, Grade P, Class 25.

.2 CAN/CGSB 19.13-M87.

.2 Acceptable *Products*:

.1 DOWSIL 'SL Parking Structure Sealant'.

.2 Momentive ‘Tosseal 817’.

.3 Sika ‘Sikasil-728 SL’.

.4 Tremco, Inc. ‘Spectrem 900SL’.

.4 Interior general sealants:

.1 VOC limit: less than 250 g/L.

.2 Interior sealant; at joints with painted gypsum board: one-component paintable acrylic or polyurethane sealant in accordance with the following:

.1 Comply with:

.1 ASTM C834-10.

.2 CGSB 19-GP-5M-1984.

.2 Acceptable *Products*:

.1 Sika ‘Sikaflex 1A’.

.2 Tremco, Inc. ‘Tremflex 834’.

.3 Interior sealant; at movement paintable joints in vertical surfaces, no detectible odour: one-component polyurethane sealant in accordance with the following:

.1 Comply with:

.1 ASTM C920-14, Type M or S, Grade NS, Class 25.

.2 CAN/CGSB 19.13-M87.

.2 Acceptable *Products*:

.1 Master Builders Solutions Canada ‘MasterSeal NP100’.

.2 Sika ‘Sikaflex 15LM’.

.4 Interior sealant; at movement joints in vertical surfaces: one-component polyurethane sealant in accordance with the following:

.1 Comply with:

.1 ASTM C920-14, Type M or S, Grade NS, Class 25.

.2 CAN/CGSB 19.13-M87.

.2 Acceptable *Products*:

.1 Master Builders Solutions Canada ‘MasterSeal NP1.

.2 Sika ‘Sikaflex 15LM’.

.3 Tremco, Inc. ‘Dymonic 100’.

.5 Interior sealant, mildew resistant one part silicone sealant in accordance with the following:

.1 Comply with:

.1 ASTM C920-14, Type S, Grade NT, Class 25.

.2 CAN/CGSB 19.22-M89.

.2 Acceptable *Products*:

.1 DOWSIL ‘786’.

.2 Master Builders Solutions Canada ‘OmniPlus’.

.3 Momentive ‘Sanitary SCS1700 Sealant’.

.4 Sika ‘Sikasil GP’.

.5 Tremco, Inc. ‘Tremsil 200’.

2.2 Accessories

.1 General: *Provide* joint sealants, primers, backings, and fillers that are compatible with one another and with joint substrates and other sealants or joint fillers specified and approved for applications indicated under joint sealant scheduled and under conditions of service and application as demonstrated by joint sealant manufacturer based on proven test results and field experience. When incompatible, inform *Consultant* and change to compatible type acceptable to *Consultant*.

.2 Cylindrical sealant backings: *Provide* joint backings that meet ASTM C1330-02, Type O (open-cell polyurethane), or Type B (non-absorbent bi-cellular backing materials with surface skin), sized 25 percent or greater than joint opening with proper density to control sealant depth and profile. Follow joint sealant manufacturer’s recommendations with backing selections for optimum joint sealant performance, in accordance with the following schedule:

.1 Use open cell foam with non-absorbing closed cell skin (Sof-Rod) for vertical joints; round shape for open joints and triangular shape for angular joints.

.2 Use closed cell foam for horizontal joints.

.3 Bond-breaker tape: Polyethylene tape or other approved plastic tape as recommended by joint sealant manufacturer to prevent 3-sided joint adhesion to rigid, inflexible joint fillers or joint surfaces at back of joint where such adhesion would restrict proper sealant movement or result in sealant failure.

.4 Masking tape: Non-staining, non-absorbent and compatible with joint sealants and adjacent surfaces.

.5 Sealant primers: Use primers only as recommended by sealant manufacturer where required to enhance adhesion of sealant to specific joint substrates indicated and as determined for use from pre-construction mock-up testing. Select primers in consultation with sealant manufacturer and manufacturer of substrate material which do not have a detrimental effect on sealant adhesion or in-service performance.

.6 Cleaners for nonporous surfaces:

.1 *Provide* non-staining, chemical cleaners of type which are acceptable to manufacturer of sealant and sealant backing material, which are not harmful to substrates and adjacent nonporous materials, and which do not leave oily residues or otherwise have a detrimental effect on sealant adhesion or in-service performance.

.2 *Provide* cleaner conditioner required for glass and glazed surfaces as recommended by sealant manufacturer.

PART 3 - EXECUTION

3.1 Manufacturer's Recommendations

.1 Unless specified otherwise herein, comply with the recommendations and directions of the manufacturer whose materials are being used in the work of this section.

3.2 Preparation

.1 Protect adjacent work areas and finished surfaces from damage during joint sealant installation.

.2 Clean and prepare joint surfaces and substrates of substance that could impair the bond of joint sealants immediately before installing joint sealants.

.3 Provide a dry, dust-free and cleaned substrate for optimum results.

.4 Clean porous joint surfaces by using heavy-duty brushing, light abrasive, mechanical abrading or combination of these methods to produce a clean, sound surface for optimum bond with joint sealants per manufacturer's recommendations.

.5 Non-porous surfaces shall be cleaned using the two-cloth wipe method as referenced in ASTM C1193-16 and outlined by joint sealant manufacturer's written requirements.

.6 Rusting or scaling surfaces shall be prepared using abrasive cleaning methods as recommended by joint sealant manufacturer prior to joint sealant installation. Efflorescence, mould, mildew and algae must be removed and neutralized prior to joint sealant installation.

.7 Prepare finish-coated surfaces per joint sealant manufacturer's specific recommendations.

.8 Test materials for indications of staining or poor adhesion before any sealing is commenced. Submit reports in writing to *Consultant* of results.

3.3 Masking

.1 Where necessary to prevent contamination or marring surfaces of adjacent materials, mask areas adjacent to joints with masking tape prior to priming or sealing application. Remove tape immediately after joint has been completed and an initial set achieved.

3.4 Installation

.1 Apply joint sealants for continuous waterproof sealant joint protection. Vertical joints shall be lapped over horizontal joints as recommended by sealant manufacturer. Comply with installation recommendations in ASTM C1193-16 for use of joint sealants as applicable to each specific sealant installation.

.2 Install sealant primers only when recommended by sealant manufacturer and demonstrated at pre-construction tests after joint surface preparation has been completed and when surfaces are verified as clean and dry. Allow any primer installation to completely dry or cure prior to installation of backing or joint sealants. Primer is mandatory for gun applied sealants.

.3 Install joint sealants using proven techniques that comply with the following and in proper sequence with installation of primers and backings.

.1 Using proper joint sealant dispensing equipment, place sealants by pushing sealant beads into opening to fully wet-out joint sealant substrates. Fill sealant joint opening to full and proper configuration.

.2 Install, providing uniform cross-sectional shapes and depths in relation to joint width for optimum sealant movement capability per joint sealant manufacturer's written requirements.

.4 Joint sealant tooling is required for non-sag joint sealant installations. Immediately after placing fresh sealants and before skinning or curing begins, tool sealants using metal spatulas designed for this purpose in accordance with manufacturer's recommendations. Provide a smooth, uniform sealant finish, eliminating air pockets and ensuring good contact for optimum sealant adhesion within each side of the joint opening.

.1 Provide concave joint configuration as indicated per figure 5-A in ASTM C1193-16 unless otherwise indicated.

.2 Use tooling agents that are approved in writing by sealant manufacturer and that do not discolour sealants or adjacent surfaces.

.3 Remove excess sealant from surfaces adjacent to joint openings using metal spatula, promptly cleaning any sealant residue from adjacent finished surfaces. Remove masking after joint sealant is installed.

.5 Allow single-component sealants to fully cure before adhesion testing is performed as recommended by joint sealant manufacturer.

.6 Match approved sealant mock-up for colour, finish and overall aesthetics. Remove, refinish or re-install work not in compliance with the *Contract Documents*.

.7 When surfaces of adjacent materials are to be painted, perform sealant work before these surfaces are painted.

.8 Check form release agent used on concrete for compatibility with primer and sealant. If they are incompatible inform *Consultant* and change primer and sealant to compatible type, or clean concrete to sealant manufacturer's acceptance.

.9 Install joint backing material, filler strips, gaskets, bond breakers and similar type material of comparable performance characteristics. Install bond breaker tape or packing over asphalt impregnated fibre board as recommended by sealant manufacturer.

.10 Where joints are 12.7 mm (1/2") or deeper, insert backing material in continuous uniform compression with setback from finished face of adjoining materials equal to required depth of sealant (width/depth ratio) as specified herein.

.11 On horizontal traffic surfaces, support joint filler against vertical movement which might result from traffic loads, including foot traffic.

.12 Install bond breaker tape in bottom of joints in lieu of sealant backing where proper depth cannot be obtained when backing is installed.

.13 Maintain correct sealant depth. Sealant depth shall be 1/2 the width of the joint, maximum depth shall be 12.7 mm (1/2"), minimum depth shall be 6 mm (1/4"). Comply with manufacturer's written recommendations.

.14 Fillet bead sealant joints to be sized to provide proper contact area with substrates, in accordance with manufacturer's written recommendations.

.15 Apply sealants using pressure-operated guns fitted with suitable nozzles in accordance with manufacturer's directions. Apply sealants in such manner as to ensure good adhesion to sides of joints and to completely fill voids in joints.

.16 Apply sealants so that surfaces of joints are smooth, full bead, free from ridges, wrinkles, sags, air pockets and embedded impurities. Tool sealant surfaces to produce a smooth surface.

.17 Install sealant with exterior face of sealant set back 10 mm (3/8") from face of adjacent materials at building movement joints, unless otherwise indicated.

.18 Do not apply sealants to areas where installation of paints, coatings or flooring is in progress. Apply sealants after such work is complete and fully cured.

3.5 Exterior Sealant Schedule

.1 Include in work of this section joint sealants in exterior assemblies to seal open joints in surfaces exposed to view, and to make building weather-tight, as indicated, and as otherwise specified, except where specified under the work of other sections.

.2 Exterior sealant work is part of the work of this section. Install sealant to:

.1 Perimeters of exterior openings where frames/glazing meet exterior facade of building.

.2 Movement and control joints in exterior surfaces of insitu concrete and masonry.

.3 Exterior joints between masonry and insitu concrete.

.4 Exterior joints in horizontal wearing surfaces.

3.6 Interior Sealant Schedule

.1 Include in work of this section sealants to seal open joints in surfaces exposed to view, and to make building weather-tight and air-tight, as applicable, as indicated, and as otherwise specified, except where specified under the work of other sections.

.2 Install sealant to:

.1 Movement and control joints on exposed insitu concrete walls.

.2 Interior control and expansion joints in floor and wall surfaces.

.3 Raked out joints at junctions of masonry with concrete walls and columns, and at intersection of masonry walls and partitions where joint reinforcement is installed.

.4 Perimeters of exterior and interior door and window frames.

.5 Joints at tops of non-load bearing masonry walls at the underside of insitu concrete.

.6 Exposed interior control joints in gypsum board.

.7 Millwork junctions with walls.

.3 Mildew resistant sealant at wet areas:

.1 Perimeter joints of wet fixtures such as:

.1 Water closets.

.2 Wall tile joints, tile to tile at bathtub or shower corners. Gap between tile backer board and edge of bathtub or shower base.

.3 Counter/wall junctions at countertops.

3.7 Adjusting and Cleaning

.1 Remove droppings and clean off excess sealant or sealant residue adjacent to sealant joint installations as the work progresses by methods approved by joint sealant manufacturer before material achieves initial set.

.2 Do not damage adjacent surfaces with harmful removal techniques and protect finished surfaces beyond those that have been masked.

.3 Remove and replace damaged joint sealants.

.4 Remove temporary coverings and masking protection from adjacent work areas upon completion.

3.8 Protection

.1 Protect installed sealants during and after final curing from damage resulting during construction.

END OF SECTION

PART 1 - GENERAL

1.1 Summary

.1 Section includes:

.1 Hollow metal doors and panels (steel doors).

.2 Insulated metal doors (insulated steel doors).

.3 Metal frames (steel frames for screens, sidelights, window assemblies).

.4 Thermally broken metal door frames (thermally broken steel frames).

1.2 Administrative Requirements

.1 Coordination:

.1 Cooperate fully with finish hardware distributor's representative during preparation of shop drawings and execution of shop fabrication.

.2 Coordinate installation of doors and frames with installation of hardware specified in Section 08 71 00.

.2 Conduct a pre-installation meeting in accordance with Section 01 31 19.

1.3 Submittals

.1 Submit required submittals in accordance with Section 01 33 00.

.2 Submit copy of NAAMM-HMMA 840-17 standard.

.3 *Product* data sheets:

.1 Submit manufacturer’s *Product* data sheets for *Products* proposed for use in the work of this section.

.4 Shop drawings:

.1 Include details of each door and frame type, finish hardware types and locations, frame profiles, door and frame elevations, mitre details, fire protection rating, glazing preparation details and anchor details and locations.

.2 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and in door schedule.

.3 Electrified hardware requirements and preparations shall be clearly indicated on shop drawings.

1.4 Quality Assurance

.1 Qualifications:

.1 Manufacturers:

.1 *Provide* doors and frames manufactured by a firm specializing in the design and production of hollow metal steel doors and frames.

1.5 Delivery, Storage, and Handling

.1 Inspect materials thoroughly upon receipt and report immediately discrepancies, deficiencies and damages, in writing, to *Supplier*.

.2 Note damages incurred during shipment on carriers' bill of lading and report immediately, in writing, to *Supplier*.

.3 Store materials properly on planks, out of water and covered to protect from damage from adverse weather conditions. Remove wet packaging immediately.

.4 Remove wrappings or coverings from doors upon receipt at the *Place of the Work*, and store in a vertical position, spaced with blocking to permit air circulation between them.

1.6 Extended Warranty

.1 Warrant work of this section in accordance with Section 01 78 36 for a period of 2 years.

.2 Repair or replace steel doors and frames that fail within the specified warranty period.

.3 Failures shall include but not be limited to out of true alignment, failure to operate and swing freely, smoothly, and easily, to remain stationary at any point, to close evenly and tightly against stops without binding, and to latch positively when doors are closed with moderate force. The warranty includes re-installation of hardware, re-hanging and fitting.

PART 2 - PRODUCTS

2.1 Manufacturer

.1 All Steel Doors 2000 Ltd.

.2 Apex Industries Inc.

.3 Artek Door (1985) Ltd.

.4 Daybar Industries Ltd.

.5 Fleming-Baron Door Products.

.6 Gensteel Doors.

.7 M.J. Daley Manufacturing Co. Ltd.

.8 Shanahan's Manufacturing Ltd.

.9 Trillium Steel Doors Limited.

.10 Vision Hollow Metal Limited.

2.2 Performance/Design Requirements

.1 Exterior insulated metal doors shall be tested to meet an operable U-value of 0.450.

.2 Fire rating requirements:

.1 Fire rated labelled doors and frames: tested to CAN/ULC-S104-15 and listed by a nationally recognized agency having a factory inspection service and shall be constructed as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

.2 Install fire labelled steel door and frame products in accordance with NFPA 80-2013, except where indicated otherwise.

2.3 Materials

.1 Steel:

.1 Fabricated from tensioned levelled steel to ASTM A924/A924M-18, galvanized to ASTM A653/A653M-13, Commercial Steel CS, Type B.

.2 Steel shall be free of scale, pitting, coil breaks, surface blemishes, buckles, waves, and other defects.

.3 Minimum sheet thickness; uncoated steel sheet: in accordance with Appendix 1 of ANSI/NAAMM HMMA 861-14 “Guide Specifications for Commercial Hollow Metal Doors and Frames”.

.4 Finish: Minimum Galvanneal coating designation ZF120 (A40).

.2 Door core materials:

.1 Honeycomb: Structural small cell 25 mm (1") maximum kraft paper 'honeycomb'. Weight: 36.3 kg (80 lb) per ream (minimum). Density: 16.5 kg/m^3 (1.03 pcf) minimum, sanded to required thickness.

.2 Polyisocyanurate: Closed cell, faced board, thermal value: conforming to ASTM C1289-17.

.3 Adhesives:

.1 Heat resistant, single component, polyurethane reactive (water) hot melt, thermoset adhesive.

.2 Rigid insulation cores: Heat resistant, epoxy resin based, low viscosity, contact cement.

.3 Lock seam doors: fire resistant, resin reinforced polychloroprene, high viscosity sealant-adhesive.

.4 Primer: rust inhibitive for touch-up.

.5 Finishing hardware: in accordance with Section 08 71 00.

.6 Miscellaneous:

.1 Door silencers: single stud rubber or neoprene type.

.2 Exterior top caps: Rigid polyvinylchloride extrusion.

.3 Frame thermal breaks: Rigid polyvinylchloride extrusion.

.4 Channel glazing stops and glazing trim: formed channel of minimum 0.81 mm (0.032”) (20 gauge) steel, 15.9 mm (5/8") high.

2.4 Fabrication - General

.1 Fabricate steel doors, frames, transoms, sidelights and borrowed lights as applicable, to the design and dimensions indicated. Take field measurements where coordination with adjoining work is necessary.

.2 Fabricate steel doors and frames to be rigid, neat in appearance and free from defects, warp, wave or buckle with all corners square unless otherwise indicated.

.3 Operating clearances:

.1 *Provide* clearance at floor with allowance made for indicated finish flooring materials.

.2 Clearances for Fire-Rated Doors: As required by NFPA 80-2013.

.3 Clearances for Non-Fire-Rated Doors: Not more than 3 mm (1/8") at jambs and heads, except not more than 6 mm (1/4") between pairs of doors. Not more than 19 mm (3/4") at bottom.

.4 Drill and tap or reinforce for mortised or surface mounted hardware in accordance with accepted hardware schedule, ANSI A115, NFPA 80-2013, or manufacturers recommendations.

.5 Countersink exposed fasteners unless otherwise shown. Use flat or oval head screws.

.6 Reinforce components to resist stresses imposed by hardware in use.

.7 Allow for anticipated expansion and contraction of frames and supports.

.8 Fit elements at intersections and joints accurately together, in true planes, and plumb and level.

.9 Perform welding to CSA W59-13.

.10 Mortise, reinforce, drill and tap to receive hardware and security devices using templates provided by respective *Supplier*.

.11 Touch up finish damaged during fabrication.

.12 Prepare doors or frames to receive seals where seals are indicated.

.13 Attach labels to suit required fire-protection ratings.

2.5 Fabrication - Steel Doors and Panels

.1 Fabricate steel doors and panels to a thickness of 45 mm (1-3/4"), unless indicated otherwise.

.2 Exterior and insulated doors and panels:

.1 Face sheets fabricated from 1.34 mm (0.053") (16 gauge) steel.

.2 Insulation core:

.1 Polyisocyanurate.

.3 Longitudinal edges mechanically interlocked.

.1 Tack welded at top and bottom of door, 150 mm (6") on centre, and above and below each edge cutout, filled and ground smooth with no visible seams.

.3 Interior and non-insulated doors and panels:

.1 Face sheets fabricated from 1.06 mm (0.042") (18 gauge) steel.

.2 Honeycomb core.

.3 Longitudinal edges mechanically interlocked.

.1 Adhesive assisted with edge seams visible.

.4 Top and bottom of clean room doors shall be provided with 16 gauge continuous flush steel non-removable door cap welded securely in place to achieve a flat smooth transition.

.4 Fabricate of composite metal face construction with each face formed from flush sheet steel without visible seams, free of scale, pitting, coil brakes, buckles and waves.

.5 Formed edges shall be true and straight with minimum radius for the thickness of steel used.

.6 Lock and hinge edges shall be bevelled 3 mm in 50 mm (1/8" in 2") unless hardware or door swing dictates otherwise.

.7 Top and bottom of doors shall be provided with inverted, recessed, 1.34 mm (0.053") (16 gauge) steel end channels, welded to each face sheet at 50 mm (2") on centre maximum.

.8 Prior to shipment, mark each door with an identification number as shown on the approved submittal drawings.

.9 Blank, reinforce, drill and tap doors for mortised, templated hardware. Locate hardware to manufacturer's standard unless indicated otherwise.

.10 Holes 12.7 mm (1/2") and larger shall be factory prepared.

.11 Glazing:

.1 For glazing materials up to and including 8 mm (5/16") thick, doors shall be provided with 0.81 mm (0.032") (20 gauge) steel glazing trim and snap-in glazing stops.

.2 For glazing materials greater than 8 mm (5/16") thick, doors shall receive 0.81 mm (0.032") (20 gauge) steel trim and screw fixed glazing stops. Screws shall be #6 x 32 mm (1-1/4") oval head Tek™ (self-drilling) type at 305 mm (12") on centre maximum.

.3 Glazing trim and stops shall be accurately fitted (within 0.39 mm (0.015”) tolerance), butted at corners, with removable glazing stops located on the 'push' side of the door.

.12 Fabricate closing stiles of paired doors as indicated or scheduled.

.13 Provide 2.5 mm (0.1") 12 gauge 'flat' or 'Z' astragal at meeting stiles of pairs of doors for fire rating according to the manufacturers listing and as scheduled.

.14 Where indicated in schedule, prepare doors and panels for installation of fire-rated door grilles. If required to meet door grille manufacturer's rated design, provide reinforcement around door grill opening.

2.6 Fabrication - Steel Frames

.1 General: Applicable to frames, transom panel frames, sidelights, and window assemblies.

.2 Exterior and thermally broken frames:

.1 Fabricated from:

.1 1.34 mm (0.053") (16 gauge) steel.

.2 1.70 mm (0.067") (14 gauge) steel for frames noted as heavy duty.

.2 Supplied set-up and welded (SUW).

.3 Interior and exterior sections of thermally broken frames, separated by continuous PVC thermal break.

.4 Thermally broken sections shall not be assembled by means of screws, grommets or other fasteners.

.5 Welds shall not cause thermal transfers between interior and exterior surfaces of the frame sections.

.6 Closed sections (mullions and center rails) factory insulated with 24 kg/m³ (1.5 pcf) loose batt type fibreglass material.

.7 Incorporate head drips of same gauge material as frame and plug weld at 150 mm (6") on centre, fill and sand smooth.

.3 Interior and non-thermally broken frames; welded:

.1 Fabricated from:

.1 1.34 mm (0.053") (16 gauge) steel.

.2 Supplied set-up and welded (SUW).

.4 Factory assembled frame product shall be square, free of defects, warps or buckles.

.5 Set-up and welded corner joints (SUW):

.1 Profile welded–punch mitred, continuously welded on inside of the profile faces, rabbets, returns and soffit intersections, with exposed faces filled and ground to a smooth, uniform seamless surface, as defined in the CSDMA - “Recommended Specifications for Commercial Steel Door and Frame Products”.

.6 Set-up and welded joints at mullions, sills and center rails:

.1 Coped accurately, butted and tightly fitted.

.2 At intersecting flush profile faces, securely weld, fill and grind to flush, smooth, uniform, seamless surface.

.3 At intersecting recessed profile faces, securely weld to concealed reinforcements, with exposed hairline face seams.

.4 At other intersecting profile elements make exposed face seams to hairline tolerance.

.7 Where required due to site access, when required for co-ordination or installation, or shipping limitations, frame product shall be fabricated in sections for splicing in the field.

.1 Field spliced jambs, heads and sills shall be provided with 1.34 mm (0.053") (16 gauge) steel splice plates securely welded into one section, extending 100 mm (4") minimum each side of splice joint.

.2 Field splices at closed sections (mullions or center rails) shall be 1.34 mm (0.053") (16 gauge) steel splice angles securely welded to the abutting member. Face of splice angle shall extend 100 mm (4") minimum into closed sections when assembled.

.3 Field splice joints shall be welded, filled and ground to present a smooth uniform surface by the installation company responsible for installation after assembly.

.8 On factory assembled frame product, provide 2 temporary steel shipping bars welded to the base of the jambs or mullions to maintain alignment during shipping and handling. Remove shipping bars prior to anchoring of frames to floor.

.9 Each door opening shall be prepared for single stud door silencers. Silencers shall be shipped loose for installation by installer, after finish painting.

.1 Single interior doors: 3 at strike jamb.

.2 Pair of interior doors: 2 at header.

.3 Weather-stripped doors: None required.

.4 Sound, light, or smoke sealed doors: None required.

.10 Prior to shipment, mark each frame with an identification number as shown on the approved submittal drawings.

.11 Provide mullions and transom bars of closed construction type. For fixed condition, attach members to frame with butt-welded joints. For removable condition, attach members with removable mullion anchors.

.12 Conceal fastenings unless otherwise indicated.

.13 Anchor frames to floor by 1.34 mm (0.053") (16 gauge) thick angle clips, welded to frame and *Provide* with 2 holes for floor anchorage.

.14 Grind welded corners to a flat plane, fill with metallic paste filler and sand to uniform smooth finish.

.15 Protect strike and hinge reinforcements using guard boxes welded to frames at masonry construction.

.16 Reinforce head of frames wider than 1220 mm (48").

.17 Brace frame units to prevent distortion in shipment and protect finish.

2.7 Hardware Reinforcements and Preparations

.1 Door and frame product shall be blanked, reinforced, drilled and tapped at the factory for fully templated mortise hardware only, in accordance with the approved hardware schedule and templates provided by the hardware supplier.

.2 Door and frame products shall be factory blanked and reinforced only for mortised hardware that is not fully templated.

.3 Where surface mounted hardware, anchor hinges, thrust pivots, pivot reinforced hinges, or non-templated hardware are required frame product shall be reinforced only, with drilling and tapping done by field installation.

.4 Templated holes 12.7 mm (1/2") diameter and larger shall be factory prepared, except mounting and through bolt holes, which shall be by installation on site. Templated holes less than 12.7 mm (1/2") diameter shall be factory prepared only when required for the function of the device (for knobs, levers, cylinders, thumb or turn pieces) or when these holes over-lap function holes.

.5 Hinge reinforcements shall be 3.12 mm (0.123") (10 gauge) steel minimum, high frequency type shall be provided.

.6 Frames shall be prepared for 114 mm (4.5”) standard weight hinges minimum unless otherwise indicated.

.7 Doors and frames in excess of 2450 mm (96") rabbet height shall be prepared for 114 mm (4.5”) heavy weight 4.6 mm (0.180”) hinges minimum.

.8 Lock, strike and flush bolt reinforcements shall be 1.34 mm (0.053") (16 gauge) steel minimum, with extruded tapped holes that provide equivalent number of threads as 2.36 mm (0.093") (12 gauge).

.9 Reinforcements for surface mounted hardware, concealed closers and holders and flush bolts shall be 1.06 mm (0.042") (18 gauge) steel minimum.

.10 Reinforcements are not required for surface applied hardware supplied with thru-bolts and spacers or sex-bolts.

.11 Provide hardware mortises on perimeter frame members to be grouted in masonry or concrete partitions with 0.66 mm (0.026") (22 gauge) steel grout guards.

2.8 Frame Anchorage

.1 Frame products shall be provided with anchorage appropriate to floor, wall and frame construction.

.2 Each wall anchor shall be located immediately above or below each hinge reinforcement on the hinge jamb and directly opposite on the strike jamb.

.3 Frame products for installation in new masonry walls shall be provided with steel adjustable wall anchors of the T-strap, stirrup or wire, 1.34 mm (0.053") (16 gauge) minimum or 3.96 mm (0.156”) diameter wire. Straps shall be not less than 50 mm (2") x 254 mm (10”) in size, corrugated and/or perforated.

.4 Frame products installed in steel stud and drywall partitions shall be provided with 0.81 mm (0.032") (20 gauge) steel snap-in or "Z" stud type anchors.

.5 Jambs of frames in previously placed concrete, masonry or structural steel shall be punched and dimpled to accept machine bolt anchors, 6.4 mm (1/4") diameter, located not more than 150 mm (6") from the top and bottom of each jamb. Anchor preparations and guides shall also be located immediately above or below the intermediate hinge reinforcing and directly opposite on the strike jamb. Each preparation shall be provided with 1.34 mm (0.053") (16 gauge) anchor bolt guides.

.6 Anchor bolts and expansion shell anchors for the above preparations shall be provided by the installation company.

.7 Where frame product is installed prior to construction of the adjacent wall, each jamb shall be provided with 1.34 mm (0.053") (16 gauge) steel floor anchors. Each anchor shall be provided with 2 holes for mounting to the floor and shall be securely welded to the inside of the jamb profile.

.8 On sidelights or windows exceeding 3 m (9’-10”) in width, installed in stud partitions, channel extensions shall be provided from the top of the frame assembly to the underside of the structure above. Extensions shall be fabricated from 2.36 mm (0.093") (12 gauge) steel formed channels, mounting angles and adjusting brackets, with mounting angles welded to the inside of frame head. Formed channels, adjusting brackets and fasteners shall be shipped loose. Channels shall be mechanically connected to mounting angles and adjusting brackets with supplied fasteners, on site, by contractor responsible for installation.

2.9 Sizes and Tolerances

.1 Widths of door openings shall be measured from inside of frame jamb rabbet with a tolerance of ± 1.6 mm (+0.063").

.2 Heights of door openings shall be measured from the finished floor (exclusive of floor coverings) to the head rabbet of the frame with a tolerance of ± 1.2 mm (± 0.047").

.3 Unless finishing hardware dictates otherwise, doors shall be sized so as to fit the above openings and allow a 3 mm (1/8") clearance at jambs and head. A clearance of 19 mm (3/4") between the bottom of the door and the finished floor (exclusive of floor coverings) shall be provided. Tolerances on door sizes shall be ± 1.2 mm (± 0.047").

.4 Manufacturing tolerances on formed frame profiles shall be ± 0.8 mm (± 0.031") for faces, door stop heights and jamb depths. Tolerances for throat openings and door rabbets shall be ± 1.6 mm (± 0.063") and ± 0.4 mm (± 0.016") respectively. Hardware cut-out dimensions shall be as per template dimensions, ±0.4 mm (+0.015").

2.10 Hardware Locations

.1 Hardware preparations in frame product shall be as noted below and locations on doors shall be adjusted for clearances specified in paragraph 2.9 of this section.

.2 Top of upper hinge preparation for 114.3 mm (4.5”) hinges shall be located 180 mm (7.5”) down from head, transom mullion or panel as appropriate. The top of the bottom hinge preparation for 114.3 mm (4.5”) hinges shall be located 310 mm (12.625”) from finished floor as defined in paragraph 2.9 of this section. Intermediate hinge preparations shall be spaced equally between top and bottom cutouts.

.3 Strike preparations for unit, integral, cylindrical and mortise locks and roller latches shall be centered 1033 mm (40-5/16") from finished floor. Strikes for deadlocks shall be centered at 1220 mm (48") from finished floor. Strikes for panic or fire exit hardware shall be located as per device manufacturer's templates.

.4 Push and/or pulls on doors shall be centered 1070 mm (42") from finished floor.

.5 Preparations not noted above shall be as per hardware manufacturer's templates.

.6 Hardware preparation tolerances shall comply with the ANSI A115 standards.

PART 3 - EXECUTION

3.1 Examination

.1 *Provide* necessary grounds, bracing and strapping for fitting and adequate for securing of the work.

.2 Cooperate with work of other sections to ensure fastenings set by others are provided and located, their work is installed to their specifications and that those responsible for back priming are notified in sufficient time for them to schedule work.

3.2 Installation - Steel Doors and Frames

.1 Set frame product plumb, square, aligned, without twist at correct elevation in accordance with NAAMM-HMMA 840-17.

.2 Frame product installation tolerances:

.1 Plumbness tolerance, measured through a line from the intersecting corner of vertical members and the head to the floor, shall be ±1.6 mm (±1/16").

.2 Squareness tolerance, measured through a line 90° from one jamb at the upper corner of the product, to the opposite jamb, shall be ±1.6 mm (±1/16").

.3 Alignment tolerance, measured on jambs, through a horizontal line parallel to the plane of the wall, shall be ±1.6 mm (±1/16").

.4 Twist tolerance, measured at face corners of jambs, on parallel lines perpendicular to the plane of the wall, shall be ±1.6 mm (±1/16").

.3 Fire labelled product shall be installed in accordance with NFPA 80-2013.

.4 Brace frame product rigidly in position while building-in. Remove temporary steel shipping jamb spreaders. Install temporary wood spreaders at mid-point of frame rabbet height to maintain frame widths. Remove wood spreaders after product has been built-in.

.5 Provide vertical support at center of head for openings exceeding 1250 mm (48") in width.

.6 Secure anchorages and connections to adjacent construction.

.7 Execute installation and assembly using skilled forces under supervision of a competent joinery foreperson.

.8 Install doors in accordance with NAAMM-HMMA 840-17, maintaining clearances outlined in paragraph 2.10 of this section.

.9 Adjust operable parts for correct clearances and function.

.10 Steel surfaces shall be kept free of grout, tar or other bonding materials or sealers.

.11 Remove grout or other bonding material from products immediately following installation.

.12 *Provide* appropriate anchorage for floor and wall construction. Each wall anchor shall be located immediately above or below each hinge reinforcement on the hinge jamb and directly opposite the strike jamb. On each jamb, install 2 anchors for openings up to and including 1525 mm (60") high and install 1 anchor for each additional height of 760 mm (30") of height or fraction thereof, except as indicated below. Frames placed in previously placed concrete, masonry or structural steel shall be *Provided* with anchors located not more than 150 mm (6") from top and bottom of each jamb, and intermediate anchors at 660 mm (26") on centre maximum.

.13 Secure frames set in previously constructed concrete or masonry openings by countersunk expansion bolts at same centres as for adjustable Tee wall anchors. Reinforce frame at fastening location to prevent indentation of frame by fastening device.

.14 Fill and grind smooth “punch and dimpled” frame installations.

.15 Prior to site touch-up, exposed surfaces of galvanneal steel to be finished shall be cleaned to remove foreign matter. Refer to paint manufacturers recommendations for additional information and requirements of Section 09 91 00.

.16 Touch-up exposed field welds shall be finished to present a smooth uniform surface and with a rust inhibitive primer.

.17 Touch-up exposed surfaces that have been scratched or otherwise marred during shipment, installation, and handling shall be with a rust inhibitive primer.

.18 Finish paint in accordance with Section 09 91 00.

.19 Install door silencers.

.20 Adequately fasten units and secure in place with concealed fixings wherever possible. Include grounds and furring where required.

.21 Make allowance for deflection to ensure structural loads are not transmitted to frames.

.22 Adjust operable parts for correct clearances and function.

3.3 Installation - Finishing Hardware

.1 Install finishing hardware in accordance with ANSI A115.1G-1994, manufacturers' templates and instructions, and Section 08 71 00.

3.4 Adjusting and Cleaning

.1 Adjust doors to swing freely, smoothly and easily, to remain stationary at any point, to close evenly and tightly against stops without binding, and to latch positively when doors are closed with moderate force.

.2 Adjust hardware so that latches and locks operate smoothly and without binding, and closers act positively with the least possible resistance in use. Lubricate hardware if required by *Supplier's* requirements.

.3 Ensure that doors equipped with closers operate to close doors firmly against anticipated wind and building air pressure, and to enable doors to be readily opened as suitable for function, location and traffic.

.4 Clean hardware after installation in accordance with *Supplier's* requirements.

END OF SECTION

PART 1- GENERAL

1.1 Summary

.1 Section includes:

.1 Fixed aluminum sidelight, transom, and entrance framing.

.2 Aluminum entrance doors.

.3 Foamed-in-place (gap filler) filler insulation.

.4 Fixed glazed aluminum windows framing.

.5 Operable aluminum windows.

.6 Extruded aluminum curtain wall, multi-chambered, pressure equalized, rainscreen design, double glazed IGU.

.7 Glass and glazing in accordance with Section 08 80 00.

.8 Seal joints within the work of this section in accordance with Sections 07 27 00 and 07 92 00, except where specified otherwise and at abutting joints between this section and the work of other sections.

.9 Sealant air barrier transitions and connections between air barriers of adjacent wall and roofing systems.

.10 Prefinished aluminum panel fabrications, including closures, sills, cap flashings at interface with roofing flashing.

1.2 Administrative Requirements

.1 Conduct a pre-installation meeting in accordance with Section 01 31 19 and the following requirements:

.1 Review methods and procedures related to glazing systems including the following:

.1 Review flashings, special interface details and scheduling with adjacent material assemblies, penetrations, and conditions of other construction that will affect glazing systems.

1.3 Submittals

.1 Submit required submittals in accordance with Section 01 33 00.

.2 Submit warranty specimen prior to commencement of shop drawings.

.3 *Product* data sheets:

.1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this section.

.4 Shop drawings:

.1 Submit engineered shop drawings.

.2 Indicate with plans, sections, elevations and sufficient full size details, components and methods of assembly, materials and their characteristics relative to their purpose, and other fabrication information including relationships to adjacent systems.

.3 Identify and describe material types being supplied, wall thicknesses of extrusions, and shapes including connections and grades, dimensions and tolerances (minimum and maximum), attachments, reinforcing, anchorage and locations of fastenings, air barrier transitions to various adjacent building envelope air barrier materials, and provisions for thermal and structural movement between components of this section and adjacent materials.

.4 Include description of materials, metal finishing specifications, and other pertinent information.

.5 Design loads, typical reactions and support movement allowances, both vertical and horizontal.

.6 Indicate the specification of materials and, where applicable, indicate installation methods and coordination with other sections.

.7 Indicate paths and methods of rainwater drainage and ventilation of framing and spandrel conditions.

.8 Indicate predrilling locations and configurations for security hardware.

.9 Shop drawings shall clearly indicate paths and methods of moisture egress (should this occur) and ventilation of framing and spandrel conditions.

.5 Design calculations:

.1 Submit under seal, calculations prepared by the professional engineer responsible for the preparation of the shop drawings that clearly indicate the following:

.1 Design assumptions regarding loadings, related to the building code.

.2 Codes and standards to which calculations are based upon.

.3 Materials proposed and their allowable shear and bending stresses.

.4 Maximum and minimum fabrication and installation tolerances for proposed materials including anchors, holes and spacings.

.5 Testing data to confirm compliance with performance requirements for the work of this section.

.6 Analysis for dead, wind, snow and guard loads as required and movements caused by temperature changes, and support deflections.

.7 Analysis to include anchors, glazing members, structural joints, sealants, glass, Show section property computations for framing members and submit full sized drawings.

.8 Analysis to include thermal transmittance (U-value) and condensation resistance.

.6 Samples:

.1 Submit 450 mm (18") x 450 mm (18") size samples of types of glass and aluminum framing assemblies including custom extruded aluminum caps with specified finishes. Submit 450 mm (18") x 450 mm (18") size samples of types of spandrel assemblies. Submit 200 mm (8") long samples of typical component sections (head, jamb, sill, meeting rail, and the like), fully assembled, indicating glazing and weatherproof methods.

.2 Control samples:

.1 Submit two 305 mm (12") square samples of aluminum having specified finish of the required colours. Submit samples as many times as required to obtain approval of the range.

.2 Mark direction of metal grain and rolling and aluminum finish application on back of control samples.

.7 Test reports:

.1 Submit valid independent laboratory test reports of full-scale mock-up for the specific glazing systems required under the work of this section, including framing members, glazing units, anchorage, slab edge covers, and materials to demonstrate compliance respecting specified air leakage and water penetration and environmental separation requirements in accordance with the building code, recognized industry standards, and specified performance requirement specified in this section.

1.4 Closeout Submittals

.1 Submit closeout submittals in accordance with Section 01 77 00.

.2 Operation and maintenance data:

.1 Provide training to the *Owner* in the operation, maintenance, and cleaning of the aluminum framed glazing systems. Submit printed copies of maintenance instructions given to the *Owner*.

.2 Submit maintenance data for cleaning and maintenance for incorporation into the operation and maintenance manuals.

1.5 Quality Assurance - General

.1 Installers / applicators / erectors:

.1 The work of this section shall be performed by a *Subcontractor* who is regularly engaged in the engineering, manufacture, fabrication, assembly, glazing and installation of aluminum framed glazing systems. *Subcontractor* shall demonstrate to the acceptance of the *Consultant*, that they have successfully performed on comparable projects.

.2 Aspects of the work of this section are required to be prepared by a professional engineer. Refer to Section 01 33 00 for specific details and requirements in this regard.

.3 Glass and glazing work under this section shall conform to the Insulating Glass Manufacturers Alliance (IGMA) and to the recommendations of the glass and sealed glazing unit manufacturers.

1.6 Delivery, Storage, and Handling

.1 Comply with AAMA CW-10 – Care and Handling of Architectural Aluminum from Shop to Site.

.2 Store parts in a dry place and permit natural ventilation over their finished surfaces.

.3 Store materials in locations protected from damage by other trades.

.4 Under conditions of high humidity or cold temperatures, supply heating or forced air ventilation to prevent accumulation of condensation.

.5 Mark components to show location on building and on drawings.

.6 Protect finishes with strippable coating that will not mar, nor deface finish on removal, or a similar method designed to afford an equivalent amount of protection. Leave protected coating intact until damage risk is past or immediately prior to final cleaning.

.7 Stacking should be done to prevent bending pressure or abrasion of finished surfaces.

1.7 Extended Warranty

.1 Special systems warranty: Standard form in which warrantor agrees to repair or replace components and assemblies that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

.1 Failures include, but are not limited to, the following:

.1 Structural failures including, but not limited to, excessive deflection.

.2 Noise or vibration created by wind and thermal and structural movements.

.3 Deterioration of metals, metal finishes, and other materials beyond normal weathering.

.4 Water penetration through fixed glazing and framing areas.

.5 Failure of operating components.

.6 Failed glass units.

.2 Warranty period:

.1 5 years.

.2 Special product warranty; glass units: in accordance with Section 08 80 00.

PART 2- PRODUCTS

2.1 Manufacturers

.1 Subject to compliance with requirements of the *Contract Documents*, provide products for the *Work*, by one manufacturer.

.2 Manufacturers forming the basis of specifications, forming the basis of design for the *Work*:

.1 Aerloc Industries

.2 Alumicor Limited.

.3 Kawneer Company Canada Limited.

.4 Sherwood Windows.

2.2 Glazing System Design - Specific Component Requirements

.1 Glass Design:

.1 Glass shall be designed according to CAN/CGSB 12.20-M89 and Section 08 80 00.

.2 Insulating glass units in accordance with Section 08 80 00.

.2 Curtainwall:

.1 Basis of Design *Products*:

.1 Alumicor 'Thermawall 2600'.

.2 Description:

.1 63.5 mm profile thermally broken glazing assemblies.

.2 High performance SSG and pressure plated as indicated on Drawings.

.3 Rain screen design performance.

.4 Fasteners: concealed.

.5 Cap extensions shall be extruded to profiles indicated and scheduled. Break-formed cap extensions will not be accepted.

.3 Basis of Design Aluminum entrances, screens, and framing:

.1 Entrance framing products; thermally broken:

.1 Exterior entrance framing; Basis of Design *Products*:

.1 Alumicor 'FlushGlaze BF 3400'.

.2

.2 Door products:

.1 Exterior doors (wide stile); acceptable Basis of Design *Products*:

.1 Alumicor 'ThermaPorte 7700', wide stiles.

.3 Description:

.1 Fasteners: concealed.

.2 Door framing connections: Reinforce mechanically-joined corners of doors by welding, spigotting, welding and spigotting or by one piece cast aluminum angle to produce sturdy door unit.

.3 Weather-stripping: Dense, bulb polymeric material, resilient and retains weathering ability under temperature extremes, complete with EPDM blade gasket sweep strip applied to the bottom door rail with concealed fasteners.

.4 Door hardware;

.1 Provide 4 hinges, closer, pull, panic device and 1 threshold for each door leaf.

.2 Hinges:

.1 Acceptable products:

.1 Similar to McKinney TA786 Heavy Weight Hinge, Finish: 32 D Satin Stainless Steel

.3 Closers:

.1 Acceptable Product:

.1 LCN 4040 Heavy Duty, Metal Cover, Finish 689 Aluminum

.2 Provide arm and accessories to match existing configuration.

.4 Pulls: Alumicor 1180 concealed mounting

.5 Panic Device

.1 Sargent 16-8810J, including cylinder dogging

.6 Thresholds: Provide aluminum mill finish threshold by aluminum framed glazing system manufacturer.

2.3 Windows

.1 Fixed windows:

.1 Basis of Design *Products*:

.1 Alumicor 'ShadowLine 970'.

.2 Thermally broken sections, inside glazed.

.3 Fasteners: concealed in closed positions, tamperproof where exposed in open positions, austenitic stainless steel.

.4 Glazing pockets shall be vented, pressure equalized and drained to the exterior.

.5 Elastomeric air seal gasket shall be installed around the full perimeter of glass and sealed at corners with silicone sealant. Air seal gasket must provide adhesion with silicone sealant.

.2 Operable windows:

.1 Basis of Design *Products*:

.1 Alumicor 'Univent 1350'.

.2 Thermally broken sections, inside glazed.

.3 Fasteners: concealed in closed positions, tamperproof where exposed in open positions, austenitic stainless steel.

.4 Glazing pockets shall be vented, pressure equalized and drained to the exterior.

.5 Elastomeric air seal gaskets shall be installed around the full perimeter of glass and sealed at corners with silicone sealant. Air seal gasket must provide adhesion with silicone sealant.

.6 Hardware; manual operated projected out windows:

.1 Material shall be corrosion resistant and compatible with aluminum. Hardware must prove its strength and suitability by being installed on units, which are tested in accordance with specifications.

.2 Fasteners: Provide nonmagnetic stainless steel screws, epoxy adhesives, or other material warranted by the manufacturer. Where locks, handles or operators screw anchor through aluminum, reinforce interior with stainless steel splined grommet nuts.

.3 *Provide* concealed controlled restriction device to limit operable windows to permit maximum opening as indicated on drawings, when device is engaged.

.4 Finish: Baked-on finish to match adjacent framing finish.

.5 Sash: corner keyed, sealed, and hydraulically staked.

.6 Hardware:

.1 Equip each operable window with 1 pair of butt hinges in accordance with manufacturer's written recommendations.

.2 Equip each window unit with crank operated, single lever type roto-operator.

.3 Equip each operable window with single lever, dual locking device.

.4 Hardware shall be ADA compliant.

.5 Screens:

.1 Screen frames: Extruded aluminum secured with turn-clip fasteners and colour to match exterior window frame.

.2 Screen: Heavy duty stainless steel screen, Phifer SeeVue Stainless Black, in extruded aluminum frame.

.6 Friction limiter.

.7 Sash limiter or Teleflex operators to be designed by installer and approved by Consultant.

.1 Sash limited installed for areas below guard height

.2 Teleflex operators installed for all remote window locations and above guard height.

.8 Remote operator system: 400mm chain openers, prefinished conduit case, steel core wire, prefinished crank control and matching saddle pack clips to hold the conduit: Teleflex supplied by Ontario Glazing Supply, installed by 401 Glass (TBC). Finish: Grey

.1 No substitutions

2.4 Performance/Design Requirements - General

.1 Design and size components to withstand live loads caused by pressure and suction of wind, acting normal to plane of system as calculated in accordance with building code.

.2 Windows shall perform and be labelled to meet AAMA/WDMA/CSA 101/I.S.2/A440-11 performance class as follows:

.1 Fixed windows: CW.

.2 Operable windows: CW.

.3 Unless specified otherwise, glazing systems shall be designed to the following standards and references:

.1 IGMA 'North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use'.

.2 GANA 'Glazing Manual'.

.3 GANA 'Sealant Manual'.

.4 American Architectural Manufacturers Association (AAMA).

.4 Removal and replacement of broken lites of glass shall be possible without cutting metal or moving the main frame in relation to the anchors.

.5 Design glazing system and framing to prevent thermal shock and edge pressure fracture damage to the glass.

.6 Metal faces of flashings, caps, framing and sheet cladding shall be visually flat.

.7 Accurately shape mullion and cover caps at intersecting joints to obtain hairline joints, just wide enough to permit thermal movements.

.8 Anchor design:

.1 Design anchors of the framing members to the building support to accommodate movements specified herein and to allow for construction tolerances.

.9 Noise:

.1 The *Work* shall be designed so that movements specified herein are accommodated without any audible noise being generated. In general, noise is produced by metal to metal contacts, and/or stresses being built up by movements and suddenly being relieved when friction forces are overcome.

.10 Conceal fasteners connecting the framing members together and anchoring fenestration products and assemblies to surrounding construction.

.11 Framing cavity shall be compartmentalized every 6000 mm (236") horizontally and at corners to prevent the movement of air, in accordance with standard rain screen design.

.12 Framing cavity shall be compartmentalized at demarcation of interior and exterior building envelope spaces to prevent the movement of air, in accordance with rain screen design.

2.5 Performance/Design Requirements - Structural

.1 Design components to the relevant sections of the building code, using limit states design methods.

.2 Design of framing systems shall include necessary adjustments to wall thickness of mullions, mullion reinforcing or other necessary structural design to comply with the above stated profiles. Such design measures shall not relieve the *Contractor* of achieving other requirements.

.3 Movement Criteria: the *Work* shall be designed and constructed so as to allow for movements of the *Work* and/or supporting structure as follows:

.1 Expansion and contraction of component materials of the *Work* produced by an exterior surface temperature range of -35°C to +60°C.

.2 Structural and thermal movements of the reinforced concrete and structural steel as prepared by the *Consultant's* structural engineers.

.3 For work connected to adjacent floor slabs the design shall accommodate total differential slab to slab movement of 16 mm (5/8") unless otherwise indicated.

.4 The above movements to be accommodated without overstressing components in the *Work*, and without buckling, failure of weather seals, undue stress on glass, glass breakage, undue stress on structural elements, or other detrimental effects.

.4 Aluminum framing members shall be designed according to CAN/CSA-S157-05/S157.1-05.

.5 Deflection Limits:

.1 The deflection of framing member in direction normal to plane of glass when subjected to uniform load deflection test in accordance with ASTM E330/E330M-14, under specified design loads, shall not exceed 1/175 of clear span clear spans up to 4110 mm (13'-6") and to 1/240 of clear span plus 6.4 mm (1/4") for spans greater than 4110 mm (13'-6") or an amount that restricts edge deflection of individual glazing lites to 19 mm (3/4"), whichever is less.

.2 In the plane of the wall, deflection of framing members shall not reduce the glass or panel bite below 75% of the design dimension and shall not reduce the glass or panel edge clearance below 25% of the design dimension or 3 mm (1/8") whichever is greater. Restrict dimensions further if required for assembly, fit of components or to accommodate movements specified herein.

.3 Deflection limits for sheet metal air/vapour barriers including backpans shall be L/240 or maximum 6.4 mm (1/4") whichever is less, under specified design loads.

.4 For the work of this section, air barrier components, including sealants and membranes shall not fail under design conditions. Failure shall include loss of adhesion, excessive deflection, movement or displacement beyond product limitations, materials placed under stress beyond manufacturers recommended range.

.6 Design structural steel structural components and fasteners in accordance with CSA-S16-09.

.7 The design of the structural action of glazing systems shall be "simply supported" and shall not induce bending moment or thrust reactions into the building.

.8 Design systems to withstand own dead load, snow, ice and wind loads and combination thereof, as calculated in accordance with the building code, to maximum allowable deflection without permanent deformation.

.9 Design systems to have a method of attachment to the structure that will take into account peculiarities at the *Place of the Work* so that there shall be no possibility of site and air vibrations or normal temperature movements of the building to loosen, weaken, or fracture the connection between building envelope assembly components and the structure or between the components themselves.

.10 Assembly shall be secured in a manner that will keep stresses on sealant within the sealant manufacturer's recommended working range.

.11 Uniform Load: No principal member shall display undue effects or permanent set in the framing members in excess of 0.2% of their clear spans after being subjected to structural load test equal to 1.5 times the specified design load, when tested in accordance with ASTM E330/E330M-14.

2.6 Performance/Design Requirements - Air Infiltration/exfiltration, Water Penetration Resistance

.1 Windows framing systems:

.1 Fixed glazing assemblies:

.1 Air infiltration: Maximum 0.5 L/s/m^2 (0.10 cfm/ft^2) of glazing area when tested in accordance with ASTM E283-04(2012) at test pressure of 75 Pa (1.57 psf).

.2 Air exfiltration: Maximum 0.5 L/s/m^2 (0.10 cfm/ft^2) of glazing area when tested in accordance with ASTM E283-04(2012) at test pressure of 75 Pa (1.57 psf).

.3 Water penetration resistance: determined in accordance with CSA-A440S1, but not less than the minimum for specified performance class, driving rain wind pressure of 20% of design wind load and not less than 240 Pa minimum.

.2 Operable window glazing assemblies:

.1 Air infiltration: Maximum 0.5 L/s/m^2 (0.10 cfm/ft^2) of glazing area when tested in accordance with ASTM E283-04(2012) at test pressure of 75 Pa (1.57 psf).

.2 Air exfiltration: Maximum 0.5 L/s/m^2 (0.10 cfm/ft^2) of glazing area when tested in accordance with ASTM E283-04(2012) at test pressure of 75 Pa (1.57 psf).

.3 Water penetration resistance: determined in accordance with CSA-A440S1, but not less than the minimum for specified performance class, driving rain wind pressure of 20% of design wind load and not less than 240 Pa minimum.

.3 Forced entry resistance: AAMA 1304.

.2 Design glazing systems using rain screen principle with the following characteristics:

.1 Interior (room-side) air seal at component interfaces.

.2 Exterior (weather-side) deterrent seal formed by continuous gaskets or flush silicone seal as applicable.

.3 Glazing pockets vented and drained to the exterior.

.4 Extrusions with integral gutters of sufficient depth to carry intruded rainwater and snow-melt to the exterior.

.5 System of baffles to prevent water entering the glazing cavity due to gravity, capillary action or rain momentum.

.6 Metal to metal joints within the glazing cavity shall be designed and installed to be sealed prior to assembly and fixing and so as to provide continuous drainage of water to points of egress from assembly. Where location of drainage must drain more than one lite and/or spandrel, the number of drainage holes shall be increased according to rain screen design principle.

.3 Cap and seal exposed ends of mullions and caps, while not compromising drainage qualities.

.4 Air barrier sealant to adjacent building air barrier systems:

.1 Air barrier transition system to resist specified window wind pressure and air leakage requirements.

.2 Water penetration resistance: determined in accordance with CSA-A440S1, but not less than the minimum for specified performance class, driving rain wind pressure of 20% of design wind load and not less than 240 Pa minimum.

2.7 Performance/Design Requirements - Thermal

.1 No condensation or frost shall form on the interior of glazing or framing members when tested under the following conditions:

.1 Interior air: 22°C, 30% R.H.

.2 Exterior air: -22°C, 24 km/h (15 ml/h) wind speed.

.3 Condensation resistance: AAMA/WDMA/CSA 101/I.S.2/A440-11, I-58 minimum.

.2 In addition to the above requirements the framing system shall be designed such that condensation or frost will not form on the interior surface of the aluminum members before appearing on the adjacent insulating glass units. To achieve this requirement, any metal on the exterior of the *Work* will require efficient thermal break between metal on the interior.

.3 Brackets and attachment shall not cause thermal bridging resulting in interior condensation forming at design conditions.

2.8 Materials

.1 Glass: in accordance with Sections 08 80 00.

.2 Aluminum extrusions: Accurately formed, extruded aluminum alloy ASTM B221-14: AA-6063-T5/T6, free from defects impairing appearance, strength and durability.

.1 Minimum thickness of 3 mm (0.125”) for framing members, and 1.27 mm (0.050”) for glazing stops, snap caps and similar components unless indicated otherwise.

.3 Aluminum flashing:

.1 Minimum wall thickness: 0.812 mm (0.0320")(20 B&S gauge), unless otherwise indicated.

.2 Aluminum alloy:

.1 For anodized finish:

.1 ASTM B209-14: AA5005-H34 Anodizing Quality.

.4 Aluminum sheet panels:

.1 Minimum wall thickness: 3 mm (0.125”).

.2 Surface flatness: 0.38 mm (0.015”) maximum deviation when measured with 150 mm (6") rule.

.3 Squareness: 0.05 mm (0.002”) maximum for each 25.4 mm (1") of length at panel edge.

.4 Aluminum alloy:

.1 For anodized finish:

.1 ASTM B209-14: 5005H14.

.5 Shims: Hard plastic material, wood materials are not acceptable.

.6 Air barrier materials; transition from glazing system air barrier and tying into building envelope air barrier systems:

.1 Air barrier sealant:

.1 Single-component neutral cure 1-part non-sag silicone, ±25% movement capability.

.2 Self-adhering to building envelope air barrier membrane membrane specified in Section 07 27 00.

.2 Acceptable product:

.1 Primerless application: Dowsil 758 Silicone Weather Barrier Sealant.

.2 Primer application in accordance with manufacturer's written requirements: Dowsil CWS.

.7 Fasteners:

.1 Non-magnetic (austenitic) 300 series alloy stainless steel unless otherwise indicated.

.2 Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.

.3 Provide nuts or washers of design having means to prevent disengagement; deforming of fastener threads is not acceptable.

.4 Provide concealed fasteners unless indicated otherwise.

.5 For exposed locations, provide countersunk flathead fasteners with finish matching item fastened.

.8 Anchors: to accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

.1 Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M-09 or ASTM A153/A153M-09 requirements.

.2 Anchors are to be along the jambs only, no fasteners are to be used along the head and sills of punched windows. Strip windows will require head and sill fasteners.

.9 Sheet metal backpans and air barriers: 0.91 mm (0.036") (20 gauge) thickness, galvanized sheet steel to ASTM A653/A653M-11, Designation G90/Z275.

.1 Fasteners: Corrosion resistant, zinc plated, covered and sealed to sheet metal with silicone sealant.

.10 Dielectric separator: Non-staining alkali resistant, rubber isolation pads or 10 mil vinyl membrane type, electrolytic isolation factor of 1.0.

.11 Internal sealant and air barrier sealant: One-part, neutral cure, high performance silicone sealant complying with ASTM C920-11, Type S, Grade NS, Class 25, capable of sustaining dynamic movements, SWRI sealant validated.

.12 Insulation at spandrels, closures and flashings: ASTM C612-10, Type IVB, non-combustible to CAN/ULC-S114-05.

.1 Acceptable *Products*:

.1 Johns Manville ‘MinWool Curtainwall’.

.2 Rockwool 'CurtainRock'.

.13 Insulation attachment; one of the following:

.1 Galvanized stick-pins, welded to sheet metal backpans, located at maximum spacing of 300 mm (12") o/c and within 150 mm (6") from edge of insulation boards. Seal welds with 1 coat zinc-rich coating.

.14 Zinc-rich coating: Touch-up paint for welded galvanized areas; 2 coats of zinc-rich paint to CAN/CGSB 1.171-98, VOC <340 g/L.

.15 Thermal barrier component:

.1 Glass fibre reinforced polyamide or PVC porthole extrusion, or poured and de-bridged polyurethane, providing full separation of interior and exterior components. Thickness shall be as required to meet design.

.16 Miscellaneous steel: CSA G40.21-04, Grade 300W.

.1 Finishes:

.1 Behind air/vapour barrier: CISC/CPMA 2-75 primer.

.2 Exterior to air/vapour barrier, and where condensation could occur: hot dip galvanized after fabrication with 380 g/m^2 (13.4 oz/ft^2) zinc coating to CAN/CSA G164-M92 or Type 300 series stainless steel.

.17 Spacers for glazing sections receiving metal flashed, panels; behind pressure plate: High density polyethylene (HDPE) or PVC.

.18 Foamed-in-place insulation: One-component CFC-free polyurethane foam for thermal insulation around exterior framing assemblies (Gap Filler) to CAN/ULC S710.1-11.

2.9 Finishes

.1 Exposed aluminum surfaces; interior and exterior; anodized to AAMA 611-14:

.1 Clear anodized to AA Designation AA-M12C21A31 or AA-M12C22A31 (Class II), to AAMA 611-14.

.2 Threshold mill finished

.3 Finish exposed metal fasteners: baked-on finish to match related aluminum surfaces.

2.10 Fabrication - General

.1 Insofar as practical, execute fitting and assembly in the shop with the various parts or assemblies ready for erection at the *Place of the Work*.

.2 Take field measurements and levels required to verify or supplement those shown for the proper layout and installation of the *Work*. Coordinate dimensional tolerances in adjacent building elements and confirm prior to the commencement of the work of this section. Commencement of installation floor by floor shall be construed as acceptance of building conditions. Glazing systems shall not deviate from tolerances specified.

.3 Verify measurements at the *Place of the Work* and fabricate systems to suit dimensions at the *Place of the Work*.

.4 Conceal nuts, bolts, screws, clips and other means of fastening in finished *Work*, except where shown or specified otherwise.

.5 Maintain dimensional tolerances from vertical and horizontal planes with the closest possible accuracy for the various parts as previously designated.

.6 Means of anchoring systems shall have sufficient adjustment to permit correct and accurate alignment. After adjustment, positively lock anchorage devices in manner to preclude movement, once alignment is achieved.

.7 Make allowances for deflection of structure above when making connection thereto, and ensure that no structural load is transmitted to glazing systems.

.8 Fixing screws shall be countersunk and concealed. Screws shall be oval head, set flush with adjacent surfaces.

.9 Assume full responsibility for the design of assemblies. Reinforcing, furring and anchoring shall suit each specific condition complying with the parameters previously specified, required and as shown.

.10 Form accurate extrusions with clean, straight, sharply defined profiles free from any defects.

.11 Form flashing bends with clean, straight, sharply defined profiles without damage and discolouration to finish.

.12 Extrusion thickness shall be adequate to satisfy loading and deflection, as required and indicated.

.13 Weld aluminum where required with inert metal arc equipment by methods recommended by the Aluminum Co. of Canada. Welders shall qualify according to CSA W47.2-11(R2015). Make exposed welds continuous and flush with adjacent surface. Do not mar surface finishes with welds in back of exposed aluminum. Do not deform the exposed metal and finish in any way by welding.

.14 Weld steel, where required, in accordance with CSA W59-13. Welded joints shall be of adequate strength and durability with jointing tight and flush. Welder shall be fully approved by the Canadian Welding Bureau and shall comply with CSA W47.1-09(R2014), Division 3. Where it is necessary to weld components already galvanized, remove galvanizing for 50 mm (2") around weld and paint over welds where galvanizing is removed as specified hereinafter.

.15 Insert concealed prime painted steel reinforcement into cavities of frame members to the interior side of integral air seal web, sized to adequately withstand wind pressure requirements specified.

.16 Include aluminum cover plates, trim components, bent plates, closure trim, extruded glazing corner posts, drips, flashings and other components required to complete the installation and as indicated whether specifically labelled/dimensioned or only notionally indicated.

.17 Trim glazing spline at continuous embedded sill flashing locations (to ensure full upturn of flashing) behind pressure plate.

.18 Include thermal barriers, and miscellaneous neoprene pads, shims and washers.

.19 *Provide* weepholes in the glazing recess to drain condensate and water to exterior wall cavity. *Provide* drainage tubes as necessary to conduct water effectively through isolated insulated areas to direct exterior discharge. Seal around tubes.

.20 Metal-to-metal joints which require sealing to maintain weathertightness shall be designed and assembled with a ribbon of sealant that shall be compressed by approximately 50% of its original thickness when the joints are secured.

.21 Fabricate frame systems complete with mullions, head and sill frames, spigots, and plugs for horizontals, spline gaskets, thermal break pressure plates, filler pieces, snap-on caps, and other necessary components.

.22 Sill flashing:

.1 Extruded aluminum, finished to match window frames.

.2 Project 25 mm (1") minimum drip projection beyond wall surface unless indicated otherwise.

.3 *Provide* preformed drip deflectors for sill ends at jambs to direct water drainage within sill zone.

.4 *Provide* preformed butt joint and corner sill splice connectors and sealant to prevent water penetration; butt joint connectors shall only be permitted when required by design requirements and to industry standard maximum lengths. Locate splice connectors (joint covers) at center line of mullions when required. Trim and detail corners uniformly flush.

2.11 Fabrication - Aluminum Sheet Panel Construction

.1 Fabricate aluminum sheet panel systems complete with continuous recesses to profiles and sizes shown, and to specified tolerances.

.2 Systems shall be designed and fabricated using non-cumulative, concealed attachment methods.

.3 Anchorage: Allow for expansion and contraction.

.4 Include cold rolled framing, furring, brackets, clips, hangers and incidental components as required for secure fastening and provide weathertight installation including non-corrosive fasteners.

.5 Allow for condensation and inner wall drainage at sill members and other shapes which would otherwise tend to trap water.

.6 Lay out panels to obtain uniform metal and paint grain finish. Mark direction of metal grain and paint application on back of panels.

2.12 Fabrication Tolerances

.1 Comply with the following maximum tolerances:

.1 Plumb: 3.2 mm in 3 m (1/8” in 10’-0”); 6.35 mm in 12.2 m (1/4” in 40’-0”).

.2 Level: 3.2 mm in 3 m (1/8” in 10’-0”); 6.35 mm in 12.2 m (1/4” in 40’-0”).

.3 Alignment:

.1 Where surfaces abut in line or are separated by reveal or protruding element up to 12.7 mm (1/2") wide, limit offset from true alignment to 1.6 mm (1/16").

.2 Where surfaces are separated by reveal or protruding element from 12.7 to 25.4 mm (1/2” to 1”) wide, limit offset from true alignment to 3.2 mm (1/8").

.3 Where surfaces are separated by reveal or protruding element of 25.4 mm (1") wide or more, limit offset from true alignment to 6.4 mm (1/4").

.4 Variation from plane: 3.2 mm in 3.6 m (1/8” in 12’-0”); 12.7 mm (1/2") over total length.

.5 Panels:

.1 Bow: 0.2% of panel dimensions up to 3.2 mm (1/8") maximum.

.2 Indicated size:

.1 Up to 1220 mm (48"): plus/minus 0.76 mm (0.030").

.2 1220 mm to 3050 mm (4’-0” to 10’-0”): plus/minus 1.52 mm (0.060").

.6 Square or rectangular: Maximum 3.2 mm (1/8") difference between diagonal measurements.

.7 Variation from indicated position: plus/minus 3 mm (1/8").

.2 Tolerances shall not be cumulative.

PART 3 - EXECUTION

3.1 Installation - General

.1 Verify dimensions of supporting structure by measurement at the *Place of the Work* so that aluminum framed glazing systems will be accurately designed, fabricated and fitted to the structure.

.2 Coordinate with the work of other sections and hand-over items to be placed during the installation of other work at the proper time to avoid delays in the *Work*.

.3 Erect frames complete with necessary reinforcing and incidental components.

.4 Include anchors and fastenings shown, specified, or necessary to anchor work together or to work of separate sections. Supply items and inserts required to be built into other work. Submit instructions for proper location, and verify proper positioning. Survey location of imbeds after initial pour to verify tolerances.

.5 Use anchors that will permit sufficient adjustment for accurate alignment.

.6 Accurately fit and rigidly frame together units where required. Match components carefully to produce continuity of line and design. *Provide* flush hairline joints and weathertight connections.

.7 Ensure adequate clearance and shim space at perimeter of openings.

.8 After welding galvanized steelwork, touch-up weld areas with 2 coats of primer, zinc-rich at galvanized locations.

3.2 Installation Tolerances

.1 Comply with the following maximum tolerances:

.1 Plumb: 3.2 mm in 3 m (1/8” in 10’-0”); 6.35 mm in 12.2 m (1/4” in 40’-0”).

.2 Level: 3.2 mm in 3 m (1/8” in 10’-0”); 6.35 mm in 12.2 m (1/4” in 40’-0”).

.3 Alignment:

.1 Where surfaces abut in line or are separated by reveal or protruding element up to 12.7 mm (1/2") wide, limit offset from true alignment to 1.6 mm (1/16").

.2 Where surfaces are separated by reveal or protruding element from 12.7 to 25.4 mm (1/2” to 1”) wide, limit offset from true alignment to 3.2 mm (1/8").

.3 Where surfaces are separated by reveal or protruding element of 25.4 mm (1") wide or more, limit offset from true alignment to 6.4 mm (1/4").

.4 Variation from plane: 3.2 mm in 3.6 m (1/8” in 12’-0”); 12.7 mm (1/2") over total length.

.5 Square or rectangular: Maximum 3.2 mm (1/8") difference between diagonal measurements.

.6 Variation from indicated position: plus/minus 3 mm (1/8").

.2 Tolerances shall not be cumulative.

3.3 Foamed-in-Place Insulation

.1 Install between aluminum framing and rough openings at exterior walls and where indicated in accordance with CAN/ULC S710.2-11 application standard.

3.4 Isolation

.1 Isolate aluminum or galvanized steel surfaces in contact with cement, concrete, masonry, plaster or dissimilar metals with air/vapour barrier membrane as specified in Section 07 27 00.

3.5 Glass and Glazing

.1 Furnish glass for work of this section to requirements herein and in accordance with Section 08 80 00, and assume total responsibility for sizing, design and other aspects of glass work and accessories.

.2 Wherever practicable, factory install glass associated with doors of this section in accordance with requirements stipulated under Section 08 80 00, except as otherwise indicated herein.

3.6 Sealant - Installation

.1 *Provide* sealants associated with this section, following the requirements of Section 07 92 00. Make entire installation watertight.

3.7 Finishing Hardware - Installation

.1 Install finishing hardware in accordance with Section 08 71 00.

.1 Hinges:

.1 Install hinges spaced accordingly with drawings.

.2 Teleflex installation:

.1 Control locations to be confirmed with Owner on site.

3.8 Field Quality Control – *Subcontractor*

.1 Be responsible for quality control of the work of this section including quality control of sub-*Subcontractors* and material suppliers for work of this section.

.2 Submit written certification by a Professional Engineer registered in *Place of the Work* stating that the glazing systems have been designed in accordance with design and performance requirements specified.

3.9 Field Quality Control – Field Review

.1 Field review programme to include:

.1 Review of exterior sealants etc.

.2 Checks for continuity of insulation plane.

.3 Verification of flashing placement and continuity.

.4 Review of exterior applied sealants and flashings.

.5 Confirmation of fastener size, type, and material

.6 Review of drainage paths to confirm clear.

.7 Verification of glass type and position

3.10 Adjusting and Cleaning

.1 Adjust operating hardware and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

.2 Remove as the work of this section progresses, corrosive and foreign materials which may set or become difficult to remove at time of final cleaning or which may damage members. Inspect as often as required to ensure cleanliness.

.3 Remove non-permanent labels.

.4 Remove dirt and residue from surfaces.

.5 Remove *Products* or materials that have been broken, chipped, cracked, discoloured, abraded, or damaged during construction period and *Provide* undamaged *Products* or materials meeting the requirements of the *Contract Documents*.

.6 Wash exposed surfaces with a cleaning solution approved by *Product* manufacturers.

.7 Glass cleaning shall be carried out to Glass Association of North America (GANA) Glass Informational Bulletin 01-0116 "Proper Procedures for Cleaning Architectural Glass Products" or as recommended by the glass and glazing supplier.

3.11 Protection

.1 At completion of the *Work*, remove protective coatings, clean glass and aluminum and remove surplus compounds and sealant materials. Replace or make good defective, scratched or damaged work.

END OF SECTION

PART 1 - GENERAL

1.1 Summary

.1 Section includes:

.1 Glass and glazing.

1.2 Submittals

.1 Submit required submittals in accordance with Section 01 33 00.

.2 *Product* data sheets:

.1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this section.

.3 Shop drawings:

.1 Show details of each type of glazing system in conjunction with the framing system indicating type of glass, sizes, shapes, glazing material and quantity. Show details indicating glazing material, glazing thickness, bite on the glass and glass edge clearance.

.4 Samples:

.1 Submit 305 mm (12") square samples of each type of glass indicated except for clear monolithic glass products, and 305 mm (12") long samples of each color required, except black, for each type of sealant or gasket exposed to view.

.1 Submit samples for each colour of spandrel panel.

.2 Submit samples of glass showing each type of shape and finish of glass edge for exposed glass edges.

.5 Test and evaluation reports:

.1 Obtain compatibility and adhesion test reports from sealant manufacturer indicating that glazing materials were tested for compatibility and adhesion with glazing sealant as well as other glazing materials including insulating units.

.6 Manufacturer reports:

.1 Submit glass fabricator's product information and structural calculations indicating compliance with glazing standards established by the Glass Association of North America (GANA). Submittal to include thermal stress and structural load analysis of the proposed glass types, configuration and sizes.

.7 Submit sample glazing warranty.

.1 Submit letter from insulating glass unit fabricator that insulating glass units supplied will bear the certification mark of IGMAC or IGCC/IGMA.

1.3 Closeout Submittals

.1 Submit closeout submittals in accordance with Section 01 77 00.

.2 Operation and maintenance data:

.1 Submit maintenance and cleaning instructions for glass and glazing for incorporation into the operating and maintenance manuals.

1.4 Quality Assurance

.1 Qualifications:

.1 Manufacturers: Fabrication processes, including low emissivity and reflective coatings, insulating, laminated, silk-screening and tempering shall be manufactured by a single manufacturer meeting ANSI / ASQC 9002 1994.

.2 Installers / applicators / erectors: *Provide* the work of this section executed by specialist *Subcontractor* who shall be thoroughly trained and experienced in skills required, be completely familiar with referenced standards and requirements of the work of this section, and personally direct installation performed under this section.

.3 Aspects of the work of this section are required to be prepared by a professional engineer. Refer to Section 01 33 00 for specific details and requirements in this regard.

1.5 Delivery, Storage, and Handling

.1 Protect glass from edge damage, dust, and contaminants during handling and storage. For insulating units exposed to substantial altitude changes, comply with insulating glass manufacturers written recommendations for venting and sealing to avoid hermetic seal ruptures.

.2 Storage and protection: Protect glazing materials according to manufacturer’s written requirements and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun or other causes.

1.6 Field Conditions

.1 Ambient Conditions: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by the glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation or other causes.

.2 Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 4.4°C.

1.7 Extended Warranty

.1 Special product warranty for coated-glass products:

.1 Provide written 10 year warranty from date of manufacture for sputter coated glass. Warranty shall cover deterioration due to normal conditions of use and not to handling, installing, and cleaning practices contrary to the glass manufacturer’s published instructions. Warranty shall be manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units.

.2 Special product warranty for laminated glass products:

.1 Provide written 5 year warranty from date of manufacture for laminated glass. Warranty shall cover deterioration due to normal conditions of use and not to handling, installing, and cleaning practices contrary to the glass manufacturer's published instructions. Warranty shall be manufacturer's standard form in which laminated-glass manufacturer agrees to replace laminated-glass units.

.3 Special product warranty for tempered glass products:

.1 Provide a written 5 year warranty from date of manufacture for fully tempered glass. Warrant that tempered glass will not break spontaneously as a result of Nickel Sulfide (NiS) inclusions at a rate exceeding 0.8% (8/1000) for a period of five years from the date of manufacture. Warranty shall be manufacturer's standard form in which tempered-glass manufacturer agrees to replace tempered-glass units.

PART 2- PRODUCTS

2.1 Performance/Design Requirements

.1 General:

.1 Publications: Comply with recommendations in the publications below, except where more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this section.

.1 GANA Glazing Manual.

.2 GANA Engineering Standards Manual.

.3 GANA Laminated Glazing Reference Manual.

.4 GANA Sealant Manual.

.2 Glass strength:

.1 Minimum thickness of annealed or heat-treated glass products to be selected so the worst case probability of failure does not exceed the following:

.1 8 breaks per 1000 for glass installed vertically less than 15 degrees from the vertical plane and under wind action.

.2 1 break per 1000 for glass guards and railings.

.2 Maximum lateral deflection; insulating glass units:

.1 For insulating glass units supported on four edges, limit centre-of-glass deflection at design wind pressure to not more than 1/175 times the long-side length or 19 mm (3/4") maximum.

.2 *Provide* annealed, heat strengthened, and tempered lights where required by the building code, and where required for the various solar exposures on the building.

.3 Glass thicknesses and glass types specified, indicated, or scheduled in the *Contract Documents* are minimums required. Glass designer/engineer to modify as required to satisfy design and building code requirements, and requirements of authorities having jurisdiction, and any such modifications shall be clearly indicated on shop drawings.

.3 Glazing systems shall be capable of withstanding normal thermal movements, without failure, including loss due to defective manufacture, fabrication and installation; deterioration of glazing materials; and other defects in construction.

.4 Protect laminated glass interlayer from damage or discolouration resulting from contact with deleterious and incompatible sealants, substances, and materials. Comply with manufacturer's recommended installation requirements.

2.2 Glass Manufacturers

.1 Subject to compliance with the requirements of the Contract Documents, provide primary glass by one of the following float glass manufacturers:

.1 AGC Glass North America.

.2 Cardinal Glass Industries.

.3 Guardian Industries, LLC.

.4 Pilkington North America.

.5 Vitro Architectural Glass.

2.3 Glass Materials

.1 General:

.1 Single source responsibility: *Provide* materials from a single manufacturer or fabricator for each kind and condition of glass indicated and composed of primary glass obtained from a single source and manufacturing plant for each type and class required.

.2 Insulating glass units:

.1 Warm edge, hermetically sealed, CAN/CGSB 12.8-97 or ASTM E2190-10, minimum 12 mm (1/2") air space, air filled, double sealed edges (primary to be polyisobutylene, secondary to be polysulphide, silicone in the structural silicone glazed units), desiccant filled warm edge spacer (splice connectors at corner of each glass unit).

.1 Warm edge spacer:

.1 Stainless steel: RPM Rollforming 'ST-2000', Allmetal 'SST', Fenzi 'Rolltech Stainless Steel'.

.2 Grey coloured polyisobutylene shall not be acceptable.

.3 Edge delete low 'E' coating down to bare glass in accordance with manufacturer's written requirements. Deletion shall be continuous around the entire periphery of glass edges to minimum deletion width from edge of glass to at least 50% through the primary sealant bead width.

.4 Set spacer bare evenly into glass units to maximum variation of +/- 2.0 mm (0.080")/length of spacer bar. Primary sealant shall not extend past spacer bar greater than 1.5 mm (0.060").

.5 IGMAC or IGCC/IGMA certified, permanently marked either on spacers or on at least one component lite of units with appropriate certification label.

.6 Low 'E' coating (pyrolytic or single silver):

.1 Acceptable *Products*:

.1 Guardian SunGuard SuperNeutral 54.

.3 Heat treated (tempered or heat strengthened) float glass:

.1 CAN/CGSB 12.1-M90.

.2 Minimum thickness: 6 mm (1/4").

.3 Fabrication process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

.4 For uncoated glass, comply with requirements for Condition A in accordance with ASTM C1048-18.

.5 For coated vision glass, comply with requirements for Condition C (other coated glass) in accordance with ASTM C1048-18.

.6 Heat strengthened glass shall have surface compression of 24-52 MPa (3,500-7,500 psi).

.4 Laminated glass:

.1 CAN/CGSB 12.1-M90.

.2 Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written recommendations. Use materials that have a proven record of no tendency to bubble, discolour, or lose physical and mechanical properties after fabrication and installation.

.3 Glass layers minimum 5 mm (0.197") thick unless otherwise indicated.

.4 Interlayer thickness: Provide thickness as needed to comply with requirements and not less than the following:

.1 Vertical glazing: not less than 0.76 mm (0.030") unless otherwise indicated.

.5 Interlayer colour: Clear.

.6 Glass type: annealed or heat strengthened or tempered, as required to suit design requirements.

.7 Laminated glass products to be fabricated free of foreign substances and air or glass pockets in autoclave with heat plus pressure.

.5 Spandrel back coating:

.1 Silicone-coated spandrel glass:

.1 Glass treatment:

.1 Heat strengthened float glass.

.2 Thickness: 6 mm (1/4") minimum thickness.

.3 Coating Location: Second surface.

.4 Fallout Resistance: Passes fallout-resistance test in ASTM C1048-12e1 for an assembly of glass and adhered reinforcing material.

.5 One component, water-based silicone coating supplied as flowable, thixotropic emulsion.

.1 Colour: Custom colour RAL 7037

.6 Acceptable silicone spandrel coating *Product*:

.1 Industrial Control Development Inc 'Opaci-Coat-300'.

2.4 Glazing Materials

.1 Glazing materials; general: Select glazing sealants, gaskets and additional glazing materials of proven compatibility with other materials they will contact, including glass products, seals of insulating glass units and glazing channel substrates, under conditions of installation and service, as demonstrated by testing and field experience.

.2 Glazing gaskets: Moulded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:

.1 Preformed, EPDM to ASTM C864-05(2015).

.2 Preformed, EPDM, silicone compatible, to ASTM C864-05(2015).

.3 Preformed silicone to ASTM C1115-17.

.3 Setting blocks: Moulded or extruded material with Shore, Type A Durometer hardness of 85, plus or minus 5, made from one of the following:

.1 Preformed, EPDM to ASTM C864-05(2015).

.2 Preformed, EPDM, silicone compatible, to ASTM C864-05(2015).

.3 Preformed silicone to ASTM C1115-17.

.4 Spacers: Moulded or extruded blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated made from one of the following:

.1 Preformed, EPDM to ASTM C864-05(2015).

.2 Preformed, EPDM, silicone compatible, to ASTM C864-05(2015).

.3 Preformed silicone to ASTM C1115-17.

.5 Edge blocks: Moulded or extruded material of hardness needed to limit glass lateral movement (side walking) made from one of the following:

.1 Preformed, EPDM to ASTM C864-05(2015).

.2 Preformed, EPDM, silicone compatible, to ASTM C864-05(2015).

.3 Preformed silicone to ASTM C1115-17.

.6 Cleaners, primers and sealers: Type recommended by sealant or gasket manufacturer.

2.5 Fabrication of Glazing Units

.1 Fabricate glazing units in sizes required to fit openings, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

.1 Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

.2 Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

.3 Grind smooth and chamfer, and polish exposed glass edges and corners.

PART 3- EXECUTION

3.1 Examination

.1 Examine framing, glazing channels, and stops, with glazing installer present, for compliance with the following:

.1 Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.

.2 Inspect butt and mitre joints in framing. Seal joints found to be open with a compatible sealant prior to glazing.

.3 Glazing pockets and surfaces are free of dust, construction debris, and contaminants.

.4 Presence and functioning of weep systems.

.5 Minimum required face and edge clearances as per FGIA and GANA standards.

.6 Effective sealing between joints of glass-framing members.

.2 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Preparation

.1 Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

.2 Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

.3 Clean contact surfaces with solvent and apply primers to surfaces to receive tapes and sealants in accordance with the manufacturer's requirements. Ensure surfaces are free of moisture and frost.

3.3 Glazing - General

.1 Comply with combined written requirements of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

.2 Adjust glazing channel dimensions as required by conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

.3 Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

.4 Clean glazing rebate surfaces of traces of dirt, dust, or other contaminants.

.5 Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

.6 Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

.7 Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

.8 Provide spacers for glass lites where length plus width is greater than 1270 mm (50").

.1 Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.

.2 Provide 3.2 mm (1/8") minimum bite of spacers on glass and use thickness equal to sealant width.

.9 Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel.

.10 Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

.11 Set glass lites with proper orientation so that coatings face exterior or interior as specified.

.12 Glaze hollow metal doors and frames specified under work of Section 08 11 13 using tape glazing installation.

.13 Install fire rated glazing in accordance with fire rated glazing *Product* manufacturer's written requirements and with current fire-resistance listing for each *Product*. Field cutting or tampering is not permissible.

3.4 Tape Glazing

.1 Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

.2 Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

.3 Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

.4 Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

.5 Do not remove release paper from tape until right before each glazing unit is installed.

.6 Centre glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centres of openings.

3.5 Gasket Glazing (Dry)

.1 Allow gaskets to relax and cut compression gaskets to lengths recommended by gasket manufacturer to fit openings to suit frame dimensions.

.2 Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

.3 Installation with drive-in wedge gaskets: Centre glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centres of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

.4 Installation with Pressure-Glazing Stops: Centre glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

.5 Install gaskets so they protrude past face of glazing stops.

3.6 Sealant Glazing (Wet)

.1 Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

.2 Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

.3 Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 Adjusting and Cleaning

.1 Immediately remove sealant and compound droppings from finished surfaces. Remove labels after work is completed.

.2 Final cleaning of glass in accordance with Section 01 77 00.

END OF SECTION

PART 1 - GENERAL

1.1 Summary

.1 Section includes:

.1 Metal support systems for interior gypsum board partitions and interior assemblies.

1.2 Submittals

.1 Submit required submittals in accordance with Section 01 33 00.

.2 *Product* data sheets:

.1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the *Work* of this section, including additional data as may be required to demonstrate compliance with the *Contract Documents*.

.3 Test and evaluation reports:

.1 Submit certified test results for each required fire resistance rated assembly for work of this section.

1.3 Quality Assurance

.1 Qualifications:

.1 Installers / applicators / erectors:

.1 *Provide* work of this section, executed by a *Subcontractor* in application of *Products*, systems and assemblies specified and with approval and training of *Product* manufacturers.

PART 2- PRODUCTS

2.1 Performance/Design Requirements - Fire Resistance Rated Assemblies

.1 Where gypsum board systems with fire resistance ratings are indicated or required, provide materials and installations that are identical with those of applicable assemblies tested by fire testing laboratories acceptable to authorities having jurisdiction.

2.2 Materials - General

.1 For sheet metal *Products*: Sheet metal thickness indicated herein pertains to the "minimum base steel thickness exclusive of coating".

.2 Protective coatings for metal supports and framing:

.1 Minimum corrosion protection: Z120 (G40) ASTM A653/A653M-13.

.3 Sheet metal screws shall have a minimum coating thickness of 0.008 mm (0.0003") of zinc. Other coatings providing equal or better corrosion protection may be used, subject to acceptance of *Consultant*.

.4 Screws:

.1 Steel screws shall be equal to or exceed minimum diameter indicated on shop drawings.

.2 Penetration beyond joined materials shall be not less than 3 exposed threads.

.3 Thread types and drilling capability shall conform to manufacturer's recommendations.

2.3 Partition Support Materials

.1 Interior non-loadbearing channel stud framing: to ASTM C645-18; roll formed from 0.455 mm (0.0179”) minimum thickness unless otherwise indicated or as recommended by gypsum board manufacturer, galvanized steel sheet. Provide service holes starting at 450 mm (18") from bottom, then 914 mm (36") on centre to top of studs.

.1 Steel studs at abuse resistant gypsum board locations: 0.836 mm (0.0329”) minimum thickness.

.2 Steel studs at tile backer board locations: 0.836 mm (0.0329”) minimum locations.

2.4 Furring

.1 Furring channels: 0.455 mm (0.0179”) minimum typical thickness, cold rolled steel, wiped coated, nominal size of 22 mm (7/8") depth x 35 mm (1-3/8") face, hat type with knurled face.

2.5 Accessories

.1 Backer plates:

.1 Plywood backer plates: Softwood plywood; 19 mm (3/4") minimum x length and width to suit size of items to be attached; fastened to studs for attachment of surface mounted fittings and accessories.

.2 Elimination of backer plates or direct attachment of accessories or equipment to studs will not be permitted.

PART 3- EXECUTION

3.1 Installation General

.1 Comply with ASTM C754-20 and manufacturer's requirements, except as modified herein. Do not bridge building expansion joints with support system. Frame both sides of joints with furring and other supports as indicated.

.2 Provide and install studs, framing, shimming, and furring to provide proper support for gypsum board to achieve the following installation tolerances:

.1 Do not exceed 3 mm (1/8") in 3 m (10’) variation from plumb, level, and plane.

.2 Do not exceed 10 mm (3/8”) from drawings locations.

.3 Do not exceed 1.5 mm (1/16”) variation between planes of abutting edges or ends.

.4 Install each framing member so fastening surfaces vary not more than 3.2 mm (1/8") from the plane formed by faces of adjacent framing.

.5 In double stud walls, do not bridge across studs on opposite sides of wall with gypsum board or metal cross bracing.

.3 Give complete cooperation and direction to trades erecting framing and furring over which this work is applied. Coordinate finished joint location with framing.

.4 Coordinate installation and cooperate with mechanical and electrical work to accommodate mechanical electrical items and any other work required to be incorporated into or coordinated with the partitions, ceiling and soffit systems.

.1 Where the presence of suspended ductwork or other mechanical or electrical services or devices above ceiling framing conflicts with ceiling framing suspension points from structure above, provide bridging framing below conflicting work as required to support ceiling framing on specified intervals.

.2 Do not suspend ceiling framing from mechanical or electrical suspension systems unless agreement is obtained in writing from engineer for *Subcontractor* installing such framing that additional imposed loads are acceptable; obtain *Consultant's* acceptance before proceeding.

.5 Provide clearances between work of this section and structural elements to prevent transference of structural loads.

.6 Do not bridge building expansion joints with steel framing or furring members. Independently frame both sides of joints with framing of furring members or as indicated.

.7 Size framing systems according to manufacturer’s engineered load tables, to meet allowable deflection without permanent deformation.

.1 Maximum allowable deflection: L/240.

3.2 Blocking

.1 Attach to framing adequate backer plates to support the load of, and to withstand the withdrawal and shear forces imposed by, items installed upon the work of this section.

.2 Such items include, but are not restricted to:

.1 Coat hooks.

.2 Washroom accessories.

.3 Future application of grab bars.

.4 Cabinetry.

.5 Shelving.

.6 Glazing accessories.

.7 Items as indicated.

3.3 Furring - General

.1 Furring indicated in *Contract Documents* is schematic. Do not regard as exact or complete. *Provide* all necessary framing and furring to support gypsum board in accordance with manufacturers' specifications.

.2 Shim furring as required to achieve required installation tolerances.

.3 Leave finished work rigid, secure, square, level, plumb, curved to detailed radius and erected to maintain finish gypsum board line dimensions and contours. Make allowance for thermal movement.

.4 Thermally separate metal studs from exterior concrete or masonry.

3.4 Metal Stud Partition Framing

.1 Provide partition tracks (runners) at floor and underside of structural assembly and as follows:

.1 Align accurately and lay out according to partition layout.

.2 Secure runners to concrete, access flooring and to concrete slabs, as applicable, with screwed or shot fasteners located 50 mm (2") from each end and spaced at maximum 610 mm (24") on centre.

.3 At partition corners, extend one runner to end of corner and butt other runner to it, allowing necessary clearance for gypsum board thickness. Runners should not be mitred.

.2 Unless otherwise indicated, place interior studs vertically at centres as follows:

.1 *Provide* studs at 400 mm (16") on centre, and as specially spaced in accordance with details indicated.

.2 *Provide* studs not more than 50 mm (2") from abutting walls, openings and each side of corners.

.3 *Provide* freedom for 19 mm (3/4") deflection under beams, structural slabs and the like to avoid transmission of structural loads to studs, or install 50 mm (2") leg ceiling tracks.

.3 Install studs in tracks at floor and ceiling.

.4 Where horizontal runs of service lines are scheduled to be installed, arrange with applicable trades and install studs simultaneously with services.

.5 At openings in stud walls, erect track at head and sills to accommodate intermediate studs. At each end of track, cut out flanges, turn up web, and fasten to studs. Install intermediate studs above and below openings in same manner and spacing as wall studs. Install double studs at each jamb, and double tracks at head of door openings.

.6 At partitions requiring fire rating, erect in accordance with requirements of listing.

.7 Size studs, connections, and runners to carry loads according to stud manufacturer's load tables, at 24 kg/m^2 (5 lb/ft^2) live load to meet maximum allowable deflection limits. Where depth of stud is indicated, size metal thickness to meet allowable deflection limits.

.8 *Provide* three studs at corner and intermediate intersections of partitions.

.9 Coordinate work with others installing horizontal runs of service lines so that work is done simultaneously. Where standard holes are too small for installed services, notch studs, and splice notched flanges with splice pieces 305 mm (12") longer than notches, each fastened with 2 screws.

.10 Coordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.

.11 Coordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other sections.

.12 Unless otherwise indicated, partitions, together with gypsum board facings, shall extend above ceilings to underside of structure above.

.13 Chase walls:

.1 *Provide* chase walls consisting of two parallel steel stud partitions.

.2 *Provide* cross bracing consisting of metal furring, located at quarter points on each pair of studs. Attach cross bracing to studs with metal screws.

.14 Install steel stud reinforcement 1.720 mm (0.0677”) at door frames and brace above ceiling. Secure to top and bottom structure with angle brackets and anchors.

.15 Where ductwork passes through a fire rated wall, *Subcontractor* is to coordinate with the mechanical *Subcontractor* to obtain from the fire damper manufacturer’s technical data on how the wall is to be assembled to meet the fire rating requirements that the manufacturer has tested for their damper. *Subcontractor* is not to board up this wall on both sides until *Consultant* has reviewed location and approved this installation.

3.5 Control Joints

.1 Control joints: in accordance with Section 09 29 00.

END OF SECTION

PART 1 - GENERAL

1.1 Summary

.1 Section includes:

.1 Plain gypsum board.

.2 Fire-rated gypsum board.

.3 Gypsum board accessories and miscellaneous related materials.

1.2 Submittals

.1 Submit required submittals in accordance with Section 01 33 00.

.2 *Product* data sheets:

.1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this section.

.3 Fire-rated assembly listings and STC assembly ratings:

.1 Submit fire-rated assembly listings for each required fire resistance rated assembly for work of this section.

.2 Submit STC assembly ratings for each required STC rated assembly for work of this section.

1.3 Quality Assurance

.1 Qualifications:

.1 Subcontractor executing the work of this section shall have experience in successful installation of work of type and quality indicated and specified.

1.4 Delivery, Storage, and Handling

.1 Store materials in protected dry areas. Store gypsum board flat in piles with edges protected.

.2 Ensure that finish metal members are not bent, dented, or otherwise deformed.

.3 Deliver *Products* supplied under the work of this section only to those who are responsible for installation, to the place they direct, and to meet installation schedules.

.4 Package fire rated materials with labels attached.

1.5 Field Conditions

.1 Comply with requirements of referenced gypsum board application standards and recommendations of gypsum board manufacturer, for environmental conditions before, during and after application of gypsum boards.

.2 When ambient outdoor temperatures are below 12°C (55°F) maintain continuous, uniform comfortable building working temperatures of not less than 12°C (55°F) for a minimum period of 48 hours before, during and following application of gypsum board and joint treatment materials or bonding of adhesives.

.3 Ventilate building spaces as required to remove water in excess of that required for drying of joint treatment material immediately after its application. Avoid drafts during dry, hot weather to prevent too rapid drying.

.4 Protection:

.1 *Provide* adequate protection of materials and work of this section from damage by weather and other causes. Protect work of other trades from damage resulting from work of this section. Make good such damage at no additional cost to the *Owner*.

.2 Exterior sheathing board's exposure to weather: Comply with manufacturer's written requirements. Provide protection prior to exposure for periods greater than manufacturer's recommendations and warranty.

PART 2 - PRODUCTS

2.1 Performance/Design Requirements

.1 Fire resistance rating:

.1 Where gypsum board systems with fire resistance ratings are indicated or required, provide materials and installations that are identical with those of applicable assemblies tested by fire testing laboratories acceptable to authorities having jurisdiction.

2.2 General

.1 Single source responsibility: Obtain gypsum board products from a single manufacturer, or from manufacturers recommended by the prime manufacturer of gypsum boards.

2.3 Gypsum Board Panels

.1 Plain gypsum board:

.1 Paper faced gypsum core panel solid set core enclosed in paper, 12.7 mm (1/2") or 16 mm (5/8") thick unless otherwise indicated, 1220 mm (48") wide x maximum practical length, ends square cut, tapered edges, to ASTM C1396/C1396M-14.

.2 Acceptable *Products*:

.1 CertainTeed 'Regular Gypsum Board'.

.2 CGC 'Sheetrock Brand Gypsum Panel'.

.3 Georgia-Pacific 'ToughRock Gypsum Board'.

.4 Continental Building Products 'Regular Drywall'.

.5 National Gypsum 'Gold Bond Gypsum Board'.

.2 Fire-rated gypsum board:

.1 Paper faced gypsum core panel with a specially formulated core for use in fire-resistive Type X or Type C designs, to ASTM C1396/C1396M-14.

.2 Acceptable *Products*:

.1 CertainTeed 'Type X and Type C'.

.2 CGC 'SHEETROCK Brand Firecode X and Firecode C'.

.3 Georgia-Pacific ‘ToughRock Fireguard X Gypsum Board and ToughRock Fireguard C Gypsum Board’.

.4 Continental Building Products ‘Type C and Type X.

.5 National Gypsum ‘Gold Bond Brand Fire-Shield Gypsum Board and Gold Bond Fire Shield C Gypsum Board’.

.6 PABCO Gypsum ‘QuietRock ES’.

2.4 Attachment Materials

.1 Screws; for gypsum board: bugle head, fine thread, self-tapping, Type W or S or S-12 point to suit framing type and metal gauge, with corrosion resistant finish to ASTM C1002-07/ASTM C954-11. Screw sizing:

.1 #6 x 25 mm (1") for single thickness board fastening.

.2 #6 x 32 mm (1-1/4") for single thickness 15.9 mm (5/8") board fastening.

.3 #7 x 41 mm (1 5/8") for double thickness board fastening.

.2 Tie wire: 1.6 mm (0.063") diameter galvanized soft annealed steel wire.

2.5 Accessories

.1 Accessories: to ASTM C1047-14a unless otherwise indicated, maximum length pieces per location. Flanges shall be free from dirt, grease, or other material that adversely affects the bond of joint treatment or decoration.

.2 Casing trim; “L” or “LC” beads: Fillable edge trim, 0.55 mm (0.022") base thickness commercial grade sheet steel with zinc wiped coating to ASTM A653/A653M-13; perforated flanges.

.1 Acceptable *Products*:

.1 Bailey ‘D200’ and ‘4411’.

2.6 Miscellaneous Materials

.1 Building paper: No. 15 asphalt impregnated building paper.

.2 Neoprene foam; thermal separator: soft white neoprene foam tape, self-adhesive, 3 mm (1/8") thick (uncompressed).

2.7 Related Support Assemblies and Backer Plates

.1 Metal support systems and backer plates at interior assemblies: in accordance with Section 09 22 00.

2.8 Joint Treatment Materials

.1 General: Comply with ASTM C475/C475M-17.

.2 Joint tape:

.1 Interior paper faced gypsum boards: Paper.

.3 Joint compound for interior gypsum board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

.1 Prefilling: Use setting-type compound as recommended by panel board manufacturer.

.2 Embedding and first coat: Use setting-type or taping compound as recommended by panel board and trim accessory manufacturers.

.3 Fill and finish coats: Use sanding type setting-type or taping compound as recommended by panel board manufacturer.

.4 Skim coat: For final coat of Level 5 finish, use one of the following:

.1 Setting-type, sandable topping compound.

.2 Drying-type, all-purpose compound.

.3 High-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.

.5 Joint compound for exterior applications:

2.9 Acoustic Wall Assembly Materials

.1 Acoustic sealant; concealed locations: to meet standards as listed in ASTM C919-12(2017):

.1 Acceptable *Products*:

.1 DAP ‘Mono Acoustic Sealant’.

.2 DowSil ‘758 Silicone Weather Barrier Sealant’.

.3 Owens Corning ‘QuietZone Acoustic Sealant’.

.4 Pecora ‘BA98’.

.5 Pecora ‘AC20’.

.6 Quiet Solution ‘QuietSeal’.

.7 Tremco ‘Acoustical/Curtainwall Sealant’.

.8 Tremco ‘Tremflex 834’.

.9 Hilti Canada Corp ‘CP 506’.

.2 Acoustic sealant; exposed locations, acrylic:

.1 Acrylic/latex acoustic sealant, Type S, Grade NS, Class 12.5 to ASTM C919-12(2017), maximum VOC content 33 g/L per EPA Method 310, non-hardening or ASTM C834-10.

.2 For exposed sealants use paintable sealant products, do use non-skinning type products where they are exposed to view or where sealant products may deteriorate (stain or bleed into) into painted surfaces.

.3 Acceptable *Products*:

.1 BASF ‘MasterSeal NP 520’.

.2 Owens Corning ‘QuietZone Acoustic Sealant’.

.3 Pecora ‘AC20’.

.4 Tremco ‘Tremflex 834’.

.3 Smoke and acoustic sealant; concealed and exposed locations, non-fire-rated acoustic assemblies:

.1 Acrylic smoke and acoustic sealant, to ASTM C834-10 maximum VOC content 60 g/L, paintable, Flame Spread Value of maximum 25 to CAN/ULC S102.

.2 Sealant shall not deteriorate (stain or bleed into) painted surfaces.

.3 Acceptable *Products*:

.1 Hilti Canada Corp 'CP 506'.

.4 Acoustic sealant for plenum locations: Smoke-seal sealant with flame-spread not more than 25 and smoke developed classification not more than 50 to CAN/ULC-S102-10, in accordance with Section 07 84 00.

.5 Acoustic compound: premixed perlite plaster.

.6 Acoustic (sound attenuation) insulation:

.1 Mineral-fibre sound attenuation batts: to CAN/ULC S702-09, Type 1, fire resistant and non-combustible to CAN/ULC-S114-05, high density for sag-free, tight fitting installation.

.1 Density: minimum 40 kg/m^3 (2.5 lbs/ft^3).

.2 Acceptable *Products*:

.1 Johns Manville 'MinWool Sound Attenuation Fire Batts'.

.2 Owens-Corning 'SAFB'.

.3 Rockwool 'AFB'.

.2 Fasteners: use mechanical fasteners where required to secure insulation into position in accordance with insulation manufacturer.

PART 3 - EXECUTION

3.1 Installation

.1 General: Comply with ASTM C840-13, GA 216-13, GA 600-12, and manufacturer's requirements, except as otherwise indicated. Do not bridge building expansion joints with support system. Frame both sides of joints with furring and other supports as indicated.

.2 Install exposed gypsum board with face side out. Do not install imperfect, damaged or damp boards. Butt boards together for a light contact at edges and ends with not more than 1.6 mm (1/16") open space between boards. Do not force into place.

.3 Cover both faces of stud partition framing with gypsum board in concealed spaces (above ceiling, and the like) unless otherwise indicated, except in chase walls which are properly braced internally.

.4 Attach gypsum board to supplementary framing and blocking provided for additional support at openings and cut-outs.

.5 Apply components of fire-rated assemblies in conformance with indicated designs.

.6 Do not apply gypsum board in close proximity to hot pipes or heating ducts.

.7 Install materials with the minimum number of joints. Tightly butt joints, without force, and neatly align them.

.8 Frame openings on every side. Provide clearances with services.

.9 Work shall include bulkheads over doors, frames, screens, and changes in ceiling levels, pipe space and as indicated.

.10 Provide clearances between work of this section and structural elements to prevent transference of structural loads in accordance with Section 09 22 00.

.11 Tolerances:

.1 Do not exceed 3 mm (1/8") in 3 m (10') variation from plumb, level, and plane in exposed surfaces, except at end joint between gypsum board panels.

.2 Do not exceed 10 mm (3/8") from indicated location.

.3 Do not exceed 1.5 mm (1/16") variation between planes of abutting edges or ends.

.4 Surface flatness shall not exceed 1.5 mm (1/16") within 305 mm (12") straight edge. For non-tapered-edge end joints between boards, measure flatness tolerance with end of straight end at centreline of joint.

3.2 Accessories

.1 At external corners install corner trim secured to framing at 230 mm (9-1/16") on centre on both flanges with screw fasteners or clinch tool.

.2 Secure casing trim at board edges where exposed to view, where board butts against other materials with no trim to conceal junction, at perimeter of ceiling surfaces at tops of partitions where they stop against continuous ceiling surfaces, and where indicated.

.3 Erect accessories straight, plumb or level, rigid and at proper plane.

.4 Use full length pieces.

.5 Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners, free from rough edges. Secure in accordance with manufacturer's specifications unless otherwise required.

.6 Installation tolerances:

.1 Alignment with board panels shall not exceed tolerances specified above.

.2 End joints shall be flush aligned to maximum offset of 0.5 mm (0.020").

3.3 Board Application - General

.1 Before application of gypsum board commences, ensure that internal services have been installed, tested, and approved; that conduits, pipes, cables, and outlets are plugged, capped, or covered; and that fastenings and supports installed by others are in place.

.2 Extend board into door, window, and other openings, reveals, behind fitments, and other applied items and on metal stud partitions to structure above unless indicated otherwise.

.3 Apply board with long dimension perpendicular to supports, unless otherwise indicated.

.4 Locate joints on opposite sides of partitions on different studs, and at least 305 mm (12") from opening jambs.

.5 Install board to minimize joints, and align end joints to be the least objectionable (where they are unavoidable), according to the indicated lighting design. Locate joints in ceilings where least prominently discerned, and never line them up with opening edges.

.6 Form smooth joints at ends and at field cut edges of board panels.

.7 Fasten board to metal support members by metal gypsum board screws, 9.5 mm (0.374") minimum to, and 12.7 mm (1/2") maximum from, center of joints. Space screws:

.1 At fire rated board as per fire-rated assembly.

.2 At typical board walls at 400 mm (16") on centre at edges and field unless otherwise required.

.3 At typical board ceilings at 305 mm (12") on centre at edges and field unless otherwise required.

.8 Offset gypsum board joints 150 mm (6") minimum from corners of openings.

.9 Gypsum panel product joints shall be located so that no joint will align with the edge of an opening unless control joints are to be installed at these locations.

3.4 Acoustic Wall Assemblies

.1 Acoustical sealant and plaster:

.1 Apply acoustical sealant to seal gaps in accordance with ASTM C919-12(2017) and in accordance with the STC rated assembly.

.2 Apply single bead or double, one for each base and face layer of gypsum board as applicable to STC rated assembly, of acoustic sealant to seal both sides of partition assembly between gypsum board and adjacent floor, wall, and ceiling assembly of partitions which contain sound attenuation insulation, and where noted.

.3 Apply bead of acoustic sealant to seal both sides of partition assembly at top and bottom of control joints.

.4 Apply bead of acoustic sealant to seal intersections with sound-isolating partitions that are extended to reduce sound flanking paths.

.5 Apply bead of acoustic sealant to seal joint between penetrations and gypsum board.

.6 Completely seal objects at wall and gypsum board penetrations (such as electrical boxes, piping, and fasteners) with heavy coating of premixed perlite plaster.

.7 Apply sealant to clean, dry surfaces.

.8 Apply sealant to close voids; no leaks around track and gypsum board.

.2 Sound attenuation insulation:

.1 Install sound attenuation insulation to fill cavity unless otherwise indicated.

.2 Trim insulation to provide close-fit contact to framing assemblies and fill the partition cavity or acoustic insulation assemblies to thicknesses specified or indicated.

.3 Maintain air space between backs of sound attenuation insulation and back of opposite partition face layer, as applicable.

.4 Cut insulation to provide close-fit contact around electrical boxes, pipes, and other obstructions and penetrations through and within acoustic assemblies.

.5 Extend acoustic partition assemblies to underside of structure. Incorporate approved provision to prevent transmittance of structural deflection to partition assembly.

.6 Staple sound attenuation insulation where required by manufacturer's installation requirements.

.7 Where studs are not faced with gypsum board on both sides, mechanically fasten wire mesh to non-faced side of stud to retain insulation.

.8 Mechanically attach sound attenuation insulation in wall assemblies where cavity of wall assembly is greater than 150 mm (6").

.9 Secure insulation in such a manner that it will not sag or settle away from required locations.

.3 Sound flanking paths:

.1 Where sound rated partition walls intersect non rated gypsum board partition walls, extend sound rated construction to completely close sound flanking paths through non rated construction.

.2 Seal joints between face layers at vertical interior angles of intersecting partitions.

3.5 Finishing

.1 Provide levels of gypsum board finish for locations as follows, in accordance with GA-214.

.1 Level 1: Ceiling plenum areas and concealed areas, except provide higher level of finish as required to comply with fire resistance ratings and acoustical ratings.

.2 Level 2: Gypsum board substrate at applied hard surfaces, except remove tool marks and ridges.

.3 Level 4: Exposed gypsum board surfaces, except where another finish level is indicated.

.4 Level 5: Exposed gypsum board surfaces where indicated.

.2 Interior gypsum board:

.1 Prefill:

.1 Use setting-type joint compound. Mix joint compound according to manufacturer's directions.

.2 Fill joints between boards flush to top of eased or beveled edge.

.3 Fill joints of gypsum board above suspended ceilings in fire rated partitions.

.4 Wipe off excess compound and allow compound to harden.

.5 Joint gaps not greater than 3.2 mm (1/8") shall be prefilled with either ready-mix or setting type joint compound; joint gaps greater than 3.2 mm (1/8") shall be prefilled with setting-type joint compound.

.2 Taping (Level 1):

.1 Butter taping compound into inside corners and joints.

.2 Center tape over joints and press down into fresh compound.

.3 Remove excess compound.

.4 Tape joints of gypsum board above suspended ceilings.

.3 First coat (Level 2):

.1 Use taping or all-purpose drying-type compound.

.2 Immediately after bedding tape, apply skim coat of compound and allow to dry completely in accordance with manufacturer's requirements.

.3 Apply first coat of compound over flanges of trim and accessories, and over exposed fastener heads and finish level with board surface.

.4 Fastener heads and accessories shall be covered with 1 coat of joint compound.

.4 Second coat (Level 3): After first coat treatment is dried, apply second coat of compound over tape and trim, feathering compound 50 mm (2") beyond edge of first coat.

.1 Fastener heads and accessories shall be covered with total of 2 separate coats of joint compound.

.5 Third coat (Level 4):

.1 After second coat has dried, sand surface lightly and apply thin finish coat to joints, fasteners and trim, feathering compound 50 mm (2") beyond edge of second coat.

.2 Allow third coat to dry. Apply additional compound, and touch-up and sand, to provide surface free of visual defects, tool marks, and ridges, and ready for application of finish.

.3 Finished joints will be accepted with a camber not greater than 1 mm (1/32") and shall be seamless, plumb, true and flush and with square, neat corners.

.4 Fastener heads and accessories shall be covered with total of 3 separate coats of joint compound.

.5 Where new partitions align with existing gypsum board, apply required amount of skim coats to make transition inconspicuous from a distance of 914 mm (36”).

.6 Completed installation at interface between new and existing construction shall provide an inconspicuous joint.

.6 Skim coat (Level 5):

.1 After the fourth coat has dried, apply skim coat of topping or all-purpose drying-type compound over exposed surfaces of gypsum board.

.2 After skim coat has dried, touch-up and sand to provide surface free of visual defects, tool marks, and ridges, and ready for application of finish.

.3 Apply high build skim coat in accordance with manufacturer’s written requirements.

.3 Joint compound:

.1 Apply finish coat of compound feathering 75 to 100 mm (3” to 4”) beyond tape edges.

.2 Feather coats onto adjoining surfaces so that camber is maximum 0.79 mm (1/32”).

.4 Trim:

.1 Use same fasteners to anchor trim accessory flanges as required to fasten gypsum board to supports, unless otherwise recommended by trim manufacturer.

.2 Install metal corner beads at external corners.

.3 Install metal casing bead trim whenever edge of gypsum base would otherwise be exposed or semi exposed, and where gypsum base terminates against dissimilar material.

.4 Erect beads plumb or level, with minimum joints.

.5 Control joints:

.1 Provide control joints set in board facing. Support control joints with studs or furring channels on both sides of joint.

.2 Provide control joints in required locations; including interior gypsum board,.

.1 Review control joint locations with *Consultant* prior to installation.

.3 Install control joints where a partition, wall, or ceiling traverses a construction joint (expansion, seismic or building control element) in the building structure.

.4 Install control joints where a wall or partition runs in an uninterrupted straight plane exceeding 9100 mm (30 linear feet).

.5 Install control joints in interior ceilings:

.1 With perimeter relief:

.1 Linear dimensions between control joints shall not exceed 15000 mm (50 ft) and total area between control joints shall not exceed 230 m² (2500 ft²).

.2 Without perimeter relief:

.1 Linear dimensions between control joints shall not exceed 9100 mm (30 ft) and total area between control joints shall not exceed 84 m² (900 ft²).

.6 Install control joints where ceiling framing members change direction.

.7 Where a control joint occurs in an acoustical or fire-rated system, blocking shall be provided behind the control joint by using a backing material such as 16 mm (5/8") type X gypsum panel products, mineral fibre, or other tested equivalent. Construct through-wall control joints at fire-rated assemblies in accordance with assembly listing requirements.

.8 Line up control joints with joints in other construction or with centre lines of mullions, columns, piers, or similar building elements, where accepted by *Consultant*.

.9 Install control joints straight and true.

.10 Ceiling height door frames may be used as control joints. Less than ceiling height frames shall have control joints extending to the ceiling from both corners. If control joints are not used, additional reinforcement is required at corners to distribute concentrated stresses.

.11 Board joints shall be located so that no joint will align with the edge of an opening unless control joints are to be installed at these locations.

3.6 Fire Separations

.1 Install fire-rated assemblies in accordance with assembly listing requirements in order to obtain fire ratings indicated and as required by authorities having jurisdiction.

.2 Vertical bulkheads in ceiling spaces over fire rated partitions, doors and the like shall have same fire rating as the partition over which they occur. Such bulkheads shall be of gypsum board construction unless otherwise indicated.

.3 Use fire rated gypsum wallboard as specified.

.4 Where lighting fixtures, diffusers, and the like are recessed into fire rated ceilings or bulkheads, provide enclosure to maintain required fire rating. Form removable panel to give access to fixture outlet box.

.5 Where fire hose cabinets or other fixtures or equipment are recessed in fire rated walls or partitions, provide gypsum board enclosure or backing to maintain required fire rating, unless otherwise detailed.

3.7 Adjusting and Cleaning

.1 Clean up and remove surplus materials and rubbish resulting from the work of this section upon completion.

.2 Clean off beads, casings, joint compound droppings and the like, leave the work of this section ready for painting trades.

END OF SECTION

PART 1 - GENERAL

1.1 Summary

.1 Section includes:

.1 Acoustical tile ceiling systems.

1.2 Administrative Requirements

.1 Coordination:

.1 Cooperate with mechanical and electrical *Subcontractors*.

.2 Coordinate layout and installation of acoustic ceiling units and suspension systems components with other work supported by or penetrating through ceilings, including light fixtures, HVAC equipment, partition system, fire suppression system components and other work required to be incorporated in or coordinated with the ceiling system.

.2 Conduct a pre-installation meeting in accordance with Section 01 31 19.

1.3 Submittals

.1 Submit required submittals in accordance with Section 01 33 00.

.2 *Product* data sheets:

.1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this section.

.3 Shop drawings:

.1 Submit manufacturer's standard details.

.2 Indicate lay-out, insert and hanger spacing and fastening details, splicing method for main and cross runners, location of access splines, and acoustical unit support at ceiling fixture.

.3 Submit reflected ceiling plans for special grid patterns as indicated.

.4 Samples:

.1 Submit sample of each component of ceiling system. Samples shall fully represent materials to be supplied in colour, texture, finish and construction.

.2 Submit samples, load test data and design tables for each type of insert to be used in the *Work* for hanger supports.

.5 Certificates:

.1 Submit certificate of compliance stating that the suspension system provided, including materials and installation, comply with the requirements of the *Contract Documents*.

1.4 Closeout Submittals

.1 Submit closeout submittals in accordance with Section 01 77 00.

.2 Maintenance data:

.1 Submit maintenance and cleaning instructions for acoustical ceiling systems for incorporation into the maintenance manuals.

.3 Maintenance materials:

.1 Deliver for maintenance use, 2% of each type and colour of suspension components and acoustical tiles used in the *Work*.

.2 Pack panels in suitable containers, clearly dated and identified as to type and location of installation in the *Work*, and store where directed by *Owner*.

1.5 Quality Assurance

.1 Qualifications:

.1 Installers / applicators / erectors:

.1 *Provide* work of this section, executed by competent installers with successful experience in application of *Products*, systems and assemblies specified and with approval and training of *Product* manufacturers.

.2 Aspects of the work of this section are required to be prepared by a professional engineer. Refer to Section 01 33 00 for specific details and requirements in this regard.

1.6 Delivery, Storage, and Handling

.1 Ship exposed members and mouldings in rigid crates to avoid damage. Bent or deformed material shall be rejected. Baked enamelled members shall be suitably wrapped and protected against damage.

.2 Deliver acoustical ceiling units to the *Place of the Work* in original, unopened packages and store in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

.3 Before installing acoustical ceiling units, permit them to reach room temperature and stabilized moisture content.

.4 Handle acoustical ceiling units carefully to avoid chipping edges or damaging units.

1.7 Field Conditions

.1 Commence installation after building is enclosed with windows and exterior doors in place and glazed, and roof watertight.

.2 Interior temperature of building to range from 15°C to 30°C and relative humidity of not more than 70% before and during installation. Maintain uniform temperatures for 72 hours prior to commencement of the work of this section and maintain temperature until completion of the work of this section.

1.8 Extended Warranty

.1 Warrant work of this section in accordance with Section 01 78 36 for a period of 2 years. In addition provide:

PART 2- PRODUCTS

2.1 Performance/Design Requirements

.1 Contractors (AWCC), 2012 Wall and Ceiling Specifications Standard Manual.

.2 Design suspension systems for a maximum mid-span deflection not exceeding L/360 in accordance with ASTM C635/C635M-17 deflection test.

.3 Design suspension system to support safely, and without distortion, the superimposed loads of:

.1 Air supply diffusers and return grilles.

.2 Lighting fixtures.

2.2 General

.1 Single source responsibility: Obtain each type of acoustical ceiling unit and suspension system from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the *Work*. Products installed as part of the work of this section shall be from same production run.

2.3 Acoustical Tiles

.1 Lay-in acoustical tiles (C1):

.1 Colour: White.

.2 24” x 48” x 5/8”.

.3 CAC: 35.

.4 NRC: Minimum 0.50.

.5 Grid: 15/16”, White colour.

.6 Acceptable *Products*:

.1 Armstrong ‘Dune’

.2 CertainTeed ‘Sand Micro’

.3 CGC ‘Olympus Micro’

.2 Lay-in acoustical tiles (C2):

.1 Colour: White.

.2 24” x 48” x 5/8”.

.3 CAC: 35.

.4 NRC: Minimum 0.50.

.5 Grid: 15/16”, White colour.

.6 Acceptable *Products*:

.1 Armstrong ‘Cortege 823’

.2 CertainTeed ‘Baroque’

.3 CGC ‘Radar’

2.4 Suspension Systems

.1 Hanger anchorage devices: Screws, clips, bolts, concrete inserts or other devices applicable to the indicated method of structural anchorage for ceiling hangers and whose suitability for use intended has been proven through standard construction practices or by certified test data. Size devices for 3 x calculated load supported except size direct pull-out concrete inserts for 5 x calculated loads.

.2 Concrete hanger anchors; post installed: Steel eye bolts and nuts to suit ceiling hangers with capability to sustain, without failure, a load equal to 4 times that imposed by ceiling construction, as determined by testing per ASTM E488/E488M-18, conducted by a qualified independent testing laboratory.

.1 Dynabolt Sleeve Anchor 'TW-1614' or Readi-Tie-Drive 'TD4-112' tie wire anchor by ITW Ramset/Red Head.

.2 Kwik-Bolt III 'HHDCA 1/4' tie wire anchor by Hilti Corporation.

.3 Fasteners exposed to weather, condensation, and corrosion: Zinc-plated or stainless steel fasteners in applicable product lines specified in preceding paragraphs.

.3 Hangers and tie wire: Galvanized wire, recommended by manufacturer of suspension system, minimum 2.66 mm (0.1") (12 gauge).

.4 Suspension system accessories:

.1 Splices, clips, and perimeter moulding, of manufacturer's standard type to suit the applicable conditions unless special conditions and access area are shown or specified.

.2 Angle wall mouldings; hemmed with prefinished exposed flanges:

.1 For 24 mm (15/16") grid applications; angle moulding with exposed bottom flange of 22 mm (7/8”).

.1 Armstrong ‘7803’.

.2 CertainTeed ‘WA15-15’.

.3 CGC ‘M7’.

.2 For 14 mm (9/16") grid applications; angle moulding with exposed bottom flange of 24 mm (15/16”).

.1 Armstrong ‘7804’.

.2 CertainTeed ‘Wall Angle WA15-9’.

.3 CGC ‘M9’.

.5 Wet environment grade suspension system:

.1 Interlocking tee system designed to support panels in patterns indicated, consisting of main tees and cross tees. System shall be complete with galvanized double-webbed steel body and aluminum face with stainless steel clips. The system shall provide lock joint intersections of cross and main tees.

.2 Acceptable *Products*:

.1 Armstrong ‘Prelude XL 15/16” Exposed Tee System for Exterior Applications’.

.2 CertainTeed 15/16" Classic Environmental Stab'.

.3 CGC 'ZXLA'.

2.5 Metal Finish

.1 Metal exposed in finished work shall have a pre-coated baked enamel finish in non-yellowing colour. Submit paint formulation of grid system to lighting fixture, speaker grille, sprinkler and diffuser manufacturers to ensure consistency of colour, sheen and texture of all exposed metal components in the ceiling assemblies.

.1 Colour: Flat white.

PART 3- EXECUTION

3.1 Installation - General

.1 Install ceiling panels and metal suspension system in accordance with manufacturer's directions. Where manufacturer's directions are at variance with *Contract Documents*, notify *Consultant* before proceeding with installation.

.2 Do not commence installation until all work above suspended ceiling has been completed, inspected and accepted.

3.2 Installation - Suspension System

.1 Install suspension system rigid, secure, square, level and plumb, framed and erected to maintain dimensions and contours indicated, and in accordance with ASTM C636/C636M-13, CISCA installation standards and any other applicable national or local code requirements. Make allowance for thermal and structural movement.

.2 Install suspension system rigid, secure, square, level and plumb, framed and erected to maintain dimensions and contours indicated, and in accordance with ASTM C636/C636M-13, ASTM E580/E580M-17, CISCA installation standards, and any other applicable national or local code requirements. Make allowance for thermal and structural movement.

.1 Install acoustical ceiling suspension system to resist seismic disturbance in accordance with ASTM E580/E580M-17.

.3 Attach hangers to structure with inserts and hanger supports. Do not use powder activated fasteners.

.4 Support hangers for suspended ceiling grid independent of walls, columns, pipes and ducts.

.5 Space hangers for ceilings at maximum 1220 mm (48") on centre in both directions. Provide additional hangers as required to comply with manufacturer's written installation requirements.

.6 Locate hangers at not more than 150 mm (6") from ends of main tee members.

.7 Install exposed tee members to pattern indicated. Securely attach hangers to main tee members.

.8 Exposed tees shall be as long as possible to minimize joints. Make joints square, tight, flush and reinforce with splines. Distribute joints to prevent clustering in one area.

.9 Space tee bars to suit ceiling panels and as detailed, and to accommodate lighting fixtures, diffusers and return grilles.

.10 Cooperate in the installation of ceiling systems, making adjustments where required to ensure that the lighting fixtures, supply diffusers, exhaust grilles and other built-in items properly fit into ceiling module and finish flush with rest of ceiling.

.11 Restrict creep inside module panels so that in all cases strips are centred on module lines.

.12 Install edge moulding as detailed where ceiling abuts vertical surfaces. Lap corners, use maximum lengths to minimize joints. Make joints square, tight and flush.

.1 Screw attach mouldings to substrates at intervals not more than 400 mm (16") on centre and not more than 210 mm (8") from ends, levelling with suspension system. Lap corners accurately and connect securely.

3.3 Installation - Tiles

.1 Take precautions during installation to ensure tile edges are not chipped or otherwise damaged.

.2 Minimize field cutting. Rectify cut tile edges of tile to match factory cut edge profile and colour.

.3 Install acoustical tiles to form horizontal and level ceiling with all parts flush and joints butted tightly to hairline appearance.

.4 Distribute variations in colour and texture of panels to obtain a uniform appearance.

3.4 Installation - Tolerances

.1 Allowable tolerances: to ASTM C636/C636M-13.

.2 Install suspension systems level to tolerance of 1:1200.

.3 Install edge mouldings level to tolerance of 3 mm in 3660 mm (1/8" in 12'-0").

3.5 Field Quality Control

.1 Conduct quality control in accordance with Section 01 45 00 and as follows:

.1 Field tests and inspections:

.1 Independent inspection and testing company shall perform random load tests for ceiling anchor installation.

3.6 Adjusting and Cleaning

.1 Replace uneven, defective or damaged materials and finishes, eliminate waves, remove soiled or stained areas.

.2 Clean dirty and discoloured surfaces of acoustical units and suspension system according to manufacturer's recommendations.

END OF SECTION

PART 1 - GENERAL

1.1 Summary

.1 Section includes:

.1 Painting of interior paintable surfaces matching existing adjacent.

.2 Paintable and non-paintable surfaces:

.1 Paint and finish paintable surfaces included in the *Work*, except where excluded by the *Contract Documents*.

.2 The following surfaces are considered non-paintable, except as otherwise indicated or scheduled:

.1 Material and equipment furnished prime and finish painted.

.2 Internal surfaces of steel tanks and stacks.

.3 Sprayed fire-resistive materials.

.4 Stainless steel, weathering steel, copper, bronze, chromium plate, nickel, anodized or lacquered or mill finished aluminum, Monel metal.

.5 Metallic and mastic insulation finishes.

.6 Abrasive material finishes on floors, stair treads, stair nosing and landings.

.7 Insulated electric cables.

.8 Machined parts of machinery and equipment.

.9 Concealed surfaces.

.10 Manufactured finish materials.

1.2 Administrative Requirements

.1 Conduct a pre-installation meeting in accordance with Section 01 31 19.

1.3 Submittals

.1 Submit required submittals in accordance with Section 01 33 00.

.2 *Product* data sheets:

.1 Submit manufacturer's *Product* data sheets and list of *Products* proposed for use in the work of this section.

.3 Samples:

.1 Samples for initial paint colour and finish selection:

.1 Submit 3 drawdowns of each matching colour for review by *Consultant* and resubmit to *Consultant* as required to obtain approval. Drawdown to be of specified colour, sheen, and paint formula for applicable surface.

.2 Samples for verification:

.1 Submit 3 samples on 200 mm x 305 mm (8"x 12") material of same type as that on which coating is to be applied, for *Consultant*'s approval, at least 30 days before materials are required.

.2 Identify each sample as to *Project*, finish, formula, colour name, number, gloss name and number, date and name of *Contractor* and painting *Subcontractor*.

.3 Resubmit as required until colours and gloss value are approved.

1.4 Closeout Submittals

.1 Submit closeout submittals in accordance with Section 01 77 00.

.2 Operation and maintenance data:

.1 Submit manufacturer's operation and maintenance instructions for inclusion in the operation and maintenance manuals.

.3 Maintenance materials:

.1 Provide 1 sealed containers, 2 litres (1/2 gallon) capacity of each paint product in each colour used in the *Work* for *Owner's* maintenance use. Containers shall be new, clearly labelled with manufacturer's name, type of paint, colour and colour number. Store at *Place of the Work* where directed by *Owner*.

1.5 Quality Assurance

.1 Qualifications

.1 Manufacturers:

.1 Paint manufacturers and *Products* used shall be as listed under the Approved Product List section of the MPI Painting Manual.

.2 Installers / applicators / erectors:

.1 Only qualified journeymen who have a "Tradesman Qualification Certificate of Proficiency" shall be engaged in painting work. Apprentices shall work under the direct supervision of a qualified journeyman in accordance with trade regulations.

.2 Mock-ups:

.1 Provide mock-ups of each paint system for indicated surfaces of each colour and finish selected to verify preliminary paint selections made under Sample submittals.

.2 Do not proceed with work, including ordering of paint *Products*, until mock-ups of each paint colour and finish and paint system for indicated surfaces have been reviewed and accepted by *Consultant*.

1.6 Delivery, Storage, and Handling

.1 Deliver painting materials in sealed, original labelled containers bearing manufacturer's name, brand name, type of paint or coating and colour designation, standard compliance, materials content as well as mixing and/or reducing and application requirements.

.2 Store paint *Products* and materials in original labelled containers in secure (lockable), dry, heated and well ventilated single designated area meeting minimum requirements of both paint manufacturer and authorities having jurisdiction, and at a minimum ambient temperature of 7°C.

.3 Protect floor and wall surfaces of storage area. Protect floors with sheets or clean plywood or metal pans where mixing is being carried out.

1.7 Field Conditions

.1 Ambient conditions:

.1 Comply with environmental requirements of MPI Manual.

.2 Perform no painting work when ambient air and substrate temperatures are below 10°C for both interior work, unless suitable weatherproof covering and sufficient heating and ventilation facilities are in place in accordance with MPI Manual.

.3 Perform no painting work when relative humidity is above 85% or when dew point is less than 3°C (5°F) variance between air/surface temperature.

PART 2 - PRODUCTS

2.1 Materials

.1 *Products* listed in MPI Manual shall be used in the *Work*, unless specified otherwise.

.2 Paint and materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, and the like) shall be in accordance with the MPI Manual “Approved Product” listing and shall be from a single manufacturer for each system used.

.3 Other paint materials, such as linseed oil, shellac, and the like, shall be highest quality *Products* of an approved manufacturer listed in the MPI Manual and shall be compatible with other coating materials as required.

.4 Paint materials shall have good flowing and brushing properties and shall dry or cure free of blemishes or sags.

.5 Where required, paints and coatings shall meet flame spread and smoke developed ratings designated by building code requirements and/or authorities having jurisdiction.

2.2 Equipment

.1 Painting and coating equipment in accordance with written requirements of MPI Manual.

2.3 Mixing and Tinting

.1 Unless otherwise specified, paints shall be ready-mixed. Re-mix prior to application to ensure colour and gloss uniformity.

.2 Paste, powder or catalyzed paint mixes shall be mixed in accordance with manufacturer’s written instructions.

.3 Perform colour tinting operations prior to delivery of paint to *Place of the Work*.

.4 Where thinner is used, addition shall not exceed paint manufacturer’s recommendations.

2.4 Colours and Gloss Levels

.1 Paint colours and gloss levels shall match adjacent surfaces in terms of colour, texture and sheen, sample to be reviewed and approved by the *Consultant*.

.1 Provide up to 5 colours to later selection by Consultant.

.2 Paint gloss shall be defined as the sheen rating of applied paint, in accordance with the following MPI values:

Gloss Level	Description	Units @ 60 degrees	Units @ 85 degrees
G1	Matte or Flat finish	0 to 5	10 maximum
G2	Velvet finish	0 to 10	10 to 35
G3	Eggshell finish	10 to 25	10 to 35
G4	Satin finish	20 to 35	35 minimum
G5	Semi-Gloss finish	35 to 70	
G6	Gloss finish	70 to 85	
G7	High-Gloss finish	> 85	

PART 3 - EXECUTION

3.1 Examination

.1 Prior to commencement of work of this section, thoroughly examine surfaces scheduled to be painted.

.2 Check moisture content and alkalinity of surfaces to be painted in accordance with paragraph above titled Field Conditions.

.3 Inspect surfaces to be coated for gouges, marks, nibs, and other defects and properly prepare patching, filling, smoothing or other surface preparation necessary to ensure satisfactory finish.

.4 Report in writing any condition adversely affecting work of this section.

.5 Proceed with work only when surfaces and conditions are satisfactory. Remove dust, grease, rust, scale and extraneous matter, tool and machine marks and insects from surfaces which could be detrimental to a satisfactory and acceptable finish.

3.2 Preparation

.1 Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

.2 Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

.1 After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

.3 Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, mildew, grease, and incompatible paints, encapsulants, and other deleterious materials.

.4 Paint surfaces when moisture content or alkalinity of surfaces to be painted comply with paragraph 3.5 Field Quality Control / Standard of Acceptance.

.5 Concrete substrates: Remove release agents, curing compounds, efflorescence, and chalk.

.6 Existing painted substrates:

.1 Clean substrates as indicated above.

.2 Sound existing paint surfaces and remove paint surfaces that are not sound, loose or are otherwise stained, cracked, wrinkled, peeling, or defective.

.3 Dull hard or glossy surfaces by sanding or other abrasive methods prior to finishing.

.4 Apply tie-coat primer product that compatible with substrate as recommended by paint coatings manufacturer.

.5 Follow with paint finish coats as specified for like substrate materials specified herein.

.6 Sand, clean, dry, etch, neutralize and/or test all surfaces under adequate illumination, ventilation and temperature requirements.

.7 Protect from repainting operations interior surfaces and areas, including adjacent surfaces and equipment and any labels and signage. Make good any damage caused by failure to provide suitable protection.

3.3 Installation

.1 Do not paint unless substrates are acceptable and/or until Field Conditions (heating, ventilation, lighting and completion of work of other sections) are acceptable for applications of *Products*.

.2 Apply primer, paint or stain in accordance with MPI Manual Premium Grade finish requirements.

.3 Apply paint and coatings within an appropriate time frame after cleaning when Field Conditions encourage flash-rusting, rusting, contamination or manufacturer’s paint specifications require earlier applications.

.4 Painting coats specified are intended to cover surfaces satisfactorily when applied at proper consistency and in accordance with manufacturer’s recommendations.

.5 Tint each coat of paint progressively lighter to enable confirmation of number of coats.

.6 Unless otherwise approved Consultant, apply a minimum of 4 coats of paint where deep or bright colours are used to achieve satisfactory results.

.7 Sand and dust between each coat to provide an anchor for next coat and to remove defects visible from a distance up to 1000 mm (39").

.8 Do not apply finishes on surfaces that are not sufficiently dry. Unless manufacturer’s directions state otherwise, each coat shall be sufficiently dry and hard before a following coat is applied.

.9 Prime coat of stain or varnish finishes may be reduced in accordance with manufacturer’s directions.

.10 Paint finish shall continue through behind wall-mounted items (i.e. chalk and tack boards).

.11 Exposed means visible in complete work including interiors of cupboards and closets, tops of doors, trim, and the like, whether in sight line or not, including behind surface mounted fixtures and heating units.

.12 *Consultant* shall have right to make changes in colour tone of finishes prior to final coat to obtain desired results without additional cost to *Owner*.

.13 Access doors, prime coated butts and other prime painted hardware, registers, radiators and covers, exposed piping and electrical panels shall be painted to match adjacent surfaces in terms of colour, texture and sheen, unless otherwise indicated.

3.4 Mechanical and Electrical Items

.1 Finish paint primed mechanical and electrical items with 2 coats of paint. Include for the following list unless otherwise indicated:

- .1 Air handling units.
- .2 Convectors.
- .3 Conduit.
- .4 Diffusers.
- .5 Ductwork.
- .6 Grilles.
- .7 Hangers.
- .8 Heaters.
- .9 Fire hose cabinets.
- .10 Fire extinguisher cabinets.
- .11 Louvres.
- .12 Radiators.
- .13 Stacks.
- .14 Vents.

.2 Prime and paint exposed insulated and bare pipes. Prime and paint exposed conduits and electrical raceways, fittings, outlet boxes, junction boxes, pull boxes and similar items. Use heat resistant epoxy paint on pipes and surfaces where operating surface temperature exceeds 65°C (149°F).

.3 Coordinate the painting of pipes, and coverings with mechanical contractor applying colour banding, flow arrows and pipe identification after the painting of pipes and coverings.

.4 Paint work to match adjacent walls and ceilings unless directed otherwise.

.5 Paint interior surfaces of air ducts and pipe trenches including heating pipes and elements that are visible through grilles and louvres with one coat of flat metal paint to limit of sight-line. Paint to be black or white as directed by *Consultant*.

.6 Gas pipes, whether concealed or exposed, shall be painted in accordance with gas code.

.7 Paint and finish wall surfaces behind convectors. Walls to be finished prior to installation of convector covers. Touch up walls after covers are installed as necessary to make good installation damage.

.8 Air diffusers shall be primed and finished with 2 coats of paint of same colour and sheen as ducts and/or ceiling.

3.5 Adjusting and Cleaning

.1 Promptly as work proceeds and on completion of *Work*, remove paint where spilled, splashed or spattered during the progress of the *Work*. Keep the premises free from unnecessary accumulation of tools, equipment, surplus materials and debris; at the conclusion of the work leave the premises clean.

3.6 Interior Paint Systems

.1 System references listed are based on MPI Manual and are Premium Grade, unless otherwise indicated:

.1 Concrete vertical surfaces: (including ceilings)

.1 INT 3.1A Latex finish (over primer); eggshell.

.2 Concrete horizontal surfaces: (floors and stairs)

.1 INT 3.2A Latex floor enamel finish; semi-gloss.

.3 Concrete masonry unit assemblies:

.1 INT 4.2P High performance architectural latex finish (over alkali resistant primer/block filler); eggshell.

.4 Primed ferrous metal; touch-up and finish coats required under this section:

.1 Ferrous metal fabrications: Prepared and primed in accordance with Section 05 50 00.

.2 Ferrous architectural metal fabrications: Prepared and primed in accordance with Section 05 50 10.

.3 INT 5.1R High performance architectural latex; gloss level G5.

.5 Galvanized metal: (doors, frames, railings, misc. steel, pipes, overhead decking, ducts, etc.)

.1 INT 5.3M High performance architectural latex; gloss level G5.

.6 Plaster and gypsum board: (gypsum wallboard and drywall)

.1 INT 9.2B High performance architectural latex finish:

.1 Gloss level:

.1 Ceilings, except as otherwise indicated: flat.

.2 Wet and service areas; ceilings: semi-gloss.

END OF SECTION

PART 1- GENERAL

1.1 Summary

.1 Section includes:

.1 Refurbishment of existing Prefinished metal lockers.

1.2 Submittals

.1 Submit required submittals in accordance with Section 01 33 00.

.2 *Product* data sheets:

.1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this section.

.3 Shop drawings:

.1 Indicate thicknesses of metal, fabricating methods, assembled banks of lockers, bases, trim, numbering, filler panels, end panels, and tops.

.4 Samples:

.1 Submit sample of colour and finish on actual base metal.

PART 2 - PRODUCTS

2.1 Materials

.1 Sheet steel: cold rolled, stretcher levelled, plain commercial galvanized or wipe coated conforming to ASTM A526.

.2 Baked enamel: synthetic type, providing good flexibility, adhesion, hardness and resistance to marring.

.3 Frames: existing.

.4 Doors: 16 ga. outer panel, and 24 ga steel inner panel welded together to form a rigid box construction. Doors shall be flush, proud doors will not be accepted. Doors shall have honeycomb core bonded to inner surfaces. Lighter gauge doors will not be acceptable.

.5 Body: existing.

.6 Metal Hasp: Single point locking shall be by means of a padlock and 11 ga metal hasp (Padlock N.I.C.), which fit into a recessed steel chrome plated pocket. Plastic or vinyl hasps will not be accepted.

.7 Shelf and bottom: Existing.

.8 Top Closure: Existing

2.2 Fabrication

.1 Fabricate locker doors to facilitate replacement of component parts by normal maintenance personnel.

.2 Door frames are existing.

.3 Locker bodies are existing to remain.

.4 Locker bottoms are existing to remain.

.5 Doors shall be of a double pan design, consisting of a 16 ga steel outer panel welded to a 24 ga inner panel to form a rigid box enclosed on all edges with a honeycomb core bonded to the inner surface. Inside and outside faces to be flush. Doors shall be hung on two gusseted alloy steel pivot hinges with silent bearings. Outer hinges leaves 3.5 mm welded rigidly to the door frame. Inner hinge leaves 3 mm bolted to the door with two bolts per hinges. The hinges shall have positive stop to prevent conflict of doors when installed in batteries. Doors shall be left hand swing to permit easy entry of padlocks and to minimize protrusion of keeper into frame opening. Doors shall have rubber silencers and recess to receive number plate.

.6 Lock pocket shall be stamped one piece chrome plated steel. Lock pocket rim to protrude 6 mm from the face of the locker to act as a bumper. The upper rim is to be widened sufficiently into the cavity to act as a finger grip. Equip door with standard pocket for use with padlock (padlocks N.I.C.).

.7 Lock keeper shall be steel, rigidly welded to door frame. Keeper shall not extend into frame opening more than 18 mm.

.8 Shelves are existing to remain

.9 Provide clear anodized number plate on each locker. Number as directed by Consultant. Provide vandal proof mounting in lock pocket.

.10 Exterior trim

.1 Replace existing filler panels with new filler panels to match new locker doors.

.2 Filler panels shall effect complete locker runs.

.3 Grind all welds smooth, hem all exposed or sharp edges of sheet metal.

2.3 Refurbishment

.1 Repaint inside surfaces of all existing lockers noted to have existing locker doors replaced.

.2 Assume 20% of existing lockers noted to have existing locker doors replaced, will require the following remedial work:

.1 Replace existing corroded and damaged locker bottoms.

.2 Replace missing coat hooks and shelves.

2.4 Locker Type and Size

.1 Type: Existing single tier

.1 Size: To match existing lockers (Width = +-330 mm. Height = +-1722 mm Site verify)

.2 Top: existing to remain.

.3 Inside equipment: existing metal shelves and hooks to remain.

.4 Base: existing to remain.

2.5 Locker Finish

.1 Clean and degrease all metal.

.2 Chemically pretreat galvanized surfaces, apply two coats of enamel and bake on under controlled temperature conditions.

.3 Produce uniform, smooth, lustrous and hard furniture finish.

.4 Colours to selection by Consultant

PART 3- EXECUTION

3.1 Installation

.1 Remove existing locker doors from existing locker bodies where noted and shown on drawings.

.2 Clean and make good existing locker fames as required to accept new doors.

.3 Install new doors onto existing locker frames.

.4 Securely anchor lockers and associated trim to supporting building elements. Use concealed fasteners.

.5 Provide dummy panels where required or where indicated on Drawings.

.6 Install closures, fillers and trim where shown and where required to provide finished appearance. Provide trim, fillers and closures of profile to match existing.

.7 Upon completion, test doors, and adjust, if required for proper functions. Touch up minor surface scratches. Replace damaged components as directed by the Consultant. Installation

3.2 Tolerances

.1 Install plumb, level, tight and secured. Comply with the following tolerances:

.1 Plumb and level: 3 mm (1/8").

.2 Variation from indicated position: plus/minus 3 mm (1/8").

END OF SECTION

PART 1 - GENERAL

1.1 Summary

.1 Section includes:

.1 Roller window room darkening (black-out) shades at interior locations.

1.2 Administrative Requirements

.1 Conduct a pre-installation meeting in accordance with Section 01 31 19.

1.3 Submittals

.1 Submit required submittals in accordance with Section 01 33 00.

.2 *Product* data sheets:

.1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this section.

.2 Submit flammability performance data.

.3 Submit manufacturers' installation instructions.

.3 Shop drawings:

.1 Submit shop drawings or fully dimensioned catalogue cuts.

.2 Window treatment schedule: Use same designations indicated on *Contract Documents*.

.3 Clearly indicate general construction, configurations, jointing methods and locations, fastening methods, handing of controls, required blocking locations, banding (tandem shades), and installation details.

.4 Samples:

.1 Submit samples of each material and finish colour selected and each accessory.

1.4 Closeout Submittals

.1 Submit closeout submittals in accordance with Section 01 77 00.

.2 Operation and maintenance data:

.1 Submit manufacturer's operation and maintenance instructions for inclusion in the operation and maintenance manuals.

1.5 Quality Assurance

.1 Qualifications:

.1 Manufacturers:

.1 Company specializing in manufacturing the *Products* specified in this section.

.2 Installers / applicators / erectors:

.1 Work of this section shall be by forces in the direct employ or under control of the system manufacturer, skilled, trained, and experienced in work of similar scope and complexity.

1.6 Delivery, Storage, and Handling

.1 Before delivery to the *Place of the Work*, check each shade for operation; remove finger marks and smudges.

.2 Package *Products* to prevent distortion in shipment and handling. Label packages and crates, and protect finish surfaces by sturdy wrappings.

PART 2- PRODUCTS

2.1 Manufacturers/Products

.1 Specifications are based on products from Sun Glow Window Covering Products of Canada Ltd. The following listed manufacturers are acceptable only when in compliance with requirements of this section.

.2 Subject to compliance with requirements, provide *Products* by one of the following manufacturers:

.1 Altex – SunProject.

.2 Draper Inc.

.3 Elite Window Fashions.

.4 Levolor Inc.

.5 MechoShade Systems, Inc.

.6 Sun Glow Window Covering Products of Canada Ltd.

.3 Acceptable *Product*:

.1 Sun Glow Window Covering Products of Canada Ltd. ‘Vision Roller Shade Systems’.

2.2 Hardware - Manual Controlled Shades

.1 Chain operated, with infinite positioning. Left or right hand operation and banding as applicable to suit *Place of the Work* condition. Operation to later selection by Consultant.

.1 Drive assembly:

.1 Must allow finger tip control and include a built in shock absorber system to prevent chain breakage under normal operating conditions;

.2 Capable of being field adjusted from the exterior of the shade unit without having to disassemble the hardware.

.3 Drive Chain: No. 10 stainless steel bead chain formed in a continuous loop. The chain shall have passed a 40 kg (90 lb) load test.

.1 *Provide* child-safe chain retainers.

2.3 Assembly

.1 *Provide* fully factory assembled shade unit consisting of 2 shade brackets, one piece extruded aluminum shade tube, extruded aluminum fascia, aluminum profile hembars, extruded vinyl fabric spline, and fabric as specified.

.2 Fabric shall hang straight, without shifting sideways more than 3 mm (1/8") in either direction due to warp distortion or weave design.

.3 Factory modify housings where necessary to bypass columns.

.4 End brackets: a two piece molded ABS construction with nylon drive sprocket.

.5 Shade tube: Minimum 1.52 mm (0.060") thick extruded aluminum with three equally spaced continuous stiffening fins, non-sag design, maximum deflection under full load of fabric L/700.

.6 Hembar: Extruded aluminum with matching plastic end finials.

.7 Mounting: Removal of shade system shall not require the disassembly of the shade unit.

2.4 Shade Mounting System

.1 Extruded aluminum bracket designed to accept preassembled shade system.

.1 Brackets to be used to facilitate the alignment with shade opening.

.2 Modular construction: Shades must be removable as a complete modular unit without any component disassembly required.

2.5 Shade Fabric Types

.1 Sun control fabric; dimensionally stable shade fabric:

.2 Room darkening (black-out) fabric; dimensionally stable fabrics:

.1 Acceptable *Products*:

.1 Sun Glow Product to later selection by Consultant.

.2 Colour: as selected by *Consultant* from manufacturer’s full range.

.3 Fabric shall hang flat, without buckling or distortion. Edge, where trimmed, shall hang true and straight, without shifting sideways more than 3 mm (1/8") in either direction due to warp distortion or weave design.

.4 Flammability performance:

.1 Certified by an independent laboratory, shade fabric shall pass CAN/ULC S109-14 Flame Tests of Flame Resistant Fabrics and Films.

2.6 Fabrication

.1 Finished assemblies shall be, square, true to size and free from distortion, twist, or other defects that could affect their strength, operation or appearance. Factory applied finish shall be uniform, smooth and without blemishes.

PART 3 - EXECUTION

3.1 Installation

.1 Install shade systems in plumb, squared, adequately anchored, maintaining uniformed clearances, accurate alignment levels, and parallel with the window plane. Fabric shall not travel more than 3 mm (1/8") in either direction within channels after installation.

.2 Fabric shall be pre-measured and manufactured off-site.

.3 Shades shall be snapped into place without screws or visible fasteners.

.4 Incorporate reinforcing, fastening and anchorage required for installation of shades.

.5 Securely attach installation fittings to their mounting surfaces with stainless steel or hardened aluminum screws of proper length and type, and durable anchors.

.6 Install shade roller true and level, and with cloth to hang flat without buckling or distortion.

.7 Room darkening shades (black-out) to be installed to eliminate passage of light from exterior.

.8 Electrical wiring, hook-up, switches; motorized shades: in accordance with Divisions 26, 27, and 28.

3.2 Adjusting and Cleaning

.1 Verify that installed shade system functions properly, and adjust it accordingly to ensure satisfactory operation.

.2 Refinish damaged or defective work so that no variation in surface appearance is discernible.

END OF SECTION

Project Manual

Issued for Construction
April 26, 2021

WATERLOO REGION DISTRICT SCHOOL BOARD – ELMIRA DISTRICT SECONDARY SCHOOL – HVAC UPGRADES

50 Parkland Crescent
Kitchener, Ontario

Consultant:
Quasar Consulting Group

QCG Project No. ED-20-300
WRDSB Tender No. 7119-KP-21

April 2021

Disclaimer:
Issued for Construction documents are issued for Contractors' convenience, for reference only and are a consolidation of issued drawings, specifications and addenda. Consultant makes no representation of they completeness. Exact construction requirements to be based on official Bid issued drawings, specifications and issued separate addenda. Contact Consultant for any clarifications.

PROCUREMENT AND CONTRACTING REQUIREMENTS GROUP

End of Document

1 General

1.01 References

.1 Division 00 and Division 01 apply to and are a part of each Mechanical Division:

.1 Division 21 – Fire Suppression;

.2 Division 22 – Plumbing;

.3 Division 23 – Heating, Ventilating, and Air Conditioning;

.4 Division 25 - Integrated Automation.

1.02 Application

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Mechanical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

1.03 Submittals

.1 Submit shop drawings/product data sheets for:

.1 pressure gauges and thermometers;

.2 electric motors (submit with equipment they are associated with).

.2 Submit weight loads for selected equipment (upon request).

.3 Submit copy of architectural reflected ceiling plan drawings and elevation drawings to indicate proposed access door locations.

.4 Submit a list of equipment identification nameplates indicating proposed wording and sizes.

.5 Submit a list of pipe and duct identification colour coding and wording.

.6 Submit a proposed valve tag chart and a list of proposed valve tag numbering and identification wording.

.7 Submit drawings indicating size and location of required sleeves, recesses and formed openings in poured or precast concrete work.

.8 As specified in Part 2 of this Section, submit a spare belt set, tagged and identified, for each belt driven piece of equipment.

.9 Submit any other submittals specified in this Section or other Sections of Mechanical Divisions.

2 Products

2.01 Pipe Sleeves

.1 Galvanized Sheet Steel – Minimum #16 gauge galvanized steel with an integral flange at one end to secure sleeve to formwork construction.

.2 Polyethylene – Factory fabricated, flanged, high density polyethylene sleeves with reinforced nail bosses.

.3 Waterproof Galvanized Steel Pipe – Schedule 40 mild galvanized steel pipe with a welded-on square steel anchor and water stop plate at sleeve midpoint.

.4 Galvanized Steel or Cast Iron Pipe – Schedule 40 mild galvanized steel, or Class 4000 cast iron.

2.02 Firestopping and Smoke Seal Materials

.1 Firestopping and smoke seal system materials for mechanical penetrations through fire rated construction are specified in Section 20 05 17 - Sleeves and Sleeve Seals for Mechanical Piping and work is to be done as part of mechanical work unless otherwise specified in Division 07.

2.03 Waterproofing Seal Materials

.1 Modular, 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 Acceptable products are:

.1 Thunderline Corp. (Power Plant Supply Co.) "LINK SEAL" Model S-316;

.2 The Metraflex Co. "MetraSeal" type ES.

2.04 Pipe Escutcheon Plates

.1 One-piece chrome plated brass or #4 finish type 302 stainless steel plates with matching screws for attachment to building surface, each plate sized to completely cover pipe sleeve or building surface opening, and to fit tightly around pipe or pipe insulation.

2.05 Piping Hangers and Supports

.1 Pipe hanger and support materials, including accessories, are to be, unless otherwise specified, in accordance with Manufacturers Standardization Society (MSS) Standard Practice Manual SP-58, Pipe hangers and Supports-Materials, Design and Manufacture, and where possible, MSS designations are indicated with each product specified below. Conform to following requirements:

.1 unless otherwise specified, ferrous hanger and support products are to be electro-galvanized;

.2 hangers and supports for insulated piping are to be sized to fit around insulation and insulation jacket.

.2 Hangers and supports for horizontal suspended piping as follows:

.1 adjustable steel clevis hanger – MSS Type 1;

.2 adjustable swivel ring band hanger – MSS Type 10;

.3 adjustable roller hanger – MSS Types 41, 43, and/or 45, with MSS Type 39 steel protection saddle.

.3 Supports for horizontal pipe on vertical surfaces as follows:

.1 steel offset pipe clamp – Anvil Fig. 103 or Myatt Fig. 170;

.2 heavy-duty steel pipe clip – MSS Type 26;

.3 single steel pipe hook – Myatt Fig. 156;

.4 epoxy coated steel pipe stays are not permitted.

.4 Floor supports for vertical risers as follows:

.1 copper tubing riser clamp – MSS Type 8;

.2 heavy-duty steel riser clamp – MSS Type 8.

.5 Supports for vertical piping on vertical surfaces as follows:

.1 steel offset pipe clamp – Anvil Fig. 103 or Myatt Fig. 170;

.2 heavy-duty steel pipe bracket or soil pipe bracket – MSS Type 26;

.3 extension split pipe clamp – MSS Type 12;

.4 epoxy coated steel pipe stays are not permitted.

.6 Base support for vertical risers in excess of 6 m (20') high extending out from base mounted equipment is to consist of a base elbow support with flange.

.7 For horizontal pipe on racks, Unistrut or equal galvanized steel pipe racks with pipe securing hardware as follows:

.1 standard galvanized steel U-bolts/clamps supplied by rack manufacturer;

.2 adjustable roller chair – MSS Type 44 with MSS Type 39 steel protection saddle.

.8 Special hangers and supports for various applications as follows:

.1 vibration isolated riser supports – black steel riser clamps as specified above, complete with neoprene–steel–neoprene sandwich type vibration isolation pads between clamp and floor;

.2 for groups of pipes having same slope – MSS Type 32 welded steel brackets, Anvil Fig. 46 universal trapeze assemblies, or Unistrut or equal support assemblies, all with U-bolts, clamps, etc., to secure pipes in place;

.3 for sections of piping connected to vibration isolated equipment – hangers and supports as specified above but complete with MSS Type 48 spring cushions;

.4 for plastic piping – generally as specified above but in accordance with pipe manufacturer's recommendations;

.5 for fire protection piping – generally as above but ULC listed and/or FM approved, and in accordance with Chapter requirements of NFPA Standard applicable to piping system;

.6 for bare horizontal copper piping – generally as above but factory vinyl coated to prevent direct copper/steel contact;

.7 for bare copper vertical piping – corrosion resistant ferrous clamps with flexible rubber gasket type material (not tape) to isolate pipe from clamp;

.8 insulation protection shields to and including 40 mm (1-½") dia. – MSS Type 40 galvanized steel shields with ribs to keep shield centred on hanger.

.9 Hanger rods are to be electro-galvanized carbon steel (unless otherwise specified), round, threaded, to ASTM A36, complete with captive machine nuts with washers at hangers, sized to suit loading in accordance with Table 3 in MSS SP-58, but in any case minimum 9.5 mm (3/8") diameter.

.10 Acceptable manufacturers are:

.1 E. Myatt & Co. Inc.;

.2 Anvil International Inc.;

.3 Empire Industries Inc.;

.4 Hunt Manufacturing Ltd.;

.5 Unistrut Canada Ltd.;

.6 Nibco Inc. "Tolco";

.7 Taylor Pipe Supports.

2.06 Access Doors

.1 Provide all access doors required for Mechanical work unless otherwise specified in Division 08. Coordinate consistency of look and finish of access doors on project with each Division of Work. Coordinate exact requirements with General Trades Contractor.

.2 Access doors to be rust resistant steel door panels, with concealed hinges and positive locking and self-opening screwdriver operated lock. Wall type frame to be suitable for wall installation and have integral keys for plaster walls. Doors in tile wall to be stainless steel and in ceilings to be suitable for plaster covering with only frame joint showing. Other doors to be prime painted steel.

.3 Size access doors to suit the concealed work for which they are supplied, and wherever possible they are to be of standard size for all applications, but in any case they are to be minimum 300 mm x 300 mm (12" x 12") for hand entry and 600 mm x 600 mm (24" x 24") for body entry.

.4 Lay-in type tiles, properly marked, may serve as access panels. Coordinate marking of ceiling tiles with Consultant. Panels in glazed tile walls to be 12 gauge, 304 alloy stainless steel, No. 4 finish, with recessed frame secured with stainless steel counter-sunk flush head screws.

.5 Panels in plaster surfaces to have dish-shaped door and welded metal lath, ready to take plaster. Provide a plastic grommet for door key access.

.6 Other access doors to be welded 12 gauge steel, flush type with concealed hinges, lock and anchor straps, complete with factory prime coat. Submit to Consultant for review, details of non-standard door construction details.

.7 Access doors in fire rated ceilings, walls, partitions, structures, etc., to be ULC listed and labelled and of a rating to maintain fire separation integrity.

.8 Where access doors are located in surfaces where special finishes are required, they are to be of a recessed door type capable of accepting finish in which they are to be installed so as to maintain final building surface appearance throughout.

.9 Acceptable manufacturers include Le Hage, SMS, Pedlar and Acudor.

2.07 Pressure Gauges and Thermometers

.1 Pressure gauges as follows:

.1 adjustable, glycerine filled, 115 mm (4" or 4-½") diameter and each accurate to within 1% of scale range;

.2 Stainless steel or aluminum case and dial display;

.3 dual scale white dial with a scale range such that working pressure of system is at approximate mid-point of scale;

.4 Provide two (2) year warranty. Contract to extend manufacturer standard warranty where required.

.2 Pressure gauge accessories and additional requirements as follows:

.1 a bronze ball type shut-off valve is to be provided in the piping to each pressure gauge;

.2 each pressure gauge for piping and equipment with normal everyday flow is to be equipped with a brass pressure snubber;

.3 pressure gauges in fire protection piping must be ULC listed and labelled.

.3 Thermometers as follows:

.1 225mm (9”) impact resistant case, universal angle and adjustable, with separable thermowell, red or blue non-mercury fluid;

.2 Provide extensions and pipe fittings where required to suit insulation or to reach fluid flow for accuracy of reading;

.3 Dual scale C/F to suit system temperature;

.4 Provide two (2) year warranty. Contract to extend manufacturer standard warranty where required.

.4 Acceptable manufacturers are:

.1 Winters 9IT/PCT series;

.2 Weiss Instruments;

.3 Trerice;

.4 Ashcroft.

2.08 Equipment Belt Drives

.1 ANSI/RMA Standard V-belt type rated at minimum 1.5 times motor nameplate rating, and in accordance with following requirements:

.1 belts are to be reinforced cord and rubber, and multiple belts are to be matched sets;

.2 sheaves are to be cast iron or steel, secured to shafts with removable keys unless otherwise specified, standard adjustable pitch (± 10% range) for motors under 10 HP, fixed pitch type with split tapered bushing and keyway for motors 10 HP and larger, and, if required, replaced as part of mechanical work to suit system air/water quantity testing and balancing work;

.3 motor slide rail adjustment plates are to allow for centre line adjustment.

.2 Supply a spare belt set (tagged and identified) for each belt drive and hand to Owner upon Substantial Performance of the Work.

2.09 Equipment Drive Guards and Accessories

.1 For V-belt drives – removable, 4-sided, fully enclosed, galvanized sheet steel guards to OHSA standards, cleaned, factory primed and painted with yellow equipment enamel, complete with a 2-piece full length hinged front panel to permit belt maintenance or replacement without removing guard, and 40 mm (1-½") diameter tachometer openings at each shaft location.

.2 For flexible couplings – removable "U" shaped galvanized steel guards to OHSA Standards with a 2.3 mm (3/32") thick frame and expanded mesh face.

.3 For unprotected fan inlets and outlets – unless otherwise specified, removable 20 mm (¾") galvanized steel wire mesh with galvanized steel frames, all to OHSA Standards.

2.10 Electric Motors

.1 Unless otherwise specified, motors are to conform to NEMA Standard MG1, applicable IEEE Standards, and applicable CSA C22.2 Standards, and are to meet NEMA standards for maximum sound level ratings under full load. Confirm motor voltages prior to ordering.

.2 Vertically mounted and submersible motors are to be purposely designed for mounting in this attitude.

.3 Efficiency of 1-phase motors to 1 HP is to be in accordance with CAN/CSA C747. Efficiency of 3-phase motors 1 HP and larger is to be in accordance with CAN/CSA C390 or IEEE 112B.

.4 Unless otherwise specified, 1-phase motors smaller than ½ HP are to be 115 volt, continuous duty capacitor start type with an NEMA 48 or 56 frame size, solid base, heavy-gauge steel shell with solid die-cast end shields, dynamically balanced die-cast rotor, integral automatic reset thermal overload protection, Class "B" insulation, and a 1.15 service factor at 40°C (105°F) ambient temperature.

.5 Explosion-proof 1-phase motors are to be totally enclosed, fan cooled, 115 volt continuous duty capacitor start type in accordance with CSA C22.2 No. 145, as specified for standard 1-phase motors but suitable for use in Class 1 Group D hazardous locations and complete with a rolled steel shell and a 1.0 service factor at 40°C (105°F) ambient temperature.

.6 Unless otherwise specified, motors ½ HP and larger are to be totally enclosed, fan cooled, 3-phase, T-frame, squirrel cage continuous duty induction motors suitable for voltages indicated on Drawings, NEMA Design "B" for normal starting torque or Design "C" for high starting torque as required by the application, each complete with Class "B" insulation, a 1.15 service factor at 40°C ambient temperature, grease lubricated open ball bearings with grease fittings to permit re-lubrication without dismantling motor, a cast iron frame with cast iron feet where required, cast iron end bracket and precision machined bearing fit, and balanced carbon steel shaft assembly with die-cast aluminum rotor windings.

.7 Explosion-proof 3-phase motors are to be totally enclosed fan cooled motors in accordance with CSA C22.2 No. 145, generally as specified above for standard 3-phase motors but suitable for use in Class 1 Group D hazardous locations and with a 1.0 service factor at 40°C (105°F) ambient temperature.

.8 Motor(s) for 2-speed cooling tower(s) are to be as specified above but 2-speed single winding type.

.9 Motor(s) for 2-speed fan(s) are to be as above but 2-speed double winding type.

.10 Unless otherwise indicated, motors 30 HP and larger are to be complete with a heat sensing PTC thermistor in the end turn of stator winding for each phase and connected in series inside motor with 2 marked leads brought out to motor conduit box.

.11 Motors for equipment with variable frequency drives are to be generally as specified above but inverter duty type to NEMA Standard MG-1 Part 31, quantified by CSA for operation from a variable frequency drive of type specified, and complete with Class "H" insulation. Motors are to be equipped with AEGIS, or approved equal, shaft grounding ring system to protect bearings from damage by diverting harmful shaft voltages and bearing currents to ground.

.12 Motors 150 HP and larger with "wye-delta" reduced voltage starters are to be complete with six leads for connection to motor starter.

.13 Motors for equipment which is scheduled or specified with a corrosion resistant coating or constructed from corrosion resistant materials are to be factory coated with a primer and epoxy paint finish.

.14 Acceptable manufacturers are:

.1 TECO-Westinghouse Motors (Canada) Inc.;

.2 Canadian General Electric;

.3 Baldor Electric Co.;

.4 U.S. Electrical Motors;

.5 Weg Electric Corp.;

.6 Marathon Electric;

.7 Toshiba Corp.;

.8 Leeson Canada.

2.11 Motor Starters and Accessories

.1 Motor starters must be capable of starting associated motors under the imposed loads. Confirm starter voltage matches motor prior to ordering.

.2 Unless otherwise specified, starters for 1-phase motors are to be 115 volt, thermal overload protected manual starting switches with a neon pilot light, a surface or recessed enclosure to suit the application, and, where automatic operation is required, a separate H-O-A switch in an enclosure to match starter enclosure.

.3 Unless otherwise specified, starters for 3-phase motors less than 50 HP are to be combination "quick-make" and "quick-break" fused disconnects and full voltage non-reversing across-the-line starters, each complete with and overload relay per phase, an enclosure to suit the application, and, a H-O-A switch, pilot lights, control transformer, auxiliary contacts, and other accessories as per motor starter schedule.

.4 Unless otherwise specified, starters for 3-phase motors 50 HP to 150 HP are to be reduced voltage, non-reversing, auto-transformer type starters complete with one overload relay per phase, an enclosure to suit the application, and, a H-O-A switch, pilot lights, control transformer, auxiliary contacts, and other accessories as per motor starter schedule.

.5 Unless otherwise specified, starters for 3-phase motors 150 HP and larger are to be reduced voltage, non-reversing, closed transition "wye-delta" starters complete with one overload relay per phase, an enclosure to suit the application, and, a H-O-A switch, pilot lights, control transformer, auxiliary contacts, and other accessories as per motor starter schedule.

.6 Starters for 2-speed double winding motors are to be generally as specified above but suitable for motor and equipped with a 45 second time delay to permit equipment to coast down to low speed before it is operated at low speed.

.7 Starters for 2-speed single winding motors are to be generally as specified above but suitable for motor and equipped with a 45 second time delay to permit equipment to coast down to low speed before it is operated at low speed.

.8 Starters for reversible motors for cooling towers are to be generally as specified above but suitable for motor and equipped with a 45 second time delay to allow fan(s) to coast down to a stop before being operated in reverse rotation.

.9 Unless otherwise specified, motor starter enclosures are to be in accordance with following NEMA ratings:

.1 enclosures located in sprinklered areas – Type 2;

.2 enclosures exposed to the elements – Type 3R, constructed of stainless steel;

.3 enclosures inside the building in wet areas – Type 3R, constructed of stainless steel;

.4 enclosures in explosion rated area – Type 7 with exact requirements to suit the area and application;

.5 enclosures except as noted above – Type 1;

.6 enclosures located in finished areas – as above but recess type with brushed stainless steel faceplate.

.10 Motor control centres are to be multi-unit, 2.28 m (9') high, NEMA Class 1, type "B", factory assembled, dead front, floor mounted, free-standing motor control centre with tin plated copper bus and an NEMA Type 1 or Type 2 enclosure as for loose starters specified above. Each motor control centre is to be complete with starters as specified above, load and control wiring terminal boards, and required facilities for line and load side power wiring connections.

.11 Disconnect switches for motor control centres are to be heavy-duty, CSA certified, front operated switches as per motor starter schedule, each complete with a handle suitable for padlocking in "off" position and arranged so that door cannot be opened with handle in "on" position and an NEMA enclosure as specified for loose starters. Fusible units are to be complete with fuse clips to suit fuse types specified below.

.12 Fuses are to be, unless otherwise scheduled or specified, English Electric Ltd. HRC fuses, Form I Class "J" for constant running equipment and Form II Class "C" for equipment that cycles on and off.

.13 Acceptable manufacturers are:

.1 Rockwell Automation Inc. - Allen-Bradley;

.2 Eaton Corp. – Cutler-Hammer;

.3 Eaton Corp. – Moeller Electric;

.4 Siemens Canada;

.5 Schneider Electric.

2.12 Sprinkler Proofing

.1 Provide drip shields for protection of surface mounted equipment enclosures from water spray and dripping of liquids. Features of shields include:

.1 factory constructed by respective equipment manufacturers;

.2 constructed from non-combustible materials (sheet steel);

.3 enamel painted to match equipment;

.4 surfaces and edges filled/sanded smooth prior to painting;

.5 supported from equipment with structural steel rods/metal framing or other method approved by Consultant;

.6 structural support finish painted to match shield.

.2 Include with equipment shop drawings, detailed dimensions of drip shields and methods of supporting.

.3 Equipment with top cable/conduit entries to include additional sealing of entries with gasketting and/or waterproof sealant to prevent water from entering enclosure.

.4 Design ventilation louvers such that live components are not exposed to water spray and dripping liquids.

.5 Above requirements are additional minimum "sprinkler proof" standards for equipment specified as NEMA 1, 2 or 12.

.6 Obtain CSA approval where required by local governing authorities.

2.13 Mechanical Work Identification Materials

.1 Confirm with the Owner if an existing mechanical work identification system is in place and, if so, match accordingly.

.2 If an existing mechanical work identification system is not in place, the following is to be used:

.1 Equipment nameplates are to be minimum 1.6 mm (1/16") thick 2-ply laminated coloured plastic plates, minimum 12 mm x 50 mm (½" x 2") for smaller items such as damper motors and control valves, minimum 25 mm x 65 mm (1" x 2-½") for equipment, and minimum 50 mm x 100 mm (2" x 4") for control panels and similar items. Additional requirements are as follows:

.1 unless otherwise specified or required, each nameplate is to be white, complete with bevelled edges and black engraved wording to completely identify equipment and its use with no abbreviations;

.2 wording is generally to be as per drawings, i.e. Fan EF-1, and is to include equipment service and building area/zone served, but must be reviewed prior to engraving;

.3 supply stainless steel screws for securing nameplates in place;

.4 nameplates for equipment suspended above floor level or generally not within easy viewing from floor level are to be increased in size so as to be easily readable from floor level.

.2 Valve tags are to be coloured, 40 mm (1-½") square, 2-ply laminated plastic with bevelled edges, red-white, green-white, yellow-black, etc., to match piping identification colour, each complete with a 3.2 mm (1/8") diameter by 100 mm (4") long brass plated steel bead chain, and four lines of engraved maximum size identification wording, i.e.:

VALVE V12 200 mm (8") CHILL. WATER NORMALLY OPEN

.3 Standard pipe identification is to be equal to Smillie McAdams Summerlin Ltd., Brady or Primark Manufacturing Inc. vinyl plastic with indoor/outdoor type vinyl ink lettering and directional arrows, as follows:

.1 for pipe less than or equal to 150 mm (6") diameter, coiled type snap-on markers of a length to wrap completely around pipe or pipe insulation;

.2 for pipe larger than 150 mm (6") diameter, saddle type strap-on markers with 2 opposite identification locations and complete with nylon cable ties.

.4 Identification wording and colours for pipe identification materials are to be as follows:

PIPE SERVICE	IDENTIFICATION COLOUR	LEGEND
domestic cold water	green	DOM. COLD WATER
domestic hot water supply	green	DOM. HW SUPPLY
domestic hot water recirculation	green	DOM. HW RECIRC.
tempered domestic water	green	TEMP. DOM. WATER
chilled drinking water	green	CH. DRINK WTR.
storm drainage	green	STORM
sanitary drainage	green	SAN.
plumbing vent	green	SAN. VENT
fire protection standpipe	red	F.P. STANDPIPE
fire protection sprinklers	red	F.P. SPRINKLER
natural gas	to Code	to Code, c/w pressure
natural gas vent	to Code	to Code
propane gas	to Code	to Code, c/w pressure
propane gas vent	to Code	to Code
heating water supply	yellow	HTG. WTR. SUPPLY
heating water return	yellow	HTG. WTR. RETURN
heating water drain	yellow	HTG. WTR. DRAIN
glycol heating supply	yellow	GLY. HTG. SUPPLY
glycol heating return	yellow	GLY. HTG. RETURN
glycol heating drain	yellow	GLY. HTG. DRAIN
glycol heat reclaim return	yellow	GLY. HTG. RECLAIM R.
glycol heat reclaim supply	yellow	GLY. HTG. RECLAIM S.
heat pump geothermal loop – source side supply	green	GEO. LOOP SOURCE SUPPLY
heat pump geothermal loop – source side return	green	GEO. LOOP SOURCE RETURN
heat pump geothermal loop – load side supply	green	GEO. LOOP LOAD SUPPLY
Heat pump geothermal loop – load side return	green	GEO. LOOP LOAD RETURN
condenser water supply	green	COND. WTR. SUPPLY

PIPE SERVICE	IDENTIFICATION COLOUR	LEGEND
condenser water return	green	COND. WTR. RETURN
chilled water supply	green	CH. WTR. SUPPLY
chilled water return	green	CH. WTR. RETURN
chilled water drain	green	CH. WTR. DRAIN
pumped condensate	yellow	PUMPED CONDENSATE
refrigerant suction	yellow	REFRIG. SUCTION
refrigerant liquid	yellow	REFRIG. LIQUID
refrigerant hot gas	yellow	REFRIG. HOT GAS
control air	green	CONTROL AIR

.5 Colours for pipe identification legends and directional arrows are to be as follows:

IDENTIFICATION COLOUR	LEGEND & ARROW COLOUR
yellow	black
green	white
red	white

.6 Duct identification is to be custom made Mylar stencils with 50 mm (2") high lettering to accurately describe duct service, i.e. "AHU-1 SUPPLY", complete with a directional arrow, and coloured ink with ink pads and roller applicators. Ink colour is generally to be black but must contrast with lettering background.

2.14 Flexible Connectors

.1 Double wall stainless steel flexible connectors for piping connections to vibration isolated equipment, each selected by manufacturer to suit the application. Shop drawings or product data sheets must indicate construction and performance requirements that suit the application. Acceptable manufacturers are:

.1 Hyspan Precision Products Inc.;

.2 Senior Flexonics Ltd.;

.3 The Metraflex Co.

3 Execution

3.01 General Piping and Ductwork Installation Requirements

.1 Unless otherwise specified, locate and arrange horizontal pipes and ducts above or at ceiling on floors, arranged so that under consideration of all other work in area, maximum ceiling height and/or usable space is maintained. If required to maintain ceiling heights, reroute and/or resize ductwork, with Consultant's approval.

.2 Unless otherwise specified, install work concealed in finished spaces, and concealed to degree possible in partially finished and unfinished spaces. Refer to and examine Architectural drawings and room finish schedules to determine finished, partially finished, and unfinished areas. Walls which are painted are considered finished.

.3 Install pipes and ducts parallel to building lines and to each other.

.4 Neatly group and arrange exposed work.

.5 Locate work to permit easy access for service or maintenance as required and/or applicable. Locate valves, dampers and any other equipment which will or may need maintenance or repairs and which are to be installed in accessible construction so as to be easily accessible from access doors. Where valves, dampers and similar piping or ductwork accessories occur in vertical services in shafts, pipe spaces or partitions, locate accessories at floor level.

.6 Make connections between pipes of different materials using adapters suitable for application. Provide cast brass dielectric type adapters/unions at connections between ferrous and copper pipe.

.7 Comply with equipment and material manufacturer's installation instructions unless otherwise specified herein or on drawings, and unless such instructions contradict governing codes and regulations.

.8 Carefully clean ducts, pipe and fittings prior to installation. Temporarily cap or plug ends of pipe, ducts and equipment which are open and exposed during construction.

.9 Install piping and ductwork which are to be insulated so that they have sufficient clearance to permit insulation and finish to be applied continuously and unbroken around pipe or duct, except for ductwork at fire barriers, in which case insulation will be terminated at each side of the duct fire damper.

.10 Inspect surfaces and structure prepared by other trades before performing work. Verify surfaces or structure to receive work has no defects or discrepancies which could result in poor application or cause latent defects in installation and workmanship. Report defects in writing. Installation of work will constitute acceptance of such surfaces as being satisfactory.

.11 Any ferrous piping that exhibits in excess of 5% surface rust, either inside or outside or both, is to be wire brush cleaned to bare metal and coated with suitable primer. Steel pipe, fittings and accessories are to be free of corrosion and dirt when work is complete or prior to being concealed from view. Where dirt is evident, clean piping prior to being concealed.

.12 For factory applied finishes, repaint or refinish surfaces damaged during shipment and installation. Quality of repair work is to match original finish. This requirement also applies to galvanized finishes.

.13 Where mechanical work is located in high humidity areas where ferrous metal products will be subject to corrosion and protection for such products is not specified, provide finishes on products to protect against corrosion or provide products which will not corrode in the environment, i.e. aluminium ductwork, copper or stainless steel pipe, etc.

.14 Provide screwed unions or flanges in piping connections to equipment and in regular intervals in long (in excess of 12 m [40']) piping runs to permit removal of sections of piping.

.15 Unless otherwise specified and except where space limitations do not permit, piping elbows are to be long radius. Eccentric reducers are to be installed with straight side at top of piping.

3.02 Pipe Joint Requirements

.1 Do not make pipe joints in walls or slabs.

.2 Ream piping ends prior to making joints.

.3 Properly cut threads in screwed steel piping and coat male threads only with Teflon tape or paste, or an equivalent thread lubricant. After pipe has been screwed into fitting, valve, union, or piping accessory, not more than 2 pipe threads are to remain exposed.

.4 Site bevel steel pipe to be welded or supply mill bevelled pipe. Remove scale and oxide from bevels and leave smooth and clean. Use factory made welding tees or welding outlet fittings for piping branches off mains. Do not use shop or site fabricated fittings unless written approval has been obtained.

.5 Welded joints are to be made by CWB certified licensed journeyman welders qualified in accordance with CSA B51, Boiler Pressure Vessel and Pressure Piping Code, and who are in possession of a proper certificate of qualification for each procedure to be performed. Each weld is to be identified with the welder's identification symbol, and welds are not to be concealed until they have been inspected and approved. Electrodes are to be in accordance with CSA W48 Series, Electrodes, and requirements of CAN/CSA W117.2, Safety in Welding, Cutting and Allied Processes are to be followed.

.6 Unless otherwise specified, make flanged joints with Garlock 5500 or equivalent gasket materials to suit the application, and bolts and nuts. Bolts are not to be longer than length necessary to screw nut up flush to the end of bolt. Bolts used for flanged connections in piping with a working pressure of 690 kPa (100 psi) and greater are to be ASTM A-193 Grade B-7, with heavy hexagon nuts to ASTM A-194 CL-2H. Provide suitable washers between each bolt head and flange and between each nut and flange.

.7 A random check of bolted flanged connections will be made to verify flanged connections are properly mated with no shear force acting on bolts. Supply labour to disconnect and reconnect selected flanged joints. If improperly mated joints are found, remove and reinstall affected piping so flanges mate properly. If improperly mated joints are found, additional joints will be checked, and you will be responsible for the repair of any other improper joints discovered.

.8 Unless otherwise specified make soldered joints in copper piping using flux suitable for and compatible with type of solder being used. Clean the outside of pipe end and inside of fitting, valve, or similar accessory prior to soldering.

.9 Install mechanical joint fittings and couplings in accordance with manufacturer's instructions.

.10 Grooves are to be rolled. Make arrangements with coupling and fitting manufacturer for shop and/or site instructions and demonstrations as required, and adhere to manufacturer's instructions with respect to pipe grooving, support, type of gasket required, anchoring and guiding the grooved piping system.

.11 If pressure crimped couplings and fittings are used, ensure gaskets are fully compatible with piping fluid, and valves and piping accessories are suitable. Use only fitting manufacturer supplied crimping equipment. Comply with manufacturer's latest published specification, instructions, and recommendations with respect to pipe, coupling, and fitting preparation and installation, and support, anchoring and guiding of the piping system.

.12 Solvent weld PVC piping in 2 parts, primer stage and cementing stage, in accordance with manufacturer's recommendations, ASTM D2855, and CSA requirements.

.13 Install PVC piping with gasketed joints in accordance with manufacturer's current published specifications, instructions and recommendations, and CSA requirements.

3.03 Installation of Pipe Sleeves

.1 Where pipes pass through concrete and/or masonry surfaces provide pipe sleeves as follows:

.1 in poured concrete slabs – unless otherwise specified, minimum 16 gauge flanged galvanized steel or, where permitted by governing authorities, factory fabricated plastic sleeves;

.2 in concrete or masonry walls – Schedule 40 galvanized steel pipe or Class 4000 cast iron pipe.

.2 Sleeves in waterproofed slabs or walls are to be lengths of Schedule 40 mild galvanized steel pipe with a waterstop plate in accordance with drawing detail. Provide waterproof sleeves in following locations:

.1 in mechanical room floor slabs, except where on grade;

.2 in slabs over mechanical, fan, electrical and telephone equipment rooms or closets;

.3 in floors equipped with waterproof membranes;

.4 in roof slab;

.5 in waterproof walls.

.3 Size sleeves, unless otherwise specified, to leave 12 mm (½") clearance around pipes, or where pipe is insulated, a 12 mm (½") clearance around pipe insulation.

.4 Pack and seal void between pipe sleeves and pipe or pipe insulation in non-fire rated construction for the length of sleeves as follows:

.1 pack sleeves in interior construction with mineral wool and seal both ends of sleeves with non-hardening silicone base caulking compound;

.2 pack sleeves in exterior walls above grade with mineral wool and seal both ends of sleeves water-tight with approved non-hardening silicone base caulking compound unless mechanical type seals have been specified;

.3 seal sleeves in exterior walls below grade (and any other wall where water leakage may be a problem) with link type mechanical seals as specified.

.5 Where sleeves are required in masonry work, accurately locate and mark sleeve location, and hand sleeves to mason for installation.

.6 Terminate piping for sleeves that will be exposed so sleeve is flush at both ends with building surface so sleeve may be completely covered by an escutcheon plate, except for sleeves in waterproof floors which are to terminate 100 mm (4") above finished floor.

.7 "Gang" type sleeving will not be permitted.

.8 Where sleeves are provided in non-fire rated construction for future piping, or where piping has been removed from existing sleeves, cap and seal both ends of sleeved opening.

3.04 Installation of Waterproof Mechanical Seals

.1 Provide watertight link type mechanical seals in exterior wall openings.

.2 Assemble and install each mechanical seal in accordance with manufacturer's instructions.

.3 After installation, periodically check each mechanical seal installation for leakage and, if necessary, tighten link seal bolts until seal is completely watertight.

3.05 Duct Openings

.1 Duct openings, air inlet and outlet openings, fire damper and similar openings will be provided in new poured concrete work, masonry, drywall and other building surfaces by trade responsible for particular construction in which opening is required.

.2 Size openings for fire dampers to 600 mm (24") high to suit damper arrangement with folding blade out of air stream.

.3 For duct openings except where fire dampers are required, pack and seal space between duct or duct insulation and duct opening as specified above for pipe openings in non-fire rated construction.

3.06 Sleeve 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.

3.07 Installation of Pipe Escutcheon Plates

.1 Provide escutcheon plates suitably secured over exposed piping passing through finished building surfaces. A finished building surface is any surface with a factory finish or that receives a site applied finish.

.2 Install plates so they are tight against building surface concerned, completely covering pipe sleeves and/or openings, except where waterproof sleeves extend above floors, in which case fit plate tightly around sleeve.

3.08 Installation of Fastening and Securing Hardware

.1 Provide fastening and securing hardware required for mechanical work to maintain installations attached to structure or to finished floors, walls and ceilings in a secure and rigid manner capable of withstanding dead loads, live loads, superimposed dead loads, and any vibration of installed products.

.2 Use fasteners compatible with structural requirements, finishes and types of products to be connected. Do not use materials subject to electrolytic action or corrosion where conditions are liable to cause such action.

.3 Where floor, wall or ceiling construction is not suitable to support loads, provide additional framing or special fasteners to ensure proper securement to structure that is to support the products. Provide reinforcing or connecting supports where required to distribute loading to structural components.

.4 Obtain written consent before using explosive actuated fastening devices. If consent is obtained, comply with requirements of CAN/CSA Z166.1 and CAN/CSA Z166.2.

.5 Do not attach fasteners to steel deck without written consent from Consultant.

3.09 Installation of Pipe Hangers and Supports

.1 Provide required pipe hangers and supports.

.2 Provide any additional structural steel channels, angles, inserts, beam champs and similar accessories required for hanging or supporting pipe. Unless otherwise shown or specified, hang or support pipes from structure only.

.3 For insulated pipe, size hanger or support to suit diameter of insulated pipe and install hanger or support on outside of insulation and insulation finish.

.4 Support requirements for underground piping are as follows:

.1 support underground pipe, unless otherwise specified, on a well compacted bed of dry, natural, undisturbed earth free from rocks or protrusions of any kind, or on compacted material as specified;

.2 support underground service piping penetrating building exterior walls or foundations to prevent pipe damage if minor building settlement occurs;

.3 ensure bedding and supports for underground pipes are flat and true and allowances are made for pipe hubs, couplings, or other protrusions so no voids are left between pipe and bedding.

.5 Unless otherwise shown or specified, hang and/or support horizontal pipe above ground by means of hangers and/or supports specified in Part 2 of this Section. Unless otherwise shown or specified, hangers for suspended pipe less than or equal to 25 mm (1") dia. are to be clevis type or adjustable ring type, and hangers for suspended pipe greater than or equal to 40 mm (1-½") dia. are to be adjustable clevis type.

.6 Space hangers and supports in accordance with following:

.1 cast iron pipe – hang or support at every joint with maximum 2.4 m (8') spacing;

.2 plastic pipe – conform to pipe manufacturer's recommended support spacing;

.3 glass pipe – conform to pipe manufacturer's recommended support spacing and support requirements;

.4 copper and steel pipe – hang or support at spacing in accordance with following schedule:

PIPE DIA.	MAX. SPACING STEEL (meters)	MAX. SPACING COPPER (meters)
to 25 mm (1")	2.4 m (8')	1.8 m (6')
40 mm (1-½")	2.7 m (9')	2.4 m (8')

PIPE DIA.	MAX. SPACING STEEL (meters)	MAX. SPACING COPPER (meters)
50 mm (2")	3.0 m (10')	2.7 m (9')
65 mm (2-½")	3.6 m (12')	3.0 m (10')
75 mm (3")	3.6 m (12')	3.0 m (10')
90 mm (3-½")	3.6 m (12')	3.6 m (12')
100 mm (4")	4.2 m (14')	3.6 m (12')
250 mm (10")	6.0 m (20')	
300 mm (12")	6.7 m (22')	

.5 flexible grooved pipe/coupling joint piping – as above but with not less than one hanger or support between joints;

.7 Where pipes change direction, either horizontally or vertically, provide a hanger or support on horizontal pipe not more than 300 mm (12") from elbow, and where pipes drop from tee branches, support tees in both directions not more than 50 mm (2") on each side of tee.

.8 When pipes with same slope are grouped and a common hanger or support is used, space hanger or support to suit spacing requirement of smallest pipe in group and secure pipes in place on common hanger or support.

.9 Provide roller hangers or supports for heat transfer piping greater than or equal to 150 mm (6") diameter and conveying a material 75°C (170°F) or greater to facilitate pipe movement due to expansion and contraction, and at each hanger or support tack weld a steel protection saddle to pipe to protect piping insulation.

.10 Unless otherwise shown or specified, support vertical piping by means of supports specified in Part 2 of this Section, spaced in accordance with following:

.1 support vertical pipes at maximum 3 m (10') intervals or at every floor, whichever is lesser;

.2 for sections of vertical piping with a length less than 3 m (10'), support pipe at least once;

.3 for vertical cast iron plain end pipe (mechanical joint type), secure riser or pipe clamp around pipe under a flange integral with pipe for vertical support purposes, or provide a length of hub and spigot pipe to facilitate proper support;

.4 for vertical steel pipe risers in excess of 3 m (10'), weld shear lugs to pipe to carry load;

.5 for vibration isolated piping risers, provide rubber-steel-rubber vibration isolation pads between riser clamps and floor.

.11 Support piping on the roof as follows:

.1 on existing roof – provide support members as specified in Part 2 of this Section spaced as per schedule above and of a type to suit the application, and, for each support, carefully scrape away roofing gravel, bed support in a heavy covering of roofing mastic, then scrape gravel back up around support and secure pipes to supports;

.2 on new roof – supply manufactured roof supports as per Part 2 of this Section to accommodate piping involved and support spacing specified above, and hand supports to roofing trade on roof for installation as part of roofing work, then secure piping in place on supports.

.12 Each hanger, support or securement for horizontal bare copper tubing is to be plastic coated to prevent direct contact between pipe and ferrous hanger. Each wall or floor clamp for vertical bare copper piping is to be isolated from pipe by means of strips of flexible rubber inserts. Use of painted ferrous hangers and supports, including those painted with copper coloured paint, is not acceptable. Site application of tape or other types of isolation is not acceptable.

.13 For insulated horizontal piping less than or equal to 40 mm (1-½") diameter, provide galvanized steel insulation protection shields between insulation and hanger or support. Install shields immediately after pipe is insulated.

.14 Do not support piping from steel deck without written consent from Consultant.

3.10 Supply of Access Doors

.1 Supply access doors to give access to mechanical work which may need maintenance or repair but which is concealed in inaccessible construction, except as otherwise specified herein or on drawings.

.2 Before commencing installation of mechanical work, coordinate with other trades and prepare on a set of reflected ceiling plans and wall elevations, complete layouts of access doors. Submit these layouts for Consultant's review and show exact sizes and locations of such access doors. Locate and arrange mechanical work to suit.

.3 Access doors will be installed by trade responsible for particular type of construction in which doors are required. Supply access doors to trade installing same at proper time.

.4 Wherever possible, access doors to be of a standard size for each application. Confirm exact dimensions and minimum size restrictions with Consultant prior to ordering.

.5 Group piping and ductwork to ensure minimum number of access doors is required.

.6 Coordinate with Electrical Contractor and General Trades Contractor to ensure access doors on project are provided by a single manufacturer, installed as part of work of General Trades Contractor and work involving both mechanical and electrical services should, where possible, be accessible from common access door. Coordinate work to ensure common location access doors are not supplied by both Mechanical Divisions and Electrical Divisions.

3.11 Installation of Valves

.1 Generally, valve locations are indicated or specified on drawings or specified in Sections of the Specification where valves are specified, however, regardless of locations shown or specified, following requirements apply:

.1 provide shut-off valves to isolate systems, at base of vertical risers, in branch take-offs at mains and risers on floors, to isolate equipment, to permit work phasing as required, and wherever else required for proper system operation and maintenance;

.2 install shut-off valves with handles upright or horizontal, not inverted, and located for easy access;

.3 unless otherwise specified, provide a check valve in discharge piping of each pump;

.4 valve sizes are to be same as connecting pipe size;

.5 valves are to be permanently identified with size, manufacturer's name, valve model or figure number and pressure rating, and wherever possible, valves are to be product of same manufacturer;

.6 for valves in insulated piping, design of valve stem, handle and operating mechanism is to be such that insulation does not have to be cut or altered in any manner to permit valve operation.

3.12 Installation of Pressure Gauges and Thermometers

.1 Provide pressure gauges in following locations where applicable:

.1 in valved tubing across suction, suction strainer (if applicable), and discharge piping of each circulating pump;

.2 in supply and return piping connections to main mechanical plant equipment such as boilers, chillers, heat exchangers, main coils, etc.;

.3 in expansion tank(s);

.4 in separate domestic hot water storage tank(s);

.5 at top most outlet in each standpipe fire protection system riser;

.6 in piping at each side of a pressure reducing valve;

.7 in potable water service piping downstream of meter;

.8 wherever else shown and/or specified.

.2 Provide thermometers in following locations where applicable:

.1 in supply and return piping connections to main mechanical plant equipment such as boilers, chillers, cooling towers, heat exchangers, main coils, etc., unless temperature indication is supplied with equipment;

.2 wherever else shown and/or specified.

.3 Conform to following installation requirements where applicable:

.1 for installation of thermometers in piping wells, provide a coat of metallic base heat transfer paste or grease in piping well;

.2 for pressure gauges in piping at equipment locations, install pressure gauge between equipment and first pipe fitting;

.3 locate, mount and adjust instruments so they are easily readable;

.4 where pressure gauges and/or thermometers are located at high level or in an area where they cannot be easily seen, provide remote reading instruments.

3.13 Installation of Equipment Drive Guards and Accessories

.1 Provide OHSA guards for exposed accessible rotating parts such as belt drives, couplings, fan wheels, and shaft ends on mechanical equipment.

.2 Install belt guards to allow movement of motors for adjusting belt tension.

.3 Provide a means to permit lubrication and use of test instruments with guards in place.

.4 Secure guards to equipment or equipment base but do not bridge sound or vibration isolation.

.5 Where equipment oil level gauges, oil reservoirs, grease cups, or grease gun fittings are integral with equipment but are not easily accessible for service, extend to an accessible location using aluminium or copper tubing.

3.14 Mechanical Work Identification

.1 Identify new exposed piping and ductwork as per Part 2 of this Section in locations as follows:

.1 at every end of every piping or duct run;

.2 adjacent to each valve, strainer, damper and similar accessory;

.3 at each piece of connecting equipment;

.4 on both sides of every pipe and duct passing through a floor, wall or partition, unless otherwise specified;

.5 at 6 m (20') intervals on pipe and duct runs exceeding 6 m (20') in length;

.6 at least once in each room, and at least once on pipe and duct runs less than 6 m (20') in length.

.2 Unless otherwise specified identify new concealed piping and ductwork as per Part 2 of this Section in locations as follows:

.1 at points where pipes or ducts enter and leave rooms, shafts, pipe chases, furred spaces, and similar areas;

.2 at maximum 6 m (20') intervals on piping and ductwork above suspended accessible ceilings, and at least once in each room;

.3 at each access door location;

.4 at each piece of connected equipment, automatic valve, etc.

.3 Provide an identification nameplate for equipment provided as part of this project, including items such as control valves, motorized dampers, instruments, and similar products. Secure nameplates in place, approximately at eye level if possible, with stainless steel screws unless such a practice is prohibitive, in which case use epoxy cement applied to cleaned surfaces. Locate nameplates in the most conspicuous and readable location.

.4 Paint new natural and/or propane gas piping with primer and 2 coats of yellow paint in accordance with Code requirements. Identify piping at intervals as specified above.

.5 Provide an identification nameplate for each motor starter or disconnect switch located in a motor control centre or on a motor starter panel, and on each individually mounted starter provided as part of mechanical work, and on each disconnect switch provided as part of the electrical work for motorized equipment provided as part of mechanical work.

.6 For electrically traced mechanical work, identification wording is to include "ELECTRICALLY TRACED".

.7 Tag valves and prepare a valve tag chart in accordance with following requirements:

.1 attach a valve tag to each new valve, except for valves located immediately at equipment they control;

.2 prepare a digital valve tag chart to list tagged valves, with, for each valve, the tag number, location, valve size, piping service, and valve attitude (normally open or normally closed);

.3 if an existing valve tag chart is available at site, valve tag numbering is to be an extension of existing numbering and new valve tag chart is to incorporate existing chart;

.4 include a copy of valve tag chart in each copy of operating and maintenance instruction manuals.

.8 Where shut-off valves, control dampers, sensors, and similar items which will or may need maintenance and/or repair are located above accessible suspended ceilings, provide round coloured ceiling tacks in ceiling panel material, or stickers equal to Brady "Quick Dot" on ceiling grid material to indicate locations of items. Unless otherwise specified, ceiling tack or sticker colours are to be as follows:

.1	HVAC piping valves and equipment:	yellow
.2	fire protection valves and equipment:	red
.3	plumbing valves and equipment:	green
.4	HVAC ductwork dampers and equipment:	blue
.5	control system hardware and equipment:	orange

3.15 Finish Painting of Mechanical Work

.1 Finish paint exposed mechanical work as specified and/or scheduled in accordance with requirements of Division 09.

.2 Touch-up paint damaged factory applied finishes on mechanical work products.

3.16 Pipe Leakage Testing

.1 Before piping has been insulated or concealed, and before equipment, fixtures and fittings have been connected, test piping for leakage.

.2 Tests are to be witnessed by Consultant and/or Owner's representative, and, where required, representatives of governing authorities. Give ample notice of tests in writing and verify attendance. Have completed test report sheets dated and signed by those present to confirm proper test results.

.3 When circumstances prevent scheduled tests from taking place, give immediate and adequate notice of cancellation to all who were scheduled to attend.

.4 Gravity Drainage and Vent Piping

.1 Test piping in accordance with local governing building code.

.2 After fixtures and fittings are set and pipes are connected to building drain or drains, turn on water into pipe, fixtures, fittings and traps in order to detect any imperfect material or workmanship. Perform a smoke test if required by local governing authorities.

.5 Pumped Drainage Piping

.1 Test piping with cold water at a pressure of 1-½ times normal working pressure and maintain pressure for a minimum of 2 hours.

.6 Domestic Water Piping

.1 Test piping with cold water at a pressure of 1-½ times normal working pressure and maintain pressure for a minimum of 2 hours.

.7 Sprinkler System Piping

.1 Test system piping in accordance with requirements of NFPA No. 13, "Installation of Sprinkler Systems", and in accordance with any additional requirements of governing authorities.

.8 Standpipe System Piping

.1 Test system piping in accordance with requirements of NFPA No. 14, "Standpipe and Hose Systems", and in accordance with any additional requirements of governing authorities.

.9 Heat Transfer (HVAC) System Piping

.1 Test piping with cold water at a pressure of 1035 kPa (150 psi) for a minimum of 2 hours.

.10 Natural Gas Piping

.1 Test piping in accordance with requirements of CAN/CSA B149.1 and any additional requirements of local governing authorities.

.2 After completion of the verification test, locate required tag stating results of the verification test at the point of entry of gas main into building, affixed to the pipe in a secure manner.

.3 Check piping joints and connections for leaks with a water/soap solution while piping is under pressure.

.11 Propane Gas Piping

.1 Test piping in accordance with requirements of CAN/CSA B149.2 and any additional requirements of local governing authorities.

.2 After completion of the verification test, locate required tag stating results of the verification test at the point of entry of gas main into building, affixed to the pipe in a secure manner.

.3 Check piping joints and connections for leaks with a water/soap solution while piping is under pressure.

.12 Refrigerant Piping

.1 Test refrigerant piping for leakage and dehydrate in accordance with requirements of Chapter 18 of ASHRAE Handbook - Fundamentals.

.13 Control Air Piping and Tubing

.1 Test control air piping and tubing with dry compressed air or nitrogen before concealing and again before connection of instruments.

.2 Rough-in test pressure is to be 345 kPa (50 psi) maintained over 24 hours with a pressure drop not to exceed 35 kPa (5 psi).

.3 Test joints for leaks with a soap solution.

.4 Finish test is to be 205 kPa (30 psi) with a permissible loss of 7 kPa (1 psi) over a 4 hour period. Prior to connecting instruments, blow systems clean and dry, and test component connections for leaks with a water/soap solution.

.14 Following requirements apply to all testing:

.1 ensure piping has been properly flushed, cleaned and is clear of foreign matter prior to pressure testing;

.2 temporarily remove or valve off piping system specialties or equipment which may be damaged by test pressures prior to pressure testing systems, and flush piping to remove foreign matter;

.3 when testing is carried out below highest level of the particular system, increase test pressure by the hygrostatic head of 7 kPa (1 psi) for every 600 mm (24") below the high point;

.4 include for temporary piping connections required to properly complete tests;

.5 piping under test pressure is to have zero pressure drop for length of test period;

.6 make tight leaks found during tests while piping is under pressure, and if this is impossible, remove and refit piping and reapply test until satisfactory results are obtained;

.7 where leaks occur in threaded joints in steel piping, no caulking of these joints will be allowed under any conditions;

.8 tests are be done in reasonably sized sections so as to minimize number of tests required;

.9 in addition to leakage tests specified above, demonstrate proper flow throughout systems including mains, connections and equipment, as well as proper venting and drainage, and include for any necessary system adjustments to achieve proper conditions.

3.17 Supply of Motor Starters and Accessories

.1 Unless otherwise shown or specified, supply a starter for each item of motorized equipment. Refer to Motor Starter Schedule.

.2 Where 3-phase starters are indicated in motor control centres, supply motor control centres with starters and bolt to a concrete housekeeping pad.

.3 Where package type equipment with integral starters, or equipment with starters integral in loose power and control panels supplied with equipment is fed from a motor control centre, provide a disconnect switch in motor control centre in lieu of a motor starter.

.4 Where 3-phase starters are indicated and/or scheduled to be mounted on a motor starter panel, starters will be mounted and connected, complete with panels and splitter trough, as part of electrical work. Hand starters to electrical trade at site when they are required.

.5 Where package type equipment with integral starters, or equipment with starters integral in loose power and control panels supplied with equipment is fed from a motor starter panel, a disconnect switch will be provided on motor starter panel as part of electrical work.

.6 Unless otherwise specified or shown on drawings, 1-phase motor starters will be mounted adjacent to equipment they serve and connected complete as part of electrical work. Hand starters to electrical trade at site at the proper time.

3.18 Electrical Wiring Work for Mechanical Work

.1 Unless otherwise specified or indicated, following electrical wiring work for mechanical equipment will be done as part of the electrical work:

.1 "line" side power wiring to motor starters or disconnect switches in motor control centres and starters or disconnects on motor starter panels, and "load" side wiring from starters or disconnects to equipment;

.2 "line" side power wiring to individual wall mounted starters, and "load" side wiring from starters to equipment;

.3 "line" side power wiring to pre-wired power and control panels and variable frequency drives (VFD), and "load" side power wiring from the panels and VFD's to equipment;

.4 provision of receptacles for plug-in equipment;

.5 provision of disconnect switches for motors in excess of 10 m (30') from starter location, or cannot be seen from starter location, and associated power wiring;

.6 motor starter interlocking in excess of 24 volts;

.7 wiring from motor winding thermistors in motors 30 HP and larger to motor starter contacts;

.8 120 volt power connections to electrical receptacles integral with small ceiling exhaust fans, including wiring through light switches or speed controllers;

.9 120 volt wiring connections to lighting fixture/switch combinations integral with air handling units;

.10 120 volt wiring connections to duplex receptacles integral with air handling unit control panels;

.11 120 volt wiring connections to BAS system controllers/panels and other control system or component requiring 120 volt power including, but not limited to, VAV boxes, dampers, low voltage transformers, etc.

.2 Mechanical wiring work not listed above or specified herein or on drawings to be done as part of electrical work is to be installed in conduit and is to be done as part of mechanical work in accordance with wiring requirements specified for electrical work.

3.19 Interruption to and Shut-Down of Mechanical Services and Systems

.1 Coordinate shut-down and interruption to existing mechanical systems with Owner. Generally, shut-downs may be performed only between the hours of 12:00 midnight Friday until 6:00 a.m. Monday morning, unless otherwise specified in Division 01. Include for costs of premium time to perform work during nights, weekends or other times outside of normal working hours, which may be necessary to comply with stipulations specified herein this Article. Services for operation of existing non-renovated areas of building are to be maintained.

.2 Upon award of a Contract, submit a list of anticipated shut-down times and their maximum duration.

.3 Prior to each shut-down or interruption, inform Owner and Consultant in writing 5 working days in advance of proposed shut-down or interruption and obtain written consent to proceed. Do not shut-down or interrupt any system or service without such written consent. Shutdowns of some essential services may require additional advance notification time.

.4 Perform work associated with shut-downs and interruptions as continuous operations to minimize shut-down time and to reinstate systems as soon as possible, and, prior to any shut-down, ensure materials and labour required to complete the work for which shut-down is required are available at site.

.5 Pipe freezing shall be used to connect new piping to existing piping. Alternative methods may be proposed, if site conditions are evaluated and permit, and are approved by the engineer.

.6 Where existing isolation valves do not hold, pipe freezing shall be used to connect new piping to existing piping.

3.20 Equipment Bases and Supports

.1 Unless otherwise specified or required, set floor mounted equipment on minimum 100 mm (4") high reinforced concrete housekeeping pads 200 mm (8") clear of equipment on each side and end, or a minimum of 200 mm (8") from centreline of equipment anchor bolts to edge of the base, whichever is larger. Conform to following requirements:

.1 supply dimensioned drawings and equipment base templates, and provide anchor bolts for proper setting and securing of equipment on pads;

.2 place anchor bolts during concrete pour and be responsible for required levelling, alignment, and grouting of equipment;

.3 as a minimum, use wire mesh reinforcement, however, for pads for large heavy equipment, use reinforcement as per structural drawing details.

.2 For equipment not designed for base mounting, where required, provide welded, cleaned and prime coat painted structural steel stands or supports conforming to following requirements:

.1 provide stands and supports, except those for small equipment, designed by a structural engineer registered in jurisdiction of the work, and submit stamped and signed design drawings with calculations as shop drawings for review;

.2 flange bolt steel stands to concrete housekeeping pads;

.3 seismically restrained stands and supports in accordance with applicable requirements.

.3 Where indicated on mechanical drawings, provide welded, cleaned and prime coat painted structural steel platforms, designed by a structural engineer registered in the jurisdiction of the work, for service access to equipment. Submit stamped and signed design drawings with calculations as shop drawings for review. Conform to following requirements:

.1 platforms in accordance with OHSA requirements and adequately sized, braced, anchored, and, as required, seismically restrained;

.2 flooring equal to Fisher & Ludlow "Tru-Weld" Type 19-4, Borden type W/B (19-W-4), welded steel bar type grating;

.3 support legs constructed of welded Schedule 40 black steel pipe with welded steel cross-bracing, securely anchored and sway braced;

.4 safety guard rails, constructed from minimum 32 mm (1-¼") dia. Schedule 40 black steel pipe, for all platforms and complete with vertical stanchions at maximum 1.2 m (48") centres, top and intermediate horizontal railing, and toe plates at floor;

.5 vertical ladders constructed of Schedule 40 black steel pipe, 25 mm (1") dia. for equal height rungs, 40 mm (1-½") for stringers, anchored to floors and walls and sway braced as required;

.6 ships ladders, used wherever space conditions permit, of welded steel construction, climbing at an approximate 60º angle, and complete with channel iron stringers, open grate equal height risers approximately 165 mm (6-½") wide and factory made by grating manufacturer, handrails, and suitable anchoring and support.

3.21 Mechanical Service Requirements for Floating Floor Slabs

.1 Where mechanical services are required to be installed in or through a vibration isolated floating slab, install such services so as not to transmit any vibration to base slab on which floating floor slab is placed.

.2 Wherever possible, arrange mechanical work to avoid penetrating a floating floor slab.

3.22 Concrete Work for Mechanical Equipment Bases/Pads

.1 Unless otherwise specified in Division 03, provide poured concrete work, including reinforcing and formwork, required for mechanical equipment bases/pads. Perform concrete work in accordance with requirements specified in Division 03.

.2 Unless otherwise specified in Division 03, concrete is to be minimum 20,700 kPa ready-mix concrete in accordance with CAN/CSA-A23.1 and the Building Code.

.3 Submit for review, dimensioned shop drawings, prepared and stamped by a professional structural engineer registered in the jurisdiction of the work, for concrete pads or bases for support of large, heavy equipment. Indicate on shop drawings total weight of pad or base as well as equipment it is provided for, and concrete reinforcing.

.4 Ensure that bases and pads are keyed into the structure to meet seismic restraint requirements where applicable.

3.23 Excavation and Backfill Work

.1 Unless otherwise specified in Division 31, provide all excavation and backfill associated with the mechanical scope of work.

.2 Before commencement of excavation for work, determine in consultation with Consultant, Owner, Municipality and utilities, presence, if any, of existing underground services at site. Engage local utilities to locate and mark out such services. Ensure trades concerned are aware of their presence.

.3 Be responsible for any damage done to underground services caused by neglect to determine and mark out location of such services prior to excavation work commences.

.4 Where Work falls under jurisdiction of local governing utility, confirm requirements and comply with utility requirements.

.5 Unless otherwise specified in Division 31, provide excavation, backfill and related work required for mechanical work. Obtain a copy of soil test report if available from Consultant. Depth of excavations must accommodate local governing requirements and local standard practices to compensate for local frost levels of Place of the Work.

.6 Inverts and locations of existing site services may have been site surveyed and approximate location may be shown on drawings. Confirm inverts and locations are correct, prior to commencing excavation and contact Utilities to accurately locate their services. Where discrepancies are found, immediately inform Consultant, and await a direction. Grade bottom of trench excavations as required.

.7 In firm, undisturbed soil, lay pipes directly on soil, unless otherwise directed.

.8 Before backfilling, arrange for inspection of work by Consultant. Do not backfill work unless reviewed with Consultant. Failure to do so prior to backfilling will require re-excavating work and re-backfill at no additional cost to Owner.

.9 Unless otherwise specified, backfill trenches within building with clean sharp sand in individual layers of maximum 150 mm (6”) thickness compacted to a density of 100% Standard Proctor. Hand compact first layers up to a compacted level of minimum 300 mm (12") above top of pipe. Hand or machine compact the balance up to grade.

.10 Unless otherwise specified, backfill trenches outside the building (not under roads, parking lots or traffic areas), up to a compacted level of 450 mm (18") thick above the pipe, hand compacted to a density of 95% Standard Proctor, using granular "A" gravel. Backfill the balance in 150 mm (6") layers with approved excavated material, compacted to 95% Standard Proctor density.

.11 Unless otherwise specified, backfill trenches outside building under roads, parking lots or traffic areas with crushed stone or granular "A" gravel in layers not exceeding 150 mm (6") thickness, compacted to 100% Standard Proctor density up to grade level.

.12 Provide minimum 1.37 m (4.5') of cover for underground piping subject to freezing and located outside building.

.13 Provide minimum 450 mm (18") of cover for underground piping subject to freezing and located inside building.

.14 After first lift of backfill has been compacted, mark entire path of pipe using continuous 75 mm (3") wide detectable identified marking tape equal to SMS Ltd. D-UGMT.

.15 Unless otherwise directed in Division 02 and/or Division 31, store and dispose of excavated materials as follows:

.1 during progress of contract, place material as directed in such a manner to minimize damage or disfigurement of ground and which in no way impedes progress of work;

.2 separately place surplus topsoil and subsoil as directed; leave site clean and unencumbered.

.16 Perform pumping as required to keep excavations free of water.

.17 Engage services of independent soils testing agency to test final backfill compaction density of each backfilled location. Compact backfill to satisfaction of testing agency and in accordance with Specification. Submit a copy of testing agency's report to Consultant for review.

.18 Fill depressions to correct grade level with appropriate material, after an adequate period has passed to reveal any settlement. Use maximum possible compaction. Pay costs required to make good damages caused by settlement.

.19 Coordinate requirements for final surface toppings (concrete, asphalt, pavers, grass sod, etc.) with General Contractor.

3.24 Cutting, Patching and Core Drilling

.1 Unless otherwise provided by General Trades, perform cutting, patching, and core drilling of existing building required for installation of mechanical work. Perform cutting in a neat and true fashion, with proper tools and equipment to Consultant's approval. Patching is to exactly match existing finishes and be performed by tradesmen skilled in particular trade or application. Work is subject to review and acceptance by Consultant.

.2 Criteria for cutting holes for additional services:

.1 cut holes through slabs only; no holes to be cut through beams;

.2 cut holes 150 mm (6") diameter or smaller only; obtain approval from Structural Consultant for larger holes;

.3 keep at least 100 mm (4") clear from beam faces;

.4 space at least 3 hole diameters on centre;

.5 for holes that are required closer than 25% of slab span from supporting beam face, use cover meter above slab to clear slab top bars;

.6 for holes that are required within 50% of slab span, use cover meter underside of slab to clear slab bottom bars;

.7 submit sleeving drawings indicating holes and their locations for Structural Consultant's review.

.3 Do not cut or drill any existing work without approval from Owner and Consultant. Be responsible for damage done to building and services caused by cutting or drilling.

.4 Where pipes pass through existing construction, core drill an opening. Size openings to leave 12 mm (½") clearance around pipes or pipe insulation.

.5 Prior to drilling or cutting an opening, determine, in consultation with Consultant and Owner, and by use of non-destructive radar scan (magnetic scan) of slab or wall, presence of any existing services and reinforcement bars concealed behind building surface to be cut and locate openings to suit. Coring is not permitted through concrete beams or girders.

.6 Where drilling is required in waterproof slabs, size opening to permit snug and tight installation of a pipe sleeve sized to leave 12 mm (½") clearance around pipe or pipe insulation. Provide a pipe sleeve, constructed of Schedule 40 galvanized steel pipe with a flange at one end and of a length to extend 100 mm (4") above slab, in opening. Secure flange to the underside of slab and caulk void between sleeve and slab opening with proper non-hardening silicone base caulking compound to produce a water-tight installation.

.7 Firestop and seal openings in fire rated construction. Do not leave openings open overnight unless approved by Owner and Consultant.

3.25 Packing and Sealing Core Drilled Pipe Openings

.1 Pack and seal void between pipe opening and pipe or pipe insulation for length of opening as follows:

.1 non-fire rated interior construction – pack with mineral wool and seal both ends of opening with non-hardening silicone base caulking compound to produce a water-tight seal;

.2 exterior walls above grade – pack with mineral wool and seal both ends of sleeves water-tight with non-hardening silicone base caulking compound unless mechanical type seals have been specified;

.3 exterior walls below grade (and any other wall where water leakage may be a problem) – seal with link type mechanical seals as specified.

3.26 Flashing for Mechanical Work Penetrating Roof

.1 Unless otherwise specified in Division 07, perform required flashing work, including counter-flashing, for mechanical work penetrating and/or set in roof.

.2 Perform flashing work in accordance with requirements of drawing details and/or requirements specified in Division 07.

3.27 Cleaning Mechanical Work

.1 Refer to cleaning requirements specified in Division 01.

.2 Clean mechanical work prior to application for Substantial Performance of the Work.

.3 Include for vacuum cleaning interior of air handling units and ductwork systems.

3.28 Connections to Other Equipment

.1 Carefully examine Contract Documents during bidding period and include for mechanical work piping and/or ductwork connections to equipment requiring such connections.

3.29 Seismic Restraint Anchor Points for Equipment

.1 Where mechanical equipment requires seismic restraint, it is to be complete with manufacturer designed and rated seismic restraint anchor points and attachments, certified by equipment manufacturers, so equipment may be bolted down or restrained in the field.

.2 Equipment to be restrained must be designed such that the strength and anchorage of the internal components of equipment exceeds force level used to restrain and anchor equipment itself to the supporting structure.

3.30 Installation of Flexible Connectors

.1 Provide flexible connectors in piping connections to seismically restrained equipment, where applicable, and wherever else shown.

.2 Provide flexible connectors in piping connections to vibration isolated equipment.

3.31 Fan Noise Levels

.1 Submit sound power levels with fan shop drawings/product data, with levels measured to AMCA 300 and calculated to AMCA 301.

3.32 Equipment and System Manufacturer's Certification

.1 When equipment/system installation is complete, but prior to start-up procedures, arrange and pay for equipment/system manufacturer's authorized representative to visit site to examine installation, and after any required corrective measures have been made, to certify in writing to Consultant that equipment/system installation is complete and in accordance with equipment/system manufacturer's instructions.

3.33 Equipment and System Start-Up

.1 When installation of equipment/systems is complete but prior to commissioning, perform start-up for equipment/systems as specified in mechanical work Sections in accordance with following requirements:

.1 submit a copy of each equipment/system manufacturer's start-up report sheet to Consultant for review, and incorporate any comments made by Consultant;

.2 under direct on-site supervision and involvement of equipment/system manufacturer's representative, start-up equipment/systems, make any required adjustments, document procedures, leave equipment/systems in proper operating condition, and submit to Consultant complete set of start-up documentation sheets signed by manufacturer/supplier and Contractor.

End of Section

1 General

1.01 Section Includes

.1 This Section specifies requirements, criteria, methods and execution for mechanical demolition work that are common to one or more mechanical work Sections, and it is intended as a supplement to each Section and is to be read accordingly.

2 Products – Not Used

3 Execution

3.01 Disconnection and Removal of Existing Mechanical Work

.1 Where indicated on drawings, disconnect and remove existing mechanical work, including hangers, supports, insulation, etc. Disconnect at point of supply, remove obsolete connecting services and make system safe. Cut back obsolete piping behind finishes and cap water-tight unless otherwise specified.

.2 Scope and extent of demolition or revision work is only generally indicated on drawings. Estimate scope, extent and cost of work at site during bidding period site visit(s). Claims for extra costs for demolition work not shown or specified but clearly visible or ascertainable at site during bidding period site visits will not be allowed.

.3 If any re-design is required due to discrepancies between mechanical drawings and site conditions, notify Consultant who will issue a Site Instruction. If, in the opinion of Consultant, discrepancies between mechanical drawings and actual site conditions are of a minor nature, required modifications are to be done at no additional cost.

.4 Where existing mechanical services extend through, or are in an area to serve items which are to remain, maintain services in operation. Include for rerouting existing services concealed behind existing finishes and which become exposed during renovation work, so as to be concealed behind new or existing finishes.

.5 Unless otherwise specified, remove from site and dispose of existing materials which have been removed and are not to be relocated or reused.

3.02 Roofing Work

.1 Where roof revisions and/or replacements are part of project, include for disconnecting, lifting, or temporarily removing mechanical equipment on roof as required to permit completion of roofing work, and for re-installing equipment when roofing work is complete.

End of Section

1 General

1.01 References

.1 Division 00 and Division 01 apply to and are a part of this Section.

1.02 Application

.1 This Section specifies requirements that are common to Mechanical Divisions work Sections and it is a supplement to each Section and is to be read accordingly. Where requirements of this Section contradict requirements of Divisions 00 or 01, conditions of Division 00 or Division 01 to take precedence.

.2 Be responsible for advising product vendors of requirements of this Section.

1.03 Definitions

.1 "concealed" – means hidden from normal sight in furred spaces, shafts, ceiling spaces, walls and partitions.

.2 "exposed" – means work normally visible, including work in equipment rooms, service tunnels, and similar spaces.

.3 "finished" - means when in description of any area or part of an area or a product which receives a finish such as paint, or in case of a product may be factory finished.

.4 “provision” or "provide" (and tenses of "provide") – means supply and install complete.

.5 "install" (and tenses of "install") – means secure in position, connect complete, test, adjust, verify and certify.

.6 "supply" – means to procure, arrange for delivery to site, inspect, accept delivery and administer supply of products; distribute to areas; and include manufacturer’s supply of any special materials, standard on site testing, initial start-up, programming, basic commissioning, warranties and manufacturers’ assistance to Contractor.

.7 "delete" or "remove" (and tenses of "delete" or “remove”) – means to disconnect, make safe, and remove obsolete materials; patch and repair/finish surfaces to match adjoining similar construction; include for associated re-programming of systems and/or change of documentation identifications to suit deletions, and properly dispose of deleted products off site unless otherwise instructed by Owner and reviewed with Consultant.

.8 "BAS" – means building automation system; "BMS" – means building management system; "FMS" – means facility management system; and “DDC” means direct digital controls; references to "BAS", "BMS", "FMS" and “DDC” generally mean same.

.9 "governing authority" and/or "authority having jurisdiction" and/or "regulatory authority" and/or "Municipal authority" – means government departments, agencies, standards, rules and regulations that apply to and govern work and to which work must adhere.

.10 "OSHA" and "OHSA" – stands for Occupational Safety and Health Administration and Occupational Health and Safety Act, and wherever either one is used, they are to be read to mean local governing occupational health and safety regulations that apply to and govern work and to which work must adhere, regardless if Project falls within either authority's jurisdiction.

.11 "Mechanical Divisions" – refers to Divisions 20, 21, 22, 23, 25 and other Divisions as specifically noted, and which work as defined in Specifications and/or on drawings is responsibility of Mechanical Contractor, unless otherwise noted.

.12 "Electrical Divisions" – refers to Divisions 26, 27, 28 and other Divisions as specifically noted, and which work as defined in Specifications and/or on drawings is responsibility of Electrical Contractor, unless otherwise noted.

.13 "Consultant" – means person, firm or corporation identified as such in Agreement or Documents, and is licensed to practice in Place of the Work, and has been appointed by Owner to act for Owner in a professional capacity in relation to the Work.

.14 Wherever words "indicated", "shown", "noted", "listed", or similar words or phrases are used in Contract Documents they are understood, unless otherwise defined, to mean product referred to is "indicated", "shown", "listed", or "noted" on Contract Documents.

.15 Wherever words "reviewed", "satisfactory", "as directed", "submit", or similar words or phrases are used in Contract Documents they are understood, unless otherwise defined, to mean that work or product referred to is "reviewed by", "to the satisfaction of", "submitted to", etc., Consultant.

1.04 Documents

.1 Documents for bidding include but are not limited to issued Drawings, Specifications and Addenda.

.2 Specification is arranged in accordance with CSI/CSC 49 Divisions of MasterFormat.

.3 Drawings and Specifications are portions of Contract Documents and identify labour, products and services necessary for performance of work and form a basis for determining pricing. They are intended to be cooperative. Perform work that is shown, specified, or reasonably implied on the drawings but not mentioned in Specification, or vice-versa, as though fully covered by both.

.4 Review Drawings and Specifications in conjunction with documents of other Divisions and, where applicable, Code Consultant's report.

.5 Unless otherwise specifically noted in Specifications and/or on Drawings, Sections of Mechanical Divisions are not intended to delegate functions nor to delegate work and supply of materials to any specific trade, but rather to generally designate a basic unit of work, and Sections are to be read as a whole.

.6 Drawings are performance drawings, diagrammatic, and show approximate locations of equipment and connecting services. Any information regarding accurate measurement of building is to be taken on site. Do not scale Drawings, and do not use Drawings for prefabrication work.

.7 Drawings are intended to convey the scope of work and do not show architectural and structural details. Provide, at your cost, offsets, fittings, transformations and similar products required as a result of obstructions and other architectural and/or structural details but not shown on Drawings.

.8 Locations of equipment and materials shown may be altered, when reviewed by Consultant, to meet requirements of equipment and/or materials, other equipment or systems being installed, and of building, all at no additional cost to Contract.

.9 Specification does not generally indicate specific number of items or amounts of material required. Specification is intended to provide product data and installation requirements. Refer to schedules, Drawings (layouts, riser diagrams, schematics, details) and Specification to provide correct quantities. Singular may be read as plural and vice versa.

.10 Starter/motor control centre (MCC)/variable frequency drive (VFD) schedule drawings are both mechanical and electrical, and apply to work of Mechanical Divisions and Electrical Divisions. Be responsible for reviewing starter, MCC, VFD, and motor specification requirements prior to Bid submission. Confirm and coordinate exact scope of work and responsibility of work between Mechanical Divisions and Electrical Divisions.

.11 Drawings and Specifications have been prepared solely for use by party with whom Consultant has entered into a contract and there are no representations of any kind made by Consultant to any other party.

.12 In the case of discrepancies between the drawings and specifications, documents will govern in order specified in "General Conditions", however, when scale and date of drawings are same, or where discrepancy exists within specification, most costly arrangement will take precedence.

1.05 Metric and Imperial Measurements

.1 Generally, both metric and imperial units of measurement are given in Sections of Specification governed by this section. Measurement conversions may be generally "soft" and rounded off. Confirm exact measurements based on application. Where measurements are related to installation and onsite applications, confirm issued document measurements with applicable local code requirements, and/or as applicable, make accurate measurements onsite. Where significant discrepancies are found, immediately notify Consultant for direction.

1.06 Examination of Documents and Site

.1 Carefully examine Documents and visit site to determine and review existing site conditions that will or may affect work, and include for such conditions in Bid Price.

.2 Report to Consultant, prior to Bid Submittal, any existing site condition that will or may affect performance of work as per Documents. Failure to do so will not be grounds for additional costs.

.3 Upon finding discrepancies in, or omissions from Documents, or having doubt as to their meaning or intent, immediately notify Consultant, in writing.

1.07 Work Standards

.1 Where any code, regulation, bylaw, standard, contract form, manual, printed instruction, and installation and application instruction is quoted it means, unless otherwise specifically noted, latest published edition at time of submission of Bids adopted by and enforced by local governing authorities having jurisdiction. Include for compliance with revisions, bulletins, supplementary standards or amendments issued by local governing authorities.

.2 Where regulatory codes, standards and regulations are at variance with Drawings and Specification, more stringent requirement will apply unless otherwise directed by Owner and reviewed with Consultant.

.3 Supplementary mandatory specification and requirements to be used in conjunction with project include but are not limited to following:

.1 Air-Conditioning, Heating and Refrigeration Institute (AHRI);

.2 Air Movement and Control Association (AMCA);

.3 American Iron and Steel Institute (AISI);

.4 American National Standards Institute (ANSI);

.5 American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc., (ASHRAE);

.6 American Society of Mechanical Engineers (ASME);

.7 American Society of Testing and Materials (ASTM);

.8 American Water Works Association (AWWA);

.9 Associated Air Balance Council (AABC);

.10 Building Industry Consulting Services, International (BICSI);

.11 Canadian Gas Association (CGA);

.12 Canadian General Standards Board (CGSB);

.13 Canadian Standards Association (CSA);

.14 Electrical and Electronic Manufacturers Association of Canada (EEMAC);

.15 Electrical Safety Authority (ESA);

.16 Electronic Industries Association (EIA);

.17 Factory Mutual Systems (FM);

.18 Illuminating Engineering Society (IES);

.19 Institute of Electrical and Electronic Engineers (IEEE);

.20 International Standards Organization (ISO);

.21 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS);

.22 National Building Code of Canada (NBC);

.23 National Electrical Manufacturers Association (NEMA);

.24 National Environmental Balancing Bureau (NEBB);

.25 National Fire Protection Association (NFPA);

.26 National Standards of Canada;

.27 NSF International;

.28 Occupational Health and Safety Act (OHSA);

.29 Ontario Building Code (OBC);

.30 Ontario Electrical Safety Code (OESC);

.31 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA);

.32 Technical Standards and Safety Authority (TSSA);

.33 Thermal Insulation Association of Canada (TIAC);

.34 Underwriters' Laboratories of Canada (ULC);

.35 Workplace Hazardous Materials Information System (WHMIS);

.36 Material Safety Data Sheets by product manufacturers;

.37 Local utility inspection permits;

.38 Codes, standards, and regulations of local governing authorities having jurisdiction;

.39 Additional codes and standards listed in Trade Sections;

.40 Owner's standards.

.4 Provide applicable requirements for barrier free access in accordance with latest edition of local governing building code.

.5 Where any governing Code, Regulation, or Standard requires preparation and submission of special details or drawings for review they are to be prepared and submitted to appropriate authorities. Be responsible for costs associated with these submittals.

.6 Unless otherwise specified, install equipment in accordance with equipment manufacturer's recommendations and instructions, and requirements of governing Codes, Standards, and Regulations. Governing Codes, Standards, and Regulations take precedence over manufacturer's instructions.

.7 Work is to be performed by journeyperson tradesmen who perform only work that their certificates permit, or by apprentice tradesmen under direct on site supervision of experienced journeyperson tradesman. Journeyperson to apprentice ratio is not to exceed ratio determined by the Board as stated in Ontario College of Trades and Apprenticeship Act or local equivalent governing body in Place of the Work.

.8 Journeyperson tradesmen are to have a copy of valid trade certificates available at site for review with Consultant at any time.

.9 Experienced and qualified superintendent is to be on-site at times when work is being performed.

.10 Coordinate work inspection reviews and approvals with governing inspection department to ensure that construction schedule is not delayed. Be responsible for prompt notification of deficiencies to Consultant and submission of reports and certificates to Consultant.

.11 Properly protect equipment and materials on site from damage due to elements and work of trades, to satisfaction of Owner and reviewed with Consultant. Equipment and materials are to be in new condition upon Substantial Performance of the Work.

.12 Mechanical piping system work, including equipment, must comply in all respects with requirements of local technical standards authorities and CSA B51, Boiler, Pressure Vessels and Pressure Piping Code. Where required, mechanical work products must bear a CRN number.

.13 Electrical items associated with mechanical equipment are to be certified and bear stamp or seal of a recognized testing agency such as CSA, UL, ULC, ETL, etc., or bear a stamp to indicate special electrical utility approval.

1.08 Permits, Certificates, Approvals, and Fees

.1 Contact and confirm with local authorities having jurisdiction including utility providers, requirements for approvals from such authorities. Obtain and pay for permits, certificates, and approvals required to complete Work.

.2 Be responsible for ensuring that authorities having jurisdiction which require on-site inspection of work, have ample notification to perform inspection, with sufficient lead time to correct deficiencies in a manner that will not impede schedule of completion of Work. If any defect, deficiency or non-compliant is found in work by inspection, be responsible for costs of such inspection, including any related expenses, making good and return to site, until work is passed by governing authorities.

.3 Obtain and submit to Consultant, approval/inspection certificates issued by governing authorities to confirm that Work as installed is in accordance with rules and regulations of local governing authorities and are acceptable.

.4 Include in each copy of operating and maintenance instruction manuals, copies of approvals and inspection certificates issued by regulatory authorities.

1.09 Requirements for Contractor Retained Engineers

.1 Professional engineers retained to perform consulting services with regard to Project work, i.e. seismic engineer, fire protection engineer or structural engineer, are to be members in good standing with local Association of Professional Engineers, and are to carry and pay for errors and omissions professional liability insurance in compliance with requirements of governing authorities in Place of the Work.

.2 Retained engineer's professional liability insurance is to protect Contractor's consultants and their respective servants, agents, and employees against any loss or damage resulting from professional services rendered by aforementioned consultants and their respective servants, agents, and employees in regards to the Work of this Contract.

.3 Unless otherwise specified in Division 00 or 01, liability insurance requirements are as follows:

.1 coverage is to be a minimum of $1,000,000.00 CDN inclusive of any one occurrence;

.2 insurance policy is not to be cancelled or changed in any way without insurer giving Owner minimum thirty days written notice;

.3 liability insurance is to be obtained from an insurer registered and licensed to underwrite such insurance in the Place of the Work;

.4 retained consultants are to ascertain that sub-consultants employed by them carry insurance in the form and limits specified above;

.5 evidence of the required liability insurance in such form as may be required is to be issued to Owner, Owner's Consultant, and Municipal Authorities as required prior to commencement of aforementioned consultant's services.

1.10 Workplace Safety

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of hazardous materials. Submit WHMIS MSDS (Material Safety Data Sheets) for products where required, and maintain one copy at site in a visible and accessible location available to personnel.

.2 Comply with requirements of Occupational Health and Safety Act and other regulations pertaining to health and safety, including worker's compensation/insurance board and fall protection regulations. When working in confined spaces, comply with requirements of Occupational Health and Safety Act - Ontario Regulation 632, "Confined Spaces" and any other applicable Ministry of Labour requirements.

.3 If at any time during course of work, hazardous materials other than those identified in Documents and pertaining to Project Scope of Work, are encountered or suspected that were not identified as being present and which specific instructions in handling of such materials were not given, cease work in area in question and immediately notify Consultant. Comply with local governing regulations with regards to working in areas suspected of containing hazardous materials. Do not resume work in affected area without approval from Owner and reviewed with Consultant.

1.11 Planning and Layout of Work

.1 Base installation layout, design, terminations, and supply of accessories, on Contract Documents with specific coordination with reviewed shop drawings.

.2 Plan, coordinate, and establish exact locations and routing of services with affected trades prior to installation such that services clear each other as well as other obstructions. Generally, order of right of way for services to be as follows:

.1 piping requiring uniform pitch;

.2 piping 100 mm (4") dia. and larger;

.3 large ducts (main runs);

.4 cable tray and bus duct;

.5 conduit 100 mm (4") dia. and larger;

.6 piping less than 100 mm (4") dia.;

.7 smaller branch ductwork;

.8 conduit less than 100 mm (4") dia..

.3 Unless otherwise shown or specified, conceal work in finished areas, and conceal work in partially finished and/or unfinished areas to extent made possible by the area construction. Install services as high as possible to conserve headroom and/or ceiling space. Notify Consultant where headroom or ceiling space appears to be inadequate prior to installation of work.

.4 Do not use Contract Drawing measurements for prefabrication and layout of piping, sheet metal work and such other work. Locations and routing are to generally be in accordance with Contract Drawings, however, prepare layout drawings for such work. Use established bench marks for both horizontal and vertical measurements. Confirm inverts, coordinate with and make allowances for work of other trades. Accurately layout work, and be entirely responsible for work installed in accordance with layout drawings. Where any invert, grade, or size is at variance with Contract Drawings, notify Consultant prior to proceeding with work.

.5 Prepare plan and interference drawings (at a minimum drawing scale of 1:50 or ¼"=1' 0") of work for coordination with each trade Contractor. Arrange for preparation of detailed section drawings of ceiling spaces of corridors and any other congested areas. Sections are to be cross referenced with plan drawings so that trades may make use of section drawings. Section drawings to indicate lateral and elevation dimensions of major services within ceiling space. Lateral dimensions are to be from grid lines and elevations from top of floor slab. Obtain from Consultant, engineering drawings for this use. Contractors' interference drawings are to be distributed among other Trade Contractors. Submit drawings to Consultant for review. Failure of

General Contractor to prepare and coordinate overall interface drawings of trades does not relieve respective Division Contractor of responsibility to ensure that work is properly planned and coordinated.

.6 Carry out alterations in arrangement of work that has been installed without proper coordination, study, and review, even if in accordance with Contract Documents, in order to conceal work behind finishes, or to allow installation of other work, without additional cost. In addition, make necessary alterations in other work required by such alterations, without additional cost.

.7 Shut-off valves, balancing devices, air vents, equipment and similar products, particularly such products located above suspended ceilings must be located for easy access for servicing and/or removal. Products which do not meet this location requirement are to be relocated to an accessible location at no additional cost.

.8 Be responsible for making necessary changes, at no additional cost, to accommodate structural and building conditions that were missed due to lack of coordination.

1.12 Phasing

.1 Include for any and all scheduling, coordination, and construction phasing to suit project, specified in Division 01 and/or as indicated on the drawings. Review exact phasing requirements with Consultant prior to start of Work.

.2 Phasing and scheduling of Work is required in order to maintain existing building operations. Include costs (including costs for "off hours" work) for scheduling, co-ordination, and construction phasing to suit this project as specified in Division 01 and on drawings. Review phasing requirements with Consultant prior to start of Work.

.3 Protect existing areas above, below and adjacent areas of Work from any debris, noise, or interruptions to existing services to satisfaction of Owner and reviewed with Consultant. Maintain in operation existing services to these areas to allow Owner to continue use of these areas. If services that are required to be maintained run through areas of renovations, provide necessary protection to services or reroute, in coordination with Owner and Consultant. Include for required premium time work to meet these requirements.

.4 Work being performed within occupied spaces and work affecting surfaces adjacent to occupied spaces may need to be performed after regular business hours. For areas where spaces are used by Owner on a 24 hours basis or over various hours, coordinate hours of work with Owner on a regular basis to suit Owner's schedule. Execute work at times confirmed with and agreed to by Owner and reviewed with Consultant, so as not to inconvenience Owner's occupation or in any way hinder Owner's use of building. Include for required premium timework to meet these requirements.

.5 Project partial occupancy permits may be required throughout project. Provide for each partial permit, required local governing authority certificate and any other testing/verification certificates for systems.

1.13 Coordination of Work

.1 Review Contract Documents and coordinate work with work of each trade. Coordination requirements are to include but not be limited to following:

.1 requirements for openings, sleeves, inserts and other hardware necessary for installation of work;

.2 concrete work such as housekeeping pads, sumps, bases, etc., required for work, and including required dimensions, operating weight of equipment, location, etc.;

.3 depth and routing of excavation required for work, and requirements for bedding and backfill;

.4 wiring work required for equipment and systems but not specified to be done as part of mechanical work, including termination points, wiring type and size, and any other requirements.

.2 Ensure materials and equipment are delivered to site at proper time and in such assemblies and sizes so as to enter into building and be moved into spaces where they are to be located without difficulty.

.3 Wherever possible, coordinate equipment deliveries with manufacturers and/or suppliers so equipment is delivered to site when it is required, or so it can be stored within building, subject to available space as confirmed with Owner and reviewed with Owner, and protected from elements.

.4 Ensure proper access and service clearances are maintained around equipment, and, where applicable, access space for future equipment removal or replacement is not impeded. Comply with code requirements with regards to access space provision around equipment. Remove and replace any equipment which does not meet this requirement.

.5 Where work is to be integrated, or is to be installed in close proximity with work of other trades, coordinate work prior to and during installation.

1.14 Products

.1 Be responsible for ordering of products (equipment and materials) in a timely manner in order to meet project-scheduling timelines. Failure to order products to allow manufacturers sufficient production/delivery time to meet project-scheduling timelines is an unacceptable reason to request for other suppliers or substitutions.

.2 Provide Canadian manufactured products wherever possible or required and when quality and performance is obtainable at a competitive price. Products are to be supplied from manufacturer's authorized Canadian representative, unless otherwise noted. Unless otherwise specified, products are to be new and are to comply with applicable respective Canadian standards. References to UL listings of products to include requirements that products are to be also Underwriters Laboratories of Canada (ULC) listed for use in Canada. Products are to meet or exceed latest ANSI/ASHRAE/IES 90.1 standards, as applicable. Do not supply any products containing asbestos materials or PCB materials.

.3 Systems and equipment of this Project are to be "State of the Art" and be most recent and up to date series/version of product that is available at time of shop drawing review process. Products that have been stored or "on shelf" for an extended period of time will not be accepted. Software is to be of latest version available and be provided with updates available at time of shop drawing review process. Systems are to be designed such that its software is backwards compatible. Future upgrades are not to require any hardware replacements or additions to utilize latest software.

.4 Products scheduled and/or specified have been selected to establish a performance and quality standard, and, in some instances, a dimensional standard. In most cases, base specified manufacturers are stated for any product specified by manufacturer's name and model number. Where acceptable manufacturers are listed, first name listed is base specified company. Bid Price may be based on products supplied by any of manufacturers' base specified or named as acceptable for particular product. If acceptable manufacturers are not stated for a particular product, base Bid Price on product supplied by base specified manufacturer.

.5 Documents have been prepared based on product available at time of Bidding. If, after award of Contract, and if successful manufacturer can no longer supply a product that meets base specifications, notify Consultant immediately. Be responsible for obtaining other manufacturers product that complies with base specified performance and criteria and meets project timelines. Proposed products are subject to review and consideration by Consultant and are considered as substitutions subject to a credit to Contract. In addition, if such products require modifications to room spaces, mechanical systems, electrical systems, etc., include required changes. Such changes are to be submitted in detail to Consultant for review and consideration for acceptance. There will be no increase in Contract Price for revisions. Above conditions supplement and are not to supersede any specification conditions with regards to substitutions or failure to supply product as per issued documents.

.6 Listing of a product as "acceptable" does not imply automatic acceptance by Consultant and/or Owner. It is responsibility of Contractor to ensure that any price quotations received and submittals made are for products that meet or exceed specifications included herein.

.7 If products supplied by a manufacturer named as acceptable are used in lieu of base specified manufacturer, be responsible for ensuring that they are equivalent in performance and operating characteristics (including energy consumption if applicable) to base specified products. It is understood that any additional costs (i.e. for larger starters, larger feeders, additional spaces, etc.), and changes to associated or adjacent work resulting from provision of product supplied by a manufacturer other than base specified manufacturer, is included in Bid Price. In addition, in equipment spaces where equipment named as acceptable is used in lieu of base specified equipment and dimensions of such equipment differs from base specified equipment, prepare and submit for review accurately dimensioned layouts of rooms affected, identifying architectural and structural elements, systems and equipment to prove that equipment in room will fit properly meeting design intent. There will be no increase in Contract Price for revisions.

.8 In addition to manufacturer's products base specified or named as acceptable, other manufacturers of products may be proposed as substitutions to Consultant for review and consideration for acceptance, listing in each case a corresponding credit

for each substitution proposed. However, base Bid Price on products base specified or named as acceptable. Certify in writing to Consultant that proposed substitution meets space, power, design, energy consumption, and other requirements of base specified or acceptable product. It is understood that there will be no increase in Contract Price by reason of any changes to associated equipment, mechanically, electrically, structurally or architecturally, required by acceptance of proposed substitution. Consultant has sole discretion in accepting any such proposed substitution of product. Indicate any proposed substitutions in areas provided on Bid Form. Do not order such products until they are accepted in writing by Consultant.

.9 Where products are listed as "or approved equal", certify in writing that product to be used in lieu of base specified product, at least meets space, power, design, energy consumption, and other requirements of base specified product and is equivalent or better than base specified product. When requested by Consultant, provide full design detail drawings and specifications of proposed products. Acceptance of these "or approved equal" products is at sole discretion of Consultant. It is understood that there will be no increase in Contract Price by reason of any changes to associated equipment, mechanically, electrically, structurally or architecturally, required by acceptance of approved equal product. There must be no increase in Contract price due to Consultant's rejection of proposed equivalent product.

.10 Whenever use of product other than base specified product is being supplied, ensure corresponding certifications and product information (detailed catalogue and engineering data, fabrication information and performance characteristics) are submitted to Consultant for review. Failure of submission of these documents to Consultant in a timely manner to allow for review will result in base specified product to be supplied at Consultant's discretion, at no additional cost to Contract.

.11 Products supplied by a manufacturer/supplier other than a manufacturer listed as acceptable may be considered for acceptance by Consultant if requested in writing with full product documentation submitted, a minimum of 10 working days prior to Bid closing date.

.12 Any proposed changes initiated by Contractor after award of Contract may be considered by Consultant at Consultant's discretion, with any additional costs for such changes if accepted by Owner and reviewed with Consultant, and costs for review, to be borne by Contractor.

.13 Whenever use of product other than based specified products or named as acceptable is being supplied, time for process of submission of other products and Consultant's review of products will not alter contract time or delay work schedule.

1.15 Shop Drawings

.1 At start-up meeting, review with Consultant products to be included in shop drawing submission. Prepare and submit list of products to Consultant for review.

.2 Submit electronic copies of shop drawings unless otherwise directed by Consultant. Coordinate exact requirements with Consultant.

.3 Submit for review, drawings showing detail design, construction, and performance of equipment and materials as requested in Specification. Submit shop drawings to Consultant for review prior to ordering and delivery of product to site. Include minimally for preparation and submission of following, as applicable:

.1 product literature cuts;

.2 equipment data sheets;

.3 equipment dimension drawings;

.4 system block diagrams;

.5 sequence of operation;

.6 connection wiring schematic diagrams;

.7 functionality with integrated systems.

.4 Each shop drawing or product data sheet is to be properly identified with project name and product drawing or specification reference. Shop drawing or product data sheet dimensions are to match dimension type on drawings.

.5 Where any item of equipment is required by Code or Standard or By-Law to meet a specific energy efficiency level, or any other specific requirement, ensure this requirement is clearly indicated on submission.

.6 Ensure proposed products meet each requirement of Project. Endorse each shop drawing copy "CERTIFIED TO BE IN ACCORDANCE WITH ALL REQUIREMENTS". Include company name, submittal date, and sign each copy. Shop drawings that are received and are not endorsed, dated and signed will be returned to be resubmitted.

.7 Consultant to review shop drawings and indicate review status by stamping shop drawing copies as follows:

.1 "REVIEWED" or "REVIEWED AS NOTED" (appropriately marked) – If Consultant's review of shop drawing is final, Consultant to stamp shop drawing;

.2 "RETURNED FOR CORRECTION" – If Consultant's review of shop drawing is not final, Consultant to stamp shop drawing as stated above, mark submission with comments, and return submission. Revise shop drawing in accordance with Consultant's notations and resubmit.

.8 Following is to be read in conjunction with wording on Consultant's shop drawing review stamp applied to each and every shop drawing or product data sheet submitted:

.1 "THIS REVIEW BY CONSULTANT IS FOR SOLE PURPOSE OF ASCERTAINING CONFORMANCE WITH GENERAL DESIGN CONCEPT. THIS REVIEW DOES NOT MEAN THAT CONSULTANT APPROVES DETAILED DESIGN INHERENT IN SHOP DRAWINGS, RESPONSIBILITY FOR WHICH REMAINS WITH CONTRACTOR. CONSULTANT'S REVIEW DOES NOT RELIEVE CONTRACTOR OF RESPONSIBILITY FOR ERRORS OR OMISSIONS IN SHOP DRAWINGS OR OF CONTRACTOR'S RESPONSIBILITY FOR MEETING REQUIREMENTS OF CONTRACT DOCUMENTS. BE RESPONSIBLE FOR DIMENSIONS TO BE CONFIRMED AND CORRELATED AT JOB SITE, FOR INFORMATION THAT PERTAINS SOLELY TO FABRICATION PROCESSES OR TO TECHNIQUES OF CONSTRUCTION AND INSTALLATION, AND FOR COORDINATION OF WORK OF SUB-TRADES."

.9 Submit each system and each major component as separate shop drawing submissions. Submit together, shop drawings for common devices such as devices of each system are to be submitted together.

.10 Obtain shop drawings for submission from product manufacturer's authorized representatives and supplemented with additional items specified herein.

.11 Do not order product until respective shop drawing review process has been properly reviewed with Consultant.

.12 Where extended warranties are specified for equipment items, submit specified extended warranty with shop drawing submittal.

.13 Applicable mechanical equipment has been selected to meet energy efficiency requirements of ANSI/ASHRAE/IES 90.1, Energy Standards for Buildings, and shop drawings/product data submittals for such equipment must indicate compliance with this Standard or they will be returned for correction and re-submittal.

1.16 Equipment Loads

.1 Supply equipment loads (self-weight, operating weight, housekeeping pad, inertia pads, etc.) to Consultant, via shop drawing submissions, prior to construction.

.2 Where given choice of specific equipment, actual weight, location and method of support of equipment may differ from those assumed by Consultant for base design. Back-check equipment loads, location, and supports, and include necessary accommodations.

.3 Where supporting structure consists of structural steel framing, it is imperative that equipment loads, location, and method of support be confirmed prior to fabrication of structural steel. Review locations of equipment with Consultant prior to construction.

1.17 Openings

.1 Supply opening sizes and locations to Consultant to allow verification of their effect on design, and for inclusion on structural drawings where appropriate.

.2 No openings are permitted through completed structure without written approval from Owner and reviewed with Consultant. Show required openings on a copy of structural drawings. Identify exact locations, elevations, and size of proposed openings and submit to Consultant for review, well in advance of doing work.

.3 Prior to leaving site at end of each day, walk through areas of work and check for any openings, penetrations, holes, and/or voids created under scope of work of project, and ensure that any openings created under scope of work have been closed off, fire-stopped and smoke-sealed. Unless directed by Owner and reviewed with Consultant, do not leave any openings unprotected and unfinished overnight.

1.18 Scaffolding, Hoisting and Rigging

.1 Unless otherwise specified or directed, supply, erect and operate scaffolding, rigging, hoisting equipment and associated hardware required for work, and subject to approval from Owner and reviewed with Consultant.

.2 Immediately remove from site scaffolding, rigging and hoisting equipment when no longer required.

.3 Do not place major scaffolding/hoisting equipment loads on any portion of structure without approval from Owner and reviewed with Consultant.

1.19 Changes in the Work

.1 Whenever Consultant proposes in writing to make a change or revision to design, arrangement, quantity or type of work from that required by Contract Documents, prepare and submit to Consultant for review, a quotation being proposed cost for executing change or revision.

.2 Quotation is to be a detailed and itemized estimate of product, labour, and equipment costs associated with change or revision, plus overhead and profit percentages and applicable taxes and duties.

.3 Unless otherwise specified in Division 00 or 01, allowable maximum percentages for overhead and profit are to be 7% and 5% respectively.

.4 Unless otherwise specified in Divisions 00 or 01, following additional requirements apply to all quotations submitted:

.1 when change or revision involves deleted work as well as additional work, cost of deleted work (less overhead and profit percentages but including taxes and duties) is to be subtracted from cost of additional work before overhead and profit percentages are applied to additional work;

.2 material costs are not to exceed those published in local estimating price guides;

.3 mechanical material labour unit costs are to be in accordance with Mechanical Contractors Association of America Labor Estimating Manual, less 25%;

.4 electrical material labour unit costs are to be in accordance with National Electrical Contractors Association Manual of Labor Units at difficult level, less 25%;

.5 costs for journeyperson and apprentice labour must not exceed prevailing rates at time of execution of Contract and must reflect actual personnel performing work;

.6 cost for site superintendent must not exceed 10% of total hours of labour estimated for change or revision, and change or revision must be such that site superintendent's involvement is necessary;

.7 costs for rental tools and/or equipment are not to exceed local rental costs;

.8 overhead percentage will be deemed to cover quotation costs other than actual site labour and materials, and rentals;

.9 quotations, including those for deleted work, to include a figure for any required change to Contract time.

.5 Quotations submitted that are not in accordance with requirements specified above will be rejected and returned for re-submittal. Failure to submit a proper quotation to enable Consultant to expeditiously process quotation and issue a Change Order will not be grounds for any additional change to Contract time.

.6 Make requests for changes or revisions to work to Consultant in writing and, if Consultant agrees, will issue Notice of Change.

.7 Do not execute any change or revision until written authorization for the change or revision has been obtained from Consultant.

1.20 Progress Payment Breakdown

.1 Prior to submittal of first progress payment draw, submit a detailed breakdown of work cost to assist Consultant in reviewing and approving progress payment claims.

.2 Payment breakdown is subject to Owner's approval and Consultant's review. Progress payments will not be processed until an approved breakdown is in place. Breakdown is to include one-time claim items such as mobilization and demobilization, insurance, bonds (if applicable), shop drawings and product data sheets, commissioning including testing, adjusting and balancing, system testing and verification, and project closeout submittals.

.3 Indicate equipment, material and labour costs for site services (if applicable) and indicate work of each trade in same manner as indicated on progress draw.

1.21 Notice for Required Field Reviews

.1 Whenever there is a requirement for Consultant to perform a field review prior to concealment of any work, to inspect/re-inspect work for deficiencies prior to Substantial Performance of the Work, for commissioning demonstrations, and any other such field review, give minimum 5 working days' notice in writing to Consultant.

.2 If Consultant is unable to attend a field review when requested, arrange an alternative date and time.

.3 Do not conceal work until Consultant advises that it may be concealed.

.4 When Consultant is requested to perform a field review and work is not ready to be reviewed, reimburse Consultant for time and travel expenses.

1.22 Preliminary Testing

.1 When directed by Consultant, promptly arrange, pay for, and perform site tests on any piece of equipment or any system for such reasonable lengths of time and at such times as may be required to prove compliance with Specification and governing Codes and Regulations, prior to Substantial Performance of the Work.

.2 When, in Consultant's opinion, tests are required to be performed by a certified testing laboratory, arrange and pay for such tests.

.3 These tests are not to be construed as evidence of acceptance of work, and it is agreed and understood that no claim for delays or damage will be made for injury or breakage to any part or parts of equipment or system due to test where such injuries or breakage were caused by faulty parts and/or workmanship of any kind.

.4 When, in Consultant's opinion, tests indicate that equipment, products, etc., are defective or deficient, immediately remove such equipment and/or products from site and replace them with acceptable equipment and/or products, at no additional cost.

1.23 Provisions for Systems/Equipment Used During Construction

.1 Permanent building mechanical systems are not to be used for temporary heating or cooling purposes during construction.

1.24 Temporary Services

.1 Coordinate with Prime Contractor, requirements for temporary services including but not limited to temporary heating, cooling and water. Unless otherwise noted, provide required services in compliance with requirements of local governing building code and local governing inspection authorities.

.2 Maintain fire protection of areas which may include fire watch during temporary shutdowns of existing systems, in accordance with requirements of local governing code and local governing authorities.

1.25 Maintaining Equipment Prior to Acceptance

.1 Maintain equipment in accordance with the manufacturer's printed instructions prior to start-up, testing and commissioning.

.2 Employ a qualified millwright to check and align shafts, drives, and couplings on all base mounted split coupled motor driven equipment.

.3 Where equipment lubrication fittings are not easily accessible, extend the fittings to accessible locations using copper or aluminium tubing.

.4 All filters are to be new upon Substantial Performance of the Work. This is in addition to any spare filters specified.

1.26 Cleaning

.1 During construction, keep site reasonably clear of rubbish and waste material resulting from work on a daily basis to the satisfaction of Owner and Consultant. Before applying for a Certificate of Substantial Performance of the Work, remove rubbish and debris, and be responsible for repair of any damage caused as a result of work.

.2 Clean equipment and devices installed as part of this project.

1.27 Record As-Built Drawings

.1 Drawings for this project have been prepared on a CAD system using AutoCAD software of release version reviewed with Consultant. For purpose of producing record "as built" drawings, copies of Contract Drawings can be obtained from Consultant.

.2 As work progresses at site, clearly mark in red in a neat and legible manner on a set of bound white prints of Contract Drawings, changes and deviations from routing of services and locations of equipment shown on Contract Drawings, on a daily basis. Changes and deviations include those made by addenda, change orders, and site instructions. Use notes marked in red as required. Maintain white print red line as-built set at site for exclusive use of recording as-built conditions, keep set up-to-date at all times, and ensure set is always available for periodic review. As-built set is also to include the following:

.1 dimensioned location of inaccessible concealed work;

.2 locations of control devices with identification for each;

.3 for underground piping and ducts, record dimensions, invert elevations, offsets, fittings, cathodic protection and accessories if applicable, and locate dimensions from benchmarks to be preserved after construction is complete;

.4 for fire protection systems, record actual locations of equipment, sprinkler heads, and valves, drains, and test locations, and deviations of pipe routing and sizing from that shown on the drawings;

.5 location of piping system air vents;

.6 location of concealed services terminated for future extension and work concealed within building in inaccessible locations.

.3 Before applying for a Certificate of Substantial Performance of the Work, update a clean copy of Contract Drawing set in accordance with marked up set of "as-built" white prints including deviations from original Contract Drawings, thus forming an "as-built" drawing set. Submit "as-built" site drawing prints to Consultant for review. Make necessary revisions to drawings as per Consultant's comments, to satisfaction of Consultant.

.4 Use final reviewed "as-built" drawing set to provide CAD files of drawings thus forming true "as-built" set of Contract Drawings. Identify set as "Project Record Copy". Load digital copies of final reviewed by Consultant as-built drawings onto USB type flash drive. Provide 2 complete sets of "as-built" drawings on separate USBs. Submit "as-built" sets of white prints and USBs to Consultant.

.5 Submitted drawings are to be of same quality as original Contract Drawings. CAD drawing files are to be compatible with AutoCAD software release version confirmed with Consultant.

.6 Unless otherwise noted in Divisions 00 or 01, failure to maintain accurate record drawings will incur additional 5% holdback on progress claims until drawings are brought up to date to satisfaction of Owner and reviewed with Consultant.

.7 For projects with phased turnover of project (refer to Division 01), review with Consultant completeness of as-built drawings prior to turn over of an area. Interim as-built drawings to be made available to Owner's maintenance personnel.

.8 Where part of the Mechanical Scope of Work, retain and pay for services of a land surveyor registered in Place of the Work to measure, verify, and record size, location, invert elevation and pitch of buried piping services, and, when complete, transfer survey work to as-built drawings.

1.28 Operating and Maintenance Manuals

.1 For each item of equipment for which a shop drawing is required (except for simple equipment), supply indexed copies of equipment manufacturers' operating and maintenance (O&M) instruction data manuals. Consolidate each copy of data as a PDF file on a USB drive. Consolidated O&M manual PDF to include:

.1 front cover: project name; wording – "Mechanical Systems Operating and Maintenance Manual"; and date;

.2 introduction sheet listing Consultant, Contractor, and Subcontractor names, street addresses, telephone and fax numbers, and e-mail addresses;

.3 equipment manufacturer's authorized contact person name, telephone number and company website;

.4 Table of Contents sheet, and corresponding index tab sheets;

.5 copy of each "REVIEWED" or clean, updated "REVIEWED AS NOTED" shop drawing or product data sheet, with manufacturer's/supplier's name, telephone and fax numbers, email address, company website address, and email address for local source of parts and service; when shop drawings are returned marked "Reviewed As Noted" with revisions marked on shop drawing copies, they are to be revised by equipment supplier to incorporate comments marked on "Reviewed" shop drawings and a clean updated copy is to be included in operating and maintenance manuals;

.6 Operating data is to include:

.1 pressure test reports, and certificates issued by governing authorities;

.2 description of each system and its controls;

.3 control schematics for equipment/systems including building environmental controls;

.4 wiring and connection diagrams;

.5 if applicable, BAS architecture and all required operating data;

.6 description of operation of each system at various loads together with reset schedules and seasonal variances;

.7 operation instruction for each system and each component;

.8 description of actions to be taken in event of emergencies and/or equipment failure;

.9 valve tag schedule, and flow diagrams to indicate valve locations.

.7 Maintenance data is to include:

.1 operation and trouble-shooting instructions for each item of equipment and each system;

.2 schedules of tasks, frequency, tools required, and estimated task time;

.3 recommended maintenance practices and precautions;

.4 complete parts lists with numbers.

.8 Performance data is to include:

.1 equipment and system start-up data sheets;

.2 equipment performance verification test results, and final commissioning report;

.3 final testing, adjusting and balancing reports.

.9 copies of warranties;

.10 items requested specifically in Section Articles.

.2 Operating and maintenance instructions are to relate to job specific equipment supplied under this project and related to Owner's building. Language used in manuals is to contain simple practical operating terms and language easy for in-house maintenance staff to understand how to operate and maintain each system.

.3 Before applying for a Certificate of Substantial Performance of the Work, assemble one copy of O & M Manual and submit to Consultant for review prior to assembling remaining copies. Incorporate Consultant's comments into final submission.

1.29 Commissioning

.1 After successful start-up and prior to Substantial Performance of the Work, commission the mechanical work. Commissioning work is the process of Contractor demonstrating to Owner and Consultant, for purpose of final acceptance, by means of successful and documented functional performance testing, that systems and/or subsystems are capable of being operated and maintained to perform in accordance with requirements of Contract Documents, as further described below.

.1 Retain services of a testing, adjusting, and balancing agency to perform testing and balancing of mechanical system air/fluid flows and capacities, prior to operational performance testing. Refer to Section 20 05 93 – Testing, Adjusting, and Balancing for Mechanical Systems.

.2 Test, adjust and operate equipment and systems after start-up but before functional performance testing, to confirm operations are in accordance with requirements of Contract Documents. Verify modes and sequences of control and monitoring, interlocks, and responses to emergency conditions. Complete commissioning data sheets to document successful operational performance testing.

.3 Repeat successful operational performance testing with completed commissioning data sheet documentation in the presence of Consultant and Owner to validate and verify equipment and systems are complete in all respects, function correctly, and are ready for acceptance.

.4 Submit final commissioning data sheets, TAB reports as specified in Section 20 05 93 – Testing, Adjusting, and Balancing for Mechanical Systems, project closeout documents, and other required submittals.

1.30 Warranty

.1 Unless otherwise specified in Divisions 00 and 01, warrant mechanical work to be in accordance with Contract Documents and free from defects for a period of two (2) years from date of issue of a Certificate of Substantial Performance of the Work.

.2 Where equipment includes extended warranty period, e.g., 5 years, first year of warranty period is to be governed by terms and conditions of warranty in Contract Documents, and remaining years of warranty are to be direct from equipment manufacturer and/or supplier to Owner. Submit signed and dated copies of extended warranties to Consultant.

.3 Warranty to include parts, labour, travel costs and living expenses incurred by manufacturer's authorized technician to provide factory authorized on-site service.

.4 Repair and/or replace any defects that appear in Work within warranty period without additional expense to Owner. Be responsible for costs incurred in making defective work good, including repair or replacement of building finishes, other materials,

and damage to other equipment. Ordinary wear and tear and damage caused wilfully or due to carelessness of Owner's staff or agents is exempted.

.5 Do not include Owner deductible amounts in warranties.

.6 It is understood that warranties are to commence from time of Substantial Performance of the Work, regardless of what is noted within following Sections of Specification. Be responsible for providing whatever "bridging" or additional extended warranty period is required from time that material is purchased until this time.

.7 Visit building during warranty period with Owner representatives. Owner to organize these visits. At these meetings, Owner representatives are to review performance of systems. If performance is satisfactory, then no further action needs to be taken. If unsatisfactory, then correct deficiencies, as directed by Owner representatives, to satisfaction of Owner's representatives. These site visits to occur:

.1 once during 1st month of building operation;

.2 once during 3rd month of building operation;

.3 once between 4th and 10th month in a season opposite to 1st and 3rd month visits.

1.31 Closeout Submittals

.1 Prior to application for Substantial Performance of the Work, submit required items and documentation specified, including following as applicable to the project:

.1 Operating and Maintenance Manuals;

.2 as-built record drawings and associated data;

.3 extended warranties for equipment as specified;

.4 operating test certificates, i.e. Sprinkler Test Certificate;

.5 final commissioning report and TAB report;

.6 identified keys for equipment and/or panels for which keys are required, and other items required to be submitted;

.7 other data or products specified.

1.32 Instructions to Owner

.1 Refer to equipment and system operational and maintenance training requirements specified in Division 01.

.2 Train Owner's designated personnel in aspects of operation and maintenance of equipment and systems as specified. Demonstrations and training are to be performed by qualified technicians employed by equipment/system manufacturer/supplier. Supply hard copies of training materials to each attendee.

.3 Unless where specified otherwise in trade Sections, minimum requirements are for manufacturer/suppliers of each system and major equipment, to provide minimum two separate sessions each consisting of minimum 4 hours on site or in factory training (at Owner's choice), of Owner's designated personnel (for up to 6 people each session), on operation and maintenance procedures of system.

.4 For each item of equipment and for each system for which training is specified, prepare training modules as specified below. Use Operating and Maintenance Manuals during training sessions. Training modules include but are not limited to:

.1 Operational Requirements and Criteria – equipment function, stopping and starting, safeties, operating standards, operating characteristics, performance curves, and limitations;

.2 Troubleshooting – diagnostic instructions, test and inspection procedures;

.3 Documentation – equipment/system warranties, and manufacturer's/supplier's parts and service facilities, telephone numbers, email addresses, and the like;

.4 Maintenance – inspection instructions, types of cleaning agents to be used as well as cleaning methods, preventive maintenance procedures, and use of any special tools;

.5 Repairs – diagnostic instructions, disassembly, component removal and repair instructions, instructions for identifying parts and components, and review of any spare parts inventory.

.5 Before instructing Owner's designated personnel, submit to Consultant for review preliminary copy of training manual and proposed schedule of demonstration and training dates and times. Incorporate Consultant's comments in final copy.

.6 Obtain in writing from Consultant list of Owner's representatives to receive instructions. Submit to Consultant prior to application for Certificate of Substantial Performance of the Work, complete list of systems for which instructions were given, stating for each system:

.1 date instructions were given to Owner's staff;

.2 duration of instruction;

.3 names of persons instructed;

.4 other parties present (manufacturer's representative, consultants, etc.).

.7 Obtain signatures of Owner's staff to verify they properly understood system installation, operation and maintenance requirements, and have received operating and maintenance instruction manuals and "as-built" record drawings.

.8 Submit to Consultant copy of electronic version of training materials and include in operating and maintenance manuals submission.

1.33 Final Inspection

.1 Submit to Consultant, written request for final inspection of systems. Include written certification that:

.1 deficiencies noted during job inspections have been completed;

.2 field quality control procedures have been completed;

.3 systems have been tested and verified, balanced and adjusted, and are ready for operation;

.4 maintenance and operating data have been completed and submitted to, reviewed with Consultant and accepted by Owner;

.5 tags and nameplates are in place and equipment identifications have been completed;

.6 clean-up is complete;

.7 spare parts and replacement parts specified have been provided and acknowledged by Consultant;

.8 as-built and record drawings have been completed and submitted to and reviewed with Consultant and accepted by Owner;

.9 Owner's staff has been instructed in operation and maintenance of systems;

.10 commissioning procedures have been completed.

2 Products – Not Used

3 Execution – Not Used

End of Section

1 General

1.01 Submittals

.1 Shop Drawings/Product Data: Submit shop drawings with product data sheets for variable frequency drives (VFDs). Include:

.1 construction and performance details;

.2 wiring and control schematics;

.3 dimensions of units;

.4 calculations specific to installation showing total harmonic voltage distortion is less than 5%;

.5 certified production test results with serial numbers for harmonic mitigation performance and energy efficiency under actual variable frequency drive loading.

.2 Certification Letter: Submit a start-up and installation certification letter from supplier of VFDs as specified in Part 3 of this Section;

.3 Parameters: Prepare list of parameters for uploading for Owner's future use as specified in Part 3 of this Section. Load on USB type flash drive and submit to Consultant.

.4 Extended Warranty: Where extended warranty is specified to be included, include a copy of VFD extended warranty in each Operating and Maintenance Manual. Prior to Substantial Performance of Work, submit a copy of warranty to Owner.

.5 Additionally, coordinate with Prime Contractor and Electrical Contractor to ensure that shop drawings clearly identify that proposed VFDs and connected motors are 100% compatible and Mechanical Contractor to sign off on selected VFDs.

1.02 Coordination with Electrical Divisions

.1 This Section specifies VFD requirements for motors. Ensure that VFDs packaged with various system equipment, complies with specifications of this Section.

.2 VFDs are each to be approved by respective manufacturers of VFDs and connected motors, as suitable for installation on scheduled motors. VFD output current rating to match or exceed connected motor nameplate full load current rating.

.3 Coordinate and review with Electrical Divisions, responsibility requirements for supply of VFDs, harmonic filters and requirements for control and power conductors and connections.

.4 Check that motors are equipped with AEGIS or approved equal, shaft grounding ring system to protect bearings from damage in motors by diverting harmful shaft voltages and bearing currents to ground.

.5 Additionally, review and confirm responsibilities with Consultant and Prime Contractor.

2 Products

2.01 VFD Basic Requirements

.1 VFDs supplied on project to be products of same manufacturer and be CSA approved, ULC listed and labelled. Base specified product is ABB ACH series units that include compliance with following standards:

.1 CSA C22.2 No.14 Industrial Control Equipment;

.2 UL 508 - Industrial Control Equipment;

.3 UL 508C – Power Conversion Equipment;

.4 NEMA ICS 7 - Adjustable-Speed Drives.

.2 Basis for limiting harmonics is to be provided generally to IEEE Standard 519 - Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems, except intended for user's electrical distribution system with point of common coupling (where harmonic limits are assessed) to be set at input terminals of harmonic mitigating equipment.

.3 Refer to Schedule of VFDs on drawings for features to include with respective VFDs.

.4 VFDs to include following basic requirements:

.1 regardless of HP rating are to be of same VFD model; I/O and control circuit boards as well as keypads are to be identical and interchangeable regardless of HP rating;

.2 to be capable of starting into a coasting load (forward or reverse) up to full speed and accelerate or decelerate to set point without safety tripping or component damage (flying start);

.3 6-pulse width modulated (PWM) AC to AC converter utilizing latest isolated gate bipolar transistor (IGBT) technology; PWM switching pattern to include a motor flux optimization circuit that automatically reduces applied motor voltage to the motor to optimize energy consumption and audible motor noise;

.4 carrier frequency control circuit that reduces the carrier frequency based on actual VFD temperature that allows higher carrier frequency without derating VFD or operating at high carrier frequency only at low speeds;

.5 provisions that determines motor torque and flux every 25 microseconds (40,000 times per second);

.6 completely assembled and tested by manufacturer in their facility;

.7 designed to provide at least 250,000 hours mean time before failure (MTBF) when specified preventative maintenance is performed.

.8 bypass system completely factory wired and tested;

.9 door interlocked padlockable disconnect switch that disconnects all input power from drive and all internally mounted options;

.10 control panel keyboard and display with password protection against parameter changes.

2.02 VFD Ratings

.1 VFDs to be rated to operate from 3 phase input voltage of 208 or 600 volts ± 10%, as scheduled, and frequency range from 48 to 63 Hz. In addition, a tolerated voltage window to allow system to operate from a line of +30% to -35% nominal voltage. System to incorporate circuitry that allows drive or bypass contactor to remain "sealed in" over this voltage tolerance at a minimum.

.2 VFDs to employ a full wave rectifier to prevent input line notching and operate at a minimum fundamental input power factor of 0.97 at all speeds and loads.

.3 VFDs efficiency to be 96% or better at full speed and load.

.4 Output voltage and current ratings to match adjustable frequency operating requirements of standard 3ph, 60Hz, NEMA design B inverter-duty motors in compliance with NEMA-MG1, Part 31 Standard. Overload current capacity for variable torque overload capacity to be 110% of rated current for 1 minute out of 10 minutes and 130% for 2 seconds. Output frequency to be adjustable between 0 and 500 Hz.

.5 Open loop static speed regulation to be 0.1% to 0.3% (10% of motor slip). Dynamic speed accuracy to be 4%-sec. or better open loop.

.6 When a suitable motor is used, drive provides breakaway torque equal to 200% of rated motor torque. Torque response time to be 5 ms or less.

.7 Enclosures:

.1 in climate controlled areas – minimum NEMA 12 with drip shield;

.2 in non-climate controlled areas – NEMA 3R.

2.03 Harmonic Filters and Reactors

.1 VFDs to include internal 5% impedance AC line reactor (or equivalent 5% impedance dual positive and negative DC bus reactors) provided as a standard to reduce input current harmonic content and provide isolation from power line transients and to reduce RFI emissions.

.2 VFDs to be provided with harmonic filters to limit harmonics distortion produced by each drive to following maximum levels as measured on input side of drive:

.1 Total harmonic distortion (voltage) – 5%;

.2 Total harmonic distortion (current) – 10%.

.3 Harmonic filter to be based on MIRUS International Inc. "LINEATOR AUHF" series, with features as follows:

.1 manufactured and tested in accordance with latest applicable standards of ULC, CSA and NEMA;

.2 treat characteristic low frequency harmonics generated by a 3-phase, diode bridge rectifier load (5th, 7th, 11th, 13th, etc.);

.3 passive inductor/capacitor network;

.4 low capacitive reactance (KVAR) of less than 20% of kVA rating, to ensure compatibility with engine generator sets;

.5 full load efficiency of harmonic mitigation equipment / VFD combination to be greater than 96%;

.6 copper wiring;

.7 220°C system insulation class and temperature rise of 130°C;

.8 anti-vibration pads between reactor or transformer core and enclosure;

.9 manufacturer's standard ventilated, NEMA-3R enclosure.

2.04 Controls and Adjustment Functions

.1 Include for following:

.1 programmable critical frequency lockout ranges to prevent VFD from operating load continuously at an unstable speed;

.2 proportional integral derivative (PID) speed loop regulators with an auto tune function as well as manual adjustments; PID set point controllers to allow pressure or flow signals to be connected to VFD, using microprocessor in VFD for closed loop control; includes 250 ma of 24 VDC auxiliary power and capability of loop powering a transmitter supplied by others; two parameter sets for first PID that allow sets to be switched via a digital input, serial communications or from keypad for night setback, summer/winter set points, etc; independent, second PID loop that can utilize second analogue input and modulate analogue outputs to maintain set point of an independent process (ie. valves, dampers, etc.); set points, process variables, etc. to be accessible from serial communication network;

.3 programmable analogue inputs that accept current or voltage signals.

.4 programmable analogue outputs (0-20ma or 4-20 ma), that may be programmed to output proportional to Frequency, Motor Speed, Output Voltage, Output Current, Motor Torque, Motor Power (kW), DC Bus voltage, Active Reference, and other data;

.5 programmable digital inputs;

.6 programmable digital Form-C relay contact outputs for programmable on and off delay times and adjustable hysteresis; rated for maximum switching current 8 amps at 24 VDC and 0.4 A at 250 VAC; maximum voltage 300 VDC and 250 VAC; continuous current rating 2 amps RMS;

.7 run permissive circuit - for damper or valve control; dry contact closure that will signal damper to open (VFD motor does not operate); when damper is fully open, a normally open dry contact (end-switch) closes; closed end-switch is wired to a VFD digital input and allows motor operation; two separate safety interlock inputs, when either is opened, motor to coast to stop, and damper to close;

.8 two independently adjustable accel and decel ramps with 1 – 1800 seconds adjustable time ramps;

.9 fireman's override input - upon receipt of a contact closure from fireman's control station, VFD operates in one of two modes: operate at a programmed predetermined fixed speed or operate in a specific fireman's override PID algorithm that automatically adjusts motor speed based on override set point and feedback; mode overrides all other inputs (analogue/digital, serial communication and keypad commands), except customer defined safety run interlock, and forces motor to run in one of the two modes; "Override Mode" to be displayed on control panel; upon removal of override signal, VFD resumes normal operation.

.2 Operator Control Panel:

.1 front mounted plug-in operator control panel consisting of keypad, multi-line backlit LCD display for programming and fault diagnostics;

.2 keys (switches) for HAND, OFF, AUTO, and manual speed control INCREASE/DECREASE;

.3 menu navigation and parameter selection keys for custom programming;

.4 date and time clock - clock to have a battery backup with 10 years minimum life span; clock to be used to date and time stamp faults and record operating parameters at time of fault; if battery fails VFD l automatically reverts to hours of operation since initial power up; clock also to be programmable to control start/stop functions, constant speeds, PID parameter sets and output relays; VFD to have a digital input that allows an override to time clock (when in off mode) for a programmable time frame; four (4) separate, independent timer functions that have both weekday and weekend settings;

.5 parameter names, fault messages, warnings and other information to be displayed in complete words or standard abbreviations to allow user to understand what is being displayed without use of a manual or cross reference table, as follows:

.1 "HAND" position to start drive and modify reference frequency by use of INCREASE/DECREASE keys;

.2 "OFF" position stops drive;

.3 "AUTO" position allows drive to be started or stopped using whichever remote start/stop command configured; drive speed controlled by external speed reference input or by PID controller.

.4 applicable operating values to be capable of being displayed in engineering (user) units; operating displayed include:

.1 Output Frequency;

.2 Motor Speed (RPM, %, or Engineering units);

.3 Motor Current;

.4 Drive Temperature;

.5 DC Bus Voltage;

.6 Output Voltage.

2.05 Protective Functions

.1 For each programmed warning and fault protection function, keypad displays a message in complete words or standard abbreviations.

.2 VFDs include metal oxide varistors (MOV's) for phase to phase and phase to ground line voltage transient protection.

.3 Short circuit current rating of 100,000 amps to be provided per UL 508C without relying on line fuses.

.4 Ground fault protection, motor phase loss protection and phase unbalance protection to be provided. Single phase protection to be provided on input and output.

.5 VFDs to provide electronic motor overload protection qualified per UL 508C.

.6 Protection to be provided for AC line or DC bus overvoltage at 130% of maximum rated or undervoltage at 65% of minimum rated.

.7 Stall protection to be programmable to provide a warning or stop VFD after motor has operated above a programmable torque level for a programmed time limit.

.8 Underload protection to be programmable to provide a warning or stop VFD after motor has operated below a selected underload curve for a programmed time limit.

.9 Overtemperature protection to provide a warning if power module temperature is less than 5C° (9F°) below overtemperature trip level.

.10 Input terminal to be provided for connecting a motor thermistor (PTC type) to drive's protective monitoring circuitry. An input to also be programmable to monitor an external relay or switch contact.

.11 VFDs through 56 kW (75HP) to be protected from damage from input and output power miss-wiring. VFD to sense this condition and display an alarm on control panel.

.12 EMI / RFI filters to be provided as per standard EN 61800-3.

.13 dv/dt long lead filter (LRC) to protect power system network.

.14 Automatic reset feature to automatically reset selected faults and attempt to restart drive based on control parameters such as adjustable time delays, number of restart attempts and duration of restart attempts. Faults include following:

.1 Overcurrent;

.2 Overvoltage;

.3 Undervoltage;

.4 Analogue input signal reference loss;

.5 External fault.

.15 Additional built-in protection circuits include:

.1 Overcurrent trip limit;

.2 Undervoltage trip limit;

.3 Microprocessor fault;

.4 Keypad control panel loss;

.5 Serial communication loss;

.6 External fault interlock inputs;

.7 Adjustable output frequency and motor speed limits;

.8 Pass code parameter change protection;

.9 Keypad operator control lockout.

2.06 Manual Bypass

.1 Bypass system to be a fully operational horsepower rated manual system for full speed operation without VFD, with following components:

.1 VFD and By-pass output contactors, mechanically and electrically interlocked to allow only one mode of operation at one time;

.2 service switch or contactor to isolate VFD from supply;

.3 VFD input fuses;

.4 door mounted VFD/OFF/BY-PASS selector switch;

.5 VFD ON and BY-PASS ON indicator lights;

.6 door mounted HAND/OFF/AUTO switch if Hand operation is unavailable at VFD control panel;

.7 terminals for external customer safety interlocks.

.2 Bypass designs, which have no VFD only fuses, or that incorporate fuses common to both VFD and bypass are not acceptable.

.3 Door interlocked padlockable fused disconnect switch that supplies power to VFD and bypass, and disconnects input power from drive, bypass and all internally mounted devices.

2.07 Communications

.1 VFD to be complete with communications connections of integrated RS-485 port suitable to allow for VFD to be controlled, supervised, monitored and programmed from one remote control panel or PC with VFD system Windows based application software.

.2 Communications protocol to be industry standard compatible to BAS of building. Coordinate exact requirements with Mechanical Divisions controls contractor and BAS vendor to ensure that appropriate interface module is supplied for drive system to communicate with BAS being used in building with interface capability to include serial communication standard protocols as follows:

.1 ModBus;

.2 Johnson Controls Metasys N2;

.3 Siemens Building Technologies FLN;

.4 BACnet.

.3 Serial communication to be used for drive setup, diagnostic analysis, monitoring and control with capabilities to include, but not be limited to:

.1 run-stop control;

.2 speed set adjustment;

.3 proportional/integral/derivative PID control adjustments;

.4 current limit;

.5 accel/decel time adjustments;

.6 ability to lock and unlock control panel keypad;

.7 capability of allowing BAS to monitor feedback such as process variable feedback, output speed / frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), and drive temperature;

.8 monitoring relays output status, and digital input status and analogue output values;

.9 transmitting diagnostic warning and fault information over communications bus to BAS or other monitoring system;

.10 remote fault reset.

.4 Serial communication and Windows based software to be used for drive setup, diagnostic analysis, monitoring and control. Software to provide real time graphical displays of drive performance. VFD software communication capabilities include, but not be limited to:

.1 system ON/OFF;

.2 system status;

.3 Suitable input for speed control;

.4 run-stop control;

.5 ability to force unit to bypass;

.6 ability to lock and unlock control panel keypad;

.7 allowing BAS to monitor feedback such as, current (in amps), kilowatt hours (resettable), operating hours (resettable), and logic board temperature;

.8 monitoring relays output status, and all digital input status;

.9 transmitting diagnostic warning and fault information over communications bus to BAS or other monitoring system;

.10 remote fault reset;

.11 keypad "Hand" or "Auto" selected, and status indications and settings transmitted over serial communications bus;

.12 monitor if motor is running under load in both VFD and bypass (proof of flow) in VFD mode over serial communications or Form-C relay output;

.13 minimum of 40 field parameters to be capable of being monitored in bypass mode.

2.08 Warranty

.1 VFDs to be warranted free from defective labour and materials for period of 36 months from date of Substantial Performance of the Work. Include for initial one year Contract warranty and an additional 2 year extended warranty direct to Owner. Extended warranty terms and conditions are to be identical to one year Contract warranty, and extended warranty period is to commence day Contract warranty expires.

2.09 Site Services, Training, and Maintenance Manuals

.1 Provide onsite inspection, testing, start up and verification work of VFDs and filters by manufacturer's authorized technician. Allow a minimum of 1/2 day per system. Also include for a second visit to site of one (1) day duration to train operating personnel in operation and maintenance of drives. Provide verification reports and supply soft copy of system programming parameters.

.2 Upon completion of installation, supplier of VFDs to supply minimum one hard copy of complete sets of service and maintenance manuals including wiring and connection diagrams. Include for digital copy loaded onto a USB type flash drive.

.3 Provide system training and instructions on operating and maintenance procedures. Refer to additional requirements in General Instructions section and Division 01.

.4 Include for manufacturer's authorized technician to be in attendance to assist Commissioning Agent during commissioning process.

2.10 Acceptable Manufacturers

.1 Acceptable VFD manufacturers are:

.1

.2 Danfoss;

.3 ABB;

.4 Schneider Electric (Square D);

.5 Rockwell Automation;

.6 Eaton Cutler Hammer;

.7 Siemens Electric;

.8 Control Techniques.

3 Execution

3.01 Installation of Variable Frequency Drives

.1 Provide variable frequency drives for motorized equipment in accordance with drawing requirements. Coordinate requirements for conductors and connections with Electrical Divisions Contractor.

.2 Ensure that variable speed drives supplied are products of same manufacturer.

.3 Unless otherwise noted on drawings or in Part 2 of this Section, include minimally, a manual bypass with each VFD. Supply electronic bypass with VFDs specifically noted and/or scheduled on drawings.

.4 Ensure wire length between VFD and motor is less than 15 m (50') with properly sized conductors.

.5 Install VFDs in accordance with manufacturer's instructions. Ensure that VFDs installation include upstream protection, either fuses or circuit breakers in accordance with VFD manufacturer's recommendations and local electrical code requirements. Advise Electrical Divisions Contractor of these requirements in addition to required conductors and connections. Provide required control wiring and connections.

.6 Review VFD and related connected motor installation. Provide local disconnect to VFD in accordance with local governing code requirements.

.7 Mount VFDs operating controls/display at approximately 1.5 m (5') above finished floor level, unless otherwise directed by Consultant. Provide dual back to back C-channel support system from floor to ceiling, complete with cross bracing to form a solid backing for VFD mounting at required locations.

.8 Properly support VFDs. Coordinate exact locations on site with Consultant.

.9 Where VFDs are required for custom made air handling units VFDs to be supplied, factory mounted on fan cabinets, and "load" side connected to fan motors by air handling unit manufacturer. "Line" side power wiring to these VFDs to be provided as part of Electrical Divisions work.

.10 Where VFDs are required for commercial fans, mount each VFD generally where shown but with exact location to ensure that VFD is accessible in accordance with local governing electrical code requirements. "Line" and "load" side power wiring to these VFD's to be provided as part of Electrical Divisions work.

.11 Where VFDs are required for pumps, mount each VFD generally where shown but with exact location to ensure that VFD is accessible in accordance with local governing electrical code requirements. "Line" and "load" side power wiring to these VFDs to be provided as part of Electrical Divisions work.

.12 Install harmonic mitigation filter equipment as follows:

.1 in accordance with manufacturer's recommended installation practices and to comply with applicable local governing codes;

.2 provide each VFD as specified in per Part 2, with a harmonic filter sized as per manufacturer's rating table to match rating of connected VFD;

.3 mount harmonic filters sized up to 110 kW (150 HP) typically to wall/ceiling construction using suitable brackets, metal C-channel framework and vibration isolators assemblies, ensuring full support of units acceptable to local governing authorities;

.4 mount harmonic filters sized greater than 110 kW (150 HP) typically to floor mounted concrete pads with suitable vibration isolators in accordance with local governing building codes;

.5 ensure that adequate ventilation and space for access is provided;

.6 review exact locations with Consultant prior to installation;

.7 coordinate with Electrical Division Contractor to ensure units are connected complete to line side supply feed and to VFD in accordance with VFD manufacturer's instructions for standalone VFDs and VFD system with bypass; include required control wiring and connections.

.13 Ground and bond equipment as per local governing electrical code requirements and manufacturer's instructions.

.14 Provide engraved lamacoid nameplate identifying each piece of equipment. Review exact nomenclature with Consultant.

.15 Be responsible for ensuring that VFDs, harmonic filters and connected motors are properly installed, connected, tested in proper working order and operation verified.

3.02 Testing, Start-Up, and Verification

.1 When installation of VFDs are complete, arrange for VFD manufacturer/supplier to:

.1 supply factory authorized technician at site for minimum of 4 hours per system to examine installation and connection of each VFD, and to perform start-up and set-up procedures in conjunction with equipment start-up and testing procedures;

.2 supply factory authorized technician at site for minimum of one 8 hour day to train Owner's personnel on VFD operating and maintenance procedures;

.3 prepare and submit letter to certify that VFDs have been properly installed, tested and adjusted, and are in proper operating condition;

.4 submit list of start-up and testing parameters for uploading for future use by Owner.

.2 Start-up data entries to include motor nameplate power, speed, voltage, frequency and current.

.3 Inspect VFDs and accessories for verification of proper operation and installation.

.4 Inspect interface wiring to BAS for verification of proper operation and installation.

.5 Verification of wire terminations to VFDs and bypass and to operational circuitry.

.6 Installation verification of VFD, bypass and motor being driven for proper operation and reliability.

.7 Verification that connections and communications to BAS or other monitoring/remote control system are of proper operation and installation and of full communications compatibility.

.8 Measurement for verification of proper operation on each of following items:

.1 Motor voltage and frequency;

.2 Verification of proper motor operation;

.3 Control input for proper building automation system interface and control calibration.

.9 Calibration check for following set points (and adjustment as necessary):

.1 minimum speed;

.2 maximum speed;

.3 acceleration and deceleration rates.

.10 Verify harmonic compliance with onsite field measurements of both voltage and current harmonic distortion at point of common coupling-input terminals of harmonic mitigating equipment with and without equipment operating. Utilize recording type Fluke 41 or equivalent harmonics analyser displaying individual and total harmonic currents and voltages.

.11 Document testing and results in a report signed by a Professional Engineer licensed in the Place of Work and authorized by system manufacturer. Include for minimum 3 hard copies and electronic copy of report to be submitted to Consultant for review.

.12 Additionally, refer to applicable installation, testing, coordination and verification requirements in Electrical Divisions Sections.

End of Section

1 General

1.01 Application

.1 This Section specifies firestopping and smoke seal requirements that are common to mechanical work Sections of the Specification and it is a supplement to each Section and is to be read accordingly.

1.02 Submittals

.1 Submit a product data sheet and a WHIMIS sheet for each firestopping and smoke seal product.

.2 Submit for review, full company name and experience of proposed firestopping and smoke seal system applicator.

.3 Submit a letter of proper firestopping and smoke seal certification as specified in Part 3 of this Section.

1.03 Quality Assurance

.1 Comply with firestopping and smoke seal product manufacturer's recommendations regarding suitable environment conditions for product installation.

2 Products

2.01 Firestopping and Smoke Seal System Materials

.1 Asbestos-free elastomeric materials tested, listed and labelled by ULC in accordance with ULC S115 and ULC S101 for installation in ULC designated firestopping and smoke seal systems to provide a positive fire, water and smoke seal, and a fire-resistance rating (flame, hose stream and temperature) not less than fire resistance rating of surrounding fire rated construction.

.2 Materials are to be compatible with abutting dissimilar materials and finishes and complete with primers, damming and back-up materials, supports, and anchoring devices in accordance with firestopping manufacturer's recommendations and ULC tested assembly.

.3 Pipe insulation forming part of a fire and smoke seal assembly is specified in Section entitled Mechanical Insulation.

.4 Acceptable manufacturers are:

.1 A/D Fire Protection Systems "FIREBARRIER";

.2 Tremco Inc. Fire Protection Systems Group "TREMSTOP";

.3 3M Canada;

.4 Hilti (Canada) Ltd. Firestop Systems;

.5 Specified Technologies Inc.

3 Execution

3.01 Installation of Firestopping and Smoke Seal Materials

.1 Where mechanical work penetrates fire rated construction, provide ULC listed and labelled firestopping and smoke seal materials installed in accordance with requirements of ULC S115, ULC S101, and other governing authorities to seal penetrations.

.2 Abide by following requirements:

.1 Examine substrates, openings, voids, adjoining construction and conditions under which firestop and smoke seal system is to be installed. Confirm compatibility of surfaces.

.2 Verify penetrating items are securely fixed and properly located with proper space allowance between penetrations and surfaces of openings.

.3 Report any unsuitable or unsatisfactory conditions to Contractor and Consultant in writing, prior to commencement of work. Commencement of work will mean acceptance of conditions and surfaces.

.4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces. Remove stains on adjacent surfaces.

.3 Conform to following application requirements:

.1 Prime substrates in accordance with product manufacturer's written instructions.

.2 Provide temporary forming as required and remove only after materials have gained sufficient strength and after initial curing.

.3 Tool or trowel exposed surfaces to a neat, smooth, and consistent finish.

.4 Remove excess compound promptly as work progresses and upon completion.

.5 At fusible link damper locations, seal perimeter of angle iron framing on both sides of wall or slab with ULC listed and labelled sealant materials to provide a positive smoke seal.

.4 Notify Consultant when work is complete and ready for inspection, and prior to concealing or enclosing firestopping and smoke seal materials and service penetration assemblies. Arrange for final inspection of work by Municipal Building Inspector prior to concealing or enclosing work. Make any corrections required.

.5 On completion of firestopping and smoke sealing installation, submit a Letter of Assurance to Consultant certifying the firestopping and smoke sealing installation has been carried out throughout the building to mechanical service penetrations and that installation has been done in strict accordance with requirements of Provincial Building Code, any applicable local Municipal Codes, ULC requirements, and manufacturer's instructions.

End of Section

1 General

1.01 Application

.1 This Section specifies vibration isolation product requirements that are common to mechanical work Sections of the Specification and it is a supplement to each Section and is to be read accordingly.

1.02 Submittals

.1 Submit copies of manufacturer's product data sheets for products specified in this Section. Product data sheets are to include product characteristics, limitations, dimensions, finishes, and installation recommendations.

.2 Submit a letter from vibration isolation manufacturer to certify correct installation of products, as specified in Part 3 of this Section.

1.03 Seismic Restraint Requirements

.1 Where applicable to the project, refer to Section 20 05 48.16 "Seismic Controls for Mechanical Systems" for requirements for the use of a Seismic Consultant and seismic restraint requirements required for vibration isolated materials and equipment.

2 Products

2.01 General

.1 Vibration isolation products are to be in accordance with the most recent edition of the ASHRAE Handbook and/or as indicated on drawings, schedules, details, and as specified below.

.2 Springs are to be stable, colour coded, selected to operate at no greater than ⅔ solid load, designed in accordance with Society of Automotive Engineers Handbook Supplement 9 entitled Manual on Design and Application of Helical and Spiral Springs, and with spring diameters in accordance with manufacturer's recommendations to suit static deflection and maximum equipment load.

.3 Steel components of isolation products not exposed to the weather or moisture are to be zinc plated. Steel components of isolation products exposed to the weather or in a damp, moist environment are to be factory painted with rust inhibiting primer and 2 coats of neoprene.

.4 Where weight of isolated equipment may change significantly due to draining or filling with a liquid, vibration isolators are to be equipped with limit stops to limit spring extensions.

.5 Seismic rated isolators and snubbers are to be listed, rated, and approved by State of California Office of Statewide Health and Planning Department (O.S.H.P.D.) and carry an O.S.H.P.D. pre-approved number. Seismic restraints supplied with vibration isolation are to meet requirements specified in Section entitled Seismic Control and Restraint.

.6 Flexible piping connections to vibration isolated equipment are specified in the appropriate piping sections of the Specification.

2.02 Isolation Pads

.1 Sandwich type pads, 20 mm (¾") nominal thickness, selected for 3.2 mm (1/8") static deflection unless otherwise specified, consisting of 2 waffle type or ribbed 50 durometer neoprene pads permanently bonded to a minimum #10 gauge steel plate, and complete with rubber bushed bolt holes and equipment anchor bolts with neoprene isolation grommets.

.2 Acceptable products are:

.1 Vibro-Acoustics Ltd. Type NSN;

.2 The VMC Group Vibration Mounting & Controls Inc. (Korfund-Dynamics) "SHEAR-FLEX PLATES";

.3 Kinetics Noise Control Vibron Products Group Type NGS/NGD;

.4 Mason Industries Inc. Type SW/S/SW with HG Bolt Insertion Washers;

.5 J. P. America Inc. Type JSJ.

2.03 Rubber Floor Isolators

.1 Captive, bridge bearing quality neoprene mount selected for a minimum 4 mm (0.15") static deflection unless otherwise specified, with an integral ductile iron housing and integral equipment anchor bolt.

.2 Acceptable products are:

.1 Vibro-Acoustics Ltd. Type R;

.2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) Type RSM;

.3 Kinetics Noise Control Vibron Products Group Type RQ;

.4 Mason Industries Inc. Type BR;

.5 J. P. America Inc. Type TRM.

2.04 Spring Floor Isolators

.1 Seismically rated captive spring mount isolator complete with levelling bolts, upper and lower neoprene spring cups, neoprene cushion, ductile iron housing, neoprene sound pads, and neoprene isolation grommets for securing bolts.

.2 Acceptable products are:

.1 Vibro-Acoustics Ltd. Type SFS;

.2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) Type AMSR;

.3 Kinetics Noise Control Vibron Products Group Type FLSS;

.4 Mason Industries Inc. Type SSLFH;

.5 J. P. America Inc. Type TSO-C-SC.

2.05 Open Spring Mounts

.1 Base mount free-standing assemblies, each complete with a stable colour coded steel spring welded in place, drilled mild steel mounting plate bonded to a ribbed rubber or neoprene acoustical pad, and an external 16 mm (5/8") diameter level adjustment bolt.

.2 Acceptable products are:

.1 Vibro-Acoustics Ltd. Type FS;

.2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) "Spring-Flex" Type A;

.3 Kinetics Noise Control Vibron Products Group Type FDS;

.4 Mason Industries Inc. Type SLFH;

.5 J. P. America Inc. Type TSO.

2.06 Closed Spring Mounts

.1 Base mount free-standing enclosed assemblies, each complete with stable colour coded spring(s), 2 piece cast housing, non-binding rubber horizontal stabilizers, a ribbed rubber or neoprene acoustical pad bonded to base of the closed housing, and an external level adjustment bolt.

.2 Acceptable products are:

.1 Vibro-Acoustics Ltd. Type CM;

.2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) "Spring-Flex" Types B and C;

.3 Kinetics Noise Control Vibron Products Group Type FLS;

.4 Mason Industries Inc. Type C;

.5 J. P. America Inc. Type TSC.

2.07 Totally Retained Spring Mounts

.1 Base mount free-standing enclosed and retained assemblies to limit both vertical and lateral movement of mounted equipment, each complete with stable colour coded spring(s), drilled welded steel housing and top plate, ribbed rubber or neoprene acoustical pad bonded to bottom of housing, vertical limit adjusting hardware, and a level adjustment bolt.

.2 Acceptable products are:

.1 Vibro-Acoustics Ltd. Type CSR;

.2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) "Spring-Flex" Type MS;

.3 Kinetics Noise Control Vibron Products Group Type SM;

.4 Mason Industries Inc. Type SLRSO;

.5 J. P. America Inc. Type TSR.

2.08 Spring Hangers

.1 Welded steel plate housing with top and bottom rod mounting holes and spring retainer, neoprene double deflection isolation element, stable colour coded spring, and heavy-duty rubber washers.

.2 Acceptable products are:

.1 Vibro-Acoustics Ltd. Type SHR-SN;

.2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) "Spring-Flex" Series HRSA;

.3 Kinetics Noise Control Vibron Products Group. Type SRH;

.4 Mason Industries Inc. Type 30N;

.5 J. P. America Inc. Type TSH.

2.09 Neoprene Hanger Isolators

.1 Neoprene double deflection rod isolators with steel housing and hanger rod bushing, selected for a minimum 4 mm (0.15") static deflection unless otherwise specified.

.2 Acceptable products are:

.1 Vibro-Acoustics Ltd. Type NH;

.2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) Type HR;

.3 Kinetics Noise Control Vibron Products Group Type RH;

.4 Mason Industries Inc. Type HD or WHD;

.5 J. P. America Inc. Type TRH.

2.10 Concrete Inertia Type Equipment Base

.1 Welded steel bases, each complete with a structural black steel channel frame, concrete reinforcing rods, and brackets for spring mounts welded to frame.

.2 Acceptable products are:

.1 Vibro-Acoustics Ltd. Type CIB;

.2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) Type CPF;

.3 Kinetics Noise Control Vibron Products Group. Type CIB;

.4 Mason Industries Inc. Type KSL;

.5 J. P. America Inc. Type BCI.

2.11 Steel Equipment Base

.1 Fully welded structural steel equipment and motor support bases, each complete with a wide flange steel frame, full depth cross members, brackets for spring mounts, and adjustable motor slide rails.

.2 Acceptable products are:

.1 Vibro-Acoustics Ltd. Type SB;

.2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) Type WFB;

.3 Kinetics Noise Control Vibron Products Group Type SFB;

.4 Mason Industries Inc. Type WFSL;

.5 J. P. America Inc. Type BWS (with motor slide rail).

2.12 Combination Steel /Concrete Inertia Equipment Base

.1 Welded steel bases with a structural black steel channel frame, concrete reinforcing rods, bottom sheet steel pan, brackets for spring mounts welded to frame and adjustable motor slide rails.

.2 Acceptable products are:

.1 Vibro-Acoustics Ltd. Type CIB (with motor slide rails);

.2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) Type WPF (with motor slide rails);

.3 Kinetics Noise Control Vibron Products Group Type CIB (with motor slide rails);

.4 Mason Industries Inc. Type BMK or K;

.5 J. P. America Inc. Type BSI (with motor slide rail).

2.13 Slung Steel Base

.1 Slung steel bases of structural members with gusset plates welded to ends and complete with adjustable motor slide rails and vertical section size to suit equipment's motor power output.

.2 Acceptable products are:

.1 Vibro-Acoustics Ltd. Type SS;

.2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) Type CPF;

.3 Kinetics Noise Control Vibron Products Group Type CIB-H;

.4 Mason Industries Inc. Type MSL.

2.14 Continuous Rail Type Isolation for Roof Mounted Equipment

.1 Continuous rooftop isolation shipped completely assembled, consisting of:

.1 galvanized steel sections formed to fit roof curb and associated equipment with a flexible air and weather seal joining upper and lower rail sections;

.2 stable springs, cadmium plated and selected to provide minimum deflection with 50% additional travel to solid;

.3 neoprene cushioned and wind restraints allowing 6 mm (¼") movement before engaging and resisting wind loads in any lateral direction.

.2 Acceptable products are:

.1 Vibro-Acoustics Ltd. Vibro-Acoustics Type RTR;

.2 The VMC Group Vibration Mounting and Controls (Korfund-Dynamics) Type RTIR;

.3 Kinetics Noise Control Vibron Products Group Type KSR;

.4 Mason Industries Inc. Type RSC;

.5 J. P. America Inc. Type BRC.

3 Execution

3.01 Installation of Vibration Isolation Materials

.1 Unless otherwise stated in the drawings, schedules and/or typical details, vibration isolation is to be provided for all mechanical equipment as per the recommendations contained within in the most recent edition of the ASHRAE Handbook.

.2 Supply to vibration isolation product manufacturer or supplier a copy of a "reviewed" shop drawing or product data sheet for each piece of equipment to be isolated and dimensioned pipe layouts of associated piping to be isolated.

.3 Unless otherwise specified, vibration isolation products are to be product of one manufacturer.

.4 Ensure vibration isolation manufacturer coordinates material selections with equipment provided in order to ensure adherence to performance criteria. Allow for expansion and contraction when material is selected and installed.

.5 Unless otherwise indicated, install isolation materials for base mounted equipment on concrete housekeeping pad bases which extend at least over the full base and isolated area of the isolated equipment. Additional requirements are as follows:

.1 block and shim bases level so ductwork and piping connections can be made to a rigid system at proper operating level, before isolated adjustment is made, and ensure there is no physical contact between isolated equipment and building structure;

.2 steel bases are to clear the sub-base by 25 mm (1");

.3 concrete bases are to clear the sub-base by 50 mm (2").

.6 Isolate piping larger than 25 mm (1") dia. directly connected to motorized and/or vibration isolated equipment with 25 mm (1") static deflection spring hangers at spacing intervals in accordance with following:

.1 for pipe less than or equal to 100 mm (4") dia. – first 3 points of support;

.2 for pipe 125 mm (5") to 200 mm (8") dia. – first 4 points of support;

.3 for pipe equal to or greater than 250 mm (10") dia. – first 6 points of support;

.7 First point of isolated piping support is to have a static deflection of twice the deflection of the isolated equipment but maximum 50 mm (2").

.8 Secure top of spring hanger frame rigidly to structure, and do not install spring hangers in concealed locations.

.9 Where it is impossible to use at least 2 spring hangers, provide Senior Flexonics Ltd. Style 102 (or 102-U as required) or equal, twin sphere, moulded rubber flexible connection assemblies, selected by manufacturer and suitable in all respects for intended application, and complete with required nipples and connections to provide proper vibration isolation.

.10 Isolate designated piping risers at floor support points in accordance with drawing detail and/or where indicated on drawings.

.11 Erect roof curb vibration isolation in accordance with instructions shipped with assembly. Match vibration isolation with associated roof top unit and orient isolation as identified by manufacturer to ensure proper loading and optimum performance. Caulk top of roof curb with 2 beads of caulking provided and centre isolation assembly onto roof curb and, unless otherwise noted, screw in place with 50 mm (2") lag screws at 900 mm (36") O.C. Position gasket on top rail or alternatively, caulk with 2 beads of caulking provided and orient and lower roof top unit onto isolation rails and, unless otherwise noted, screw unit into top rail with 25 mm (1") lag screws at 900 mm (36") O.C. After roof top unit is secured in place, but before damageable work is installed, spray each isolated equipment assembly with water and correct any water leaks.

.12 For control wiring connections to vibration isolated equipment ensure flexible metallic conduit with 90° bend is used for conduit 25 mm (1") dia. and smaller, and for conduit larger than 25 mm (1") dia., use Crouse Hinds EC couplings. Connections are to be long enough so that conduit will remain intact if equipment moves 300 mm (12") laterally from its installed position, and flexible enough to transmit less vibration to structure than is transmitted through vibration isolation. Coordinate these requirements with mechanical trades involved. If electrical power connections are not made in a similar manner as part of the electrical work, report this fact to Consultant.

.13 Arrange and pay for vibration isolation product manufacturer to visit site to inspect installation of his equipment. Perform revision work required as a result of improper installation. When vibration isolation equipment manufacturer is satisfied with the installation, obtain and submit a letter stating manufacturer has inspected the installation and equipment is properly installed.

.14 Refer to Section entitled Seismic Control and Restraint for requirements pertaining to seismically restrained vibration isolation.

End of Section

1 General

1.01 Section Includes

.1 This Section specifies mechanical system testing, adjusting, and balancing requirements that are common to mechanical work Sections of the Specification and it is a supplement to each Section and is to be read accordingly.

1.02 Definitions

.1 "Agency" – means agency to perform testing, adjusting and balancing work.

.2 "TAB" – means testing, adjusting and balancing to determine and confirm quantitative performance of equipment and systems and to regulate specified fluid flow rate and air patterns at terminal equipment, e.g., reduce fan speed, throttling, etc.

.3 "hydronic systems" – includes heating water, chilled water, glycol-water solution, condenser water, and any similar system.

.4 "air systems" – includes outside air, supply air, return air, exhaust air, and relief air systems.

.5 "flow rate tolerance" – means allowable percentage variation, minus to plus, of actual flow rate values in Contract Documents.

.6 "report forms" – means test data sheets arranged for collecting test data in logical order for submission and review, and these forms, when reviewed and accepted, should also form permanent record to be used as basis for required future testing, adjusting and balancing.

.7 "terminal" – means point where controlled fluid enters or leaves the distribution system, and these are supply inlets on water terminals, supply outlets on air terminals, return outlets on water terminals, and exhaust or return inlets on air terminals such as registers, grilles, diffusers, louvers, and hoods.

.8 "main" – means duct or pipe containing system's major or entire fluid flow.

.9 "submain" – means duct or pipe containing part of the systems' capacity and serving 2 or more branch mains.

.10 "branch main" – means duct or pipe servicing 2 or more terminals.

.11 "branch" – means duct or pipe serving a single terminal.

1.03 Submittals

.1 Within 30 days of work commencing at site, submit name and qualifications of proposed testing and balancing agency in accordance with requirements of article entitled Quality Assurance below.

.2 Submit sample test forms, if other than those standard forms prepared by Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB), are proposed for use.

.3 Submit a report by Agency to indicate Agency's evaluation of mechanical drawings with respect to service routing and location or lack of balancing devices. Include set of drawings used and marked-up by Agency to prepare report.

.4 Submit a report by Agency after each site visit made by Agency during construction phase of this Project.

.5 Submit a draft report, as specified in Part 3 of this Section.

.6 Submit a final report, as specified in Part 3 of this Section.

.7 Submit a testing and balancing warranty as specified in Part 3 of this Section.

.8 Submit reports listing observations and results of post construction site visits as specified in Part 3 of this Section.

1.04 Quality Assurance

.1 Employ services of an independent testing, adjusting, and balancing agency meeting qualifications specified below, to be single source of responsibility to test, adjust, and balance building mechanical systems to produce design objectives.

.2 Testing, adjusting and balancing of complete mechanical systems is to be performed over entire operating range of each system in accordance with 1 of following publications:

.1 National Standards for a Total System Balance published by Associated Air Balance Council;

.2 Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems published by National Environmental Balancing Bureau;

.3 Chapter 37, Testing, Adjusting, and Balancing of ASHRAE Handbook HVAC Applications.

1.05 Acceptable Service Companies

.1 Acceptable service companies are as follows:

.1 Air Audit;

.2 Clarke Balancing;

.3 Airwaso;

.4 Dynamic Flow Balancing;

.5 Air Velocities Control;

.6 Flowset Balancing.

2 Products – Not Used

3 Execution

3.01 Scope of Work

.1 Perform total mechanical systems testing, adjusting, and balancing. Requirements include measurement and establishment of fluid quantities of mechanical systems as required to meet design specifications and comfort conditions, and recording and reporting results.

.2 Mechanical systems to be tested, adjusted and balanced include:

.1 TAB of domestic water systems (all piping extended from Municipal main) is to include:

.1 domestic hot water recirculation piping;

.2 tempered water piping flows.

.2 TAB of heating systems is to include piping and equipment fluid temperatures, flows and control, and if TAB is not done during heating season, a follow-up site visit during heating season will be required to confirm proper flows and temperatures, and any required system "fine tuning".

.3 TAB of cooling systems is also to include piping and equipment fluid temperatures, flows and control, and if TAB is not done during cooling season, a follow-up site visit during cooling season will be required to confirm proper flows and temperatures, and any required system "fine.

.4 TAB of air handling systems is to include equipment and ductwork air temperatures, capacities and flows.

3.02 Testing, Adjusting, and Balancing

.1 Conform to following:

.1 as soon as possible after award of Contract, Agency is to carefully examine a set of mechanical drawings with respect to routing of services and location of balancing devices, and is to issue a report listing results of the evaluation;

.2 set of drawings examined by Agency is to be returned with evaluation report, with red line mark-ups to indicate locations for duct system test plugs, and required revision work such as relocation of balancing devices and locations for additional devices;

.3 after review of mechanical work drawings and specification, Agency is to visit site at frequent, regular intervals during construction of mechanical systems, to observe routing of services, locations of testing and balancing devices, workmanship, and anything else that will affect testing, adjusting and balancing;

.4 after each site visit, Agency is to report results of site visit indicating date and time of visit, and detailed recommendations for any corrective work required to ensure proper adjusting and balancing;

.5 testing, adjusting and balancing is not to begin until:

.1 building construction work is substantially complete and doors have been installed;

.2 mechanical systems are complete in all respects, and have been checked, started, adjusted, and then successfully performance tested.

.6 mechanical systems to be tested, adjusted and balanced are to be maintained in full, normal operation during each day of testing, adjusting and balancing;

.7 obtain copies of reviewed shop drawings of applicable mechanical plant equipment and terminals, and temperature control diagrams and sequences;

.8 Agency is to walk each system from system "head end" equipment to terminal units to determine variations of installation from design, and system installation trades will accompany Agency;

.9 Agency is to check valves and dampers for correct and locked position, and temperature control systems for completeness of installation before starting equipment;

.10 wherever possible, Agency is to lock balancing devices in place at proper setting, and permanently mark settings on devices;

.11 Agency is to leak test ductwork as specified in Section entitled HVAC Air Distribution in accordance with requirements of SMACNA "HVAC Air Duct Leak Test Manual", coordinate work with work of aforementioned Sections, provide detailed sketch(es) to Sheet Metal Contractor and Consultant identifying ductwork not in accordance with acceptable leakage values specified in aforementioned Sections, and retest corrected ductwork;

.12 Agency is to balance systems with due regard to objectionable noise which is to be a factor when adjusting fan speeds and performing terminal work such as adjusting air quantities, and should objectionable noise occur at design conditions, Agency is to immediately report problem and submit data, including sound readings, to permit an accurate assessment of noise problem to be made;

.13 Agency is to check supply air handling system mixing plenums for stratification, and where variation of mixed air temperature across coils is found to be in excess of ±5% of design requirements, Agency is to report problem and issue a detail sketch of plenum baffle(s) required to eliminate stratification;

.14 Agency is to perform testing, adjusting and balancing to within ±5% of design values, and make and record measurements which are within ±2% of actual values;

.15 for air handling systems equipped with air filters, test and balance systems with simulated 50% loaded (dirty) filters by providing a false pressure drop;

.16 Balance air flow keeping the building slightly positive at 0.01"wc (3Pa) pressure whenever possible to allow doors to properly close.

.17 test, adjust and balance air conditioning systems during summer season and heating systems during winter season, including at least a period of operation at outside conditions within 2.8°C (5°F) wet bulb temperature of maximum summer design condition, and within 5.5°C (10°C) dry bulb temperature of minimum winter design condition, and take final temperature readings during seasonal operation.

.2 Prepare reports as indicated below.

.1 Upon completion of testing, adjusting, and balancing procedures, prepare draft reports on AABC or NEBB forms. Draft reports may be hand written, but must be complete, factual, accurate, and legible. Organize and format draft reports in same manner specified for final reports and submit for review.

.2 Upon verification and approval of draft reports, prepare final reports organized and formatted as specified below. Use units of measurement (SI or Imperial) as used on Project Documents.

.3 Report forms are to be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Report forms complete with schematic systems diagrams and other data are to be consolidated in electronic format as a PDF. PDF file to be indexed and organized into sections, as it applies to the project, as follows:

.1 General Information and Summary;

.2 Air Systems;

.3 Hydronic Systems;

.4 Temperature Control Systems;

.5 Special Systems.

.4 Agency is to provide following minimum information, forms and data in report:

.1 inside cover sheet to identify Agency, Contractor, and Project, including addresses, and contact names and telephone numbers and a listing of instrumentation used for procedures along with proof of calibration;

.2 remainder of report is to contain appropriate forms containing as a minimum, information indicated on standard AABC or NEBB report forms prepared for each respective item and system;

.3 Agency is to include for each system to be tested, adjusted and balanced, a neatly drawn, identified (system designation, plant equipment location, and area served) schematic "as-built" diagram indicating and identifying equipment, terminals, and accessories;

.4 Agency is to include report sheets indicating building comfort test readings for all rooms.

.3 After final testing and balancing report has been submitted, Agency is to visit site with Contractor and Consultant to spot check results indicated on balancing report. Agency is to supply labour, ladders, and instruments to complete spot checks. If results of spot checks do not, on a consistent basis, agree with final report, spot check procedures will stop and Agency is to then rebalance systems involved, resubmit final report, and again perform spot checks with Contractor and Consultant.

.4 When final report has been accepted, Contractor is to submit to Owner, in name of Owner, a certificate equal to AABC National Guaranty Certification or a NEBB Quality Assurance Program Bond, and in addition, Contractor is to submit a written extended 2-year warranty from Agency covering one full heating season and one full cooling season, during which time any balancing problems which occur, with exception of minor revision work done during scheduled site visits, will, at no cost, be investigated by

Agency and reported on to Owner, and if it is determined that problems are a result of improper testing, adjusting and balancing, they are to be immediately corrected without additional cost to Owner.

.5 Balancing Company shall re-visit the site at least once after the system has operated for a period of approximately three months and make necessary adjustments in the airflows / water flows to insure space temperatures meeting the approval of the Owner and Consultant are maintained.

End of Section

1 General

1.01 Application

.1 This Section specifies insulation requirements common to Mechanical Divisions work Sections and it is a supplement to each Section and is to be read accordingly.

1.02 Definitions

.1 "concealed" – means mechanical services and equipment above suspended ceilings, in non-accessible chases, in accessible pipe spaces, and furred-in spaces.

.2 "exposed" – means exposed to normal view during normal conditions and operations.

.3 "mineral fibre" – includes glass fibre, rock wool, and slag wool.

.4 "domestic water" or "potable water" – means piping extended from building Municipal supply main.

1.03 Submittals

.1 At least 4 weeks prior to insulation work commencing, submit a sample of each type of insulation (and insulation accessories and finish), in applied form, for review. Mount samples on a plywood board. Identify each product with manufacturer's name and insulation type, and proposed use of insulation. When sample board has been approved, mechanical insulation work is to conform to approved sample board.

.2 Submit a product data sheet for each insulation system product.

.3 Submit a fabrication drawing for each custom made cover to indicate material and fabrication details, and a 300 mm (12") square sample of proposed cover material.

.4 In accordance with Part 3 of this Section, submit a letter from fire rated duct wrap supplier to certifying duct wrap has been properly installed.

.5 Submit a colour chart for coloured lagging adhesive for canvas jacketed insulation.

1.04 Quality Assurance

.1 Mechanical insulation is to be applied by a licensed journeyman insulation mechanic, or by an apprentice under direct, daily, on-site supervision of a journeyman mechanic.

.2 Do not apply insulation unless leakage tests have been satisfactorily completed.

.3 Ensure surfaces to be insulated are clean and dry.

.4 Ensure ambient temperature is minimum 13°C (55°F) for at least 1 day prior to application of insulation, and for duration of insulation work, and relative humidity is and will be at a level such that mildew will not form on insulation materials.

.5 Insulation materials must be stored on site in a proper and dry storage area. Any wet insulation material is to be removed from site.

2 Products

2.01 Fire Hazard Ratings

.1 Unless otherwise specified, insulation system materials inside building must have a fire hazard rating of not more than 25 for flame spread and 50 for smoke developed when tested in accordance with ULC S102, Surface Burning Characteristics of Building Materials and Assemblies.

2.02 Thermal Performance

.1 Unless otherwise specified, thermal performance of insulation is to meet or exceed values given in Tables entitled Minimum Piping Insulation Thickness Heating and Hot Water Systems and Minimum Piping Insulation Thickness Cooling Systems, as stated in ANSI/ASHRAE/IES Standard 90.1 version referenced in Ontario Building Code.

2.03 Pipe Insulation Materials

.1 Horizontal pipe insulation at hangers and supports are to be equal to Belform Insulation Ltd. "Koolphen K-Block" insulated pipe support inserts consisting of minimum 150 mm (6") long, pre-moulded, rigid, sectional phenolic foam insulation (of same thickness as adjoining insulation) with a reinforced foil and kraft paper vapour barrier jacket and a captive galvanized steel saddle.

.2 Flexible foam elastomeric is to be closed cell, sleeve type, longitudinally split self-seal, foamed plastic pipe insulation with a water vapour transmission rating of 0.10 in accordance with ASTM E96, Procedure B, and required installation accessories. Acceptable products are:

.1 Armacell AP/Armaflex SS;

.2 IK Insulation Group K-Flex "LS" Self-Seal Pipe Insulation.

.3 Closed cell foamed glass is to be Pittsburgh Corning "FOAMGLASS", expanded, sectional, rigid sleeve type insulation with a liquid or vapour permeability rating (as per ASTM C240) of 0.00, and a factory applied "PITTWRAP SSII" self-sealing jacket.

.4 Fire rated pre-moulded mineral wool is to be non-combustible, fire-rated, rigid, sectional, longitudinally split mineral wool or basalt pipe insulation with a reinforced vapour barrier jacket and compatible with ULC S115 and ULC-S101 firestopping. Acceptable products are:

.1 Roxul "Techton 1200";

.2 IIG (Johns Manville Inc.) MinWool-1200;

.3 Paroc 1200.

.5 Pre-moulded mineral fibre is to be rigid, sectional, sleeve type insulation to ASTM C547, with a factory applied vapour barrier jacket. Acceptable products are:

.1 Johns Manville Inc. "Micro-Lok AP-T Plus";

.2 Knauf Fiber Glass "Pipe Insulation" with "ASJ-SSL" jacket;

.3 Manson Insulation Inc. "ALLEY K APT";

.4 Owens Corning “Fiberglas” Pipe Insulation.

.6 Blanket mineral fibre is to be blanket type roll insulation to CGSB 51-GP-11M, 24 kg/m3 (1-½ lb/ft³) density, with a factory applied vapour barrier facing. Acceptable products are:

.1 Johns Manville Inc. Microlite FSK Duct Wrap Type 150;

.2 Knauf Fiber Glass Blanket Insulation FSK Duct Wrap Type III;

.3 Manson Insulation Inc. ALLEY WRAP FSK Duct Wrap Type III;

.4 Certainteed Corporation Softtouch FSK Duct Wrap Type 150.

.7 Pre-moulded weatherproof jacketed mineral fibre is to be Knauf Insulation "Redi-Klad 1000" sectional, sleeve type pipe insulation with a self-sealing weather-proof jacket and a 100 mm (4") butt joint sealing strip with each section.

2.04 Barrier-Free Lavatory Piping Insulation Kits

.1 Removable, flexible, reusable, white moulded plastic insulation kits for barrier-free lavatory drain piping and potable water supplies exposed under lavatory.

.2 Acceptable products are:

.1 Truebo "Lav-Guard 2" E-Z Series;

.2 Zeston "SNAP-TRAP";

.3 McGuire Manufacturing Co. Inc. "ProWrap".

2.05 Equipment Insulation Materials

.1 Blanket mineral fibre is to be blanket type roll form insulation to ASTM C553, 24 kg/m3 (1-½ lb/ft³) density, with a factory applied vapour barrier facing. Acceptable products are:

.1 Johns Manville Inc. Microlite FSK Duct Wrap Type 150;

.2 Knauf Fiber Glass Blanket Insulation FSK Duct Wrap Type III;

.3 Manson Insulation Inc. ALLEY WRAP FSK Duct Wrap Type III;

.4 Certainteed Corporation Softtouch FSK Duct Wrap Type 150.

.2 Semi-rigid mineral fibre board is to be roll form, moulded insulation to ASTM C1393, with a factory applied vapour barrier facing consisting of laminated aluminum foil and kraft paper. Acceptable products are:

.1 Knauf Fiber Glass Pipe and Tank Insulation;

.2 Manson Insulation Inc. "AK FLEX";

.3 Johns Manville Inc. Pipe and Tank Insulation “Micro-Flex”;

.4 Multi-Glass Insulation Ltd. "MULTI-FLEX MF";

.5 Owens Corning Pipe and Tank Insulation;

.6 Glass-Cell Fabricators Ltd. "R-Flex".

.3 Closed cell foamed glass is to be Pittsburgh Corning "FOAMGLAS" expanded, rigid board and block type insulation with a liquid or vapour permeability rating (as per ASTM C240) of 0.00.

2.06 Removable/Reusable Insulation Covers

.1 Valve, etc. covers are to be NO SWEAT reusable insulation wraps with vapour barrier jacket and self-sealing ends and longitudinal seam, with a length to suit the application and an insulation thickness equal to adjoining insulation.

.2 Custom manufactured equipment covers conforming to shape of item to be insulated, designed to be easily removable and replaceable to suit use and maintenance procedures of particular item, and to provide adequate personnel protection. Covers are to be complete with minimum 95 kg/m3 (6 lb/ft³) density ceramic fibre insulation sewn between minimum 542.5 g/m2 (1.8 oz/ft²) weight silicone impregnated fibreglass fabric in a quilted pattern using double stitches made with Kelvar or Teflon coated fibreglass thread. Overlap flaps are to be secured using laces, snaps, or Velcro double stitched in place. Acceptable manufacturers are:

.1 Crossby Dewar Inc.;

.2 Insufab Systems Inc.;

.3 ADL Insulflex Inc.;

.4 Firwin Corp.;

.5 GlassCell Isofab Inc.

2.07 Ductwork System Insulation Materials

.1 Rigid mineral fibre board is to be pre-formed board type insulation to ASTM C612, 48 kg/m3 (3 lb/ft³) density, with a factory applied reinforced aluminum foil and kraft paper facing. Acceptable products are:

.1 Knauf Fiber Glass Insulation Board with FSK facing;

.2 Manson Insulation Inc. "AK BOARD FSK";

.3 Johns Manville Inc. Type 814 "Spin-Glas";

.4 Owens Corning 703.

.2 Semi-rigid mineral fibre board is to be roll form insulation to ASTM C1393, consisting of cut strips of rigid mineral board insulation glued to an aluminium foil and kraft paper facing. Acceptable products are:

.1 Multi-Glass Insulation Ltd. "Multi-Flex MKF";

.2 Glass-Cell Fabricators Ltd. "R-FLEX";

.3 Owens Corning Pipe and Tank Insulation;

.4 Johns Manville Inc. Pipe and Tank Insulation.

.3 Blanket mineral fibre is to be blanket type roll form insulation to ASTM C553, 24 kg/m3 (1½ lb/ft3) density, 40 mm (1-½") thick, with a factory applied vapour barrier facing. Acceptable products are:

.1 Johns Manville Inc. Microlite FSK Duct Wrap Type 150;

.2 Knauf Fiber Glass Blanket Insulation FSK Duct Wrap Type III;

.3 Manson Insulation Inc. ALLEY WRAP FSK Duct Wrap Type III;

.4 Certainteed Corporation Softtouch FSK Duct Wrap Type 150.

.4 Pre-moulded calcium silicate is to be rigid block and sheet insulation. Acceptable products are:

.1 Johns Manville Inc. "Thermo-12 Gold";

.2 Industrial Insulation Group "Thermo-12 Gold".

.5 Flexible foam elastomeric sheet is to be sheet form, CFC free, closed cell, self-adhering elastomeric nitrile rubber insulation with a water vapour permeability rating of 0.08 in accordance with ASTM E96 Procedure A. Acceptable products are:

.1 Armacell "AP/Armaflex SA";

.2 IK Insulation Group "K-Flex Duct Wrap", S2S.

2.08 Fire Rated Duct Wrap

.1 Flexible, non-combustible, blanket type mineral fibre duct wrap completely encapsulated in reinforced foil, suitable for installation with zero clearance to combustibles (for grease ducts), and ULC tested and listed (ULC Designs FRD-17 & 23 for ventilation ducts, ULC Design FRD-19 for kitchen exhaust/grease duct) to facilitate a 2 hour fire resistance rating (76 mm [3"] thick) to

kitchen grease exhaust duct in accordance with requirements of NFPA-96, and/or a 1 or 2 hour fire resistance rating (38 mm [1-½"] thick) to ventilation or pressurization ductwork in accordance with requirements of ISO 6944.

.2 Acceptable manufacturers are:

.1 3M Fire Barrier Duct Wrap 615;

.2 CL4 Inc. "CL4Fire";

.3 Unifrax Corp. "FyreWrap Elite 1.5";

.4 Morgan Thermal Ceramics "FireMaster FastWrap XL".

2.09 Insulating Coatings

.1 Equal to Robson Thermal Manufacturing Ltd. insulating coatings as follows:

.1 anti-condensation coating, "No Sweat-FX";

.2 thermal insulating coating, "ThermaLite".

2.10 Insulation Fastenings

.1 Wire – minimum #15 gauge galvanized annealed wire.

.2 Wire with Mesh – minimum #15 gauge galvanized annealed wire factory woven into 25 mm (1") hexagonal mesh.

.3 Aluminium Banding – equal to ITW Insulation Systems Canada "FABSTRAPS" minimum 12 mm (½") wide, 0.6 mm (1/16") thick aluminium strapping.

.4 Stainless Steel Banding – equal to ITW Insulation Systems Canada "FABSTAPS" 0.6 mm (1/16") thick, minimum 12 mm (½") wide type 304 stainless steel strapping.

.5 Duct Insulation Fasteners – weld-on 2 mm (3/32") diameter zinc coated steel spindles of suitable length, complete with minimum 40 mm (1-½") square plastic or zinc plated steel self-locking washers.

.6 Tape Sealant – equal to MACtac Canada Ltd. self-adhesive insulation tapes, types PAF, FSK, ASJ, or SWV as required to match surface being sealed.

.7 Mineral Fibre Insulation Adhesive – clear, pressure sensitive, brush consistency adhesive, suitable for a temperature range of -20°C to 82°C (-4°F to 180°F), compatible with type of material to be secured, and WHMIS classified as non-hazardous.

.8 Flexible Elastomeric Insulation Adhesive – Armacell "Armaflex" #520 air-drying contact adhesive.

.9 Closed Cell Foamed Glass Insulation Adhesive – Pittsburgh Corning PC88 multi-purpose 2-component adhesive.

.10 Lagging Adhesive – white, brush consistency, ULC listed and labelled, 25/50 fire/smoke rated lagging adhesive for canvas jacket fabric, suitable for colour tinting, complete with fungicide and washable when dry.

.11 Screws – No. 10 stainless steel sheet metal screws.

2.11 Insulation Jackets and Finishes

.1 Canvas Jacket Material – ULC listed and labelled, 25/50 fire/smoke rated, roll form, minimum 170 g (6 oz.).

.2 Roll Form Sheet and Fitting Covers – minimum 15 mm (1/2") thick white PVC, 25/50 fire/smoke rated tested in accordance with ULC S102, complete with installation and sealing accessories. Acceptable products are:

.1 Proto Corp. "LoSMOKE";

.2 The Sure-Fit System "SMOKE-LESS 25/50";

.3 Johns Manville Inc. "Zeston" 300.

.3 Rigid Aluminium Jacket – equal to ITW Insulation Systems Canada "Lock-on" 0.406 mm (0.016") thick embossed aluminum jacket material to ASTM B209, factory cut to size and complete with polysurlyn moisture barrier and continuous modified Pittsburgh Z-Lock, butt straps with "Fabstraps" to weatherproof the end to end joints, and 2-piece epoxy coated pressed aluminum fittings with weather locking edges.

.4 Adhesive backed flexible aluminium is to be MFM Building Products Corp. "Flex-Clad 400" roll form sheet material with an aggressive rubberized asphalt adhesive backing, high density polyethylene reinforcement, and an embossed aluminum facing.

.5 Heat resistant, trowel consistency thermal insulating and finishing cement to CAN/CGSB 51.12, and suitable for the application.

.6 Foamed glass insulation protective coating is to be Pittsburgh Corning "PITTCOTE 404" flexible acrylic latex weather barrier coating, white unless otherwise specified.

.7 Flexible foam elastomeric insulation protective coating equal to Armacell "WB Armaflex" weatherproof, water-based latex enamel finish.

3 Execution

3.01 General Insulation Application Requirements

.1 Unless otherwise specified, do not insulate following:

.1 factory insulated equipment and piping;

.2 heating piping within radiation unit enclosures, including blank filler sections of enclosures;

.3 heating piping in soffits and/or overhang spaces and connected to bare element radiation in spaces;

.4 branch potable water piping located under counters to serve counter mounted plumbing fixtures and fittings, except barrier-free lavatories;

.5 exposed chrome plated potable water angle supplies from concealed piping to plumbing fixtures and fittings, except barrier-free lavatories;

.6 heated liquid system pump casings, valves, strainers and similar accessories;

.7 heating system expansion tanks;

.8 fire protection pump casings;

.9 manufactured expansion joints and flexible connections;

.10 acoustically lined ductwork and/or equipment;

.11 factory insulated flexible branch ductwork;

.12 fire protection system water storage tanks;

.13 piping unions, except for unions in "cold" category piping.

.2 Install insulation directly over pipes and ducts, not over hangers and supports.

.3 Install piping insulation and jacket continuous through pipe openings and sleeves.

.4 Install duct insulation continuous through walls, partitions, and similar surfaces except at fire dampers.

.5 When insulating "cold" piping and equipment, extend insulation up valve bodies and other such projections as far as possible, and protect insulation jacketing from the action of condensation at its junction with metal.

.6 When insulating vertical piping risers 75 mm (3") diameter and larger, use insulation support rings welded directly above lowest pipe fitting, and thereafter at 4.5 m (14.7') centres and at each valve and flange. Insulate as per Thermal Insulation Association of Canada National Insulation Standards, Figure No. 9.

.7 Where piping and/or equipment is traced with electric heating cable, ensure cable has been tested and accepted prior to application of insulation, and ensure cable is not damaged or displaced during the application of insulation.

.8 Where existing insulation work is damaged as a result of mechanical work, repair damaged insulation work to Project work standards.

.9 Where mineral fibre rigid sleeve type insulation is terminated at valves, equipment, unions, etc., neatly cover exposed end of insulation with a purpose made PVC cover on "cold" piping, and with canvas jacket material on "hot" piping.

.10 Carefully and neatly gouge out insulation for proper fit where there is interference between weld bead, mechanical joints, etc., and insulation. Bevel away from studs and nuts to permit their removal without damage to insulation, and closely and neatly trim around extending parts of pipe saddles.

.11 Where thermometers, gauges, and similar instruments occur in insulated piping, and where access to heat transfer piping balancing valve ports and similar items are required, create a neat, properly sized hole in insulation and provide a suitable grommet in the opening.

3.02 Insulation for Horizontal Pipe At Hangers and Supports

.1 At each hanger and support location for piping 50 mm (2") diameter and larger and scheduled to be insulated, except where roller hangers and/or supports are required, and unless otherwise specified, supply a factory fabricated section of phenolic foam pipe insulation with integral vapour barrier jacket and captive galvanized steel shield. Supply insulation sections to piping installers for installation as pipe is erected.

.2 For 100 mm (4") diameter and larger heating system piping where roller type hangers and supports are provided, a steel saddle will be tack welded to pipe at each roller hanger or support location. Pack saddle voids with loose mineral wool insulation.

3.03 Pipe Insulation Requirements – Mineral Fibre

.1 Insulate following pipe inside building and above ground with mineral fibre insulation of thickness indicated:

.1 domestic cold water piping, less than 100 mm (4") dia. – 25 mm (1") thick;

.2 domestic cold water piping, greater than or equal to 100 mm (4") dia. – 40 mm (1-½") thick;

.3 domestic hot water piping, less than 40 mm (1-½") dia. – 25 mm (1") thick;

.4 domestic hot water piping, greater than or equal to 40 mm (1½") dia. – 40 mm (1-½") thick;

.5 tempered domestic water piping, supply and return, less than 40 mm (1-½") dia. – 25 mm (1") thick;

.6 tempered domestic water piping, supply and return, greater than or equal to 40 mm (1-½") dia. – 50 mm (2") thick;

.7 storm drainage piping from roof drains to the point where main vertical risers extend straight down, without offsets, and connect to horizontal underground mains – 25 mm (1") thick;

.8 condensate drainage piping from fan coil unit or any other air conditioning system/unit drain pans to main vertical drain risers or to indirect drainage point – 25 mm (1") thick;

.9 drainage piping from refrigerated drinking fountains to nearest 75 mm (3") dia. or larger drain pipe – 25 mm (1") thick;

.10 chilled water piping, supply and return, less than 100 mm (4") dia. – 25 mm (1") thick;

.11 chilled water piping, supply and return, greater than or equal to 100 mm (4") dia. – 40 mm (1-½") thick;

.12 chilled glycol solution piping, supply and return, less than 100 mm (4") dia. – 25 mm (1") thick;

.13 chilled glycol solution piping, supply and return, greater than or equal to 100 mm (4") dia. – 40 mm (1-½") thick;

.14 hot water heating piping, supply and return, less than 40 mm (1-½") dia. – 40 mm (1-½") thick;

.15 hot water heating piping, supply and return, greater than or equal to 40 mm (1-½") dia. – 50 mm (2") thick;

.16 glycol solution heating or heat reclaim piping, supply and return, less than 40 mm (1-½") dia. – 40 mm (1-½") thick;

.17 glycol solution heating or heat reclaim piping, supply and return, greater than or equal to 40 mm (1-½") dia. – 50 mm (2") thick;

.18 chilled domestic cold water piping from remote water cooler(s) to drinking fountain(s) – 40 mm (1-½") thick;

.19 piping indicated to be traced with electric heating cable – minimum 50 mm (2") thick;

.20 drum drip(s) in dry zone standpipe and/or sprinkler system piping – 50 mm (2") thick;

.21 refrigerant suction piping (between compressor and evaporator coil) inside building – 25 mm (1") thick;

.22 refrigerant hot gas piping (between compressor and condenser) inside building – 25 mm (1") thick;

.23 refrigerant hot gas by-pass piping (between compressor discharge and evaporator coil) inside building – 25 mm (1") thick;

.24 air compressor set fresh air intake piping – 25 mm (1") thick;

.25 heat pump equipment earthloop piping – 25 mm (1") thick.

.2 Secure overlap flap of the sectional insulation jacket tightly in place. Cover section to section butt joints with tape sealant.

.3 Insulate fittings with sectional pipe insulation mitred to fit tightly, and cover butt joints with tape sealant, or, alternatively, wrap fittings with blanket mineral fibre insulation to a thickness and insulating value equal to the sectional insulation, secure in place with adhesive and/or wire, and cover with PVC fitting covers.

.4 Unless otherwise specified, insulate unions, valves, strainers, and similar piping system accessories in "cold" piping with cut and tightly fitted segments of sectional pipe insulation with joints covered with tape sealant, or, alternatively, wrap piping union, valve, strainer, etc., with blanket mineral fibre and cover with PVC covers as for paragraph above.

.5 Terminate sectional insulation approximately 50 mm (2") from flange or coupling on each side of flange or coupling. Cover flange or coupling with a minimum 50 mm (2") thickness of blanket mineral fibre insulation wide enough to butt tightly to ends of adjacent sectional insulation. Secure blanket insulation in place and cover with a purpose made PVC coupling cover.

.6 Drum drips in dry zone sprinkler and/or standpipe system piping will be traced with electric heating cable as part of electrical work, and are generally not shown on drawing(s). Confirm number and size of drum drips required with trade providing piping and include for insulation to suit. Wherever possible drum drips will be located in heated areas.

.7 Take special care at concealed water rough-in piping at plumbing fixtures to ensure piping is properly insulated. If necessary due to space limitations, use 12 mm (½") thick sectional pipe insulation in lieu of 25 mm (1") thick insulation.

.8 Insulate seismic restraint hardware such as hanger rods, braces, anchors, etc., directly connected to "cold" category piping and equipment for a distance of 300 mm (12") from piping or equipment with insulation and finish to match pipe or equipment insulation. Coat seismic restraint hardware for a distance of 300 mm (12") from the termination of insulation with Robson Thermal "NO-SWEAT-FX" water based anti-condensation coating.

3.04 Pipe Insulation Requirements – Flexible Foam Elastomeric

.1 Install flexible elastomeric pipe insulation in strict accordance with manufacturer's published instructions to suit the application, and using adhesive, joint sealants and finish to produce a water-tight installation. Insulate following pipe with flexible elastomeric pipe insulation of thickness indicated:

.1 refrigerant suction and hot gas piping outside building – 25 mm (1") thick.

3.05 Pipe Insulation Requirements – Closed Cell Foamed Glass

.1 Install closed cell foamed glass insulation in strict accordance with manufacturer's published instructions to suit the application, and using adhesive, joint sealants, and jacketing to produce a water-tight installation. Insulate following pipe with closed cell foamed glass of thickness indicated:

.1 piping located outside building and indicated to be heat traced – minimum 50 mm (2") thick.

3.06 Pipe Insulation Requirements – Fire Rated Insulation

.1 Where pipe (inside building and above ground) which is to be insulated as specified above penetrates fire rated construction, provide fire-rated, non-combustible sectional insulation on portion of pipe in fire barrier and for a distance of 50 mm (2") on either side of fire barrier. Insulation thickness is to be as specified, but in any case minimum 25 mm (1").

3.07 Installation of Barrier Free Lavatory Insulation Kits

.1 Provide manufactured insulation kits to cover exposed drainage and water piping under barrier free lavatories.

3.08 Equipment Insulation Requirements – Blanket Type Mineral Fibre

.1 Insulate following equipment with mineral fibre blanket type insulation of thickness indicated:

.1 chilled water and/or domestic cold water pump casings – 40 mm (1-½") thick;

.2 roof drain sumps where inside the building – 25 mm (1") thick;

.3 water meter(s) – 40 mm (1-½") thick;

.4 top of radiant ceiling panels – 50 mm (2") thick.

.2 Unless otherwise noted, wrap equipment to a thickness and insulating value equal to an equivalent thickness of rigid sectional pipe insulation. Laminate insulation in place with a full coverage of adhesive and secure with wire. Apply a jacket of insulation vapour barrier material secured in place with adhesive or sealant tape.

.3 Cover roof drain sumps with purpose made PVC fitting covers.

.4 Lay fibreglass blanket on radiant ceiling panels after testing is complete.

3.09 Equipment Insulation Requirements – Semi-Rigid Mineral Fibre

.1 Insulate following equipment with semi-rigid mineral fibre board insulation of thickness indicated:

.1 refrigeration machine water chiller(s) and suction elbow(s) – 50 mm (2") thick;

.2 uninsulated domestic hot water storage tank(s) – 40 mm (1-½") thick;

.3 shell and tube type heat exchangers – 40 mm (1-½") thick;

.4 chilled water or chilled glycol solution storage tank – 50 mm (2") thick;

.5 heating main air separator – 40 mm (1-½") thick;

.6 chilled water expansion tank – 40 mm (1-½") thick.

.2 Install insulation as required to fit shape and contour of equipment. Secure insulation in place with adhesive, and with aluminum straps on 450 mm (18") centres. Apply a 6 mm (¼") thick skim coat of insulating cement, then, when insulating cement has dried, apply a 6 mm (¼") thick coat of cement trowelled smooth.

.3 For "cold" equipment, prime insulation with suitable sealer and apply a jacket of glass thread reinforced foil and kraft paper vapour barrier jacket material laminated in place with a full coverage of adhesive.

.4 Provide removable and replaceable insulated metal covers for equipment with removable heads to permit heads to be removed and replaced without damaging adjacent insulation work.

3.10 Equipment Insulation Requirements – Removable/Reusable Type

.1 Provide custom designed and manufactured removable and reusable insulation covers for following:

.1 plate type heat exchanger(s);

.2 150 mm (6") dia. and larger piping strainers, backflow preventers, etc.;

.2 Provide "wrap type" removable and reusable insulation covers for "cold" circuit balancing valves, backflow preventers, and similar items, and for steam traps and similar items requiring service in piping less than 150 mm (6") dia.

3.11 Ductwork Insulation Requirements – Mineral Fibre

.1 Insulate following ductwork systems inside building and above ground with mineral fibre insulation of thickness indicated:

.1 outside air intake ductwork, casings and plenums from fresh air intakes to and including mixing plenums or sections, or, if mixing plenums or sections are not provided, to first heating coil, or if both mixing plenums or sections and heating coil sections are not provided, and fresh air is not tempered, then the fresh air ductwork system complete – minimum 40 mm (1-½") thick as required;

.2 mixed supply air or preheated supply air casings, plenums and sections to and including the fan section where not factory insulated – minimum 25 mm (1") thick rigid board or minimum 40 mm (1-½") thick flexible blanket as required;

.3 supply air ductwork outward from fans, except for supply ductwork exposed in area it serves – minimum 25 mm (1") thick rigid board or minimum 40 mm (1-½") thick flexible blanket as required;

.4 exhaust discharge ductwork for a distance of 3 m (10') downstream (back) from exhaust openings to atmosphere, including any exhaust plenums within the 3 m (10') distance – minimum 25 mm (1") thick rigid board or minimum 40 mm (1-½") thick flexible blanket as required;

.5 any other ductwork, casings, plenums or sections specified or detailed on drawings to be insulated – thickness as specified.

.2 Provide rigid board type insulation for casings, plenums, and exposed rectangular ductwork. Provide blanket type insulation for round ductwork and concealed rectangular ductwork.

.3 Liberally apply adhesive to surfaces of exposed rectangular ducts and/or casings. Accurately and neatly press insulation into adhesive with tightly fitted butt joints. Provide pin and washer insulation fasteners at 300 mm (12") centres on bottom and side surfaces. Secure and seal joints with 75 mm (3") wide tape sealant. Additional installation requirements as follows:

.1 at trapeze hanger locations, install insulation between duct and hanger;

.2 provide drywall type metal corner beads on edges of ductwork, casings and plenums in equipment rooms, service corridors, and any other area where insulation is subject to accidental damage, and secure in place with tape sealant.

.4 Liberally apply adhesive to surfaces of concealed rectangular or oval ductwork, and wrap insulation around duct with a top butt joint and tight section to section butt joints. Provide pin and washer insulation fasteners at 300 mm (12") centres on bottom

surfaces. Secure and seal joints with 75 mm (3") tape sealant. At each trapeze type duct hanger, provide a 100 mm (4") wide full length piece of rigid mineral fibre board insulation between duct and hanger.

.5 Accurately cut sections of insulation to fit tightly and completely around exposed and concealed round or oval ductwork. Liberally apply adhesive to surfaces of duct, and wrap insulation around duct with a top butt joint and tight section to section butt joints. Seal joints with tape sealant. At duct hanger locations install insulation between duct and hanger. At each hanger location for concealed ductwork where flexible blanket insulation is used, provide a 100 mm (4") wide full circumference strip of semi-rigid board type duct insulation between duct and hanger.

.6 Insulation application requirements common to all types of rigid ductwork are as follows:

.1 at duct connection flanges, insulate flanges with neatly cut strips of rigid insulation material secured with adhesive to side surfaces of flange with a top strip to cover exposed edges of the side strips, then butt the flat surface duct insulation up tight to flange insulation, or, alternatively, increase insulation thickness to depth of flange and cover top of flanges with tape sealant;

.2 installation of fastener pins and washers is to be concurrent with duct insulation application;

.3 cut insulation fastener pins almost flush to washer and cover with neatly cut pieces of tape sealant;

.4 accurately and neatly cut and fit insulation at duct accessories such as damper operators (with standoff mounting) and pitot tube access covers;

.5 prior to concealment of insulation by either construction finishes or canvas jacket material, patch vapour barrier damage by means of tape sealant.

3.12 Ductwork Insulation Requirements – Flexible Elastomeric

.1 Insulate exposed exterior ductwork (except fresh air intake ductwork) and associated plenums and/or casings outside building with minimum 40 mm (1-½") thick flexible elastomeric sheet insulation as required, applied in 2 minimum 20 mm (¾") thick layers with staggered tightly butted joints.

.2 Install with adhesive in strict accordance with manufacturer's instructions to produce a weather-proof installation. Ensure sheet metal work joints are sealed watertight prior to applying insulation.

3.13 Ductwork Insulation Requirements – Calcium Silicate

.1 Insulate following kitchen exhaust ductwork with minimum 40 mm (1-½") thick calcium silicate block insulation:

.1 kitchen exhaust ductwork from exhaust hood to masonry shaft – 2 hour rating;

.2 Secure insulation in place with adhesive and with wire on 450 mm (18") centres. Point gaps and joints with insulating cement. Where ductwork is exposed, cover insulation with wire mesh secured to wire and with edges laced together and apply a coat of finishing cement trowelled smooth. Use drywall type metal corner bead for duct edges where finishing cement is applied.

3.14 Duct Wrap Requirements – Fire Rated Material

.1 Provide blanket type fire rated duct wrap system material for following ductwork to produce fire rating indicated:

.1 kitchen exhaust ductwork from exhaust hood to masonry shaft – 2 hour rating;

.2 Install duct wrap material in accordance with ULC design requirements and supplier's/manufacturer's instructions.

.3 Coordinate installation of duct wrap with installation of ductwork.

.4 Arrange and pay for duct wrap supplier to examine completed duct wrap system at site. Submit a letter from supplier to certifying duct wrap system has been properly installed.

3.15 Application of Insulating Coatings

.1 Apply, in accordance with manufacturer's instruction, insulating coatings to following bare metal surfaces:

.1 paint bare metal surfaces clear of "cold" piping and/or equipment insulation for a distance of from 300 mm (12") to 600 mm (24") clear of pipe or equipment insulation, with "No Sweat-FX" anti-condensation coating;

.2 paint bare metal surfaces associated with mechanical systems with an operating temperature 60°C (140°F) with "ThermaLite" insulating coating.

.2 Apply coatings with a brush. Remove any splatter or excess coating from adjacent surfaces.

3.16 Insulation Finish Requirements

.1 Unless otherwise shown and/or specified, jacket exposed mineral fibre insulation, and calcium silicate duct insulation work inside building with canvas secured in place with a full covering coat of lagging adhesive. Accurately cut canvas with scissors or a knife. Do not rip or tear canvas to size. Remove lagging adhesive splatter from adjacent uninsulated surfaces.

.2 Jacket exposed pipe insulation work inside building with white sheet PVC and fitting covers. Install sheet PVC and fitting covers tightly in place with overlapped circumferential and longitudinal joints arranged to shed water. Seal joints to produce a neat water-tight installation. Provide slip-type expansion joints where required by manufacturer's instructions.

.3 Apply 2 heavy coats of "PITTCOTE 404" coating with 24 hr. between coats to foamed glass insulation exposed above grade.

.4 Apply 2 coats (with 24 hr. between coats) of specified coating to flexible elastomeric insulation outside building.

End of Section

1 General

1.01 Application

.1 This Section specifies commissioning requirements that are common to Mechanical Divisions work Sections and it is a supplement to each Section and is to be read accordingly. When requirements of this Section contradict requirements of Division 00 or Division 01, conditions of Division 00 or Division 01 to take precedence.

1.02 Reference

.1 Refer to commissioning requirements specified in Division 01.

1.03 Commissioning Agent Involvement Versus Warranty Obligations

.1 Involvement of Commissioning Agent performing duties as described in this Section is not in any way to void or alter any Contractual warranty obligations.

1.04 Submittals

.1 Submit to Commissioning Agent, at same time as submittal to Consultant, one copy of each shop drawing or product data sheet associated with equipment or systems to be commissioned.

.2 Submit for review, a Commissioning Plan with schedule, commissioning procedures for commissioning events, and a copy of Commissioning Agent's commissioning data sheets for equipment/systems to be commissioned.

.3 Submit a list of commissioning instruments and for each instrument, indicate purpose of instrument and include a recent calibration certificate.

.4 Submit equipment and system manufacturer's start-up and test report sheets for review a minimum of 1 month prior to equipment and system start-up procedures.

.5 After start-up and successful pre-functional performance testing and submittal of completed forms, submit, for each system or subsystem, a letter confirming pre-functional performance testing has been successfully completed and system or subsystem is ready for functional performance testing and commissioning process to commence.

1.05 Definitions

.1 Commissioning: process of demonstrating to Owner and Consultant, for purpose of final acceptance, by means of successful and documented functional performance testing, that systems and/or subsystems are capable of being operated and maintained to perform in accordance with requirements of Contract Documents, all as further described below.

.2 Commissioning Agent: commissioning authority who will supervise commissioning process, and who will recommend final acceptance of commissioned mechanical work.

.3 Start-Up and Adjusting: process of equipment manufacturer's/supplier's technical personnel, with Contractor, starting and operating equipment and systems, making any required adjustments, documenting process, and submitting manufacturer's/supplier's start-up reports to confirm equipment has been properly installed and is operational as intended.

.4 Pre-Functional Performance Testing: testing, adjusting and operating of components, equipment, systems and/or subsystems, by Contractor, after start-up but before functional performance testing, to confirm components, equipment, systems and/or subsystems operate in accordance with requirements of Contract Documents, including modes and sequences of control and monitoring, interlocks, and responses to emergency conditions, and including submittal of pre-functional performance testing documentation sheets.

.5 Functional Performance Testing: a repeat of successful pre-functional performance testing by Contractor, in presence of Commissioning Agent and Consultant with completed Commissioning Agent's commissioning documentation sheets to document, validate and verify equipment, systems and subsystems are complete in all respects, function correctly, and are ready for acceptance.

.6 Commissioning Documentation Sheets: prepared sheets for pre-functional performance testing and for functional performance testing supplied by Commissioning Agent for each piece of equipment/system to be commissioned, each sheet or set of sheets complete with Project name and number, date of commissioning, equipment/system involved, equipment/system name and model number, equipment tag in accordance with drawings, and, for each commissioning procedure listed, a column giving expected data in accordance with Contract Documents, a column to fill in observed data during commissioning, and space for signatures of Contractor and Commissioning Agent.

.7 Systems Operating Manual: a manual prepared by Commissioning Agent to present an overview of building mechanical systems and equipment to be used by building maintenance personnel to assist them in daily operation of systems.

.8 Validate: to confirm by examination and witnessing tests correctness of equipment and system operation.

1.06 Quality Assurance

.1 Commissioning work is to be in accordance with requirements of following:

.1 CSA Z320, Building Commissioning Standard and Check Sheets;

.2 ASHRAE Guideline 0, The Commissioning Process;

.3 ASHRAE Guideline 1.1, The HVAC Commissioning Process;

.4 ASHRAE Guideline 1.2, The Commissioning Process for Existing HVAC&R Systems;

.5 ASHRAE Guideline 1.5, Commissioning Smoke Control Systems;

.6 Owner designated Commissioning Agent.

1.07 Commissioning Objectives

.1 Objectives of commissioning process:

.1 to support quality management by means of monitoring and checking installation;

.2 to verify equipment/system performance by means of commissioning of completed installation;

.3 to move completed equipment/systems from "static completion" state to "dynamic" operating state so as to transfer a complete and properly operating installation from Contractor to Owner.

1.08 Testing Equipment

.1 Supply instruments and test equipment required to conduct start-up, testing and commissioning procedures.

2 Products – Not Used

3 Execution

3.01 Commissioning

.1 Commission work in accordance with requirements of this Section and as required by Commissioning Agent.

.2 Prerequisites to successful completion of commissioning:

.1 submittal of signed start-up and test reports;

.2 completion of system testing, adjusting and balancing (TAB), and acceptance of TAB reports;

.3 permanent electrical and control connections of equipment;

.4 successful completion and documentation of pre-functional performance testing;

.5 submittal of letters to Consultant certifying systems and subsystems have been started, tested, adjusted, successfully pre-functional performance tested, are ready for functional performance testing, and are in accordance with requirements of Contract Documents.

3.02 Phasing of Commissioning

.1 If Project will be constructed in phases, phase commissioning accordingly to suit progress and phases of Work.

3.03 Deficiencies Listed During Commissioning

.1 Correct deficiencies listed by Consultant and Commissioning Agent during commissioning process within 15 calendar days of notification unless agreed otherwise with Consultant, and when deficiencies have been corrected, notify Consultant and Commissioning Agent immediately.

3.04 Systems to be Commissioned

.1 Mechanical systems to be commissioned include, but are not to be limited to, systems described below. Specific commissioning procedures are to be as directed by Commissioning Agent.

.2 Commissioning of drainage systems includes:

.1 commissioning of drainage pumps and controls by means of tests recommended by manufacturer to confirm proper operation and performance;

.2 commissioning of equipment such as interceptors and backflow preventers.

.3 Commissioning of fire protection systems will be considered complete upon preparation and submittal by Contractor of completion certificates required by applicable NFPA Standards, demonstration of proper system operation to local Fire Chief and any other authorities, including Owner's insurance underwriter as required, and coordination and cooperation with fire alarm system commissioning procedures, in particular smoke control systems and other such fan system control sequences.

.4 Commissioning of water systems (all piping extended from Municipal main) includes:

.1 commissioning of pumps and controls;

.2 commissioning of water heaters;

.3 commissioning of piping specialties such as backflow preventers, mixing valves, and similar components;

.4 commissioning of trap seal primer units, including adjustment of water flows and confirmation of water flow at each connected trap;

.5 commissioning of plumbing fixtures.

.5 Commissioning of swimming pool systems includes pool piping and fittings, pumping equipment and controls, filtering equipment, and chemical treatment equipment, as well as any specialized equipment for pool area such as dehumidifiers.

.6 Commissioning of laboratory systems includes piping, fittings including bench work fittings, and associated equipment including special ventilation systems.

.7 Commissioning of medical gas systems is not part of mechanical commissioning work and will be done as part of work specified in the Section 22 63 00 – Gas Systems for Laboratory and Healthcare Facilities.

.8 Commissioning of compressed air system includes "head end" compressor equipment, pressure reducing equipment, and outlets.

.9 Commissioning of natural gas system includes pressure regulating equipment. Perform commissioning in accordance with requirements of CAN/CSA B149.1, and any supplemental requirements of governing authorities.

.10 Commissioning of propane gas system includes pressure regulating equipment. Perform commissioning in accordance with requirements of CAN/CSA B149.2, and any supplemental requirements of governing authorities.

.11 Perform commissioning of fuel oil system in accordance with requirements of CAN/CSA B139.

.12 Commissioning of heating systems includes piping, piping specialties, equipment, and control, as well as checking and validating temperature and flow documentation contained in TAB reports. If TAB is not done during heating season, a follow-up site visit during heating season will be required to confirm proper flows and temperatures, and any required system "fine tuning".

.13 Commissioning of cooling systems includes piping, piping specialties, equipment, and control, as well as checking and validating temperature and flow documentation contained in TAB reports. If TAB is not done during cooling season, a follow-up site visit during cooling season will be required to confirm proper flows and temperatures, and any required system "fine tuning".

.14 Commissioning of HVAC chemical treatment systems includes feed and monitoring equipment, and testing of system fluids to confirm proper concentration of chemical.

.15 Commissioning of air handling systems includes equipment, ductwork, ductwork specialties, controls, interlocks, and checking and validating air capacities and flows in accordance with TAB reports.

.16 Control work commissioning includes confirmation of proper operation of individual control components, and overall operation of controls in conjunction with operation of connected building systems, including heating season/cooling season testing requirements specified above.

.17 Commissioning of BAS includes confirmation of proper operation of components, input/output points, hardware and software, and demonstration of system performing required procedures.

.18 Commissioning of special usage room controls includes confirmation of proper operation of individual components, and proper operation of overall control system, all in accordance with governing Codes and Standards.

.19 Commissioning of noise and vibration control equipment includes noise and vibration measurements to confirm proper operation of equipment.

3.05 Commissioning Process

.1 Perform commissioning process in stages and include, but not be limited to, following:

.1 Stage 1: Commissioning of equipment/systems as listed in this Section, which is a prerequisite to an application for Substantial Performance of the Work and includes supervising and validating results of functional performance testing, and submittal of reviewed Systems Operating Manual.

.2 Stage 2: Commissioning work performed 12 months after issue of a Certificate of Substantial Performance and which includes supervision of Contractor's "fine tuning" of equipment/systems through seasonal occupancy, and any other such work to achieve optimal comfort and performance conditions.

.3 Stage 3: Successful completion of satisfactory equipment/system operation during 1st month after issue of a Certificate of Total Performance of the Work.

.4 Stage 4: Successful completion of satisfactory equipment/system operation during 3rd month after issue of a Certificate of Total Performance of the Work.

.5 Stage 5: Successful seasonal commissioning of building.

3.06 Responsibilities of Contractor

.1 During construction phase, Contractor is to:

.1 prepare and submit an installation schedule which includes a time schedule for each activity with lead and lag time allowed and indicated, shop drawing and working detail drawing submissions, and major equipment factory testing and delivery dates;

.2 prepare and submit a commissioning schedule which is to include a time schedule coordinated with installation schedule referred to above and Commissioning Agent, and allowances for additional time for re-tests as may be required, and update schedule on a monthly basis as required;

.3 when requested by Commissioning Agent, arrange site commissioning meetings with Owner, Consultant, and applicable subcontractors present, to be chaired by Commissioning Agent who will also prepare and distribute meeting minutes;

.4 promptly correct reported deficient work, and report when corrective work is complete;

.5 where required by Codes and/or Specification, retain equipment manufacturers/suppliers or independent 3rd parties to certify correct installation of equipment/systems;

.6 under supervision of equipment manufacturers/suppliers, start-up and adjust equipment to design requirements, and submit start-up sheets which include equipment data such as manufacturer and model number, serial number where applicable, and performance parameters, all signed by equipment manufacturer/supplier and Contractor;

.7 complete Commissioning Agent's commissioning data sheets for multiple items of smaller equipment such as air terminal boxes, fan coil units, backflow preventers, etc., submit sheets to Commissioning Agent, accompany Commissioning Agent for an on-site check of 30% of data sheet information for each type of equipment, and perform any corrective action required as a result of site checks;

.8 perform system testing, adjusting and balancing and, when complete, issue a copy of final report to Commissioning Agent for review and a site check of results, and perform any corrective work required as a result of site checks by Commissioning Agent;

.9 in accordance with updated commissioning schedule and actual progress at site, certify in writing to Consultant and Commissioning Agent that equipment and/or systems are complete, have been checked, started and adjusted, successfully pre-functional performance tested and documented, and are ready for functional performance testing and commissioning procedures, giving Consultant and Commissioning Agent a minimum of 5 working days' notice;

.10 perform system and subsystem functional performance testing under supervision of Commissioning Agent, and submit to Consultant and Commissioning Agent, completed and signed functional performance testing and commissioning data sheets (issued by Commissioning Agent) and also signed by Commissioning Agent.

.2 During post construction phase, Contractor is to:

.1 optimize system operation in accordance with building occupant's needs and comments using System Operation Manual prepared by Commissioning Agent as reference;

.2 complete commissioning procedures, activities, and performance verification procedures that were delayed or not concluded during construction phase;

.3 accompanied by Commissioning Agent, complete system checks and "fine tuning" with signed documentation as follows:

.1 once during 1st month of building operation;

.2 once during 3rd month of building operation;

.3 once between 4th and 10th months in a season opposite to 1st and 3rd month visits.

.4 correct deficiencies revealed by system checks described above, and, where required, involve equipment manufacturers/suppliers during corrective actions, and report completion of corrective work;

.5 3 months after Substantial Completion conduct a question and answer session(s) at building with Owner's operating and maintenance personnel, with duration of session(s) dictated by number of questions and concerns that have to be addressed.

End of Section

1 General

1.01 Submittals

.1 Submit shop drawings/product data sheets for all products specified in Part 2 of this Section except for pipe, fittings, and chlorine solution.

1.02 Closeout Submittals

.1 Submit laboratory water purity test results indicating chlorine residual prior to application for Substantial Performance of the Work.

.2 Prior Substantial Performance of the Work, submit a minimum of 3 identified keys for key operated hydrants.

.3 Submit signed test results and inspection and test log cards for each backflow preventer as specified in Part 3 of this Section.

.4 Submit anchor drawing(s) to detail fabrication and installation of water piping anchors. Drawing(s) are to be prepared and stamped by a professional structural engineer registered and licensed in jurisdiction of the work.

.5 As specified in Part 3 of this Section, submit a letter from anchor design engineer stating anchor installation has been examined at site and anchors are properly fabricated and installed.

1.03 Quality Assurance

.1 Domestic water piping and valves are to comply with following codes, regulations and standards (as applicable):

.1 applicable local codes and regulations;

.2 CAN/CSA B125.1, Plumbing Supply Fittings;

.3 CAN/CSA B125.3, Plumbing Fittings;

.4 CAN/CSA B137 Series, Thermoplastic Pressure Piping Compendium;

.5 NSF/ANSI 14, Plastics Piping System Components and Related Materials;

.6 NSF/ANSI 61, Drinking Water System Components – Health Effects;

.7 NSF/ANSI 372, Drinking Water System Components – Lead Content.

2 Products

2.01 Pipe, Fittings, and Joints

.1 PVC

.1 ULC listed, rigid, Class 150, DR18, 1035 kPa (150 psi) pressure rated bell and spigot pattern PVC pipe to CAN/CSA B137.3, and CSA certified fittings to CAN/CSA B137.2, and AWWA C900, complete with gasket joints, and Ford "Uni-Flange" or equal restraint collars as per Part 3 of this Section.

.2 Soft Copper

.1 Type "K" soft copper to ASTM B88, supplied in a continuous coil with no joints if possible, and complete with, if joints are required, compression type flared joint couplings.

.3 Copper - Solder Joint

.1 Type "L" hard drawn seamless copper to ASTM B88, complete with copper solder type fittings to ASME/ANSI B16.18 and soldered joints using The Canada Metal Co. Ltd. "SILVABRITE 100" or equal lead-free solder for cold water pipe, and 95% tin / 5% Antimony or "SILVABRITE 100" solder for other services.

.4 Copper - Pressure Coupled Joint

.1 Type "L" hard drawn seamless copper to ASTM B88 with Viega "ProPress with Smart Connect feature" copper fittings with EDPM seals, and pressure type crimped joints made by use of manufacturer recommended tool.

.5 Copper - Grooved

.1 Type "L" hard drawn seamless copper to ASTM B88 with Victaulic QuickVic Style 607 non-reducing, bolted connection type suitable and approved for application intended, 2" - 8" for copper tubing consisting of ductile iron cast housings, complete with a Grade P fluoroelastomer gasket of a pressure-responsive design, with plated nuts and bolts to secure unit together.

.6 Semi-Rigid Polyethylene Tubing

.1 Versa Fittings and Mfg. Inc. 12 mm (½") dia., high density, semi-rigid polyethylene tubing, 1380 kPa (200 psi) rated.

.7 CPVC

.1 Ipex "Aquarise" CPVC pipe and fittings to CAN/CSA B137.6, 25/50 flame spread and smoke developed rated in accordance with CAN/ULC S102.2, and complete with primer/solvent weld joints.

.2 Option: Fittings equal to Victaulic PGS-300 grooved piping system for schedule 40 and schedule 80 CPVC pipe per ASTM F441, 23447 minimum cell classification per ASTM D1784. Sizes 50-300 mm (2" - 12") consisting of ductile iron cast housings, complete with a grade "EHP" EPDM gasket of a pressure-responsive design, with plated nuts and bolts to secure unit together (Viictaulic Style 357).

.8 Cross-Linked Polyethylene (PEX) Tubing

.1 Non-barrier type PEX piping in accordance with CAN/CSA B137.5, ASTM F876 and tested for compliance by an independent third-party agency, 25/50 flame spread/smoke developed rated when tested to CAN/ULC S102.2 and complete with brass inserts and crimp-ring or cold-expansion joint fittings and couplings.

2.02 Shut-Off Valves

.1 Ball Valves

.1 Class 600, 4140 kPa (600 psi) WOG rated, lead-free, full port ball type valves, each complete with a forged brass body with solder ends, forged brass cap, blowout-proof stem, solid forged brass chrome plated ball, "Teflon" or "PTFE" seat, and a removable lever handle. Valves in insulated piping are to be complete with stem extensions.

.2 Acceptable products are:

.1 Toyo Valve Co. Fig. 5049A-LF;

.2 Milwaukee Valve Co. #UPBA485B;

.3 Kitz Corporation Code 859;

.4 Apollo Valves #77LF-200;

.5 Watts Industries (Canada) Inc. #LFFBVS-3C.

.2 Butterfly Valves - Flanged Joint

.1 Non-corrosive, minimum 1200 kPa (175 psi) cold water pressure rated, resilient seated butterfly valves, each complete with a coated cast ductile iron lug type body, stainless steel shaft, bronze disc, and EPDM seat, and each suitable for

domestic water bubble-tight dead end service with valve in position and either side of connecting piping removed. Butterfly valves to and including 100 mm (4") dia. are to be equipped with lever handles. Butterfly valves larger than 100 mm (4") dia. are to be equipped with worm gear operators.

.2 Acceptable products are:

.1 DeZurik #632L Series;

.2 Kitz Corporation Code #6122EL/EG;

.3 Toyo Valve Co. #918BESL/EG;

.4 Bray Valve and Controls Canada Series 31;

.5 Apollo Valves #141 Series;

.6 Watts Industries (Canada) Inc. #BF-03.

.3 Butterfly Valves – Grooved End

.1 Equal to Victaulic Series 608N, for copper pipe rated to 300 psi and be both bi-directional and dead-end service capable to full rated pressure. Seat material shall be EPDM UL Classified in accordance with ANSI/NSF 61 for ambient +86°F and hot +180°F potable water service and ANSI/NSF 372.

.2 Victaulic Series 461, for stainless steel pipe rated to 300 psi and be both bi-directional and dead-end service capable to full rated pressure. Seat material shall be EPDM UL Classified in accordance with ANSI/NSF 61 for ambient +86°F and hot +180°F potable water service and ANSI/NSF 372.

2.03 Drain Valves

.1 Minimum 2070 kPa (300 psi) water rated, 20 mm (¾") dia., straight pattern full port bronze ball valves, each complete with a threaded outlet suitable for coupling connection of 20 mm (¾") dia. garden hose, and a cap and chain.

.2 Acceptable products are:

.1 Toyo Valve Co. Fig. 5046;

.2 Dahl Brothers Canada Ltd. Fig. No. 50. 430;

.3 Kitz Corporation Code 58CC;

.4 Apollo Valves #78-104-01;

.5 Watts Industries (Canada) Inc. #B6000.

2.04 Domestic Hot Water Thermostatic Mixing Valves

.1 Lawler Manufacturing Co. Inc. 800 Series "High-Low Thermostatic Mixer" factory assembled rough bronze thermostatic mixing valve assembly complete with rotatable union end inlet piping with check stops and stainless steel strainer screens, union outlet piping with thermometer connection, all sized as shown, and following:

.1 mixing valve with liquid motor, stainless steel piston and liner, tamper-resistant control adjustment, and 3-way protection against runaway temperatures, thermal shock, and scalding;

.2 dial type thermometer conforming to requirement specified in Section 20 05 00 – Common Work Results for Mechanical;

.3 ball type outlet shut-off valve conforming to valve requirements specified in this section;

.4 surface wall mounting enamelled steel cabinet with hinged door, key lock, and permanent identification;

.5 recessed wall mounting type 304 stainless steel cabinet with a #4 finish, hinged door, key lock, and permanent identification.

.2 Acceptable manufacturers are:

.1 Lawler Manufacturing Co. Inc.;

.2 Leonard Valve Co.;

.3 Symmons Industries Inc.

2.05 Floor Drain Trap Seal Primers

.1 Primer Valve Type

.1 Precision Plumbing Products Inc. Model P2-500 trap primer valve, constructed of brass, adjustable to high or low water pressures and complete with "O" ring seals, 12 mm (½") threaded inlet and outlet connections, and, for priming two traps from the same primer, a DU-2 dual outlet distribution unit.

.2 Primer Valve Type with Manifold

.1 Precision Plumbing Products Inc. Model P1-500 trap primer valve constructed as specified above for the Model P2-500 primer valve, complete with a Model DU-3 or DU-4, 3 or 4 outlet distribution unit for priming 3 or 4 traps, and at Model "YS-8" supply tube with combinations of Model DU-3 and DU-4 distribution units for priming from 5 to 6 traps.

.3 Electronic Type

.1 Precision Plumbing Products #PT Series surface wall mounting, CSA certified, 115 volt, 1-phase, 60 Hz., electronic, automatic trap priming manifolds, each sized to suit the number of drain traps or interceptors serviced, and each complete with:

.1 galvanized steel cabinet with door;

.2 20 mm (¾") dia. NPT copper pipe inlet with shut-off valve and water hammer arrestor;

.3 solenoid valve, an atmospheric vacuum breaker, and a discharge manifold with 12 mm (½") dia. compression type copper tube connections on 40 mm (1-½") centres with quantity to suit the number of items to be primed;

.4 control panel with circuit breaker, 5 ampere fuse, 24 hour timer, and manual override toggle switch.

2.06 Pipe Anchors

.1 Welded structural black steel anchors of a design, size, and type to securely anchor pipe at point shown. Each anchor is to withstand 150% axial thrust, and is to be designed and detailed by a professional structural engineer registered and licensed in jurisdiction of the work. Submit anchor design and fabrication shop drawings, stamped by design engineer.

2.07 Lavatory Supply Fitting Tempering Valves

.1 Equal to Powers "HydroGuard" Series 490, model LM490 12 mm (½") dia. or model LM491 20 mm (¾") dia. as required, each CSA B125 certified, forged brass, tamper-proof thermostatic mixing valves, adjustable for water supply between 29°C and 49°C (85°F and 120°F), sized to suit number of lavatories in grouping, and complete with a stop and check valve and a lockable handle.

.2 Each mixing valve is to be complete with a stainless steel flush wall mounting cabinet with vandal-proof hinged door.

2.08 Air Vents

.1 Equal to ITT Hoffman Specialty No. 78 cast brass, 1035 kPa (150 psi) rated, 20 mm (¾") straight water main vent valves, each tapped at the top for a 3.2 mm (1/8") safety drain connection.

3 Execution

3.01 Demolition

.1 Refer to demolition requirements specified in Section 20 05 05 – Selective Demolition for Mechanical.

3.02 Piping Installation Requirements

.1 Provide required domestic water piping.

.2 Piping, unless otherwise specified, is as follows:

.1 for underground piping 100 mm (4") dia. and larger outside and/or inside the building – rigid PVC;

.2 for underground piping less than 100 mm (4") dia. inside building – Type "K" soft copper;

.3 for pipe 100 mm (4") dia. and larger inside building and above ground – Schedule 10 stainless steel;

.4 for 12 mm (½") dia. trap seal primer tubing located underground or in concrete or masonry construction – semi-rigid polyethylene;

.5 for pipe inside building and aboveground in sizes to 100 mm (4") dia., except in vertical shafts and through fire barriers – rigid CPVC;

.6 for branch hot and cold piping aboveground from mains and risers to fixtures, fittings, and equipment where fire rated construction is not penetrated – at your option, PEX tubing installed and joined in strict accordance with manufacturer's instructions;

.7 for underground piping outside building to fixtures/outlets at grade level – flexible polyethylene, snaked in the trench and in a continuous length wherever possible;

.8 for pipe inside building and aboveground in sizes to 100 mm (4") dia. – Type "L" hard copper with solder joints.

.1 Option: Type "L" hard copper with pressure coupled mechanical joints.

.2 Option: Type "L" hard copper with grooved end mechanical joints.

.1 Grooved pipe ends shall be clean and free from indentations, projections and roll marks in the area from pipe end to groove for proper gasket sealing. All couplings will meet Victaulic standards for visual inspection sizes 2" to 8". The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Install in accordance with manufacturer's latest recommendations. A Victaulic factory trained representative shall periodically visit the job site and review the installation for best practices. The installing Contractor shall correct any identified deficiencies. Victaulic product that has been examined and has not met the visual inspection criteria for proper installation must be corrected and re-examined by Victaulic prior to the completion of the project.

.3 Brace and secure underground water service pipe at bends, tees and similar fittings with restraint devices, and provide concrete thrust blocks in accordance with Municipal standards and details. Regardless of what is specified elsewhere in this Specification regarding provisions of concrete, provide thrust block concrete. Paint restraint devices with 2 coats of corrosion resistant black asphalt base coating prior to backfilling.

.4 Lay pipes true to line and grade with bells upgrade. Fit sections together so that, when complete, pipe has a smooth and uniform invert. Keep pipe thoroughly clean so jointed compound will adhere. Inspect pipe for defects before being lowered into trench.

.5 Slope piping so it can be completely drained.

.6 Provide cast brass dielectric type adapters/unions at connections between ferrous and copper pipe or equipment.

3.03 Installation of Shut-Off and Check Valves

.1 Refer to Part 3 of Section 20 05 00 – Common Work Results for Mechanical.

.2 For shut off valves installed on solder joint copper piping up to and including 75 mm (3") diameter, provide ball type valves, and for flanged joints copper or stainless steel piping larger than 75 mm (3") diameter provide butterfly type valves.

3.04 Installation of Domestic Hot Water Thermostatic Mixing Valves

.1 Provide a domestic hot water thermostatic mixing valve assembly and wall mount.

.2 Adjust each valve to design requirements and check and test operation. Set maximum temperature limit stops.

.3 Identify each valve and its water temperature delivery setting with an engraved nameplate.

3.05 Installation of Trap Seal Primers

.1 Provide required accessible trap seal primers to automatically maintain a water seal in floor drain traps, whether shown on drawings or not.

.2 Water closet flush valves may be used for priming washroom floor drain traps if flush tube is properly tapped and primer tubing exposed in washroom is chrome plated.

.3 Provide trap primer valves to prime single or multiple (1 to 6) traps. Install trap primer valves in domestic cold water piping to frequently used plumbing fixtures. Where from 2 to 6 traps are to be primed from same primer valve, provide appropriate supply and distribution tube assemblies. Ensure primer valves are accessible.

.4 Provide 115 volt, electronic, surface wall mounting trap primer assemblies for multiple (4 to 30) traps. Include for a 115 volt 15 ampere panel breaker and wiring in conduit from closest panelboards to primer assembly, all to wiring standards of Electrical Division. Adjust primer water flow and timing to suit number of traps served.

.5 Ensure trap primer piping is secured to floor drain primer tappings and not terminated through the tapping in the throat of the drain.

3.06 Installation of Expansion Compensators, Guides, and Anchors

.1 Provide expansion compensators in domestic water piping.

.2 Ensure pipe ends are properly aligned. Provide alignment guides on each side of expansion compensators, properly secured to building structure.

.3 Provide anchors to secure domestic water piping to structure. Locate anchors generally where shown but with exact locations to suit piping as installed and requirements of reviewed anchor shop drawings.

.4 When installation of anchors is complete, arrange, and pay for anchor design engineer to visit site to review anchor installation. Submit a letter from design engineer confirming each anchor is properly installed.

3.07 Installation of Lavatory Supply Fitting Tempering Valves

.1 Provide thermostatic water tempering valves for hot water supply to public washroom lavatory supply fittings. Conceal valves and piping.

.2 Provide a flush wall mount panel for each valve. Confirm exact location prior to roughing-in.

.3 Install in accordance with manufacturer's instructions and set mixing valves to deliver 32°C (90°F) tempered water.

3.08 Installation of Air Vents

.1 Provide accessible air vents in domestic water piping to prevent air binding.

.2 Extend copper indirect drain piping from top drain connection of each vent to nearest suitable drain.

.3 Locate exact vent locations on as-built record drawings.

3.09 Flushing and Disinfecting Piping

.1 Flush and disinfect all new and/or reworked domestic water piping after leakage testing is complete.

.2 Isolate new piping from existing piping prior to flushing and disinfecting procedures.

.3 Flush piping until all foreign materials have been removed and flushed water is clear. Provide connections and pumps as required. Open and close valves, faucets, hose outlets, and service connections to ensure thorough flushing.

.4 When flushing is complete, disinfect the piping with a solution of chlorine in accordance with AWWA C601.

.5 When disinfecting is complete, submit water samples to a certified laboratory for purity testing and, when testing indicates pure water in accordance with governing standards, submit a copy of test results and fill the systems.

End of Section

1 General

1.01 Submittals

.1 Submit shop drawings/product data sheets for all products specified in this Section except pipe and fittings.

1.02 Closeout Submittals

.1 Submit a copy of plumbing inspection certificate prior to application for Substantial Performance of the Work.

.2 Submit letters from product manufacturers/suppliers to certify correct installation of products as specified in Part 3 of this section.

2 Products

2.01 Pipe, Fittings, and Joints

.1 PVC Sewer

.1 DR35 rigid, green PVC hub and spigot pattern sewer pipe and fittings to CAN/CSA B182.2, with gasket joints assembled with pipe lubricant.

.2 DR35 rigid, PVC sewer pipe and fittings, with solvent weld joints, all certified to CSA B182.1 and colour-coded as per local governing codes, regulations and standards.

.2 PVC - DWV

.1 Equal to Ipex System XFR 15-50 rigid PVC drain, waste and vent pipe and fittings to CAN/CSA B181.2, complete with a flame spread rating less than 25 and a smoke developed rating less than 50 when tested to CAN/ULC S102.2, solvent weld joints, and, for fire barrier penetration, approved firestop conforming to CAN/ULC S115.

.3 Copper - Solder Joint

.1 Type DWV hard temper to ASTM B306, with forged copper solder type drainage fittings and 50% lead - 50% tin solder joints.

.4 Cast Iron

.1 Class 4000 cast iron pipe, fittings, and mechanical coupling joints to CAN/CSA B70.

.5 Copper-Victaulic Coupling Joint

.1 Type DWV hard temper to ASTM B306, with factory or site rolled grooved ends (with grooving rolls designed for copper) and Victaulic "Copper Connection" wrought copper or cast bronze fittings and Style 606 gasket type couplings.

.6 Galvanized Steel - Victaulic Coupling Joint

.1 Schedule 40 mild steel, galvanized, ASTM A53, factory or site rolled grooved, complete with Victaulic galvanized ductile iron grooved end fittings and, unless otherwise specified, Victaulic Style 77 hot dip galvanized mechanical joint couplings with Grade M gaskets.

.7 PVC Weeper Piping

.1 150 mm (6") dia. corrugated perforated PVC pipe with an integral geodesic sock, supplied in coils.

2.02 Shut-Off and Check Valves

.1 Shut-off Valves

.1 Class 600, 4140 kPa (600 psi) WOG rated full port ball valves, each complete with a forged brass body, blowout-proof stem, chrome plated solid brass ball, solder or screwed ends as required, and removable lever handle.

.2 Acceptable products are:

.1 Toyo Valve Co. Fig. 5049A or Fig. 5044A;

.2 Milwaukee Valve Co. #BA-155 or #BA -125;

.3 Kitz Corporation Code 58 or Code 59;

.4 Victaulic Co. of Canada Ltd. Series 722;

.5 Apollo Valves # 77-100 or # 77-200;

.6 Watts Industries (Canada) Inc. #FBVS-3C.

2.03 Vent Stack Covers

.1 Equal to Lexcor Model "Flash-Tite" seamless, spun aluminum, insulated vent stack covers with caps and a factory applied asphalt primer coating on top and bottom of flange.

.2 Each vent stack cover is to be complete with a vandal-proof cap.

2.04 Cleanouts

.1 Horizontal Piping

.1 TY pipe fitting with an extra heavy brass plug screwed into the fitting.

.2 Vertical Piping

.1 Bronze or copper cleanout tees in copper piping, each complete with a bronze ferrule, and, for cast iron piping, "BARRETT" type cast iron cleanout tees, each gas and water-tight and complete with a bolted cover.

.3 Urinal(s)

.1 Wall access cleanout assemblies, each complete with a tapered plug, threaded brass insert, urethane rubber seal, and polished stainless steel access cover with vandal-proof stainless steel securing screw.

.2 Acceptable products are:

.1 Watts Industries (Canada) Ltd. #CO-590-RD.

.2 Jay R. Smith #SQ4-1819;

.3 Zurn #ZSS-1666-1;

.4 Mifab #C1440-RD;

2.05 Floor Cleanout Terminations

.1 Factory finished cast iron terminations, each adjustable and complete with a cast iron body with neoprene sleeve, solid, gasketed, polished nickel-bronze scoriated top access cover to suit floor finish, a seal plug, and captive, vandal-proof, stainless steel securing hardware.

.2 Acceptable products are:

.1 Watts Industries (Canada) Ltd. # CO-200-R-1.

.2 Jay R. Smith #4020-F-C Series;

.3 Zurn # ZN-1602-SP Series;

.4 Mifab # C1100-XR-1 or #C1000-R-3;

.3 Cleanout terminations in areas with a tile or sheet vinyl floor finish are to be as above but with a square top in lieu of a round top.

2.06 Floor Drains, Funnel Floor Drains, and Hub Drains

.1 Unless otherwise specified or indicated, floor drains are to be vandal-proof drains in accordance with drawing symbol list, each complete with a cast iron body and a trap seal primer connection. Cast iron components are to be factory finished with latex based paint coating.

.2 Floor drains in areas with a tile or sheet vinyl floor finish are to be as above but with a square grate in lieu of a round grate.

.3 Acceptable manufacturers are:

.1 Watts Industries (Canada) Ltd.;

.2 Jay R. Smith Manufacturing Co.;

.3 Zurn Industries Ltd.;

.4 Mifab Inc.

3 Execution

3.01 Demolition

.1 Refer to demolition requirements specified in Section 20 05 05 – Selective Demolition for Mechanical.

3.02 Drain and Vent Piping Installation Requirements

.1 Provide required drainage and vent piping. Pipe, unless otherwise specified, as follows:

.1 for underground pipe inside building and to points 1.5 m (5') outside building lines – rigid PVC sewer pipe, minimum 75 mm (3") dia.;

.2 for pipe inside building and aboveground in sizes less than or equal to 65 mm (2-½") dia. – type DWV copper;

.3 for pipe inside building and aboveground in sizes greater than or equal to 75 mm (3") dia. – Class 4000 cast iron;

.4 for pipe inside building and aboveground in lieu of type DWV copper and cast iron, at your option and where permitted by governing Codes and Regulations – rigid PVC DWV;

.5 for drainage pump discharge pipe connections from pump to and including shut-off and check valve connections – Type "DWV" copper with Victaulic "Copper Connection" fittings and couplings, or Schedule 40 galvanized steel with Victaulic fittings and couplings.

.2 Unless otherwise specified, slope horizontal drainage piping aboveground in sizes to and including 75 mm (3") dia. 25 mm (1") in 1.2 m (4'), and pipe 100 mm (4") dia. and larger 25 mm (1") in 2.4 m (8').

.3 Install and slope underground drainage piping to inverts or slopes indicated on drawings to facilitate straight and true gradients between points shown. Verify available slopes before installing pipes.

.4 Unless otherwise specified, slope horizontal branches of vent piping down to fixture or pipe to which they connect with a minimum pitch of 25 mm (1") in 1.2 m (4').

.5 Extend vent stacks up through roof generally where shown but with exact locations to suit site conditions and in any case a minimum of 3 m (10') from fresh air intakes. Terminate vent stacks a minimum of 330 mm (13") above roof (including roof parapets) in vent stack covers. Where not shown on drawings, route vent piping from source to building exterior as required in order to satisfy local governing codes and authority. Coordinate vent routing with other building services and ensure there is no architectural impact.

.6 Provide cast brass dielectric unions at connections between copper pipe and ferrous pipe or equipment.

3.03 Installation of Shut-Off and Check Valves

.1 Provide a shut-off valve and a check valve in discharge piping of each drainage pump.

.2 Locate valves so they are easily accessible without the use of ladders or other such devices.

3.04 Supply of Vent Stack Covers

.1 Supply a properly sized vent stack cover for each vent stack penetrating roof.

.2 Hand vent stack covers to roofing trade at site for installation and flashing into roof construction as part of roofing work. Coordinate installation to ensure proper locations. Provide waterproofing caps over vent stacks.

3.05 Installation of Cleanouts

.1 Provide cleanouts in drainage piping in locations as follows:

.1 in building drain or drains as close as possible to inner face of outside wall, and, if a building trap is installed, locate cleanout on downstream side of building trap;

.2 at or as close as practicable to the foot of each drainage stack;

.3 at maximum 15 m (50') intervals in horizontal pipe 100 mm (4") dia. and smaller;

.4 at maximum 30 m (100') intervals in horizontal pipe larger than 100 mm (4") dia.;

.5 in the wall at each new urinal or bank of urinals in a washroom;

.6 wherever else shown on drawings.

.2 Cleanouts are to be same diameter as pipe in piping to 100 mm (4") dia., and not less than 100 mm (4") dia. in piping larger than 100 mm (4") dia.

.3 Where cleanouts in vertical piping are concealed behind walls or partitions, install cleanouts near floor and so cover is within 25 mm (1") of the finished face of the wall or partition.

3.06 Installation of Floor Cleanout Terminations

.1 Where cleanouts occur in horizontal inaccessible underground piping, extend cleanout TY fitting up to floor, and provide a cleanout termination set flush with finished floor.

.2 In waterproof floors, ensure each cleanout termination is equipped with a flashing clamp device. Cleanout terminations are to suit floor finish.

.3 Where cleanout terminations occur in finished areas, confirm locations prior to rough-in and arrange piping to suit.

.4 Ensure cleanout termination covers in tiled floor are square in lieu of round.

3.07 Installation of Floor Drains, Funnel Floor Drains and Hub Drains

.1 Provide floor drains, funnel floor drains and hub drains.

.2 Coordinate location of floor drains, funnel floor drains and hub drains with equipment provided by Mechanical Division and Owner's supplied equipment. Install in accordance with manufacturer's instructions.

.3 Equip each drain with a trap.

.4 In equipment rooms and similar areas, exactly locate floor drains to suit location of mechanical equipment and equipment indirect drainage piping. In washrooms, exactly locate floor drains to avoid interference with toilet partitions.

.5 Confirm exact location of drains prior to roughing in. Where floor drains occur in washrooms coordinate locations with toilet partition installations.

.6 Temporarily plug and cover floor drains during construction procedures. Remove plugs and covers during final clean-up work and when requested, demonstrate free and clear operation of each drain. Replace any damaged grates, and refinish any areas of the drain where cast iron finish has been damaged or removed, including rusted areas.

End of Section

1 General

1.01 Submittals

.1 Submit shop drawings/product data sheets for all equipment and associated hardware specified in this Section.

.2 Include pump motor product data sheets and pump performance curves with shop drawing/product data sheet submission.

.3 Include design and fabrication shop drawings for shop fabricated heat exchanger support assemblies.

.4 Submit with delivery of heater(s) a copy of the factory inspection and test report for each heater, and include a copy of each report with O&M Manual project close-out data.

.5 Submit manufacturer/supplier installation certification letters as specified in Part 3 of this Section.

.6 Submit spare softener salt and a soap hardness test set and hand to Owner at site. Store salt where directed.

.7 Submit influent water analysis of municipal water supply for the following minimum criteria and anticipated softening results in parts per million (ppm): Calcium, Iron, Manganese, Magnesium, Total Hardness, Total Dissolved Solids, Turbidity, Colour, PH.

.8 After installation is complete, submit a written report verifying that the installation provides softening based on influent water analysis, signed by manufacturer's technical representative.

.9 Submit sufficient granular salt for 12 complete regenerations

.10 Submit a copy of a letter from the domestic cold water booster pump set supplier certifying proper installation, and a copy of pump supplier's start-up report, all as specified in Part 3 of this Section.

.11 Submit, prior to Substantial Performance of the Work, start-up or test data specified in Part 3 of this Section.

2 Products

.1 Pumps to be provided with two (2) year warranty and contractor to extend manufacturers standard warranty where required;

.2 Pumps are to have ceramic seals.

2.02 Horizontal In-Line Circulating Pumps

.1 All bronze construction centrifugal pumps in accordance with drawing schedule and complete with:

.1 lead free cast bronze casing with flanged pipe connections;

.2 alloy steel shaft with integral thrust collar, copper shaft sleeve, and oil lubricated bronze sleeve bearings;

.3 balanced lead free cast bronze impeller;

.4 motor conforming to requirements of Section 20 05 00 – Common Work Results for Mechanical, connected to motor by means of a 4-spring coupling with guard;

.5 mechanical seal.

.2 Acceptable manufactures are:

.1 S.A. Armstrong Ltd.;

.2 ITT Bell & Gossett;

.3 Grundfos Canada Inc.;

.4 Taco.

2.03 Circulating Pump Automatic Control

.1 Equal to ITT Bell & Gossett Model TC-1 115 volt, programmable, Automatic Timer Kit to control circulating pump on and off at pre-set minimum 15 minute intervals, and equipped with ON (continuous run), OFF (at all times), and TIMER (run at programmed times) modes.

.2 Equal to ITT Bell & Gossett AQS Series 115 volt Aquastat to automatically control pump on and off in response to domestic water temperature and equipped with a stainless steel pipe clip, bimetal sensing element, and insulated #18 AWG 450 mm (18") wire leads.

3 Execution

3.01 Drainage coordination

.1 Coordinate drain requirements of plumbing equipment provided by Mechanical Division and or Owner with location of drains specified in Section 22 13 00.

3.02 Installation of Circulating Pumps

.1 Provide horizontal in-line domestic hot water circulating pumps.

.2 Install pumps in place in vertical piping approximately 1.2 m (4') above floor in accordance with pump manufacturer's instructions.

.3 Refer to Section 20 05 00 – Common Work Results for Mechanical for equipment/system start-up requirements.

.4 Include for 2 hours of on-site training for 2 groups of 6 people. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

3.03 Installation of Circulating Pump Control

.1 Provide a programmable timer to control circulating pump on and off at pre-set times. Mount timer and connect to pump in accordance with timer manufacturer's instructions. Programme timer in accordance with Consultant's instructions.

.2 Provide an aquastat to control pump on and off in response to domestic water temperature. Install in accordance with manufacturer's instructions. Set on and off temperatures in accordance with Consultant's instructions.

.3 Provide a programmable timer and an aquastat to automatically control pump on and off in response to pre-set times and domestic water temperatures. Install in accordance with manufacturer's instructions. Programme both devices in accordance with Consultant's instructions.

End of Section

1 General

1.01 Submittals

.1 Submit shop drawings/product data for all products specified in Part 2 of this section except for pipe, fittings, and unions. Indicate performance criteria, conformance to appropriate reference standards, and limitations.

.2 For each gas pressure regulating station, submit:

.1 a selection sheet for each PRV, indicating connected equipment, heating loads, design allowance, meter model, body size, spring range and orifice size;

.2 a selection sheet for each relief valve(s) serving a PRV.

1.02 Quality Assurance

.1 All gas system work is to be in accordance with requirements of CAN/CSA-B149.1, Natural Gas and Propane Installation Code, as amended by local Gas Codes.

.2 All gas system work is to be performed only by licensed gas pipe fitters (holding Gas Technician 1 Certificate) authorized under the TSSA Act.

.3 Apply for, on TSSA forms, approval of the gas system design by the TSSA prior to work beginning at the site and prior to ordering any equipment. Submit the completed TSSA Form and copies of shop drawings/product data sheets as required to the TSSA and obtain an approval certificate. Pay all costs for the TSSA review and approval process. If the TSSA requires revisions to the system and the revisions result in an extra cost, a Notice of Change will be issued by the Consultant for the revision.

2 Products

2.01 Pipe, Fittings and Joints

.1 Coated Black Steel - Welded Joints: "Yellow Jacket" Schedule 40 mild black carbon steel, ASTM A53, Grade B, factory coated with yellow plastic, mill or site bevelled, and complete with forged steel butt welding fittings and welded joints. All bare metal surfaces are to be cleaned and corrosion protected with a suitable Denso primer and tape corrosion protection system.

.2 Polyethylene: Safety yellow coloured polyethylene pipe, fittings, and joints to CSA-B137.4.

.3 Coated Copper: Type "K" soft temper copper with a factory applied external yellow plastic coating and flare fittings with forged brass nuts to CAN/CSA-B149.1. Nuts are to be stamped with the designation C37700 to indicate that they are forged brass.

.4 Uncoated Black Steel - Screwed Joints: Schedule 40 mild black carbon steel, ASTM A53, Grade B, complete with malleable cast iron screwed fittings to ANSI B2.1, and screwed joints.

.5 Uncoated Black Steel - Welded Joints: Schedule 40 mild black carbon steel, ASTM A53, Grade B, mill or site bevelled, complete with factory made forged steel butt welding fittings and welded joints.

.6 Copper-Uncoated: Type "G" seamless copper tubing to ASTM B837, hard temper with wrought copper capillary brazed joint type fittings to ASTM B.61, and brazed joints made with "Sil-Fos" or "Sil-Fos 5" brazing alloy, or, soft temper with flared brass fittings of a single 45º flare type, forged or with a machined long nut and copper to copper threaded connectors, and, where required, flared brass copper to NPS adapters.

.7 Flexible Stainless Steel: Flexible, CSA certified, 860 kPa (125 psi) rated, gas-tight, convoluted stainless steel tubing factory jacketed with a bright yellow PVC coating which is continuously identified. The tubing is to be supplied in coils and is to be complete with factory attached stainless steel end fittings, and adapter unions, protective plates, and steel clamps. Acceptable products are:

.1 Tru-Flex Metal Hose LLC. "Pro-Flex";

.2 Titeflex Corp. "Gastite";

.3 Omega Flex Canada "TracPipe".

2.02 Piping Unions

.1 Screwed Piping: Malleable iron, ground joint, bronze or brass to iron or bronze to bronze seat screwed unions and union elbows with a minimum pressure rating of 1725 kPa (250 psi) steam at 260°C (500°F).

.2 Flanged Piping: Forged carbon steel slip-on type raised faced welding flange unions to ASTM A105, 150 lb. Class for steel pipe, and slip-on type 150 lb. Class bronze flanges for copper pipe.

.3 Copper to Steel: Equal to Kamco Products "Copper Stopper".

2.03 Shut-Off Valves

.1 Ball Type: CSA certified, minimum 3100 kPa (450 psi) WOG rated, 1/4 turn, full port non-lubricated brass ball valves, each complete with a Teflon PTFE seat, chrome plated solid ball, removable lever handle, and screwed ends. Acceptable products are:

.1 Neo Valves Inc. #425;

.2 Kitz Corp. Code 58;

.3 Toyo Valve Co. Fig. 5044A.

.2 Plug or Ball Type: CSA certified, plain face flanged, Class 125, 1380 kPa (200 psi) rated, 1/4 turn, cast iron lubricated plug valves, each wrench operated and complete with cylindrical plug with lubricant grooves, lubricant screw, and lubricant receptacle, or full port carbon steel ball valves with flanged ends. Acceptable products are:

.1 Neo Valves Inc. #1AS40114 plug valve;

.2 Newman Hattersley #171M plug valve;

.3 Kitz Corp. Code No. 150 SCTAM-FS-CGA ball valve.

2.04 Pressure Regulators

.1 CSA certified pressure regulators as follows:

.1 non-vented type: lever action, dead end lockup type, each complete with a vent limiter, self-aligning valve, die-cast aluminium housing, and synthetic rubber compound diaphragm;

.2 vented type: spring-loaded self-operated design, tight closing, selected for the facility gas pressure and piping pressure loss, and connected equipment load at full firing rate plus 20% spare, and complete with:

.1 1035 kPa (150 psi) rated cast iron body finished with corrosive resistant epoxy enamel;

.2 aluminum diaphragm and spring case with Nitrile diaphragm, disc, and body o-ring;

.3 throttling type, high flow rate, tight shut-off relief valve selected to protect equipment downstream of the regulator in coordination with regulator capacity.

.2 Acceptable manufacturers are:

.1 Maxitrol Co.;

.2 Fisher Controls;

.3 Leslie Controls Inc.;

.4 Lakeside Process Controls.

2.05 Natural Gas Piping Roof Supports

.1 Bases and blocks are to be UV resistant.

.2 Clamps for gas piping to be one (1) size larger than pipe to allow for expansion.

.3 Clamps and screws to be galvanized.

.4 Piping supports to be provided with two (2) year warranty.

.5 Acceptable products are as follows:

.1 Pipe Ease – Quick Block – Polypropylene support block with rigid foam base;

.2 Mifab – CX/C Series – UV Resistant Recycled Rubber support with base;

.3 Nelson/Olsen – Quick Pipe Block – HDPE support with rigid foam base;

.4 Erico – Caddy Pyramid Series – Thermoplastic support with base.

3 Execution

3.01 Demolition

.1 Do all required gas system demolition work. Refer to demolition requirements specified in Section 20 05 05 – Selective Demolition for Mechanical.

3.02 Natural Gas Service

.1 Make all required arrangement with the natural gas supply utility on behalf of the Owner for installation of natural gas service piping with gas pressure regulator and meter assembly.

.2 Provide an earthquake activated automatic shut-off valve in gas service piping outside the building in accordance with the valve manufacturer's installation instructions. Provide an angle iron framed wire mesh enclosure around the valve and bolted to the wall.

.3 Provide 2 m (7') high minimum 200 mm (8") diameter Schedule 80 galvanized steel concrete filled bollards at the meter-regulator location in a pattern to protect the meter-regulator. Install the pipe straight and plumb a 1.2 m (4') below grade in a continuous 600 mm (2') diameter reinforced concrete footing. Smoothly crown the top of the concrete above the top of the pipe.

3.03 Natural Gas Piping Installation Requirements

.1 Provide all required natural gas distribution piping and connect gas fired or operated equipment, and provide all required vent piping to atmosphere, including vent piping from pressure regulators. Do all piping work in accordance with requirements of CAN/CSA-B149.1, Natural Gas and Propane Installation Code, as amended by local Gas Codes.

.2 Piping is to be as follows:

.1 for underground piping, coated Schedule 40 black steel, coated soft copper, or polyethylene;

.2 for above ground piping, uncoated Schedule 40 black steel, hard temper or soft copper, or, if permitted, flexible stainless steel.

.3 Install flexible stainless steel pipe in strict accordance with the pipe manufacturer's printed instructions.

.4 Slope gas piping in the direction of flow to low points.

.5 Ensure that supports for roof mounted piping are sized (height) to accommodate the roof slope and the required piping slope, and to permit the installation of low point dirt pockets. Refer to mechanical details on drawings for more requirements.

.6 Provide full pipe diameter 150 mm (6") long drip pockets at the bottom of all vertical risers, at all piping low points, and wherever else shown and/or required.

.7 Identify all natural gas piping above ground with two coats of safety yellow enamel applied over primer, and SMS Ltd. or equal coil type vinyl identification makers with arrows.

.8 For all underground gas piping, provide continuous 75 mm (3") wide yellow PVC warning tape with "CAUTION - GAS LINE BURIED BELOW" wording at 750 mm (30") intervals located above the pipe approximately 250 mm (10") below grade.

.9 Rough-in all required natural gas piping for kitchen and laundry equipment in accordance with drawing plans and schedules. Obtain accurately dimensioned rough-in drawings for the equipment and confirm exact locations prior to roughing-in. When the equipment has been installed, connect the equipment from the roughed-in Work. Provide shut-off valves in all piping connections to the equipment.

.10 Include for mounting only of a solenoid valve in the gas piping to kitchen cooking equipment.

3.04 Installation of Shut-Off Valves

.1 Provide CSA approved ball type or lubricated plug type shut-off valves to isolate equipment, and wherever else shown.

.2 Ensure that valves are located for easy accessibility and maintenance.

3.05 Installation of Natural Gas Convenience Outlets

.1 Provide natural gas convenience outlets and wall mount.

.2 Provide a shut-off valve in connecting piping, confirm exact location prior to roughing-in, and ensure that the outlet is rigidly secured in place.

3.06 Installation of Pressure Regulators

.1 Provide pressure regulators in gas distribution piping where indicated and/or required.

.2 For indoor appliances, use lever acting design vent limiter type, sized as shown and mounted in a horizontal upright position in strict accordance with the manufacturer's instructions. Note that these pressure regulators do not require vent piping.

.3 Use vented type pressure regulators for all other applications.

.4 Install regulating stations in accordance with requirements of CAN/CSA-B149.1.

.5 Provide 6 mm (¼") diameter test ports upstream and downstream of each regulator assembly.

.6 Locate outdoor regulating stations a minimum of 300 mm (12") away from walkways, and 3 m (10') away from equipment air intakes and building openings. Provide all required vent piping and terminate vents in a turn-down elbow fitting with bronze bug screen secured in place.

.7 Locate indoor regulating stations in locations accessible without the use of ladders or lifts. Combine vents where permitted and increase vent pipe size accordingly. Extend vent piping up through the roof 3 m (10') away from equipment air intakes and building openings and terminated in a turn-down elbow fitting with bronze bug screen secured in place.

.8 Indicate operating set-points, relief settings and vent arrangements for each regulating station on as-built record drawings.

End of Section

1 General

1.01 Submittals

.1 Submit shop drawings/product data sheets for all products specified in this section except piping and unions.

.2 Submit motor product data sheets and certified performance curves with all pump shop drawings.

.3 Submit with delivery of each unit a copy of factory inspection and test report, and include a copy of each report with O & M Manual project close-out data.

.4 Submit a site inspection and start-up report from manufacturer's representative as specified in Part 3 of this section.

.5 Prior to Substantial Performance of the Work, submit a spare seal flush line filter for each pump equipped with a seal flush line.

.6 Shop drawings for piping anchors must be prepared and stamped by a professional Structural Engineer registered in the jurisdiction of the work. Refer to requirements for Contractor retained engineers specified in Section 20 05 10 - Mechanical Work General Instructions.

.7 Submit a letter from pipe anchor design engineer to stating engineer has visited site to examine installation of pipe anchors and pipe anchor installation is in accordance with reviewed anchor shop drawing.

1.02 Quality Assurance

.1 Pump motors are to comply with requirements of Section 20 05 00 – Common Work Results for Mechanical.

2 Products

2.01 Pipe, Fittings, and Joints

.1 Black Steel - Screwed Joint

.1 Mild black carbon steel, Grade B, ASTM A53, complete with Class 125 cast iron threaded fittings to ANSI/ASME B16.4, and screwed joints.

.2 Black Steel - Welded Joint

.1 Mild black carbon steel, Grade B, ASTM A53, mill or site bevelled, complete with factory made seamless carbon steel butt welding fittings to ASTM A234, Grade WPB, with long sweep pattern elbows unless otherwise specified, and welded joints.

.3 Black Steel - Grooved End Mechanical Joint

.1 Mild black carbon steel, Grade B, ASTM A53, factory or site roll grooved, complete with cast ductile iron grooved end fittings, including full flow elbows, and conforming to ASTM A536.

.2 Acceptable products are:

.1 Equal to Victaulic Style 107 "QuickVic" rigid couplings for sizes 2" to 12", Style 07 "Zero-Flex" rigid couplings, Style W07 AGS rigid couplings for sizes 350 mm (14") to 1525 mm (60");

.4 Black Steel – Plain End Mechanical Joint

.1 Mild black carbon steel, Grade B, ASTM A53, mill or site bevelled, complete with cast ductile iron end fittings conforming to ASTM A536.

.2 Acceptable products are:

.1 Equal to Victaulic QuickVic SD rigid couplings for sizes 1/2" to 2", rated for a working pressure of 300 psi.

.5 Soft Copper Pipe

.1 Type "L" seamless soft copper to ASTM B77.

.6 Hard Copper - Solder Joint

.1 Type "L" hard drawn seamless copper to ASTM B88, complete with wrought copper fittings to ANSI B16.22, and 95% tin / 5% Antimony solder joints.

.7 Hard Copper - Pressure Coupled Joint

.1 Type "L" hard drawn seamless copper to ASTM B88, complete with Viega "ProPress with Smart Connect feature" system copper fittings with EDPM seals, and pressure type crimped joints made by use of manufacturer recommended tool.

2.02 Piping Unions

.1 Screwed Piping

.1 Malleable iron, ground joint, bronze or brass to iron or bronze to bronze seat screwed unions and union elbows with a minimum pressure rating of 1725 kPa (250 psi) steam at 260°C (500°F).

.2 Flanged Piping

.1 Forged carbon steel slip-on type raised faced welding flange unions to ASTM A105, 150 lb. Class for steel pipe, and slip-on type 150 lb. Class bronze flanges for copper pipe.

2.03 Shut-Off Valves

.1 Ball Type

.1 Class 600, 4140 kPa (600 psi) WOG rated full port ball valves, each complete with a forged brass or bronze body and cap, blowout-proof stem, solid forged brass chrome plated ball, "Teflon" or "PTFE" seat, threaded ends, and removable lever handle.

.2 Acceptable products are:

.1 Toyo Valve Co. Fig. 5044A;

.2 Watts Industries (Canada) Inc. #FBV-3;

.3 Kitz Corp. Code 58;

.4 Victaulic Co. of Canada Ltd. Series 722;

.5 Apollo Valve #77-100.

.2 Butterfly Type

.1 Cast ductile iron, lug body style, 1200 kPa (175 psi) rated butterfly valve, each complete with a neck to permit 50 mm (2") of insulation above the flange, a field replaceable EPDM seat, ductile iron disc, stainless steel shaft with EPDM seal, a lever handle for valves to and including 150 mm (6") diameter, a handwheel and gear type operator for valves larger than 150 mm (6") diameter, and each suitable for bubble-tight dead end service with valve closed and either side of connecting piping removed.

.2 Acceptable products are:

.1 DeZurik of Canada Ltd., Figure No. 632;

.2 Victaulic Co. of Canada Ltd. Vic-300 MasterSeal or AGS Vic-300;

.3 Apollo Valve 143 Series;

.4 Watts Industries (Canada) Inc. #BF-03;

.5 Kitz Corp. 6112 Series;

.6 Toyo Valve Co. 918DESL/G2.

2.04 Swing Check Valves

.1 Bronze - Screwed

.1 Class 125, 1380 kPa (200 psi) WOG rated horizontal swing check valves, each complete with a "Y" pattern bronze body, hinged brass disc, easy access screw-in cap, and screwed ends.

.2 Acceptable products are:

.1 Toyo Valve Co. Fig. 236;

.2 Nibco #T-433;

.3 Kitz Corp. Code No. 22.

.2 Steel - Grooved Ends

.1 Victaulic Co. of Canada Ltd. Series 716, 779 or W715 grooved end carbon steel check valves suitable for mounting horizontally or vertically.

.3 Cast Iron - Screwed and Flanged

.1 Cast iron, bronze trim, 1380 kPa (200 psi) rated swing check valves, each complete with a bronze disc and seat, malleable iron hinge, bolted cover, and screwed or flanged ends as required.

.2 Acceptable products are:

.1 Toyo Valve Co. Fig. 435A;

.2 Watts Industries (Canada) Inc. #F-511;

.3 Kitz Corp. Code No. 78.

2.05 Vertical Lift Check Valves

.1 Class 150, 1380 kPa (200 psi) WOG rated bronze vertical lift check valves, each complete with screwed ends and a bronze disc.

.2 Acceptable products are:

.1 Toyo Valve Co. Fig. 231;

.2 Watts Industries (Canada) Inc. #600;

.3 Kitz Corp. Code No. 36.

2.06 Wafer Check Valves

.1 Threaded lug body type, full bore, ANSI Series 150, 1965 kPa (285 psi) rated at 38°C (100°F), non-slam wafer check valves, each complete with a carbon steel body, stainless steel discs, a shaft, springs, disc stop and thrust bearings constructed of type

316 stainless steel, and seat materials to suit the application. The inside diameter of the valve must equal the inside diameter of the connecting pipe.

.2 Acceptable products are:

.1 Gulf Valve Co. "WAFER CHECK";

.2 Watts Industries (Canada) Inc. Series ICV-125;

.3 The Metraflex Co. Style CVXX.

2.07 Drain Valves

.1 Minimum 2070 kPa (300 psi) WOG rated, 20 mm (¾") diameter straight pattern bronze ball valves, each complete with a threaded outlet suitable for coupling connection of 20 mm (¾") diameter hose, and a cap and chain.

.2 Acceptable products are:

.1 Toyo Valve Co. Ltd. Fig. 5046;

.2 Watts Industries (Canada) Inc. #B-6000-CC;

.3 Kitz Corp. Code No. 68AC;

.4 Apollo Valves #78-104-01.

2.08 Circuit Balancing Valves

.1 Screwed or flanged as required, globe style, non-ferrous circuit balancing valves designed to facilitate precise flow measurement, precision flow balancing, and positive shut-off, complete with capped and valved drain connection, and valved ports for connection to a differential pressure meter.

.2 Acceptable products are:

.1 Equal to Victaulic Co. of Canada Ltd. (Tour & Anderson) Series 787 screwed, Series 788 flanged, and 789 grooved end, and Series 78K "Koil Kit" valves.

2.09 Radiator Shut-Off and Balancing Valves

.1 Heavy pattern, straight, 1750 kPa (250 psi) rated at 120°C (250°F) bronze radiator valves, each complete with composition disc, spring loaded packing, and union. Equip inlet valves with a handle for shut-off. Equip outlet valves with a lockshield for shut-off and balancing.

.2 Acceptable products are:

.1 Dahl Brothers Canada Ltd. #11042 and #13013;

.2 Spirax Sarco Ltd. Type R.

2.10 Pressure Relief Valves

.1 ASME tested, rated, and certified, bronze or cast iron bronze fitted, 1725 kPa (250 psi) rated pressure relief valves, each capable of relieving full output of equipment it is associated with, and each factory set at 415 kPa (60 psi) unless otherwise specified.

.2 Acceptable products are:

.1 ITT Bell & Gossett 3301/4100, or 790/1170;

.2 Dresser Industries "CONSOLIDATED";

.3 Spirax Sarco Ltd. SVI Series;

.4 McDonnell & Miller Models 250 and 260;

.5 Conbraco 10-600 Series;

.6 Watts Industries (Canada) Inc. 174A or 740.

2.11 Air Vents

.1 Manual Air Vents

.1 Equal to Conbraco 27 Series, 3.2 mm (⅛") diameter with a key handle.

.2 Automatic Air Vents

.1 Float actuated air vents, each complete with a semi-steel body and cap, a stainless steel float assembly and seat, and a neoprene head.

.2 Acceptable products are:

.1 Spirax Sarco Ltd., Type 13 W for system working pressures to 1035 kPa (150 psi), 13 WH for system working pressures greater than 1035 kPa (150 psi);

.2 Armstrong International Inc. No. 1-AV.

2.12 Strainers

.1 Cast iron wye shaped strainers, minimum 890 kPa (125 psi) rated and complete with a removable type 304 stainless steel screen with perforations sized to suit the application, and, for strainers 50 mm (2") diameter and larger, a blowdown pipe connection tapping.

.2 Acceptable products are:

.1 Spirax Sarco Ltd. Type IF-125 screwed or Type AF-250 flanged;

.2 Toyo Valve Co. Ltd. Fig. 380A screwed or Fig. 381 flanged;

.3 Victaulic Co. of Canada Style 732 or W732 "Vic-Strainer";

.4 Armstrong International Inc. A1 Series;

.5 Watts Industries (Canada) Inc. #77SCI;

.6 Mueller Steam Specialty Products Model 11M screwed or Model 758 flanged.

2.13 Piping Expansion Joints

.1 Steel Piping Mains:

.1 Controlled flexing, flanged expansion joints, 2070 kPa (300 psi) rated, with corrugated stainless steel bellows with closely matched neck rings and reinforcing or control rings, and selected for operating pressure plus 25% safety factor.

.2 Acceptable products are:

.1 Senior Flexonics Ltd. Series CSF "High-Corr";

.2 Victaulic Co. of Canada Ltd. Style 155 with Style 07 or 107 "Zero-Flex" couplings on each side of assembly and a full length steel "V" shaped support trough with hangers;

.3 The Metraflex Co. Model MC.

.2 Steel or Copper Branch/Runout Piping:

.1 Externally pressurized, 1380 kPa (200 psi) rated expansion joints with a stainless steel bellows and shroud, welding or threaded steel nipple ends for steel piping, and copper sweat nipple ends for copper piping.

.2 Acceptable products are:

.1 Senior Flexonics Ltd. Series "H";

.2 The Metraflex Co. Model "HP".

2.14 Piping Alignment Guides

.1 Prime coat painted black carbon steel pipe alignment guides sized and fabricated to suit pipe size and pipe insulation thickness.

.2 Acceptable products are:

.1 Senior Flexonics Ltd. Series PGT;

.2 E. Myatt & Co. Ltd. Fig. 1267;

.3 Empire Tool & Mfg. Inc. Fig 256;

.4 The Metraflex Co. Style IV.

2.15 Pipe Anchors

.1 Welded structural black steel anchors of a design, size, and type to securely anchor pipe at point shown. Each anchor is to withstand 150% of axial thrust, and, as specified in Part 1 of this section, is to be designed and detailed by a Professional Structural Engineer.

2.16 Flexible Pump Connections

.1 Flexible metal hose assemblies, each complete with annular corrugated unbraided type 321 stainless steel inner core, braided type 321 stainless steel hose, and a collar and flange at each end, all suitable for twice the working pressure of the system.

.2 Acceptable products are:

.1 Senior Flexonics Inc. A1 and A6 Series;

.2 The Metraflex Co. Model SST and "METRA-MINI".

.3 Option: Victaulic Series 380, 381 or 382 pump drop assemblies. Includes flow control, vibration-controlling flexible couplings, access ports for gauges and thermowells and an integral flanged pump connection. Rated to the working pressure of Class 150 flange connection. Sizes 2” to 12”.

2.17 Air Separators

.1 Vortex type vertical air separator with side tangential inlet and outlet connections, a top air outlet connection, and bottom drain connection. Separator is to be constructed of cast iron or fabricated steel for a pressure of 1105 kPa (160 psi) at 180°C (350°F) in accordance with Section VIII, Division 1 of the ASME Boiler and Pressure Vessel Code.

.2 Acceptable products are:

.1 S.A. Armstrong Ltd. Model "VA";

.2 ITT Bell & Gossett "Rolairtrol";

.3 Taco Canada Ltd. "Vortech".

2.18 Expansion Tanks

.1 Replaceable bladder type, factory pressurized expansion tank with permanent separation of air and water, in accordance with drawing schedule and complete with:

.1 steel pressure tank suitable for a working pressure of 870 kPa (125 psi) at 115°C (240°F), constructed and stamped in accordance with the ASME Code for Unfired Pressure Vessels and complete with a system connection, drain connection, air charging valve, and a red oxide primer finish;

.2 heavy-duty butyl rubber (EDPM) bladder;

.3 tapping for installation of a pressure gauge;

.4 for horizontal tanks only, mounting saddles supplied loose;

.5 factory secured seismic restraint connection hardware.

.2 Acceptable products are:

.1 Hamlet & Garneau Inc. AL Series "Expanflex";

.2 S.A. Armstrong Ltd. Series "AX-V" Series "L";

.3 ITT Bell & Gossett Series "B" (ASME);

.4 Amtrol "Extrol";

.5 Taco (Canada) Ltd. "CBX" Series.

2.19 Glycol Solution Mixing and Storage Tanks

.1 Package type glycol solution mixing, storage and automatic feed assembly designed to maintain minimum system pressure levels and complete with:

.1 round, polyethylene or polypropylene tank sized to suit system capacity, complete with a solution level scale in litres and Imperial gallons, removable cover, and a welded steel angle stand assembly with legs, pump shelf, and control panel bracket, all factory finished with enamel;

.2 factory pre-piped minimum 1/3 HP, 115 volt, 1-phase rotary bronze gear pump with capacity and pressure differential to suit system requirements, factory wired to control panel, mounted on a shelf integral with steel stand assembly, and complete with shut-off valve and strainer;

.3 tank pressure relief valve with discharge piped back into tank;

.4 tank low level switch;

.5 pressure gauge;

.6 Honeywell #L404A "Pressurtrol" or equal pipe mounting differential pressure switch with a 100 to 1000 kPa (15 to 150 psi) range;

.7 115 volt, 1-phase, factory mounted and pre-wired control panel with an NEMA 2 enamelled steel enclosure, designed to control and operate glycol gear pump either manually or automatically to pump glycol solution into system, and to stop pump and initiate an audible/visual alarm if a low glycol solution level occurs in tank, and complete with:

.1 terminal blocks for power and control wiring connections;

.2 H-O-A switch with green "Power On" indicator light;

.3 120 volt/12 volt control transformer;

.4 low glycol solution level alarm buzzer with silencing switch, an alarm light which remains illuminated until low-level switch is reset, and an alarm push-to-test button;

.5 dry contacts for building automation system alarm annunciation.

.8 factory secured seismic restraint connection hardware.

.2 Acceptable products are:

.1 ITT Bell & Gossett Series GMU;

.2 S. A. Armstrong Ltd. GLA Standard Series;

.3 HG Spec. Inc.

2.20 Glycol

.1 Propylene glycol blended with Nitrite based corrosion inhibitors.

2.21 General Re: Circulating Pumps

.1 Pumps are to be bronze fitted centrifugal pumps in accordance with drawing schedule, each non-overloading under all operating conditions and factory tested at specified operating conditions;

.2 Pumps to be provided with two (2) year warranty and contractor to extend manufacturers standard warranty where required;

.3 Pumps are to have ceramic seals;

.4 Acceptable manufacturers are:

.1 S.A. Armstrong Ltd.;

.2 ITT Bell & Gossett;

.3 Grundfos CBS Inc. PACO;

.4 Hydromatic;

.5 Myers;

.6 Taco.

2.22 Split Coupled Vertical In-Line Pump

.1 Split coupled, single stage, vertical in-line pump complete with:

.1 radially split, gasketed cast iron volute with equally sized suction and discharge flanged connections, tappings for gauge, drain and flush line connections, and a cast iron motor mount bracket;

.2 dynamically balanced cast bronze impeller secured to a type 416 stainless steel shaft which is connected to motor by means of a high tensile strength aluminium bar split type spacer coupling with guard designed to permit servicing of mechanical seal without disturbing pump, motor, or electrical wiring;

.3 TEFC vertical mount motor;

.4 watertight John Crane Inc. #JC8B2, XP1D1 or Durametallic #RA EU5-FV carbon rotating face type outside mechanical seal with tungsten carbide stationary seat, Viton secondary seal and alloy 20 springs, and bronze gland plate with stainless steel gland bolts to secure stationary seat;

.5 factory installed seal flush line tubing with 50 micron Cuno cartridge type filter with 2 extra cartridges, a sight flow indicator, air vent, and valved tubing;

.6 for pump(s)___ , in lieu of a flush line filter, factory installed valved seal flush line tubing with cyclone type separator and sight flow indicator.

2.23 Close Coupled Vertical In-Line Pump

.1 Close coupled, single stage vertical in-line pump complete with:

.1 radially split, gasketed cast iron volute with equally sized suction and discharge flanged connections, and tappings for gauge, drain and flush line connections;

.2 dynamically balanced bronze impeller with bronze shaft sleeve, secured to motor shaft;

.3 face mounted TEFC vertical motor;

.4 watertight John Crane Inc. #JC 8B2, XP1D1 or Durmetallic #RA EU5-FV carbon rotating face type inside mechanical seal with tungsten carbide stationary seat, Viton secondary seal and alloy 20 springs, and bronze gland plate with stainless steel gland bolts to secure stationary seat.

.2 Acceptable manufacturers are:

.1 S.A. Armstrong Ltd.;

.2 ITT Bell & Gossett;

.3 Grunfos CBS Inc. PACO;

.4 Patterson Pump Company.

2.24 Split Coupled, Dual Vertical In-Line Pump

.1 Split coupled, single stage, vertical in-line pump assemblies incorporating 2 radially split pumps, complete with:

.1 cast iron volute with equally sized suction and discharge flanged connections, tappings for gauge, drain and flush line connections, and cast iron motor mount brackets;

.2 for each pump, dynamically balanced cast bronze impeller secured to a type 416 stainless steel shaft which is connected to motor by means of a high tensile strength aluminium bar split type spacer coupling with guard designed to permit servicing of mechanical seal without disturbing pump, motor, or electrical wiring;

.3 for each pump, a TEFC vertical mount motor;

.4 for each pump, a watertight John Crane Inc. #JC8B2, XP1D1 or Durametallic #RA EU5-FV carbon rotating face type outside mechanical seal with tungsten carbide stationary seat, Viton secondary seal and alloy 20 springs, and bronze gland plate with stainless steel gland bolts to secure the stationary seat;

.5 factory installed seal flush line tubing with 50 micron Cuno cartridge type filter with 2 extra cartridges, a sight flow indicator, air vent, and valved tubing;

.6 for pump(s) ___ , in lieu of a flush line filter, factory installed valved seal flush line tubing with cyclone type separator and sight flow indicator.

.2 Acceptable manufacturers are:

.1 S. A. Armstrong Ltd.;

.2 ITT Bell & Gossett;

.3 Grunfos CBS Inc. PACO.

2.25 Split Coupled, Dual, VFD Drive Vertical In-Line Pump

.1 Split coupled, single stage, vertical in-line pump assemblies incorporating 2 radially split pumps, complete with:

.1 cast iron volute with equally sized suction and discharge flanged connections, tappings for gauge, drain and flush line connections, and cast iron motor mount brackets;

.2 for each pump, a dynamically balanced cast bronze impeller secured to a type 416 stainless steel shaft which is connected to motor by means of a high tensile strength aluminium bar split type spacer coupling with guard designed to permit servicing of mechanical seal without disturbing pump, motor, or electrical wiring;

.3 for each pump, a TEFC vertical mount motor;

.4 for each pump, a watertight John Crane Inc. #JC8B2, XP1D1 or Durametallic #RA EU5-FV carbon rotating face type outside mechanical seal with tungsten carbide stationary seat, Viton secondary seal and alloy 20 springs, and bronze gland plate with stainless steel gland bolts to secure stationary seat;

.5 factory installed seal flush line tubing with 50 micron Cuno cartridge type filter with 2 extra cartridges, a sight flow indicator, air vent, and valved tubing;

.6 for each pump, a factory mounted VFD pre-wired to pump motor, capable of operating in any of following control modes:

.1 duty/standby pumps with sensorless control;

.2 duty/standby pumps with remote sensor or building automation system control;

.3 parallel pumps with single or multiple sensor(s) system control with IPS controller.

.7 for pump(s)___, in lieu of a flush line filter, factory installed valved seal flush line tubing with cyclone type separator and sight flow indicator.

.2 Acceptable manufacturers are:

.1 S. A. Armstrong Ltd.;

.2 ITT Bell & Gossett;

.3 Grundfos CBS Inc. PACO.

2.26 Close Coupled, Dual Vertical In-Line Pump

.1 Close coupled, single stage, vertical in-line pump assemblies incorporating 2 radially split pumps, complete with:

.1 cast iron volute with equally sized suction and discharge flanged connections, tappings for gauge, drain and flush line connections, and cast iron motor mount brackets;

.2 for each pump, a dynamically balanced cast bronze impeller secured to a type 416 stainless steel shaft which is connected to motor by means of a high tensile strength aluminium bar split type spacer coupling with guard designed to permit servicing of mechanical seal without disturbing pump, motor, or electrical wiring;

.3 for each pump, a TEFC vertical mount motor;

.4 for each pump, a watertight John Crane Inc. #JC8B2, XP1D1 or Durametallic #RA EU5-FV carbon rotating face type outside mechanical seal with tungsten carbide stationary seat, Viton secondary seal and alloy 20 springs, and bronze gland plate with stainless steel gland bolts to secure stationary seat;

.5 factory installed seal flush line tubing with 50 micron Cuno cartridge type filter with 2 extra cartridges, a sight flow indicator, air vent, and valved tubing;

.6 for pump(s)___, in lieu of a flush line filter, factory installed valved seal flush line tubing with cyclone type separator and sight flow indicator.

2.27 Vertical In-Line Pump Variable Frequency Drives

.1 Variable frequency drives for vertical in-line pumps as scheduled are to be in accordance with Section 20 05 13.13 - Variable Frequency Drives for Mechanical Equipment.

2.28 Circulating Pump Suction And Discharge Connection Accessories

.1 Circulating pump manufacturer supplied suction guides with a cast iron body, stainless steel strainer screen, removable fine mesh start-up strainer screen and steel guide vanes, and cast iron body, angle, or straight type control valve assemblies, each acting as a check valve, balancing valve, and shut-off valve. Unless otherwise shown or specified, suction and discharge connection accessories are to be piping line size.

.2 Acceptable products are:

.1 S.A. Armstrong Ltd. Type "SG" suction guides and "Flo-Trex" triple duty valve assemblies;

.2 ITT Bell & Gossett Bulletin B-820D suction guides and Bulletin B-821F triple duty valve assemblies.

2.29 Horizontal In-Line Pump

.1 Horizontal, in-line pump complete with:

.1 cast iron casing with flanged in-line pipe connections;

.2 alloy steel shaft with integral thrust collar, copper shaft sleeve, and oil lubricated bronze bearings;

.3 balanced, corrosion resistant steel, cast bronze, or stamped brass impeller;

.4 motor connected to pump by means of a 4-spring coupling with guard;

.5 mechanical seal.

.2 Acceptable manufacturers are:

.1 S.A. Armstrong Ltd.;

.2 ITT Bell & Gossett;

.3 Grundfos Canada Inc.

2.30 Wet Rotor 3-Speed Horizontal In-Line Pump

.1 Grundfos Canada Inc. "VersFlo" Series UPS wet rotor design, 3-speed horizontal in-line pump with a head-capacity curve that has a steady rise in head from maximum to minimum flow within preferred operating range, factory tested as an assembly and with a maximum noise level when operating of 41 dBA, capable of continuous operation at 120°C (248°F), and equipped with:

.1 cast iron housing with flanged inlet and outlet with gauge taps, laser welded stainless steel impeller, bearing plate and shaft, stainless steel neck ring, dynamically balanced rotor with stainless steel cladding, and tungsten carbide sleeve type motor bearings;

.2 3-speed asynchronous, squirrel cage, self-venting motor cooled by pumped fluid and complete with stator housing drain holes to permit condensed water to drain;

.3 bolt-on terminal box with 3-speed switch assembly with each speed having a distinct pump performance curve, and fibre optic indicator lights for visual inspection of on/off, rotation, and troubleshooting;

.4 terminal box add-on protective module to permit direct electrical connection to feeder switch;

.5 terminal box add-on relay module to permit direct connection to electrical feeder switch, signals output for external operating or fault indications, and to permit operation of 2 pumps in parallel with 24 hour alternation;

.2 Acceptable manufacturers are:

.1 Grundfos Canada Inc.;

.2 S. A. Armstrong Ltd.

2.31 Wet Rotor Variable Speed Horizontal In-Line Pump

.1 Grundfos Canada Inc. "Magna" Series wet rotor design, horizontal, variable frequency drive in-line pump with a head-capacity curve that has a steady rise in head from maximum to minimum flow within preferred operating range, factory tested as an assembly and with a maximum noise level when operating of 41 dBA, capable of continuous operation at 120°C (248°F), and equipped with:

.1 cast iron housing with flanged inlet and outlet with gauge taps, laser welded stainless steel impeller, bearing plate and shaft, stainless steel neck ring, dynamically balanced rotor with stainless steel cladding, and tungsten carbide sleeve type motor bearings;

.2 squirrel cage, self-venting motor suitable for a VFD, cooled by pumped fluid and complete with stator housing drain holes to permit condensed water to drain;

.3 bolt-on, integrated, CSA or ETL certified variable frequency drive assembly with "AUTOADAPT" function which automatically adjusts proportional pressure and sets an efficient performance curve whenever possible, an operating panel with control modules and clear indications for pump flow rate and head, and a bus communication module for site connection into building automation system.

.2 Acceptable manufacturers are:

.1 Grundfos Canada Inc. “Magna” Series;

.2 Taco Canada Ltd. “Delta T”.

3 Execution

3.01 Demolition

.1 Perform required hydronic piping system demolition/revision work. Refer to demolition requirements specified in Section 20 05 05 – Selective Demolition for Mechanical.

3.02 Piping Installation Requirements

.1 Provide required hydronic piping. Pipe, unless otherwise specified, is to be:

.1 for pipe to and including 65 mm (2-½") diameter, Schedule 40 black steel, screwed, or type "L" hard copper with solder joints or pressure coupled joints;

.2 for pipe 65 mm (2-½") to 300 mm (12") dia. and larger, Standard weight grooved end black steel (10 mm [0.375"] thickness) pipe with grooved end fittings and couplings, or, Standard weight black steel (10 mm [0.375"] thickness) pipe with welding fittings and welded joints;

.3 for short branch connections to heating equipment where structural obstructions occur and site bending of pipe is advantageous, a single length of type "L" soft copper.

.2 Slope horizontal piping mains to provide a minimum continuous up-grade of 25 mm (1") in 6 m (20') to high points. Slope branch supply and return piping connections to equipment a minimum of 25 mm (1") in 1.2 m (4'). Leave sufficient room at high points for installation and maintenance of air vents.

.3 Install automatic control valves, piping wells and similar piping and/or equipment mounted control components required for automatic temperature control systems supplied as part of the control work. Refer to drawing control diagrams and details.

.4 Connect equipment provided as part of the work of other sections with piping as indicated and/or required. Refer to pipe connection details on drawings.

.5 Provide screwed unions, removable mechanical joint couplings, or weld-on or solder-on flanges in piping at all connections to valves, strainers and similar piping system components which may need maintenance or repair, at equipment connections, in runs of piping exceeding 9 m (30') at 4.5 m (15') regular intervals to permit removal of sections of piping, and wherever else indicated on drawings.

.6 Provide shut-off valves in piping connections to equipment, to isolate piping risers, to isolate other sections of systems as shown, and wherever else indicated on drawings. Valves in piping to and including 50 mm (2") dia. are to be ball type. All other shut-off valves are to be ball or butterfly type unless otherwise specified. Locate valves so they are easily accessible. Wherever possible, install valves at uniform height. Provide chain operators for valves which are inaccessible for operation from floor level.

.7 Provide a check valve in discharge piping of every pump, and elsewhere in piping where shown on drawings. Where check valves are required in vertical piping, ensure they are suitable in all respects for the application. Check valves for vertical in-line and/or base mounted circulating pumps are integral with the discharge accessory.

.8 Provide a drain valve at base of each piping riser, in drain connections to equipment, in low points of horizontal piping, and wherever else shown and/or specified.

.9 Provide circuit balancing valves in piping generally where shown on drawings but with exact locations in accordance with instructions of personnel doing system flow balancing work. Confirm locations prior to installation.

.10 Grooved pipe ends shall be clean and free from indentations, projections and roll marks in the area from pipe end to groove for proper gasket sealing. All couplings will meet Victaulic standards for visual inspection sizes 2” to 12”. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Install in accordance with manufacturer’s latest recommendations. A Victaulic factory trained representative shall periodically visit the job site and review the installation for best practices. The installing Contractor shall correct any identified deficiencies. Victaulic product that has been examined and has not met the visual inspection criteria for proper installation must be corrected and re-examined by Victaulic prior to the completion of the project.

3.03 Installation of Pressure Relief Valves

.1 Provide factory set pressure relief valves. Pipe discharge of each water piping relief valve to drain unless otherwise shown or specified.

.2 Pipe discharge of each glycol solution piping relief valve back to system expansion tank or return piping.

.3 Confirm relief valve settings.

3.04 Installation of Air Vents

.1 Provide an air vent in piping mains at all high points, at equipment connections, and wherever else shown and/or specified. Equip each air vent with a ball type shut-off valve. Install vents in 100 mm (4") dia. and larger piping and all vents in mechanical rooms in accordance with drawing detail.

.2 Provide 9 mm (3/8") dia. copper drain piping from each automatic air vent to nearest suitable drain and terminate so discharge is visible. Identify drain piping.

3.05 Installation of Strainers

.1 Provide strainers in piping. Locate strainers so baskets are easily accessible and removable. Clean strainer baskets during and after piping system flushing and cleaning is complete, and before water quantity balancing commences.

3.06 Installation of Expansion Compensators

.1 Provide expansion compensation in piping.

.2 Generally, locate expansion compensation where shown, but with exact locations to suit piping as installed.

.3 Provide double pipe alignment guides in horizontal piping at each side of expansion compensation facilities to permit movement in axial direction only. Secure guides to building structure only.

.4 Provide a pipe guide at each side of expansion joints in vertical risers.

.5 When using grooved piping in a riser refer to a Victaulic riser design for anchor and guide locations.

3.07 Installation of Piping Anchors

.1 Provide anchors to secure piping to structure. Locate anchors generally where shown but with exact locations to suit piping as installed and requirements of reviewed anchor shop drawings.

.2 When installation of anchors is complete, arrange, and pay for anchor design engineer to visit site to review anchor installation. Submit a signed letter with engineer's stamp from design engineer confirming each anchor is properly installed.

3.08 Installation of Air Separator

.1 Provide an air separator in piping and connect with valved inlet and outlet piping.

.2 Extend valved blowdown piping from bottom pipe connection tapping to nearest floor drain location.

.3 Equip top pipe connection tapping with an automatic air vent, and piping as detailed.

3.09 Installation of Expansion Tank

.1 Provide an expansion tank.

.2 Secure horizontal expansion tank in place from structure by means of properly sized galvanized steel hanger rods and support saddles supplied with tank.

.3 Secure tank stand to a concrete housekeeping pad by means of machine bolts.

.4 Brace and secure tank in accordance with requirements specified in Section 20 05 48.16 - Seismic Controls for Mechanical.

.5 Connect tank with system piping. Extend a drain line from tank piping and terminate drain line with a drain valve. Provide an air vent.

.6 Provide a water make-up connection line complete with relief valve and pressure gauge and connect to system piping. Terminate make-up piping for connection to domestic cold water piping as part of the work of Section 22 11 00 – Facility Water Distribution. Check relief valve operation and adjust as required.

.7 Check tank air charge and adjust to suit system.

3.10 Installation of Glycol Solution Mixing and Storage Tank

.1 Provide a mixing and storage tank and feed assembly for each glycol solution circulating system.

.2 Secure tank stand to a concrete housekeeping pad. Connect with system piping. Refer to drawing detail.

.3 Brace and secure each unit in accordance with requirements specified in Section 20 05 48.16 - Seismic Controls for Mechanical.

.4 Fill tank with, unless otherwise specified, a solution of 50% water, 50% propylene glycol, and test solution to confirm proper concentrations.

.5 When installation is complete, test operation of assembly, including alarms, and adjust as required. Adjust pressure switch to suit glycol solution circulating system pressure.

3.11 Installation of Flexible Piping Connections

.1 Provide flexible connections in piping connections to equipment.

.2 Install in accordance with manufacturer's instructions.

3.12 Installation of Circulating Pumps

.1 Provide centrifugal circulating pumps.

.2 Secure base mounted pumps in place on seismic rated structural steel bases with vibration isolators as specified in Section 20 05 48.13 - Vibration Controls for Mechanical Systems, and restrain as specified in Section 20 05 48.16 - Seismic Controls for Mechanical Systems. Provide flexible connectors in pump suction and discharge piping 450 mm (18") from suction and discharge connection accessories.

.3 Secure base mounted pumps in place on a concrete housekeeping pad. Shim pump baseplate level using metal wedges prior to tightening bolts. When installation is complete and pump-motor alignment has been checked, fill void between pump base and housekeeping pad with KPM Industries Ltd. "In-Pakt" or equal non-shrink grout. Provide flexible connections in pump suction and discharge piping 450 mm (18") from suction and discharge connection accessories.

.4 Floor mount vertical inline pumps with seismically rated neoprene vibration isolators as specified in Section 20 05 48.13 - Vibration Controls for Mechanical Systems, and seismically rated steel pump mounting brackets custom welded to suction and discharge connections of pump. Refer to Section 20 05 48.16 - Seismic Controls for Mechanical Systems for further mounting requirements. Provide flexible connectors in vertical suction and discharge piping 450 mm (18") above suction and discharge connection accessories.

.5 Secure vertical inline pumps in place in accordance with requirements of drawing detail and provide flexible piping connections in vertical suction and discharge piping approximately 450 mm (18") above suction and discharge connection accessories.

.6 Provide a shut-off valve and suction guide in pump suction piping, and a combination check-balance-shut-off valve assembly in pump discharge piping, installed in accordance with manufacturer's instructions. Remove suction guide start-up strainer screens after piping flushing and cleaning is complete. Combination check-balance-shut-off valve assemblies are to be 150 mm (6") away from pump discharge for discharge piping to 150 mm (6") dia., and 300 mm (12") away from pump discharge for discharge pipe larger than 150 mm (6") dia.

.7 For pumps equipped with seal flush line filters, replace flush line filter cartridge when pipe flushing and cleaning is complete, and hand identified spare filter cartridges to Owner at site.

.8 Supply variable frequency drives (VFD) for pumps as scheduled. Hand VFD's to electrical trade at site for installation as part of the electrical work.

.9 Install horizontal inline pumps in place in vertical piping approximately 1.2 m (4') above floor in accordance with pump manufacturer's instructions.

.10 If circulating pumps are used for piping flushing and cleaning, and pump seal flush line filters are not installed, replace pump mechanical seals when flushing and cleaning is complete.

.11 Refer to Section 20 05 00 – Common Work Results for Mechanical for equipment/system manufacturer certification requirements.

.12 Refer to Section 20 05 00 – Common Work Results for Mechanical for equipment/system start-up requirements.

.13 Include for a 1/2 day on-site operation demonstration and training session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

3.13 Flushing and Cleaning Piping

.1 Flush and clean new piping in accordance with requirements specified in Section 23 25 00 - HVAC Water Treatment.

3.14 Testing, Adjusting and Balancing

.1 When work is complete and equipment is operating as intended, test, adjust and balance water flows in accordance with requirements specified in Section 20 05 93 - Testing, Adjusting, and Balancing for Mechanical and Section 20 08 00 – Commissioning of Mechanical Systems.

End of Section

1 General

1.01 Submittals

.1 Submit shop drawings/product data sheets for all products specified in Part 2 of this section except for pipe and fittings.

.2 Submit, in shop drawing form, a schematic piping diagram for each refrigerant piping system indicating pipe sizes, slopes, valves, traps, and piping specialties. Piping schematics must be reviewed, approved, and signed by refrigeration equipment manufacturers prior to being submitted to Consultant for review.

.3 Submit letters from equipment suppliers certifying proper installation and start-up of piping systems and equipment as specified in Part 3 of this section.

1.02 Quality Assurance

.1 Refrigerant piping systems are to be in accordance with CSA B52, Mechanical Refrigeration Code, and any applicable local Codes and Regulations.

.2 Refrigerant piping installing contractor is to be certified by Technical Standards and Safety Authority (TSSA). Installing contractor is to install refrigerant piping in accordance with manufacturer's installation instructions and in accordance with local codes. Contractor is responsible for all regulatory approvals, if required. Upon completion of installation, documentation of refrigerant amount, test certificates and verification documentation, etc., is to be provided in a binder, in accordance with requirements of local authorities having jurisdiction.

.3 Refrigerant piping and direct expansion refrigeration equipment must be installed by or under direct on site supervision of a licensed journeyman refrigeration mechanic.

2 Products

2.01 Pipe, Fittings and Joints

.1 Type ACR hard drawn seamless copper refrigerant tubing to ASTM B280, factory degreased, dehydrated and capped or nitrogen filled and capped, complete with factory washed and bagged wrought copper soldering fittings to ASME B16.22, and brazed joints made with high melting point silver brazing alloy conforming to AWS Classification BcuP-5.

2.02 Piping Line Sets

.1 Equal to Great Lakes Copper Inc. "EZ-Roll" soft annealed copper to ASTM B280, suitable for use with refrigerant involved, factory cleaned and capped, and with sizes and lengths as required.

2.03 General Re: Valves and Piping Specialties

.1 Refrigerant valves and piping specialties specified below are to factory cleaned, degreased, and supplied to site with capped ends.

2.04 Shut-Off Valves

.1 Ball Valves

.1 ¼ turn, CSA certified forged brass ball valves, each suitable for a maximum working pressure of 3445 kPa (500 psi) and complete with carbon filled Teflon ball seals, 2 O-ring stem seals, a gasketed seal cap, a flow direction arrow cast into body, a ball position indicator on stem, and extended copper tube connections to permit brazing the valve into line without disassembling valve.

.2 Acceptable manufacturers are:

.1 Mueller Industries Inc.;

.2 Sporlan Valve Co.;

.3 Superior Refrigeration Products/Sherwood.

.2 Diaphragm Valves

.1 Forged brass, frost-proof, Type 1 Series, CSA certified packless diaphragm valves, each suitable for a 3445 kPa (500 psi) working pressure and complete with an O-ring to prevent moisture from entering diaphragm chamber, one phosphor bronze and 2 stainless steel diaphragms, and extended copper tube brazing connections.

.2 Acceptable manufacturers are:

.1 Mueller Industries Inc.;

.2 Sporlan Valve Co.;

.3 Superior Refrigeration Products/Sherwood.

2.05 Check Valves

.1 Straight through type for valves 6.4 mm to 16 mm (¼" to 5/8") diameter, globe type for valves 22 mm (7/8") diameter and larger, each complete with extended tubing for brazing connections, and as follows:

.1 straight through type check valves complete with a machined brass gasketed body, phosphor bronze spring, and neoprene seat;

.2 globe type check valves complete with a cast bronze body, forged brass cap, phosphor bronze spring, Teflon seat disc, and neoprene O-ring seal.

.2 Acceptable manufacturers are:

.1 Mueller Industries Inc.;

.2 Sporlan Valve Co.;

.3 Superior Refrigeration Products/Sherwood.

2.06 Piping Traps

.1 Mueller Industries Inc. Style No. WE-554P brazing end copper "P" traps.

.2 Acceptable manufacturers are:

.1 Mueller Industries Inc.;

.2 Sporlan Valve Co.;

.3 Superior Refrigeration Products/Sherwood.

2.07 Pressure Vessel Relief Valves

.1 Factory set pressure relief valves, straight through or angle type as required, each constructed in accordance with requirements of ANSI B9.1 and the ASME Code for Unfired Pressure Vessels, and each complete with a brass body, neoprene seat disc, and lead seal and locking wire.

.2 Acceptable manufacturers are:

.1 Mueller Industries Inc.;

.2 Sporlan Valve Co.;

.3 Superior Refrigeration Products/Sherwood.

2.08 Refrigerant Liquid Moisture Indicators

.1 Forged brass, triple sealed, CSA certified liquid moisture indicators, each suitable for a maximum working pressure of 3445 kPa (500 psi) and complete with a liquid indicator which shows "FULL" when system is fully charged with refrigerant and remains blank when there is a restriction or shortage of refrigerant in liquid line, a moisture indicator which changes colour from blue to pink when moisture is present in system, a plastic dust cover, and extended copper tube brazing connections.

.2 Acceptable manufacturers are:

.1 Mueller Industries Inc.;

.2 Sporlan Valve Co.;

.3 Superior Refrigeration Products/Sherwood.

2.09 Liquid Line Filter-Drier

.1 Mueller Industries Inc. "Drymaster" CSA certified filter-driers, each suitable for a maximum 3445 kPa (500 psi) working pressure and complete with a combination of desiccants in a fluted briquette for drying, and a fluted briquette type filter.

.2 Acceptable manufacturers are:

.1 Mueller Industries Inc.;

.2 Sporlan Valve Co.;

.3 Superior Refrigeration Products/Sherwood.

2.10 Flexible Piping Connections

.1 Senior Flexonics Canada "VIBRA-SORBERS" phosphor bronze construction, factory cleaned, dried, and sealed flexible piping connections with copper tube brazing ends.

.2 Acceptable manufacturers are:

.1 Senior Flexonics Canada;

.2 The Metraflex Co.

2.11 Thermostatic Expansion Valves

.1 Factory tested, balanced port design thermostatic expansion valves, with exact selection to suit the application and refrigerant used, each complete within a replaceable stainless steel diaphragm and welded element construction thermostatic element charged with hydraulic fluid, and removable inlet strainer.

.2 Acceptable manufacturers are:

.1 Mueller Industries Inc.;

.2 Sporlan Valve Co.;

.3 Superior Refrigeration Products/Sherwood.

2.12 Refrigerant Piping Roof Supports

.1 Bases and blocks are to be UV resistant.

.2 Clamps for refrigerant piping to be one (1) size larger than pipe to allow for expansion.

.3 Clamps and screws to be galvanized.

.4 Piping supports to be provided with two (2) year warranty.

.5 Acceptable products are as follows:

.1 Pipe Ease – Quick Block – Polypropylene support block with rigid foam base;

.2 Mifab – CX/C Series – UV Resistant Recycled Rubber support with base;

.3 Nelson/Olsen – Quick Pipe Block – HDPE support with rigid foam base;

.4 Erico – Caddy Pyramid Series – Thermoplastic support with base.

3 Execution

3.01 Demolition

.1 Perform required refrigerant piping system demolition work. Refer to demolition requirements specified in Section 20 05 00 – Selective Demolition for Mechanical.

3.02 Installation of Refrigerant Piping, Valves and Specialties

.1 Provide required refrigerant piping. Piping is to be type ACR copper with wrought copper fittings. Install piping in accordance with requirements of reviewed refrigerant piping schematics referred to in Part 1 of this section.

.2 Make refrigerant piping joints using a light coat of approved brazing flux applied to both pipe and fitting. Do not use acid flux. During brazing process, ensure pipe and fittings are kept full of nitrogen or carbon dioxide to prevent scale formation inside pipe and fitting.

.3 Where shown or specified, use soft copper refrigerant piping line sets.

.4 Provide shut-off valves to isolate each piece of equipment if shut-off valves are not supplied integral with equipment. Provide ball or diaphragm type shut-off valves inside building. Provide diaphragm shut-off valves outside building.

.5 Provide a refrigerant charging valve for each system if such a valve is not supplied integral with equipment.

.6 Provide refrigerant piping accessories shown and/or required and install in accordance with manufacturer's recommendations.

.7 Provide required refrigerant.

.8 Provide flexible connections at piping connections to roof mounted condensing units. Install in accordance with manufacturer's instructions. Refer to mechanical details on drawings for more requirements.

.9 Provide expansion valves where shown and/or required, each matched to coil and installed in accordance with manufacturer's instructions.

End of Section

1 General

1.01 Submittals

.1 Submit shop drawings/product data sheets for all products specified in this section except shop fabricated ductwork and fittings.

.2 Include capacity, throw and terminal velocity, noise criteria, and pressure drops with grille and diffuser shop drawing/product data sheet submission.

.3 With shop drawing/product data sheet submission, supply evidence that fire rated duct manufacturer is ULC listed to size requirements shows on drawings.

.4 Submit duct leakage test data prior to ductwork being covered from view.

.5 Submit manufacturer's colour chart(s) for all items for which a finish colour is to be selected.

.6 Submit proper installation certification from fire rated duct manufacturer as specified in Part 3 of this section.

.7 Submit a site inspection and start-up report from fan filter diffuser manufacturer's representative as specified in Part 3 of this section.

.8 Supply and hand to Owner at Substantial Performance of the Work, a minimum of 10 identified (with tags) grille/diffuser volume control damper adjustment keys.

.9 Supply reviewed copies of ventilator/curb assembly shop drawings or product data sheets to trade who will cut roof openings for ventilators, and ensure openings are properly sized and located.

1.02 Quality Assurance

.1 Grilles and diffusers are to be tested and performance certified to ANSI/ASHRAE 70, Method of Testing the Performance of Air Outlets and Air Inlets.

2 Products

2.01 Galvanized Steel Ductwork

.1 Galvanized steel sheet is to be hot dipped in accordance with requirements of ASTM A653. G60 galvanizing for bare uncovered duct to be finish painted. G90 for all other galvanizing.

.2 Rectangular

.1 Lock forming grade hot dip galvanized steel, ASTM A653, shop fabricated, minimum #26 gauge.

.3 Round

.1 Factory machine fabricated, spiral, mechanically locked flat seam, single wall duct, fittings and couplings.

.4 Flat Oval

.1 Factory machine fabricated, single wall, 4-ply spiral lock seam duct, fittings and couplings.

2.02 Flexible Metallic Ductwork

.1 Bare

.1 Spirally wound, semi-rigid, self-supporting corrugated aluminum duct with continuous triple lock seams, SMACNA Form "M-UN", ULC S110 listed and labelled as a Class 1 Air Duct, constructed of dead soft aluminum strip, and supplied in 3 m (10') lengths.

.2 Insulated

.1 Spirally wound, semi-rigid, self-supporting corrugated aluminum duct with continuous triple lock seams, SMACNA Form "M-I", ULC S110 listed and labelled as a Class 1 Air Duct, constructed of dead soft aluminum strip, supplied in 3 m (10') lengths and factory covered with 40 mm (1-½") thick, 12 kg/m3 (0.75 lb/ft³) density fibreglass insulation with a vinyl jacket meeting 25/50 flame spread and smoke developed requirements tested in accordance with CAN/ULC S102.

2.03 Flexible Fabric Ductwork

.1 Equal to DuctSox Corp. round fabric air duct, 25/50 flame spread/smoke developed rated when tested in accordance with CAN/ULC S102, white or coloured (to manufacturer's standards), and complete with 3 x 1 tension cable suspension system.

2.04 Flexible Connection Material

.1 Waterproof, indoor-outdoor type flexible connection material meeting requirements of NFPA 90A, consisting of woven glass fibre fabric coated on both sides with synthetic rubber. Acceptable products are:

.1 Duro Dyne Canada Inc. "DUROLON";

.2 Dyn Air Inc. "HYPALON".

.2 Waterproof, flameproof, high temperature flexible connection material meeting requirements of NFPA 90A, consisting of a woven glass fibre fabric coated on both sides with silicone rubber. Acceptable products are:

.1 Duro-Dyne Canada Inc. "THERMAFAB";

.2 Dyn Air Inc. "SILICON HI-T".

2.05 Metal Duct System Joint Sealant

.1 ULC listed and labelled, premium grade, grey colour, water base, non-flammable duct sealer, brush, or gun applied, with a CAN/ULC S102 tested maximum flame spread rating of 5 and smoke developed rating of 0.

.2 Acceptable manufacturers are:

.1 Johns Manville;

.2 Manson Insulation;

.3 Knauf Insulation.

2.06 Acoustic Lining

.1 Minimum 25 mm (1") thick acoustic lining material meeting 25/50 flame spread and smoke developed ratings tested in accordance with CAN/ULC S102, meeting NFPA 90A, ASTM C1071, and ASTM G21 requirements, not supporting microbial growth, flexible for round ducts, board type for rectangular ducts, consisting of a bonded fiberglass mat coated on inside (airside) face with a black fire-resistant coating.

.2 Acceptable manufacturers are:

.1 Johns Manville;

.2 Manson Insulation;

.3 Knauf Insulation.

2.07 Kitchen Exhaust Duct Expansion Joint

.1 Hyspan Precision Products Inc. Series 2500 flanged, carbon steel, rectangular expansion joints sized to suit ductwork.

2.08 Uninsulated Kitchen Grease Exhaust Duct

.1 Minimum #16 gauge black sheet steel liquid-tight ductwork with welded joints or listed in accordance with CAN/ULC S662.

.2 Grease-tight access doors in accordance with requirements of NFPA 96, constructed of same material as duct and as large as possible, up to 600 mm (24") in any dimension, located in the sides of the duct for ease of inspection and cleaning at each change in duct direction, at not less than 3 m (10') in straight duct including risers, and not less than 40 mm (1-½") from bottom of duct.

2.09 Factory Insulated Round Kitchen Grease Exhaust Duct

.1 Equal to Selkirk ZeroClear kitchen exhaust duct, 2 hour fire rated to UL 2221, constructed, listed and labelled to UL/ULC 1978, and meeting requirements of NFPA 96. Duct is constructed of a type 304 stainless steel inner liner, 75 mm (3") of high temperature fibre insulation, and a stainless steel outer jacket, and is complete with all required fittings and accessories, including access and cleanout fittings where required.

2.10 Factory Insulated Rectangular/Square Kitchen Grease Exhaust Duct

.1 Equal to DuraSystems "DuraDuct KEX" kitchen exhaust duct, 2 hour rated kitchen exhaust listed and labelled to CAN/ULC S144, and meeting requirements of NFPA 96. Duct is constructed of minimum #16 gauge black sheet steel inner liner, high temperature fibre insulation and a minimum #24 gauge galvanized steel outer jacket, and complete with required fittings and accessories, including access and cleanout fittings where required. Factory-fabricated grease duct assembly is to not require additional wraps or enclosures to achieve required fire resistance rating.

2.11 Factory Insulated Fire Rated Ductwork

.1 Equal to DuraSystems Barriers Inc. "DuraDuct HP" or "DuraDuct GNX" duct, 2 hour fire rated, constructed, ULC listed and labelled for fire rated ventilation applications. Duct is constructed of a galvanized steel inner liner, a galvanized steel outer jacket, and all required fittings and accessories, including support hardware.

2.12 Casing And Plenum Material and Accessories

.1 Unless otherwise specified, casing and plenum material is to be same as connecting duct material.

.2 Accessories such as access doors and drain pans are to be constructed of same material as casing and plenum and are to be in accordance with Chapter 6 of SMACNA HVAC Duct Construction Standards Metal and Flexible.

2.13 Acoustic Plenum Panels

.1 Vibro-Acoustics Ltd. type "AP", 100 mm (4") thick panels with acoustic media meeting NFPA 90A requirements sandwiched between minimum #24 gauge galvanized sheet steel, with airside face perforated, access doors where shown, and with acoustic performance as follows:

Octave Bands, (Hz)	125	250	500	1000	2000	4000
Transmission Loss	21	28	39	50	53	56
Absorption Coefficient	0.7	0.9	.99	.99	0.9	0.9

.2 Acoustic plenum media factory encapsulated in sealed DuPont "Tedlar" polyvinyl fluoride film to ensure no media enters the airstream.

.3 Acceptable manufacturers are:

.1 Vibro-Acoustics Ltd.;

.2 Kinetics Noise Control Inc.;

.3 Carrier Corp. – Racan;

.4 Haakon Industries;

.5 Price Industries Inc.

2.14 Plenum Access Doors

.1 Factory fabricated, double wall insulated access doors, sized as indicated on drawings, and constructed of same material as connecting ductwork in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible to suit operating pressure of the system.

2.15 Round to Rectangular Duct Connections

.1 Equal to Flexmaster Canada Ltd. galvanized steel, flared, flanged or notched "Spin-On" round duct take-off collars with locking dampers in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.

2.16 Splitter Dampers

.1 Minimum #20 gauge damper blade constructed of same material as duct, reinforced as required to suit blade size, system velocity, and to prevent "chatter", and complete with operating hardware equal to DynAir Inc. #Q-50 "DYN-A-QUAD S-S" quadrant regulator with RW-50 backup washers to prevent leakage, long square bearing pin, and slide pin.

2.17 Air Turning Vanes

.1 For square elbows, multiple-radius turning vanes interconnected with bars, adequately reinforced to suit pressure and velocity of system, constructed of same material as duct they are associated with, and in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.

.2 For short branch ducts at grille and diffuser connections, air extractor type each equipped with a matching bottom operated 90° opposed blade volume control damper, constructed of same material as duct it is associated with and in accordance with requirements and details in ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.

2.18 Manual Balancing (Volume) Dampers

.1 Flanged and drilled, single or parallel blade (depending on damper size) manual balancing dampers, each constructed of same material as connecting ductwork unless otherwise specified, each designed to maintain internal free area of connecting duct, and each complete with:

.1 hexagonal or square shaft extension through frame;

.2 non-stick, non-corrosive synthetic bearings for rectangular dampers, flange stainless steel bearings for round dampers;

.3 blade stops for single blade dampers, designed to prevent blade from moving more than 90°;

.4 linkage for multiple blade dampers;

.5 locking hand quadrant damper operator with, for insulated ducts 50 mm (2") standoff mounting.

.2 Rectangular Dampers: Nailor Industries Inc. 1800 Series, maximum size 1.2 m x 1.2 m (4' x 4') for a single damper.

.3 Round Dampers: Nailor Industries Inc. Model 1890, maximum 600 mm (24") diameter, equipped with a minimum 200 mm (8") deep frame, and blade stiffeners where required.

.4 Multiple Rectangular Damper Section Assembly: Rectangular assembly supplied with the dampers or site constructed, of same material as damper and designed for tight and secure mounting of individual dampers.

.5 Acceptable manufacturers are:

.1 Nailor Industries Inc.;

.2 T.A. Morrison & Co. Inc. "TAMCO";

.3 NCA Manufacturing Ltd.;

.4 Greenheck Fan Corp.;

.5 Ruskin Co.

2.19 Backdraft Dampers

.1 Nailor Industries Model 1370CB counterbalanced backdraft dampers, vertical or horizontal mounting, 50 mm (2") wide, sized as shown and complete with:

.1 extruded 6063-T5 aluminum frame, 2.3 mm (0.090") nominal wall thickness, with mitred corners;

.2 extruded 6063-T5 aluminum blades, 1.3 mm (0.050") nominal wall thickness on 92 mm (3-5/8") centres, and with extruded PVC blade seals;

.3 corrosion-resistant synthetic bearings;

.4 adjustable plated steel counterweights mounted internally in the airstream;

.5 concealed blade linkage located out of the airstream.

.2 Acceptable manufacturers are:

.1 Nailor Industries Inc.;

.2 T.A. Morrison & Co. Inc. "TAMCO";

.3 NCA Manufacturing Ltd.;

.4 Greenheck Fan Corp.;

.5 Ruskin Co.

2.20 Fusible Link Dampers

.1 Curtain blade type, dynamic, galvanized steel (unless otherwise specified) fusible link dampers, ULC classified to CAN/ULC S112 and in accordance with NFPA 90A requirements, factory tested for closure under airflow, 1-1/2 hour or 3 hour rated as required, and complete with a constant force type 301 stainless steel closure spring, a blade lock assembly, a steel sleeve, retaining angles, and, unless otherwise specified, a 74°C (165°F) rated standard fusible link.

.2 Fusible link dampers are to be Type "B" or Type "C" (as required) with folded curtain blade out of air stream except where damper size or location requires use of type "A" dampers with curtain blade in air stream.

.3 Dampers in ductwork other than galvanized steel are to be as specified above but constructed of type 316 stainless steel.

.4 Acceptable manufacturers are:

.1 Nailor Industries Inc.;

.2 Greenheck Fan Corp.;

.3 NCA Manufacturing Ltd.;

.4 Ruskin Co.;

.5 Price Industries (E.H. Price).

2.21 Combination Fire/Smoke Dampers

.1 Nailor Industries Series 1220, ULC listed to CAN/ULC S112 and CAN/ULC S112.1, meeting requirements of NFPA 80, 90A, 92, 101 and 105, consisting of type A, B, or C fusible link fire dampers as required and a fail-safe, opposed blade, normally closed, motor operated smoke damper complete with factory installed and tested 120 V electric actuator.

.2 ULC 1-1/2 hour fire rated and ULC Class I leakage rated for smoke, and equipped with a 74°C (165°F) ULC classified fusible link that will cause damper to close and lock independent of actuator when duct temperature reaches maximum temperature of damper assembly.

.3 Supply damper with factory installed sleeves of minimum 400 mm (16") length, field verified by contractor dependent on wall thickness. Caulk sleeves to ULC requirements and constructed of 20 gauge for sizes up to 2.1 m (84") wide and 18 gauge for sizes greater than 2.1 m (84") wide.

.4 Dampers in ductwork other than galvanized steel are to be as specified above but constructed of type 316 stainless steel.

.5 Acceptable manufacturers are:

.1 Nailor Industries Inc.;

.2 Greenheck Fan Corp.;

.3 NCA Manufacturing Ltd.;

.4 Ruskin Co.;

.5 Price Industries (E.H. Price).

2.22 Smoke Dampers

.1 Multi-blade type, fail-safe, dynamic, galvanized steel (unless otherwise specified) smoke dampers, ULC classified to CAN/ULC S112.1, ULC Class I leakage rated for smoke, meeting requirements of NFPA 90A, 92, 101 and 105, normally closed, low pressure drop design, dynamically tested, each complete with jamb and blade seals, linkage concealed in the frame, a steel sleeve to suit the opening, and an electric actuator to automatically close damper upon receiving an external signal, and to automatically open damper when system is reset.

.2 Dampers in ductwork other than galvanized steel are to be as specified above but constructed of type 316 stainless steel.

.3 Acceptable manufacturers are:

.1 Nailor Industries Inc.;

.2 Greenheck Fan Corp.;

.3 NCA Manufacturing Ltd.;

.4 Ruskin Co.;

.5 Price Industries (E.H Price).

2.23 Roof Duct Supports

.1 Equal to PHP Systems Design Model PHP-D adjustable duct support assemblies sized to suit duct size, each assembly complete with injection moulded recycled plastic and carbon black bases and tubular hot dip galvanized steel framing.

2.24 Duct Access Doors

.1 In accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, with sizes suitable in all respects for purpose for which they are provided, and, unless otherwise specified, constructed of same material as duct they are associated with.

2.25 Ductwork Drain Points

.1 Equal to Ductmate Canada Ltd. "Moisture Drain", 20 mm (¾") diameter moisture drains with galvanized sheet metal funnel, and chrome plated brass threaded drain, nut and cap.

2.26 Instrument Test Ports

.1 Equal to Duro-Dyne of Canada Ltd. #IP1 or #IP2 (to suit insulation thickness where applicable) gasketed, leakproof instrument test ports for round or rectangular ducts as required, each complete with a neoprene expansion plug and a plug securing chain.

2.27 Wire Mesh (Birdscreen)

.1 Heavy-gauge galvanized steel or aluminum mesh, 12 mm x 12 mm (½" x ½") secured in a rigid galvanized steel or aluminum framework, sized as indicated on drawings, and constructed so as to be removable.

2.28 Louvres

.1 Price Industries Inc. DE439 or DE635, 100 mm (4") or 150 mm (6") deep (to suit wall thickness) factory assembled stationary, drainable, louvres sized as indicated on drawings, each AMCA water penetration and air performance certified, constructed of welded, extruded, alloy 6063-T5 aluminum with drainable blades, mounting and securing hardware to suit the application, and 12 mm (½") mesh aluminum birdscreen in an aluminum frame.

.2 Acoustical Louvres: Price Industries Inc. Model QA1245 300 mm (12") deep, welded, extruded alloy 3003-H14 aluminum, storm-proof, stationary, drainable acoustical louvers, AMCA water penetration and air performance certified, with high density mineral wool acoustic media secured to blades and protected by perforated aluminum, sound ratings in accordance with ASTM E90 and ASTM E413, and mounting and securing facilities as required.

.3 Louvres are to be factory finished with a finish equal to PPG Industries "Duranar" fluoropolymer powder coating over primer with colour as selected from manufacturer's standard colour range.

.4 Acceptable manufacturers are:

.1 Price Industries Inc.;

.2 The Airolite Co. LLC;

.3 Construction Specialities;

.4 Nailor Industries Inc.;

.5 Ventex

.6 Ruskin

2.29 Louvre Blank-Off Panels

.1 Insulated, framed, sandwich construction panels consisting of 40 mm (1-½") thick rigid insulation (meeting NFPA 90A requirements) between minimum #20 gauge galvanized sheet steel with exterior face of panels finished to match finish of exterior wall louvres.

2.30 Brick And Block Vents

.1 Equal to Price Industries Inc. vents constructed of 6063-T5 alloy extruded aluminum, sized as shown, complete with stainless steel fasteners, aluminum rod vertical supports on minimum 300 mm (12") centres, #2 mesh fixed aluminum screen, and all required accessories to suit the application.

.2 Vent(s) to be factory finished with a finish equal to a baked "Kynar 500-XL" colour coat and a clear coat over cleaned and primed metal with colour as selected from manufacturer's standard colour range.

.3 Acceptable manufacturers are:

.1 Price Industries Inc.;

.2 The Airolite Co. LLC;

.3 Construction Specialities;

.4 Nailor Industries Inc.;

.5 Ventex

.6 Ruskin

2.31 Fire Stop Flaps and Thermal Blanket Material

.1 Rectangular or round, ULC listed and labelled, blade type galvanized steel fire stop flaps in accordance with CAN/ULC S112, Standard Methods of Fire Test of Fire-Damper Assemblies and CAN/ULC S112.2, Standard Method of Fire Test of Ceiling Firestop Flap Assemblies, each complete with #22 gauge G60 galvanized steel blade(s) and frame, a 74°C (165°F) fusible link, and, for dampers 300 mm (12") and larger, ceramic fibre insulation on both sides of the blades.

.2 Ceramic fibre material in accordance with 25/50 flame spread/smoke developed ratings when tested to CAN/ULC S102 and of a thickness to suit required fire rating.

2.32 Grilles and Diffusers

.1 Grilles and diffusers of type, size, capacity, finish, and arrangement as shown on drawings and in accordance with drawing schedule, each equipped with all required mounting and connection accessories to suit mounting location and application.

.2 Acceptable manufacturers are:

.1 Price Industries Inc.;

.2 Carnes;

.3 Krueger Division of Air System Components Inc.;

.4 Titus;

.5 Nailor Industries Inc.;

.6 Metalaire;

2.33 Louvred Penthouse Type Ventilators

.1 Low silhouette, rectangular, roof mounting louvred penthouse type hoods in accordance with drawing schedule, each constructed of aluminium, supplied in knock-down form for site assembly, and each complete with:

.1 extruded aluminium, welded storm-proof louver blades with mitred corners and stainless steel securing screws;

.2 removable cover for internal access, lined with glass fibre insulation material and equipped with stainless steel fasteners;

.3 12 mm x 12 mm (½" x ½") aluminium mesh birdscreen;

.4 welded aluminium, minimum 300 mm (12") high insulated roof mounting curb with damper tray and curb seal;

.5 aluminium backdraft damper supplied loose, for site installation in roof curb damper tray;

.6 non-corrosive motorized damper supplied loose for site installation in roof curb damper tray, equal to T. A. Morrison TAMCO Series 9000 insulated damper with linkage, end switch, and a Belimo or equal motor with voltage to suit site control voltage requirements;

.2 Acceptable manufacturers are:

.1 Greenheck Fan Corp.;

.2 Twin City Fan and Blower;

.3 PennBarry.

3 Execution

3.01 Cleanliness Requirements for Handling and Installation of Ductwork

.1 Handle and install ductwork in accordance with CSA Z317.2, Special Requirements for Heating, Ventilation, and Air-Conditioning (HVAC) Systems in Healthcare Facilities and SMACNA's Duct Cleanliness for New Construction Guidelines at the Advanced Level.

.2 Handle and install ductwork in accordance with SMACNA's Duct Cleanliness for New Construction Guidelines at the Advanced Level.

3.02 Fabrication and Installation of Galvanized Steel Ductwork

.1 Provide required ductwork, rectangular, round and/or flat oval. Where rectangular ductwork is shown, round or flat oval ductwork of equivalent cross-sectional area is acceptable.

.2 It is to be understood that all duct dimensions shown on drawings are clear internal dimensions.

.3 Unless otherwise specified, construct and install ductwork in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible to suit duct pressure class designation of minimum 500 Pa (2" w.c.) positive or negative as applicable, a minimum velocity of 10 m/s (2000 fpm), and so ductwork does not "drum". Flat surfaces of rectangular ductwork are to be cross-broken. Duct system sealing is to meet ANSI/SMACNA Seal Class A requirements.

.4 Variable air volume ductwork from supply fans to boxes is as above but rectangular duct take-offs are double side straight taper type with a take-off length equal to 0.5 times the branch duct width but minimum 150 mm (6") length, and double taper side is to have an included angle of minimum 60°.

.5 Confirm routing of all ductwork at site and site measure ductwork prior to fabrication. Duct dimensions may be revised to suit site routing and building element requirements, if dimension revisions are reviewed with and approved by Consultant. Duct routing and/or dimension revisions to suit conditions at site are not grounds for a claim for an extra cost.

.6 Refer to structural drawings. Where ductwork is to be run within or through open web steel joists, ductwork shown on mechanical drawings is schematic only and is to be altered as required to suit steel joist configuration, spacing, panel points, and cross-bridging at no additional cost.

.7 Wherever ductwork is required at locations where sprayed fireproofing is applied to building construction, install ductwork only after fireproofing work is complete and do not compromise fire rating of sprayed fireproofing.

.8 Install (but do not connect) duct system mounted automatic control components supplied as part of the automatic control work.

.9 Where indicated, provide duct connections to fan powered heat transfer equipment with integral coils.

.10 Flange connect ductwork to hot water reheat coils in accordance with requirements of ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible. Coils will be suspended independent of connecting ductwork as part of the heat transfer work.

.11 Support horizontal rectangular ducts inside building in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, but use trapeze hangers with, unless otherwise specified, galvanized steel channels, and galvanized steel hanger rods for exposed ducts and concealed ducts wider than 500 mm (20"). Support hardware constructed of same material as duct for metal duct, and, unless otherwise specified, type 316 stainless steel for non-metal duct. Supports for "heavy" duct such as cementitious core duct is to be suitable in all respects for the application and approved by Consultant.

.12 Support round and flat oval ducts inside building in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, but, unless otherwise specified, for both uninsulated and insulated ducts exposed in finished areas, use bands and secure at top of duct to a hanger rod, all similar to Ductmate Canada Ltd. type "BA". If duct is insulated, size strap to suit diameter of insulated duct. Unless otherwise specified, duct support hardware for metal duct is constructed of same material as duct, and for non-metal duct, type 316 stainless steel.

.13 Where flanged duct joints are used, do not locate joints in wall or slab openings, or immediately at wall or slab openings. Do not use flanged joints for exposed uninsulated ducts in finished areas.

.14 Where watertight horizontal ductwork is required, construct ducts without bottom longitudinal seams. Solder or weld joints of bottom and side sheets. Seal all other joints with duct sealer. Slope horizontal duct to hoods, risers, or drain points. Provide drain points. Provide watertight ductwork for:

.1 ductwork outside building or otherwise exposed to the elements;

.2 shower exhaust ducts from grilles to duct main or riser;

.3 fresh air intakes;

.4 wherever else shown.

.15 Leakage Testing:

.1 Ductwork leakage is not to exceed following:

.1 ductwork to 2" W.C. Class, 1% of total air quantity handled by respective fans;

.2 ductwork exceeding 2" W.C. Class, 2% of total air quantity handled by respective fans.

.2 Leakage testing is to be performed by the Testing, Adjusting and Balancing (TAB) agency in accordance with SMACNA HVAC Air Duct Leakage Test Manual and is to be witnessed by Consultant.

.3 Be responsible for following:

.1 preparing duct systems for leakage testing prior to installation of external insulation including capping duct runouts and provision of final tap-in for test equipment;

.2 schedule testing with TAB agency in advance, be present for all testing and ensure notice is given to Consultant so they may witness testing;

.3 resealing and/or replacement of defective ductwork;

.4 bearing all costs associated with retesting ductwork which has failed to pass leakage testing.

.16 Seal all ductwork in accordance with SMACNA Seal Class "A", except for round duct with self-sealing gasketed fittings and couplings which does not require site applied sealant. Apply sealants by brush or gun to cleaned metal surfaces. Where bare

ductwork is exposed apply neat uniform lines of sealant. Randomly brushed, sloppy looking sealant applications will be rejected and must be repaired or replaced with a neat application of sealant.

.17 Apply sealants by brush or gun to cleaned metal surfaces. Where bare ductwork is exposed apply neat uniform lines of sealant. Randomly brushed, sloppy looking sealant applications will be rejected and must be repaired or replaced with a neat application of sealant.

.18 Clean exterior exposed (uninsulated) ducts and coat with a heavy full coverage of Bakor #410-02 black metal paint.

.19 Where dissimilar metal ducts are to be connected, isolate ducts by means of flexible duct connection material.

.20 Round exposed ductwork in Gymnasium is to be 2 metal gauges heavier than standard metal gauge for same size duct, and duct hangers are to be pairs of 9.5 mm (⅜") diameter hanger rods secured to 40 mm (1-½") wide #12 gauge galvanized steel split clamps around full circumference of duct at maximum 1.8 m (72") centres. Provide double nuts and lock washers on each hanger rod above and below each clamp.

3.03 Installation of Fabric Ductwork

.1 Provide fabric ductwork.

.2 Secure duct from structure by means of tension cable and suspension components supplied with ductwork.

.3 Install tension cable and suspension components in accordance with duct manufacturer's instructions.

.4 Provide metal duct connection collars as required.

.5 Start-up fabric duct system in accordance with manufacturer's instructions.

.6 Do not penetrate fire barriers with fabric duct.

3.04 Installation of Flexible Ductwork

.1 Provide maximum 3 m (10') long lengths of flexible ductwork for connections between galvanized steel duct mains and branches, and necks of ceiling grilles and diffusers. Do not install flexible ductwork through walls, even if shown on drawings.

.2 At rectangular galvanized steel duct, accurately cut holes and provide flanged or "Spin-in" round flexible duct connection collars. Seal joints with duct sealer.

.3 Install flexible ducts as straight as possible and support in accordance with requirements of ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, and secure at each end with nylon or stainless steel gear type clamps, and seal joints. Provide long radius duct bends where they are required.

.4 Do not penetrate fire barriers with flexible duct.

3.05 Installation of Acoustic Lining

.1 Provide acoustic lining in ductwork in locations as follows:

.1 wherever shown and/or specified on drawings;

.2 supply ductwork downstream of air terminal boxes for a distance of 2.4 m (8') measured along duct and outward from box in all directions;

.3 all transfer air ducts.

.2 Install lining in accordance with requirements of ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, however, for all installations regardless of velocity, at leading and trailing edges of duct liner sections, provide galvanized steel nosing channel in accordance with detail entitled Flexible Duct Liner Installation found in the ANSI/SMACNA manual referred to above.

3.06 Installation of Fire Rated Ductwork

.1 Provide 2 hour fire rated ductwork.

.2 Install ductwork in strict accordance with duct manufacturer's instructions using support hardware supplied with duct.

.3 When installation is complete, arrange, and pay for duct manufacturer to visit site and examine duct installation. Make any revisions requested by manufacturer, and when manufacturer is satisfied with installation, obtain and submit a letter certifying proper installation in accordance with ULC requirements.

3.07 Installation of Sheet Steel Kitchen Grease Exhaust Ductwork

.1 Provide welded sheet steel kitchen grease exhaust ductwork from exhaust hood(s) to roof mounted exhaust fans, all in accordance with requirements of NFPA 96. Construct ductwork watertight with continuous externally welded seams and joints, cleanouts, duct expansion provisions, riser residue traps, etc.

.2 Clean and prime coat ground welds in black steel ducts.

.3 Support ductwork at not greater than 1.5 m (5') intervals and ensure fasteners at hangers do not penetrate duct. Install without forming dips, sags or traps where grease reside might collect, and locate access door/cleanouts for ease of maintenance.

.4 Slope horizontal ductwork 25 mm per 300 mm (1" per foot) back to exhaust hood.

3.08 Installation of Casings and Plenums

.1 Provide required shop or site fabricated casings and plenums. Unless otherwise specified or shown, construct casings and plenums of same material as connecting duct system.

.2 Construct and install casings and plenums in accordance with Chapter 6 of ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible to suit systems' pressure classification. Ensure plenums and casings secured to building structure are gasketed air-tight and equipped with angle reinforcing.

.3 Provide drain pans with accessible trapped drains for fresh air intake plenums, and wherever else shown.

.4 In addition to SMACNA duct construction standards specified above, casings and plenums are to be constructed and installed to meet seismic requirements of British Columbia Building Code and ANSI/SMACNA - The Seismic Restraint Manual: Guidelines for Mechanical Systems.

3.09 Installation of Acoustic Panels

.1 Provide acoustic panels for plenums. Integrate acoustic plenums with standard casings and plenums. Install acoustic panels in strict accordance with manufacturer's instructions. Seal panels with acoustic caulking where pipes, ducts or conduit penetrate and make air and watertight.

.2 Provide floor to ceiling high acoustic plenums where shown, each complete with required framing, including framing for access doors and other openings, each structurally designed to resist excessive deflection or bowing, constructed to be air-tight when subjected to a pressure differential of 2.48 kPa (0.36 psi), and designed so any one panel can be removed without dismantling entire plenum.

.3 Provide acoustic type access doors where shown, and provide acoustic caulking at all locations where acoustic plenums abutt building walls or slabs, and at all points where pipe, ducts or conduit penetrate acoustic panels.

.4 In addition to SMACNA duct construction standards specified above, acoustic plenums are to be constructed and installed to meet seismic requirements of British Columbia Building Code and ANSI/SMACNA, The Seismic Restraint Manual: Guidelines for Mechanical Systems.

3.10 Installation of Casing and Plenum Access Doors

.1 Provide access doors into all site or shop fabricated casings and plenums requiring access, and wherever shown.

.2 Construct access doors to open in or out to suit positive and negative pressures of system.

.3 Provide pitot tube openings in access doors where required for system air quantity balancing purposes.

.4 Provide suitably sized, engraved, red-white laminated Lamacoid warning nameplates on access doors into casings and plenums where equipment is located, i.e. fans.

3.11 Installation of Round to Rectangular Duct Connections

.1 Cut round holes in rectangular ducts and provide round to rectangular lock-in fittings with dampers for connection of flexible round ductwork.

3.12 Installation of Splitter Dampers

.1 Provide splitter dampers in supply ductwork at branch duct connections off supply air mains, and wherever else shown and/or specified on drawings. Install splitter dampers so they cannot vibrate and rattle and so damper operation mechanisms are in an easily accessible and operable location. Ensure operators for dampers in insulated ducts are equipped with stand-off mounting brackets.

3.13 Installation of Turning Vanes

.1 Provide turning vanes in ductwork elbows where shown on drawings and wherever else required where, due to site installation routing and duct elbow radius, turning vanes are recommended in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.

.2 Provide volume extractor type turning vanes in short branch supply duct connections off mains to grilles and diffusers where shown and/or specified.

3.14 Installation of Manual Balancing (Volume) Dampers

.1 Provide manual balancing dampers as required to provide a fully balanced system, including but not limited to in all open end ductwork, in all duct mains, and wherever else shown and/or specified.

.2 Install dampers so operating mechanism is accessible and positioned for easy operation, and so dampers cannot move or rattle. Ensure operating mechanisms for dampers in insulated ducts are complete with stand-off mounting brackets.

.3 Where a duct for which a balancing damper is required has dimensions larger than dimensions of maximum size volume damper available, provide multiple dampers bolted together in a properly sized assembly, or bolted to a heavy-gauge black structural steel angle or channel framework which is properly sized. Seal to prevent air by-pass, and provide connecting linkage.

.4 Confirm exact damper locations with personnel doing air quantity balancing testing work and install dampers to suit. Include for providing 5 additional dampers at no additional cost.

3.15 Installation of Backdraft Dampers

.1 Provide backdraft dampers.

.2 Install and secure dampers so they cannot move or rattle.

3.16 Installation of Fusible Link Dampers

.1 Provide fusible link dampers. Ensure damper rating (1-½ or 3 hr.) is suitable for fire barrier it is associated with.

.2 Install dampers with retaining angles on all 4 sides of sleeve on both sides of damper and connect with ductwork in accordance with damper manufacturer's instructions and details, and Code requirements.

.3 Provide expansion clearance between damper or damper sleeve and opening in which damper is required. Ensure openings are properly sized and located, and all voids between damper sleeve and opening are properly sealed to maintain rating of fire barrier.

.4 Where size of fire barrier opening requires use of a sectionalized fire damper assembly, provide multiple fusible link dampers (sized to CAN/ULC S112) bolted together in a properly sized assembly or bolted to a heavy-gauge black structural steel angle or channel framework.

3.17 Installation of Combination Fire/Smoke Dampers

.1 Provide combination fire/smoke dampers. Install dampers with retaining angles on all 4 sides of each side of damper, and, where required, connect with ductwork, all in accordance with damper manufacturer's instructions and details, and Code requirements.

.2 Coordinate damper installation with electrical work where electrical connections to damper actuators are specified.

3.18 Installation of Smoke Dampers

.1 Provide smoke dampers. Install dampers with retaining angles on all 4 sides of sleeve on both sides of damper and connect with ductwork in accordance with damper manufacturer's instructions and details, and Code requirements.

.2 Coordinate damper installation with electrical work where electrical connections to damper actuators are specified.

3.19 Installation of Flexible Connection Material

.1 Provide a minimum of 100 mm (4") of flexible connection material where ducts, plenums, and/or easings connect to fans, and wherever else shown or specified.

.2 Rigidly secure a minimum of 75 mm (3") of duct material (minimum #24 gauge) to each edge of flexible fabric and to fan, duct, plenum, etc., in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible. Ensure connections to flexible fabric material are arranged and supported so as to not impose any external forces on the fabric.

3.20 Installation of Roof Mounted Duct Supports

.1 Supply supports for roof mounted ductwork.

.2 For new roof construction, hand adjustable structural supports to roofing trade on roof for installation and flashing into roof construction as part of roofing work. Accurately mark exact locations and spacing of structural supports and supervise installation. Provide properly sized hot dip galvanized structural steel angles between structural supports and secure in place on support studs. Support ductwork on the angles and provide galvanized steel banding to secure ducts to the angles.

.3 For installations on existing roof, accurately mark location and spacing of roof support assemblies. At each plastic base location, carefully scrape away loose roof ballast (gravel) and all other debris and dirt. Prime existing membrane with a primer which is compatible with existing roofing components. Set bases in adhesive in accordance with manufacturer's installation instructions. Scrape loose ballast back around and on bases. Install framing, and install ductwork on the cross-members. Secure ductwork to cross-members with galvanized steel banding.

3.21 Installation of Duct Access Doors

.1 Provide access doors in ductwork for access to all components which will or may need maintenance and/or repair, including reheat coils. Install in accordance with requirements of ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.

.2 Identify access doors provided for fusible link damper maintenance with "FLD" stencil painted or marker type red lettering and ensure doors are properly located for damper maintenance.

.3 When requested, submit a sample of proposed duct access doors for review.

.4 Where sectionalized fusible link dampers and/or balancing dampers are provided in large ducts, provide a plenum type access door to suit, and adequately reinforce ductwork to suit access door installed.

3.22 Installation of Instruments Test Ports

.1 Provide instrument test ports in all main ducts at connections to fans, plenums or casings, in all larger branch duct connections to mains, and wherever else required for proper air quantity balancing and testing.

.2 Locate test ports where recommended by personnel performing air quantity testing and balancing work.

3.23 Installation of Wire Mesh (Birdscreen)

.1 Provide framed, removable wire mesh panels over openings in ducts and/or walls where shown and/or specified on drawings. Rigidly secure in place but ensure panels are removable.

.2 Provide wire mesh panels for open-end return air ducts in ceiling spaces whether shown on drawings or not.

3.24 Installation of Louvres

.1 Provide louvres for wall openings.

.2 Install louvre assemblies and secure in place in accordance with manufacturer's instructions and details.

.3 Confirm exact louvre sizes and finish prior to ordering.

.4 Intake outdoor air louvres to be at a minimum of 3m/10ft distance of washroom exhausts, gas fired equipment flues or other contaminants to prevent cross contamination.

3.25 Installation of Louvre Blank-Off Panels

.1 Provide blank-off panels for inactive portions of exterior wall louvres.

.2 Secure panels in place with non-ferrous hardware so they cannot move or rattle, yet are easily removable.

.3 Confirm exact finish of panels prior to fabrication.

3.26 Installation of Brick and Block Vents

.1 Supply brick or block vents for installation in exterior walls.

.2 Hand assemblies to masonry trade for installation.

.3 Accurately mark exact locations and coordinate installation.

3.27 Installation of Fire Stop Flaps and Thermal Blankets

.1 Provide fire stop flaps in duct connection necks of grilles and diffusers installed in ULC fire rated suspended ceiling systems where shown on drawings.

.2 Provide thermal blanket material to completely cover grille and/or diffuser pans above suspended ULC fire rated ceilings. Cut, install, and secure in place in accordance with manufacturer's instructions and ULC requirements.

3.28 Installation of Grilles and Diffusers

.1 Provide grilles and diffusers. Wherever possible, grilles and diffusers are to be product of same manufacturer.

.2 Unless otherwise specified connect grilles and diffusers in accordance with requirements of SMACNA HVAC Duct Construction Standards Metal and Flexible.

.3 Exactly locate grilles and diffusers to conform to final architectural reflected ceiling plans and detailed wall elevations, and to conform to final lighting arrangement, ceiling layout, ornamental and other wall treatment.

.4 Equip supply diffusers having a basic 4-way or all round air pattern for operation in 1-, 2-, or 3-way pattern where indicated on drawings.

.5 Provide sheet metal plenums, constructed of same material as connecting duct, for linear grilles and/or diffusers where shown. Construct and install plenums in accordance with requirements of SMACNA HVAC Duct Construction Standards Metal and

Flexible. Where individual sections of linear grilles or diffusers are not equipped with a volume control device, equip duct connection collar(s) with volume control device(s).

.6 Where linear type diffusers/grilles are installed in suspended T-bar ceilings, clip diffusers/grilles in place using clip supplied by diffuser/grille manufacturer.

.7 Confirm grille and diffuser finishes prior to ordering.

3.29 Supply of Door Grilles

.1 Supply door grilles as shown and scheduled.

.2 Hand grilles to appropriate trade at site for installation.

3.30 Installation of Roof Mounted Gravity Ventilators

.1 Provide roof mounted gravity ventilators.

.2 Supply a roof mounting curb with each ventilator and hand curbs to roofing trade on roof for mounting and flashing into roof construction as part of the roofing work. Site assemble gravity ventilators as required, and secure in place on curbs.

.3 Brace and secure each unit in accordance with requirements specified in Section 20 05 48.16 – Seismic Controls for Mechanical Systems.

.4 Install dampers in curb damper tray and secure in place.

3.31 Duct System Protection, Cleaning and Start-Up

.1 Temporarily cover all open ends of ducts during construction.

.2 Remove all dirt and foreign matter from entire duct systems and clean duct system terminals and interior of air handling units prior to operating fans.

.3 Prior to starting any supply air handling system provide 50 mm (2") thick glass fibre construction filters at fan equipment in place of permanent filters.

.4 Provide cheesecloth over duct system inlets and outlets and run system for 24 hours, after which remove cheesecloth and construction filters, and install new permanent filters.

.5 Include all labour for a complete site walk-through with testing and balancing personnel following route of all duct systems to be tested, adjusted and balanced for the purpose of confirming proper position and attitude of dampers, location of pitot tube openings, and any other work affecting testing and balancing procedures. Perform corrective work required as a result of this walk-through.

End of Section

1 General

1.01 Submittals

.1 Submit shop drawings/product data sheets for fans and accessories. Include following:

.1 certified fan performance curves at specified operating point with flow, static pressure and HP clearly plotted;

.2 certified sound power data that conforms to specified levels;

.3 product data sheets for all accessories;

.4 product data sheets for fan motors.

.2 Submit with delivery of each unit a copy of the factory inspection report, and include a copy of each report with O&M Manual project close-out data.

.3 Submit a site inspection and start-up report from manufacturer's representative as specified in Part 3 of this section.

.4 Supply reviewed copies of fan/curb assembly shop drawings or product data to trade who will cut roof openings for fans, and ensure openings are properly located.

.5 Supply reviewed copies of fan assembly shop drawings or product data to trade who will form/prepare wall openings for fans, and ensure openings are properly located.

.6 Submit a signed copy of destratification fan manufacturer's 5 year extended parts and labour warranty.

.7 Submit a signed copy of ceiling mounted fan manufacturer's extended 3 year warranty.

1.02 Quality Assurance

.1 Fan manufacturers, as applicable, are to be current members of the Air Movement and Control Association International Inc. (AMCA), and fans are to be rated (capacity and sound performance) and certified in accordance with requirements of following standards:

.1 ANSI/AMCA Standard 210, Laboratory Method of Testing Fans for Certified Aerodynamic Performance Rating;

.2 AMCA Standard 211, Product Rating Manual for Fan Air Performance;

.3 ANSI/AMCA Standard 300, Reverberant Room Method for Sound Testing of Fans;

.4 AMCA Standard 311, Product Rating Manual for Fan Sound Performance;

.5 AMCA Standard 99-2408, Operating Limits for Centrifugal Fans.

2 Products

2.01 Utility Fans

.1 Centrifugal, single width and inlet, factory run tested utility fans in accordance with drawing schedule, and capable of operating over complete pressure class limits as specified in AMCA Standard 2408.

.2 Rotatable, continuously welded heavy-gauge steel housing, braced and reinforced as required to prevent vibration or pulsation, equipped with a spun, aerodynamically designed inlet cone, and an attached welded steel bearing and motor support platform.

.3 Riveted aluminum or welded steel wheel, statically and dynamically balanced.

.4 For belt driven fans only, AISI C1040 or C1045 hot rolled steel shaft, accurately turned, ground, polished, and ring gauged for accuracy, and sized for a first critical speed of at least 1.43 times maximum rated speed for fan, equipped with heavy-duty,

grease lubricated, ball, pillow block type bearings, selected for a minimum average AFBMA L-50 bearing life of 200,00 hours at the maximum fan RPM, and secured to bearing support platform, and an adjustable V-belt drive with OHSA guard (weather cover) in accordance with requirements of Section 20 05 00 – Common Work Results for Mechanical.

.5 NEMA Premium TEFC motor conforming to requirements of Section 20 05 00 – Common Work Results for Mechanical.

.6 Unless otherwise specified, the finish is to consist of rust inhibiting primer applied to cleaned and deburred metal surfaces prior to assembly, then a second coat of primer after assembly and an air dried epoxy enamel finished coat both inside and outside to a 3 mm dry film thickness.

.7 Factory secured seismic restraint connection hardware.

.8 Acceptable manufacturers are:

.1 Carnes Company Inc.

.2 Loren Cook Co.;

.3 Delhi (complete with direct Drive EC motor);

.4 Greenheck Fan Corp.;

.5 PennBarry.

2.02 Centrifugal Inline Fans

.1 Centrifugal, ULC listed, factory run tested rectangular inline fans in accordance with drawing schedule.

.2 Heavy-gauge galvanized steel housing with removable side panels to permit removal of power assembly without disturbing duct connections, universal mounting brackets and hardware including spring vibration isolators to accommodate horizontal or vertical mounting as required, a flanged inlet panel with inlet venturi, a flanged outlet panel, both with duct connection collars, and galvanized steel wire grid fan inlet/outlet guard(s).

.3 Non-overloading aluminium wheel with backward inclined blades with matching inlet venturi, statically and dynamically balanced as an assembly.

.4 For belt-drive fans only, hot rolled steel shaft, accurately turned, ground, and polished, and sized for a first critical speed of at least 1.25 times maximum rated speed for fan, and heavy-duty, self-aligning pillow block type bearings selected for an AFBMA L-50 minimum average life in excess of 500,000 hours and equipped with lubrication line and fitting, and an adjustable V-belt drive with guard conforming to requirements of Section 20 05 00 – Common Work Results for Mechanical.

.5 TEFC motor conforming to requirements specified in Section 20 05 00 – Common Work Results for Mechanical, mounted out of the airstream, complete with a cover, and factory pre-wired to a NEMA 4 disconnect switch.

.6 For fans as scheduled, factory supplied accessories as follows:

.1 for fans as scheduled, housing insulation (lining), consisting of neoprene spray coated glass fibre semi-rigid insulation meeting NFPA 90A requirements and 25/50 flame spread/smoke developed ratings when tested in accordance with CAN/ULC S102, permanently secured in place with no exposed edges;

.2 for fans as scheduled, a galvanized steel filter box with frame suitable for 25 mm (2") thick disposable panel type filters;

.3 factory secured seismic restraint connection hardware.

.7 Acceptable manufacturers are:

.1 Carnes Company Inc.

.2 Loren Cook Co.;

.3 Delhi (complete with direct Drive EC motor);

.4 Greenheck Fan Corp.;

.5 PennBarry.

2.03 Roof Mounted Exhaust Fans

.1 Centrifugal, ULC listed, factory run tested roof mounted exhaust fans in accordance with drawing schedule.

.2 Spun aluminium housing with deep venturi inlet, aluminium curb cap with continuously welded corners, pre-punched mounting holes, galvanized steel or aluminium birdscreen, and EMT conduit chase to the motor compartment.

.3 Centrifugal, non-overloading aluminum wheel with backward inclined blades matched to inlet venturi, statically and dynamically balanced as an assembly.

.4 For belt-drive fans only, hot rolled steel shaft, accurately turned, ground, and polished, and sized for a first critical speed of at least 1.25 times maximum rated speed for fan, and one-piece grease lubricated pillow block type bearings selected for an AFBMA L-50 minimum average life in excess of 500,000 hours at maximum catalogue operating speed and equipped with a lubrication fitting, and a heavy-gauge galvanized steel adjustable V-belt drive with guard conforming to requirements of Section 20 05 00 – Common Work Results for Mechanical.

.5 Motors are to conform to requirements specified in Section 20 05 00 – Common Work Results for Mechanical, mounted on vibration isolation in a compartment outside of the airstream, and factory pre-wired to a NEMA 4 disconnect switch.

.6 Prefabricated, minimum 300 mm (12") high heavy-duty aluminum roof mounting curb with factory installed wood nailer, 40 mm (1-½") thick insulation, continuously welded seams, and damper tray.

.7 For fans as scheduled, factory supplied accessories as follows:

.1 gravity backdraft damper with #20 gauge galvanized steel frame and #26 gauge aluminum blades with felt edge blade seals;

.2 non-corrosive motorized damper with linkage, end switch, and motor with voltage to match fan motor;

.3 continuous non-corrosive piano type curb hinge to permit access to fan, damper and connecting duct, complete with retaining chain and a security hasp to prevent removal of unit from curb cap and prevent building entry through connecting ductwork;

.4 2-speed switch and 2-speed double winding 1-phase motor in accordance with Section 20 05 00 – Common Work Results for Mechanical;

.8 Acceptable manufacturers are:

.1 Carnes Company Inc.

.2 Loren Cook Co.;

.3 Delhi (complete with direct Drive EC motor);

.4 Greenheck Fan Corp.;

.5 PennBarry;

.6 ACME.

2.04 Ceiling Mounted Destratification Fans

.1 Northwest Envirofan "Gold Line" white, down-blowing, extra heavy-duty industrial grade, CSA certified direct drive ceiling mount destratification fans in accordance with drawing schedule, each complete with:

.1 curved aluminum fan blades secured to a steel hub;

.2 permanent magnet, brushless, non-ventilated, heat sink design motor rated for continuous operation at maximum speed in a 55°C (130°F) ambient temperature and capable of modulating fan speed from 0 to 100% without the use of a gearbox or other mechanical means of control, and a factory programmed controller housed in an enclosure independent of motor to minimize starting and braking torques, with a simple diagnostic program and a LED to identify and relay faults in system;

.3 250 mm (10") long down rod, a 330 mm (13") long galvanized steel safety chain, and all other required mounting and securing hardware;

.4 400 mm (16") long power cord with 3-prong plug, factory pre-wired to motor;

.5 "Protecto-Guard" welded wire fan guard sized to suit fan blade size;

.6 120 volt variable speed (Off-High-Low) solid-state infinite speed fan controller with stainless steel faceplate designed to mount to a 100 mm (4") outlet box and to control fan groupings as indicated on drawings;

.7 factory secured seismic restraint connection hardware.

.2 Acceptable manufacturers are:

.1 Northwest Envirofan;

.2 Big Ass Fan Co.;

.3 Marley Engineered Products "Leading Edge".

2.05 Ceiling Mounted Fans

.1 ULC listed and labelled ceiling mounted centrifugal, AMCA rated and certified (capacity and sound to AMCA Standards 211 and 311), exhaust fans in accordance with drawing schedule, complete with:

.1 minimum #20 gauge galvanized steel housing equipped with duct connection collar(s), integral spring loaded aluminum backdraft damper, 12 mm (½") thick acoustic insulation meeting 25/50 flame spread/smoke developed ratings when tested in accordance with CAN/ULC S102, multi-position mounting brackets, and an integral CSA certified electrical receptacle in an outlet box for plug-in connection of fan motor;

.2 low RPM, resiliently mounted, direct connected fan wheel and motor assembly with a forward curved, statically and dynamically balanced galvanized steel or calcium carbonate filled polypropylene centrifugal wheel direct connected to a 1-phase motor conforming to requirements specified in Section 20 05 00 – Common Work Results for Mechanical, and equipped with a length of power cord and plug;

.3 for fans as indicated and/or scheduled, a white calcium carbonate exhaust grille;

.4 factory supplied accessories in accordance with drawing schedule, as follows:

.1 rectangular to round duct transitions;

.2 roof cap with backdraft damper and birdscreen;

.3 wall cap with backdraft damper and birdscreen.

.2 Acceptable manufacturers are:

.1 Broan-NuTone;

.2 Panasonic;

.3 Carnes Company Inc.

.4 Loren Cook Co.;

.5 Delhi;

.6 Greenheck Fan Corp.;

.7 PennBarry.

3 Execution

3.01 Installation of Utility Fans

.1 Provide utility fans.

.2 Secure each fan in place, level, and plumb, on vibration isolation on a concrete housekeeping pad or base as indicated.

.3 Secure suspended units in place from structure, level, and plumb, by means of vibration isolation spring hangers, properly sized galvanized steel hanger rods, and galvanized structural steel angle or channel trapeze supports.

.4 Refer to Section 20 05 00 – Common Work Results for Mechanical for equipment/system manufacturer certification requirements.

.5 Refer to Section 20 05 00 – Common Work Results for Mechanical for equipment/system start-up requirements.

.6 Include for a 4 hour on-site operation demonstration and training session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

3.02 Installation of Centrifugal Inline Fans

.1 Provide inline centrifugal fans.

.2 Secure each fan in place from structure with vibration isolation, independent of connecting ductwork and in accordance with fan manufacturer's instructions.

.3 Ensure duct connections are made using flexible connection material.

.4 Refer to Section 20 05 00 – Common Work Results for Mechanical for equipment/system manufacturer certification requirements.

.5 Refer to Section 20 05 00 – Common Work Results for Mechanical for equipment/system start-up requirements.

.6 Include for a 4 hour on-site operation demonstration and training session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

3.03 Installation of Roof Mounted Exhaust Fans

.1 Provide roof mounted exhaust fans.

.2 Supply a roof mounting curb with each fan and hand curbs to roofing trade on roof for mounting and flashing into roof construction as part of roofing work. Secure fans in place on curbs.

.3 Install dampers in curb damper tray and secure in place.

.4 Install tamper proof or lockable access panel.

.5 Refer to Section 20 05 00 – Common Work Results for Mechanical for equipment/system manufacturer certification requirements.

.6 Refer to Section 20 05 00 – Common Work Results for Mechanical for equipment/system start-up requirements.

.7 Include for a 4 hour on-site operation demonstration and training session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

3.04 Installation of Ceiling Destratification Fans

.1 Provide ceiling destratification fans.

.2 Secure each fan in place at the ceiling from structure in accordance with manufacturer's instructions and drawing details. Confirm exact locations prior to roughing-in. Install safety chains and fan blade guards.

.3 Plug each fan motor into an adjacent receptacle.

.4 Supply a fan speed controller for fans as indicated and hand to electrical trade at site for wall mounting and connection to fan motor controllers. Confirm exact speed controller locations prior to installation, and include for identification of each speed controller.

.5 Refer to Section 20 05 00 – Common Work Results for Mechanical for equipment/system manufacturer certification requirements.

.6 Refer to Section 20 05 00 – Common Work Results for Mechanical for equipment/system start-up requirements.

.7 Include for a 1/2 day on-site operation demonstration and training session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

3.05 Installation of Ceiling Fans

.1 Provide ceiling exhaust fans.

.2 Secure each ceiling mounted fan housing in place in ceiling space, flush with suspended ceiling.

.3 Secure suspended units in place from structure, level, and plumb, by means of vibration isolation spring hangers and galvanized steel hanger rods.

.4 Plug fan motors into housing receptacles.

.5 Supply exterior wall/roof discharge caps as indicated.

.6 Hand roof caps to roof trade for installation and flashing into roof construction as part of roofing work.

.7 Install wall caps and secure in place. Caulk perimeter of each wall cap in accordance with caulking requirements specified in Division 07.

.8 Connect fan housings and discharges with ductwork.

.9 Refer to Section 20 05 00 – Common Work Results for Mechanical for equipment/system start-up requirements.

End of Section

1 General

1.01 Submittals

.1 Submit shop drawings/product data sheets for all products specified in this section.

.2 Prior to Substantial Performance of the Work, submit a set of spare filters in original identified packaging for each air handling unit requiring filters. Store filters on site where directed by Consultant or Owner.

.3 Prior to Substantial Performance of the Work, submit a spare bottle of red manometer filter gauge oil, with instructions, to Owner for each manometer type gauge installed.

2 Products

2.01 General

.1 Unless otherwise specified or noted, filters are to be synthetic and/or glass fibre disposable media type in accordance with drawing schedule(s).

.2 Minimum Efficiency Reporting Values (MERV) ratings in accordance with ASHRAE Standard 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Sizes.

.3 Unless otherwise specified or noted, filters are to be UL/ULC Class 1 in accordance with UL Standard 900, Air Filter Units, ULC S111, Standard Method of Fire Tests for Air Filter Units, and CAN/CGSB 115.10, Disposable Air Filters for Removal of Particulate Matter from Ventilation Systems.

.4 Acceptable manufacturers are:

.1 AAF International;

.2 Camfil Farr Inc.;

.3 Modern Air Filter Corp.

2.02 Construction Filters

.1 Roll type, disposable, MERV 7 to 9 woven glass fibre media, UL Class 2.

2.03 Hepa Filters

.1 HEPA high capacity filters in accordance with drawing schedule and UL Standard 586, High-Efficiency, Particulate, Air Filter Units, 99.995% efficient on 0.12 µm particles, consisting of a continuous pleating of water-proof micro glass fibre media with pleats uniformly separated by aluminum separators, urethane sealant to encapsulate the filter pack in minimum #16 gauge galvanized steel frame with one-piece urethane gasket or neoprene dove-tailed gasket for positive leak-free filter-to-holding mechanism seal.

2.04 Filter Framing and Racks

.1 No. 16 gauge galvanized steel filter framing/racks, sized and arranged to suit filters and filter bank, easily accessible for filter service and replacement, and complete with slide-in tracks or lay-in flanges as required for filter placement, and all required gasketing and facilities to prevent air by-pass.

2.05 Inclined Manometer Air Filter Gauge

.1 Dwyer Instruments Inc. Model 250.5-AF inclined tube differential pressure type filter gauge of solid acrylic construction, complete with vent valves for zeroing, built-in level vial, over-pressure safety traps, adjustable mirror polished scale, and 2, 1.5 m (5') lengths of 6.4 mm (¼") dia. tubing, 2 static pressure tips, mounting hardware, and a spare bottle of red gauge oil and instructions.

2.06 Dial Type Air Filter Gauge

.1 Dwyer Instruments Inc. Series 2000 "Magnehelic" differential dial type filter gauge, accurate to within ± 2% of full scale and complete with a die-cast aluminum housing and bezel, acrylic cover, over-pressure relief plug, a pair of 3.2 mm (1/8") dia. female NPT pressure taps at both the side and back of gauge, 2 pressure tap plugs, flexible vinyl tubing, a scale overlay or marker to indicate dirty filters, and all other required mounting and connection accessories.

.2 Each filter gauge is to be complete with contacts suitable for connection into building automation system.

3 Execution

3.01 Installation of Construction Filters

.1 Provide roll type medium efficiency disposable media filter(s) across entire filter bank of each supply air handling unit, either at factory where fan is produced or at site as soon as fan is installed. Secure media in place so it will not be dislodged by fan operation. Replace roll media periodically if it becomes loaded and clogged.

.2 For exhaust systems, secure filter media across exhaust air openings and ductwork to prevent construction dirt and dust from fouling the fan

.3 Leave media in place until fan start-up, at which time remove and dispose of construction media.

3.02 Installation of Filters

.1 Provide required filter media when fan equipment is ready for start-up and performance testing. Provide any required filter framing/racks.

.2 Prior to Substantial Performance of the Work, supply a complete spare set of filter media in original packaging and clearly identified as to the applicable system for each air handling system with filters. Store filters at site where directed by Owner.

3.03 Installation of Inclined Manometer Filter Gauges

.1 Provide an inclined manometer filter gauge for air handling system filter banks.

.2 Secure gauge to filter section casing and install differential pressure tubing and tips. Fill gauges with red oil and adjust as required.

.3 Affix a red arrow to scale so it indicates point on scale where filters are clogged and require replacement.

3.04 Installation of Dial Type Filter Gauges

.1 Provide dial type filter gauges for air handling system filter banks.

.2 Secure gauge to filter section casing and install differential pressure tubing and accessories. Set gauges to suit fresh clean filter media and mark scales at point where filter media requires replacement.

End of Section

1 General

1.01 Submittals

.1 Submit product data sheets for flue gas vents/air intakes and accessories.

.2 Supply a reviewed shop drawing to appropriate trade to indicate vent size and flashing materials supplied, and accurately locate building openings.

2 Products

.1 All venting is to be provided with two (2) year warranty. Contractor to extent manufacturer warranty where required.

.2 Acceptable manufacterers for venting are as follows:

.1 Cheminee Lining;

.2 Don Park;

.3 Duravent;

.4 Pro-Tech Systems;

.5 Security Chimneys;

.6 Selkirk;

.7 Van-Packer;

.8 Z-Flex.

2.02 Condensing Appliance Type BH Flue Gas Vents (and Combustion Air Intakes)

.1 Equal to Ipex "System 636" PVC (for vent gas to 65°C [130°F]) or CPVC (for vent gas to 90°C [195°F]) solvent weld vent pipe and fittings, in accordance with CAN/CSA B149.1, certified as type BH vents to ULC S636, Standard for Type BH Gas Venting Systems, suitable for negative or positive venting and complete with an orange warning label to verify compliance with ULC S636, and a moulded cap with screen for vertical termination, or low profile wall termination kit, as applicable.

2.03 Double Wall Type "A" Vent

.1 Sectional, prefabricated, double wall, type 316 stainless steel, insulated Type "A" all fuel vent, ULC listed and labelled to CAN/ULC S604, Standard for Factory-Built Type "A" Chimney, maximum 540°C (1000°F) rated, with prefabricated mated fittings, couplings and accessories including a flashing accessory, storm collar counter-flashing piece, and a termination cap.

2.04 Double Wall Type "B" Vent

.1 Sectional, prefabricated, double wall Type "B" gas vent, ULC listed and Labelled to CAN/ULC S605, Gas Vents, maximum 243°C (460°F) rated, with an aluminium alloy inner wall, G90 galvanized steel outer wall, annular air space, prefabricated mated fittings, couplings and accessories including a flashing accessory, storm collar counter-flashing piece, and a termination cap.

2.05 Double Wall Stainless Steel Vent for Condensing Equipment

.1 Positive pressure double wall stainless steel flue gas vent with a type 304 outer casing, an AL29-4C inner flue, and a 25 mm (1") annular air space, ULC S636 listed and labelled, complete with prefabricated mated fittings and accessories including a flashing accessory, storm collar counter-flashing piece, and a termination cap.

2.06 Double Wall Type "L" Vent

.1 Type "L" Neutral or negative pressure Type "L" double wall stainless steel flue gas vent, listed and labelled to CAN/ULC-S609, Low Temperature Vents-Type L, with a type 304 stainless steel outer casing, type 304 stainless steel inner flue, and a 12 mm (½") annular air space, maximum 300°C (570°F) rated, complete with prefabricated mated fittings and accessories including a flashing accessory, storm collar counter-flashing piece, and a termination cap.

2.07 Barometric Dampers

.1 Equal to Field Controls UL/ULC listed and CSA certified Type M+MG2, field adjustable, single or double acting barometric damper to suit burner fuel, each complete with a gate which rests on a long, thin, stainless steel knife edge which in turn is supported by self-aligning and self-cleaning bearings, sized to suit the application, approved by equipment manufacturer, and complete with a field thermal switch accessory for dual fuel oil/gas fired burners.

3 Execution

3.01 General for Installation in Existing Masonry Chimneys

.1 For installation in existing masonry chimneys, provide stainless steel drain pan below base of breeching system to accommodate possible water penetration or sweating. Extend drain accordingly;

.2 Provide heavy gauge stainless steel cap atom of existing masonry chimney with drip edge around perimeter. Slope top to allow drainage. Minimize use of seams. Provide standing seams where required.

3.02 Installation of Type BH Flue Gas Vents (and Combustion Air Intakes)

.1 Provide type BH flue gas vents and combustion air intakes for condensing appliances.

.2 Support spacing is to be in accordance with flue gas vent manufacturer's instructions. Installation is to be in accordance with gas fired appliance manufacturer's instructions and requirements of CAN/CSA B149.1.

.3 Route piping using shortest route possible to termination point while avoiding interference with other work. Slope vent piping for positive drainage.

.4 Equip termination of vent with a turn-down elbow with open end covered with bronze insect screen. Terminate exhaust vent a minimum of 3 m (10') away from fresh air intakes and operable windows.

.5 Provide stainless steel / CPVC condensate drainage to suit building construction extended to diluted building drain to accommodate pH.

.6 CPVC piping subject to damage shall be cradled using Unistrut or similar.

.7 Confirm flue gas vent diameter prior to ordering.

3.03 Installation of Flue Gas Vents

.1 Provide ULC listed and labelled flue gas vents for equipment. Confirm flue gas vent diameters prior to ordering.

.2 Secure horizontal sections in place by means of support hardware supplied with vents and conforming to flue diameter, and hanger rods attached to structure. Support spacing is to be in accordance with vent manufacturer's instructions.

.3 Support vertical flue sections inside building at roof level and wherever else required by means of purpose made vertical support accessories supplied by manufacturer.

.4 Hand flashing collars to roofing trade at site on roof for installation and flashing into roof construction. Install counter-flashing pieces over collars.

.5 Equip termination of each chimney with a rain cap. Confirm height requirement for chimney above roof prior to installation, and ensure proper distance from fresh air intakes is maintained.

.6 Provide braided stainless steel aircraft cable guy wires attached to roof anchors and to stainless steel strap anchors on the vents as required and/or shown.

.7 Anchor and restrain vents in accordance with requirements of Section 20 05 48.16 - Seismic Controls for Mechanical Systems.

.8 Provide required accessories, including insulated thimbles at building wall penetrations, barometric damper(s), cleanout(s), fire stops, and expansion joints where shown and/or required.

.9 Locate and install barometric dampers in accordance with manufacturer's instructions and field adjust to suit operating conditions.

End of Section

1 General

1.01 Section Includes

.1 Heat Recovery Ventilators

1.02 Submittals

.1 Submit shop drawings/product data sheets for heat recovery ventilators, including accessories, and all required power and control wiring schematics.

.2 Submit with delivery of each unit a copy of the factory inspection report, and include a copy of each report with O & M Manual project close-out data.

.3 Submit a site inspection and start-up report from manufacturer's representative as specified in Part 3 of this section.

.4 Supply a spare filter set for each ventilator and store at site where directed prior to Substantial Performance of the Work.

.5 Submit a signed extended warranty direct from manufacturer to Owner covering the energy recovery wheel from material and workmanship defects for an additional 4 years after Contract warranty expires.

.6 Supply reviewed copies of ventilator/curb assembly shop drawings or product data to trade who will cut roof openings for ventilators, and ensure openings are properly located.

1.03 Quality Assurance

.1 Heat recovery ventilator manufacturers are to be current members of Air Movement and Control Association International Inc. (AMCA), and fans are to be rated (capacity and sound performance) and certified in accordance with requirements of following standards:

.1 ANSI/AMCA Standard 210, Laboratory Method of Testing Fans for Certified Aerodynamic Performance Rating;

.2 AMCA Standard 211, Product Rating Manual for Fan Air Performance;

.3 ANSI/AMCA Standard 300, Reverberant Room Method for Sound Testing of Fans;

.4 AMCA Standard 311, Product Rating Manual for Fan Sound Performance;

.5 AMCA Standard 99-2408, Operating Limits for Centrifugal Fans;

.6 AHRI Standard 1060, Performance Rating of Air-to-Air Exchangers for Energy Recovery Ventilation Equipment;

.7 ASHRAE 84, Method of Testing Air-to-Air Heat/Energy Exchangers;

.8 UL 1812, Ducted Heat Recovery Ventilators;

.9 CSA or ETL certification for all electrical components.

.2 Provide two (2) year warranty and contractor to extend manufacturer warranty where required.

.3 Acceptable manufacturers are:

.1 Greenheck Fan Corp. – ERVe Series;

.2 Cook – ERV Series;

.3 PennBarry – D Series;

.4 Ruskin – EVT Series;

.5 Spinnaker – RERV Series.

2 Products

2.01 Heat Recovery Ventilators

.1 Minimum 65% effectiveness rate in summer and winter at conditions selected.

.2 Permanently bonded silica gel desiccant on polymer media (or aluminum media preferred) and capable of being periodically cleaned (no spray-on coated desiccant);

.3 Exhaust only defrost freeze protection.

.4 Modular sectional wheel or slide out chassis to facilitate service.

.5 Variable speed wheel control.

.6 Provided with 24" (600mm) roof curb.

.7 30/30 disposable pleated filters on intake and exhaust.

.8 Exhaust hoods w/ bird screens & washable filter on intake

.9 Premium efficiency motors and belt drive blower sections with integral vibration isolation.

.10 Electrical/mechanical controls to suit TAC/Distech BAS system.

.11 Motorized intake damper (spring closed if electrical power if lost);

.12 Factory or field installed galvanized latches c/w ss screws or equivalent to suit 2" (50mm) padlock by WRDSB.

.13 Electrical disconnect to be field supplied and installed by elec. contractor.

.14 Factory assembled, internally wired heat recovery ventilators in accordance with drawing schedule, and with AHRI certified energy recovery ratings.

.15 Interior Unit Casings and Frame: Internal frame type casing constructed of heavy-gauge G90 galvanized sheet steel with interior surfaces lined with 25 mm (1") thick, 24 kg/m³ (1-½ lb./ft.³) density coated glass fibre duct lining material meeting 25/50 flame spread/smoke developed ratings when tested in accordance with CAN/ULC S102, Surface Burning Characteristics of Building Materials and Assemblies, and installed with all exposed edges tucked under flanges. Additional features and requirements as follows:

.1 casings complete with factory sealed metal-to-metal joints, a solid integral base with up-turned lips around bottom openings, separate openings and knock-outs for power and control wiring conduit connections, top panels, where joints are required, are to be equipped with a standing seam, and all metal exposed to weather is to be factory cleaned, primed, and finished with baked enamel;

.2 removable gasketed panels or hinged gasketed access doors provided for access to all interior components;

.3 stainless steel drain pan pitched for positive drainage and equipped with captive condensate drain pipe connection.

.16 Exterior Unit Casings and Frame: Internal frame type double wall weather-proof casing constructed of heavy-gauge G90 galvanized sheet steel, minimum #18 gauge for exterior panels, minimum #24 gauge with interior panels, with 25 mm (1") thick, 24 kg/m³ (1-½ lb./ft.³) density coated glass fibre insulation material meeting 25/50 flame spread/smoke developed ratings when tested in accordance with CAN/ULC S102, Surface Burning Characteristics of Building Materials and Assemblies and secured in place between panels such that it will not sag. Additional features and requirements as follows:

.1 weather-tight casings, complete with factory sealed metal-to-metal joints, a solid integral base with up-turned lips around bottom openings, and separate openings and knock-outs for power and control wiring conduit connections;

.2 removable gasketed panels or hinged gasketed access doors provided for access to all interior components;

.3 stainless steel drain pan pitched for positive drainage and equipped with captive condensate drain pipe connection;

.4 downturned design air intake and exhaust hoods constructed and factory finished as for casings, each with an "A" water penetration classification rating up to 200 mm/hr (8"/hr) rainfall at 22 m/s (50 mph) when tested in accordance with AMCA Standard L-500, and washable aluminium mesh pre-filters;

.5 Intake and exhaust hoods c/w bird screens & washable filer on intake

.6 minimum 200 mm (8") high, full perimeter, galvanized steel insulated roof curb supplied loose with each unit for field assembly, consisting of die-formed sections with gasket material for installation between curb and unit base.

.17 Enthalpy type energy recovery wheel for both sensible and latent heat recovery, designed to ensure laminar air flow, with energy transfer ratings in accordance with ASHRAE 84 and AHRI certified to AHRI 1060, designed to transfer moisture entirely in vapour phase, consisting of removable segments for larger wheels, and complete with:

.1 silica gel desiccant permanently bonded to lightweight polymer media mounted in a stainless steel rotor;

.2 bearings selected for a minimum L-10 life in excess of 400,000 hours;

.3 high-strength urethane drive belt factory installed in a pre-stretched state, and a motor conforming to requirements specified in Section 20 05 00 – Common Work Results for Mechanical;

.4 frost control protection with an electric pre-heater.

.18 Disposable glass fibre media filters, ULC listed Class 2, side removable, 50 mm (2") thick, pleated, MERV 8 rating, factory or field installed in a die-formed galvanized steel filter rack at air intake opening.

.19 Centrifugal, draw-through within reference to the energy recovery wheel, double width and inlet exhaust and supply fans with forward curved blades, belt driven or direct driven as indicated, statically and dynamically balanced, mounted to unit base with neoprene vibration isolation, and equipped with:

.1 ground and polished steel fan shafts mounted in permanently lubricated sealed ball bearing pillow blocks selected for a minimum L-10 life in excess of 200,00 hours at maximum operating speed;

.2 motors and where indicated, belt drives conforming to requirements specified in Section 20 05 00 – Common Work Results for Mechanical.

.20 Each ventilator is to be equipped with a sealed and factory pre-wired control box containing terminal blocks for power and control wiring connections, integral door interlocking disconnect switch, an overload protected contactor for each motor, fuses, and 24 VAC secondary control transformer.

.21 Control system in accordance with drawing control schematic/sequence, and to include if indicated, all required hardware and circuitry for connection into building automation system using protocol as specified with the system.

.22 Factory supplied, mounted, and wired variable frequency drives conforming to requirements of Section 20 05 13.13 - Variable Frequency Drives for Mechanical Equipment.

.23 Auxiliary coil(s) rated and certified in accordance with AHRI Standard 410, Forced-Circulation Air-Cooling and Air-Heating Coils, drainable, designed and constructed to meet requirements of the ASME Code Category "H" as a registered fitting, and complete with a CRN. Coil data, performance, and specific features not specified below are to be in accordance with drawing detail. Each coil is to be complete with:

.1 slide in/slide out galvanized steel mounting framework;

.2 16 mm (5/8") O.D. seamless copper tubes with 1.24 mm (1/16") thick tube walls;

.3 aluminum fins mechanically bonded to tubes;

.4 welded Schedule 40 ASTM A53 seamless steel pipe headers with same end supply and return connections, and 9.5 mm (3/8") tappings for an air vent and a drain valve;

.5 flanged #14 gauge type 304 stainless steel casing designed to drain off standing water;

.6 for cooling coils only, an insulated stainless steel drain pan sloped for positive drainage from all points and equipped with a captive drain pipe connection coupling.

3 Execution

3.01 Installation

.1 Provide heat recovery ventilators.

.2 For suspended units, provide galvanized steel mounting brackets with vibration isolators and suspend each unit, level, and plumb, by means of hanger rods. Provide supplementary support steel as required.

.3 Secure each indoor floor mounted ventilator in place, level and plumb, on neoprene-steel-neoprene vibration isolation pads on a concrete housekeeping pad.

.4 Supply an assembled roof curb for each outdoor roof mounted ventilator and hand to roof trade at site on roof. Carefully locate and size roof openings. Provide gasket material supplied with curb on perimeter of curb and secure ventilator in place.

.5 Brace and secure each unit in accordance with requirements specified in Section 20 05 48.16 - Seismic Controls for Mechanical Equipment.

.6 For ventilators with auxiliary hydronic coils, connect each coil to system valved hydronic piping with flexible connectors in accordance with Section 23 21 00 - Hydronic Piping and Pumps. Provide trapped condensate drainage piping connection to cooling coil condensate drain pans in accordance with Section 22 13 00 – Facility Sanitary Sewerage.

.7 Coordinate power wiring connection and provision of a disconnect switch for each ventilator in accordance with electrical work Specification where power wiring is specified.

.8 Refer to Section 20 05 00 – Common Work Results for Mechanical for equipment/system manufacturer certification requirements.

.9 Refer to Section 20 05 00 – Common Work Results for Mechanical for equipment/system start-up requirements.

3.02 Demonstration and Training

.1 Include for a ½ day on-site heat recovery ventilator operation demonstration and training session. Training is to be a full review of all components including, but not limited to, a full heat recovery ventilator internal inspection, construction details, operation, maintenance, abnormal events, and setting up controls.

End of Section

1 General

1.01 Submittals

.1 Submit shop drawings/product data for all units. Include:

.1 certified fan performance curves;

.2 estimated sound power levels to be expected across individual octave bands in dB;

.3 certified power and control wiring diagrams which differentiate between factory and site wiring;

.4 dimensioned layouts, including dimensioned curb layouts and duct penetrations, as applicable;

.5 product data for fan motors and drives;

.6 all items shipped loose for site installation.

.2 Submit with delivery of each unit a copy of the factory inspection and fire test report, and include a copy of each report with O&M manual project close-out data.

.3 Submit a site inspection and start-up report from manufacturer's representative as specified in Part 3 of this section.

.4 Submit spare air filters as specified in Part 2 of this section.

.5 Supply reviewed copies of curb assembly shop drawings or product data sheets to trade who will cut roof openings for ductwork, and ensure openings are properly sized and located.

.6 Submit signed copies of manufacturer's extended warranties as follows:

.1 stainless steel gas fired unit heat exchanger: 10 years;

.2 refrigerant compressor(s): 5 years;

.3 integrated modular control: 3 years.

1.02 Quality Assurance

.1 Heating and air conditioning equipment is to be rated (capacity, performance, efficiency and sound) and certified in accordance with requirements of following Air-Conditioning, Heating and Refrigeration Institute Standards:

.1 ANSI/AHRI 210/240, Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment;

.2 ANSI/AHRI 270, Sound Performance Rating of Outdoor Unitary Equipment;

.3 ANSI/AHRI 340/360, Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment.

.2 Heating and air conditioning equipment is also to be in accordance with requirements of following Codes, Standards, and Regulations:

.1 CSA B52, Mechanical Refrigeration Code;

.2 CAN/CSA-C22.2 No. 236/UL 1995, Heating and Cooling Units;

.3 ANSI/ASHRAE/IES 90.1, Energy Standard for Buildings Except Low Rise Residential Buildings;

.4 CSA or ETL certification and labelling for all electrical components;

.5 CAN/CSA B149, Natural Gas and Propane Code;

.6 governing local Codes and Regulations.

.3 Gas fired heating and air conditioning units are to be installed by licensed journeyman gas fitters.

.4 Acceptable manufacturers are:

.1 Lennox Industries Inc. – LGH Series;

.2 Carrier Corp. – 48HC Series;

.3 AAON – RN Series;

.4 RUUD – RRPL / RRNL Series;

.5 Daikin DPS Series;

.6 Johnson Controls York – ZJ Series.

2 Products

2.01 Outdoor Air Conditioning Units

.1 Package type, factory tested, outdoor, weatherproof heating and air conditioning units in accordance with drawing schedule.

.2 Min EER 12.0 / SEER 13.2.

.3 Free cooling economizer / CO2 controlled fresh air via TAC/Distech BAS system.

.4 Premium efficiency motor(s).

.5 Blower section(s) c/w integral vibration isolation.

.6 Maximum 85 dB sound rating.

.7 Electric disconnect to be field supplied and installed by electrical division.

.8 GFCI receptacle (where required) to be flied wired by electrical division.

.9 Contractor to extend manufacturer standard warranty where required for full two (2) year coverage and provide PM service during warranty. Contractor to provide info to the Board on all available extended warranties and procure extended warranty registration as available from each manufacturer.

.10 Cabinet constructed of minimum #18 gauge galvanized steel panels erected on full perimeter minimum #14 gauge galvanized steel base rails with lifting lugs, finished with 2 coats of baked exterior enamel paint on primer, arranged and constructed for airflow configurations as shown, and complete with collars for electrical power and duct connection openings, and following:

.1 fully insulated base, and insulation for all panels adjacent to conditioned air, with 50 mm (2") thick neoprene faced, 32 kg/m³ (2 lb/ft³) density insulation meeting 25/50 flame spread/smoke developed ratings when tested to CAN/ULC S102 and secured in place such that insulation will not sag and fibres will not erode or enter airstream;

.2 hinged access panels, each air and water sealed and equipped with ¼ turn latching handles, and provided for compressor/controls/heating areas, blower access, and air filter and economizer access.

.11 Vibration isolated scroll type hermetically sealed compressor(s) with direct drive vertical discharge propeller type condenser fan(s) and copper tube/aluminium fin factory leak and pressure tested condenser coil(s), and equipped with following:

.1 PVC coated condenser fan guard and condenser coil guard;

.2 permanently lubricated totally enclosed, resiliently mounted, overload protected condenser fan motor(s) conforming to requirements of Section 20 05 00 – Common Work Results for Mechanical, totally enclosed from the weather;

.3 refrigeration system capable of operating down to -17°C (0°F) without installation of additional controls, complete with self-sealing discharge, suction and liquid line service gauge ports, freeze-stats, expansion valves, copper refrigerant tubing and insulation where required, liquid line filter drier, a full charge of R410a refrigerant, automatic reset high and low pressure compressor circuit controls, and fan control for -34°C (-30°F) low ambient operation;

.4 copper tube/aluminium fin factory tested evaporator coil with thermal expansion valve with adjustable superheat and external equalizer, and non-corrosive condensate drain pain removable for cleaning, designed to prevent standing water and equipped with a drain connection with deep seal trap.

.12 Cooling controls include following:

.1 smoke detectors in both supply and return air streams;

.2 motorized normally closed fresh air and exhaust air dampers and normally open return air damper (equal to T. A. Morrison Tamco Series 1000 for return air and Series 9000 for fresh air and exhaust air), with 24 volt spring return Belimo or equal operators and a control package to automatically vary the outside air quantity;

.3 adjustable mixed air controls to maintain 13°C (55°F), or as indicated, mixed air temperature;

.4 up to 4 stages of cooling control;

.5 controls for blower on delay of up to 60 seconds after a cooling demand has been received, with a default value of zero, and controls to allow blower off delay of up to 240 seconds after cooling demand has ended, with a default value of zero;

.6 minimum compressor on and off time of 300 seconds, both adjustable between 60 and 510 seconds;

.7 default maximum high pressure switch trip occurrence during cooling or dehumidification cycle of 3 (adjustable between 1 and 8 occurrences), with compressor lock-out if maximum occurrence limit is reached, and digital output for service activated;

.8 low pressure trip read delay of 5 minutes (adjustable between 0 and 34 minutes) if compressor off time has been less than 4 hours (adjustable between 1 and 6 hours) and outdoor temperature is less than 21°C (70°F), adjustable between -12°C (10°F) and 38°C (100°F);

.9 low pressure trip read delay of 15 minutes (adjustable between 0 and 34 minutes) if compressor off time has been less than 4 hours (adjustable between 1 and 6 hours) and outdoor temperature is less than 21°C (70°F), adjustable between -12°C (10°F) and 38°C (100°F);

.10 low pressure trip read delay of 2 minutes (adjustable between 0 and 34 minutes) if the compressor off time has been less than 4 hours and outdoor air temperature is 21°C (70°F) or greater;

.11 low pressure trip read delay of 8 minutes (adjustable between 0 and 34 minutes) if the compressor off time has been 4 hours and outdoor air temperature is 21°C (70°F) or greater;

.12 each pressure switch trip occurrence (either high or low) to record an error in non-volatile memory and identify compressor circuit;

.13 low outdoor air temperature compressor lockout set-point of -18°C (0°F) for each compressor circuit, individually adjustable from 27°C (80°F) to -34°C (-30°F);

.14 maximum allowable evaporator freeze-stat trip occurrence of 3 (adjustable between 1 and 4 occurrences) during cooling demand, with circuitry to shut-off compressor each time a freeze-stat trip occurs and record an error in non-volatile memory, and if maximum limit is reached, compressor is to be locked-out and a digital output for service is to be displayed;

.15 condenser fan control including:

.1 6 second (adjustable between 0 and 16 seconds) between condenser fan shut-off and restart to prevent reverse rotation of fan(s);

.2 cooling stage low outdoor temperature set-point control (4°C to 13°C [40°F to 55°F]) depending on number of fans and adjustable between -12°C and 16°C (10°F and 60°F) to reduce airflow through condenser by turning off some or all fans, depending on number of condenser fans.

.13 Roll type glass fibre mesh construction filter media factory installed when unit is shipped, and disposable, 50 mm (2") thick, pleated, UL Class 1 MERV 7 rated, metal framed filters with an initial loading of filters, and a spare set of filters for each unit, supplied loose in sealed containers.

.14 Completely accessible gas heating system, multiple flue pass removable heat exchanger and burner assembly suitable for a natural gas supply pressure of 1.7 kPa (7" w.c.), with stainless steel primary heating surface and stainless steel tube type secondary heating surface, inshot type gas burner with direct spark ignition with 100% safety shut-down flame sensor controls, and flame rollout switch, limit controls, and redundant dual gas valves with staging control and combustion air proving switch on combustion air inducer. Gas heating controls include following:

.1 Flue extension kit;

.2 controls to operate supply fan 40 seconds after a heating demand signal is received, with 8 to 60 second adjustable time delay, and controls to turn off supply fan 120 seconds after heating demand has ended, with 80 to 300 second adjustable time delay;

.3 time delay of 30 seconds (adjustable between 30 and 160 seconds) between low and high fire of 2-stage gas valve system;

.4 heat off delay of 100 seconds (adjustable between 30 and 300 seconds) after thermostat heating demand has ended, and controls to keep supply fan running if overheat limit occurs;

.5 maximum overheat limit trip count during heating cycle of 3 (adjustable between 1 and 15), with digital output limit indicator and circuitry to report an error with each occurrence of overheat limit trip and to identify limit that tripped, and with error code stored in non-volatile memory;

.6 controls to shut-off gas heat if flame rollout occurs and to report an error identifying rollout switch;

.7 maximum flame rollout switch trip of 3 (adjustable between 1 and 6) during heating cycle, with digital output, limit indicator;

.8 controls to turn off heat if induced airflow is too low, and to report an error identifying pressure switch;

.9 maximum induced airflow pressure switch trip count of 3 (adjustable between 1 and 6) during heating cycle, with digital output, limit indicator;

.10 circuitry to report an error (gas valve) if gas valve is not energized 2 minutes after heating demand;

.11 maximum ignition failure count of 3 (adjustable between 1 and 6), with digital output, limit indicator;

.12 controls to shut-off the gas valve if flame is not sensed, and to report an error which is stored in non-volatile memory;

.13 delay between stages of gas valve;

.14 control to shut-off unit if gas valve is energized with no demand for heat, and to report an error which is stored in non-volatile memory.

.15 Centrifugal, statically and dynamically balanced, removable (slide-out) blower assembly complete with:

.1 motor, drive assembly and guard conforming to requirements specified in Section 20 05 00 – Common Work Results for Mechanical;

.2 motor conforming to requirements specified in Section 20 05 00 – Common Work Results for Mechanical, and a variable frequency drive conforming to requirements specified in Section 20 05 13.13 - Variable Frequency Drives for Mechanical Equipment.

.16 Integral solid-state control board to operate unit, compatible in all respects with building automation system, and with built-in functions as follows:

.1 blower on/off delay;

.2 control parameter defaults;

.3 service relay output;

.4 dirty filter switch input;

.5 dehumidistat input;

.6 economizer control;

.7 gas valve delay between stages;

.8 unit diagnostics;

.9 diagnostics code storage;

.10 indoor air quality input;

.11 low ambient controls;

.12 minimum run time;

.13 night setback mode;

.14 smoke alarm mode;

.15 low pressure control;

.16 thermostat bounce relay;

.17 3-digit display and °F or °C display;

.18 heat/cool thermostat compatible with warm-up mode.

.17 Minimum 600 mm (24') high prefabricated and insulated curb conforming to requirements of National Roofing Contractors Association.

3 Execution

3.01 Installation

.1 Provide outdoor heating and air conditioning units.

.2 Provide required rigging and hoisting/moving equipment required to move each unit to required locations. Perform rigging/hoisting/moving in accordance with unit manufacturer's directions and details.

.3 Hand a curb for each roof mounted unit to roofing trade on roof for installation and flashing into roof construction. Secure each unit in place on roof curb. Provide continuous gasketing around perimeter of each curb between curb and unit mounting frame.

.4 Secure base mounting units in place, level, and plumb, on a fabricated steel base or concrete pad.

.5 Brace and secure each unit in accordance with requirements specified in Section 20 05 48.16 - Seismic Controls for Mechanical Systems..

.6 Install components shipped loose with units. Install in accordance with manufacturer's recommendations. Calibrate control components requiring field calibration.

.7 Extend condensate trapped drains using Schedule 40 galvanized steel piping to roof.

.8 Provide remote control panels. Confirm exact locations prior to roughing-in. Connect complete with 24 volt control wiring in conduit to standards of electrical work and in accordance with manufacturer's certified wiring diagram.

.9 Provide thermostats and wall mount on a recessed box. Confirm exact locations prior to roughing-in. Connect complete with 24 volt control wiring in conduit to standards of electrical work and manufacturer's certified wiring diagram. Set-up and program thermostats in accordance with Owner's requirements.

.10 Carefully coordinate installation of each unit with all other trades making connections to unit, in particular, power, interlock connections, and control connections.

.11 Refer to Section 20 05 00 – Common Work Results for Mechanical for equipment/system manufacturer certification requirements.

.12 Refer to Section 20 05 00 – Common Work Results for Mechanical for equipment/system start-up requirements.

3.02 Demonstration and Training

.1 Include for a 1/2 day on-site operation demonstration and training session. Training is to be a full review of all components including, but not limited to, a full operation and maintenance demonstration, with abnormal events.

End of Section

1 General

1.01 Submittals

.1 Submit shop drawings/product data sheets for all heating only air units. Include following:

.1 certified fan performance curves;

.2 certified sound power data;

.3 hardware for section-to-section site connections;

.4 dimensioned layouts, including dimensioned curb layouts as applicable;

.5 product data for fan motors.

.2 Submit with delivery of each furnace a copy of the factory inspection and fire test report as specified in Part 2 of this section, and include a copy of each report with O & M Manual project close-out data.

.3 Submit a site inspection and start-up report from manufacturer's representative as specified in Part 3 of this section.

.4 Submit spare air filters as specified in Part 2 of this section.

1.02 Quality Assurance

.1 Heating only air units and installation are to be in accordance with requirements of following:

.1 all applicable Provincial Codes and Standards;

.2 CAN/CSA B149, Natural Gas and Propane Installation Codes;

.3 CSA or cETL listed and labelled electrical components.

.2 Unit installation tradesmen are to be journeyman and licensed gas fitters.

.3 Contractor to extend manufacturer standard warranty where required for full two (2) year coverage and provide PM service during warranty. Contractor to provide info to the Board on all available extended warranties and procure extended warranty registration as available from each manufacturer.

.4 Acceptable manufacturers are:

.1 Engineered Air – DJE (DJX) Series;

.2 AAON – RN Series;

.3 Daikin – RDS Series;

.4 Bousquet – BC Series.

2 Products

2.01 Gas Fired Heating-Only Air Handling Units

.1 Air-tight, weather-proof heating only air units, approved for operation in ambient temperatures of -50°C (-60°F), in accordance with drawing schedule and details, factory inspected and fire tested with an inspection and fire test report prepared and submitted, and following additional performance features:

.1 units are to be suitable for operation at any supply gas pressure between 1.7 kPa and 3.5 kPa (0.25 psi and 0.51 psi);

.2 unless otherwise specified, sound emitted through casings or intakes of roof mounted units at maximum air flow rate is not to exceed 78.4 dBA at 1 m (4'), and for interior spaces, sound emitted through supply and return air openings is not to exceed 82 dBA at 1.5 m (5').

.2 Complete with free cooling economizer / CO2 controlled fresh air via TAC/Distech BAS system.

.3 Power exhaust or modulating relief damper (set to maintain space slightly pressurized at approx. 0.05”wc / 12Pa)

.4 Complete with premium efficiency motor(s).

.5 Blower section(s) c/w integral vibration isolatio.

.6 Max 85dB sound rating

.7 2” (50mm) 30/30 disposable filters (350 fpm / 1.8 mps max filter velocity).

.8 Bousquet heat exchangers c/w inspection port to allow PM service on exchanger w/out disassembling unit enclosure.

.9 VFDs (if any) shall have a bypass switch to ensure fan blower operation without need for programming or re-wiring (for emergency / after hrs use).

.10 Dynamically balanced fans and drives (factory or field as required).

.11 Hinged service panels suitable for padlocks (field install stainless steel or galvanized latches c/w ss screws). 2” padlock by WRDSB.

.12 Sectional, double wall insulated casing and section construction with dimensions and arrangements as shown and detailed on drawings and as follows:

.1 rigid, full perimeter structural channel iron base frame with reinforcing channels cleaned and coated with rust resistant primer, lifting lugs and identified lifting points;

.2 minimum #16 gauge G90 galvanized sheet steel exterior casing panels, #22 gauge G60 galvanized steel liner panels over all interior insulation including underside of floor, with over-lapped roof panels, all joints neatly caulked with water resistant sealant, and rain shields over all access doors;

.3 50 mm (2") thick, minimum 48 kg/m³ (3 lb/ft³) density semi-rigid glass fibre acoustic insulation meeting 25/50 flame spread/smoke developed ratings when tested to CAN/ULC S102, secured in place by means of adhesive and pins;

.4 double wall insulated access doors constructed as for casing panels, of sufficient size and number to permit physical entry into sections from both sides of unit for servicing of filters, fans and motors, burners, and other equipment requiring maintenance and service, and each complete with:

.1 full perimeter captive gasketing;

.2 full length galvanized steel hinges;

.3 2 lever lock roller handles operable from both inside and outside casing;

.4 for sections such as fan sections requiring full access, double doors of sufficient size with a removable mullion.

.5 galvanized steel intake hood complete with storm louvre, aluminium mesh birdscreen, motorized inlet damper, "V" bank filter framing, and 50 mm (2") thick, UL Class 1, 25% to 30% efficient MERV 7 disposable glass fibre filters with an extra set of filters in identified packaging for each unit;

.6 clean and prime casing, both inside and outside, and finish with epoxy enamel applied to all panel surfaces, including exterior undersides.

.13 Fully modulating direct fired type burners capable of minimum 5:1 turndown ratio and located in a burner section with a heat treated glass observation port for full viewing of flame, and a control panel/gas manifold vestibule with access door and weather-proof electric heater with thermostat, a 120 volt marine light with guard and lighted switch, and a duplex 15 ampere GFI receptacle factory wired to a separate 120 volt, 1-phase circuit with disconnect switch. Burner efficiency is to limit products of combustion to maximum 5 ppm carbon monoxide and 0.5 ppm nitrogen dioxide, and equip burner with:

.1 adjustable profile plates, stainless steel combustion baffles, non-clogging gas ports, and spark-ignition intermittent pilot with 100% flame safety shut-down;

.2 pre-piped gas manifold with main gas pressure regulator, manual shut-off and test firing valves, main and auxiliary gas automatic shut-off valve, a modulating control system, pilot pressure regulator and automatic shut-off valve, pilot needle valve, and multiple test ports.

.3 flue extension kit.

.14 Burner control, located in burner control/manifold vestibule, factory pre-wired, and consisting of:

.1 blower motor starter with ambient compensated overloads, and auxiliary contacts;

.2 primary 120 volt control transformer;

.3 6000 volt ignition transformer;

.4 control circuit breaker and service switch;

.5 automatic rest temperature high limit;

.6 solid-state flame safeguard relay with LED status and flame rod;

.7 discharge temperature control sensor with RTS;

.8 all hardware required for site connection of the remote control panel.

.15 AMCA rated and certified double width and inlet centrifugal fan with forward curved blades, secured to a heavy-duty machined and polished steel shaft with an operating speed not to exceed 75% of its first critical speed, and statically and dynamically balanced. Fan motor, V-belt drive, and OHSA guard in accordance with requirements specified in Section 20 05 00 – Common Work Results for Mechanical.

.16 Surface wall mounting (to a recessed or surface mounting outlet box) supervisory control panel with 2 switches, 5 indicating lights including "Clogged Filter", a temperature selector, and a LED discharge temperature readout.

.17 Roof mounting curb factory supplied loose and ready for site assembly and insulation, 600 mm (24") high, complete with wood nailer and site assembly hardware.

.18 Electric disconnect to be field supplied and installed by electrical division.

.19 GFCI receptacle (where required) to be flied wired by electrical division.

3 Execution

3.01 Installation of Gas Fired Heating Only Rooftop Unit

.1 Provide a gas fired heating only unit on roof.

.2 Unless otherwise specified or required, provide required rigging and hoisting/moving equipment required to move units to required location. Perform rigging/hoisting/moving in accordance with unit manufacturer's directions and details.

.3 Supply a curb for each unit, assemble curb, and hand curb to roofing trade on roof for installation and flashing into roof construction. Provide continuous gasketing around perimeter of curb between curb and unit mounting frame. Insulate curb with rigid weather-proof board type insulation in accordance with curb manufacturer's details.

.4 Install components shipped loose with units. Install a discharge air temperature sensor in supply ductwork approximately 2 m (6-½') downstream of unit and in accordance with manufacturer's recommendations.

.5 Brace and secure unit in accordance with requirements specified in Section 20 05 48.16 - Seismic Controls for Mechanical Systems.

.6 Refer to Section 20 05 00 – Common Work Results for Mechanical for equipment/system manufacturer certification requirements.

.7 Refer to Section 20 05 00 – Common Work Results for Mechanical for equipment/system start-up requirements.

3.02 Demonstration and Training

.1 Include for a 1/2 day on-site operation demonstration and training session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

End of Section

1 General

1.01 Section Includes

.1 Hot water unit heaters and cabinet unit heaters.

1.02 Related Requirements

.1 Section 23 21 00 – Hydronic Piping and Pumps.

1.03 Submittals

.1 Submit shop drawings/product data sheets for motorized heaters, including accessories.

.2 Submit a site start-up report from manufacturer's representative as specified in Part 3 of this section.

2 Products

2.01 Unit Heaters

.1 CSA certified hot water unit heaters in accordance with drawing schedule, each complete with:

.1 for vertical unit casing, top and bottom heavy-gauge circular steel plates, top plate equipped with a depression for motor and an opening for motor cooling air as well as threaded hanger rod connections, bottom plate equipped with a die-formed fan venturi and a bolt-on adjustable air deflector, both plates bolted together with a circular heating coil in between;

.2 for horizontal unit casing, minimum #20 gauge die-formed steel front and back casing halves with formed ribs and rounded corners, both halves secured together top and bottom with screws and equipped with threaded hanger rod connections in the top, a formed fan venturi with bolt-on wire grid guard in the back, and a rectangular formed discharge opening with adjustable horizontal and vertical air deflectors in the front;

.3 factory applied casing finish, consisting of electrostatically applied baked powder epoxy on cleaned and primed casing surfaces;

.4 factory leak tested heating coil, consisting of minimum 16 mm (5/8") OD seamless copper tubing mechanically expanded into and permanently bonded to continuous plate type aluminum fins, and equipped with screwed steel supply and return piping connections and silver braced tube joints;

.5 continuous duty TEFC motor conforming to requirements specified in Section 20 05 00 – Common Work Results for Mechanical, direct connected to a balanced propeller type fan wheel with aluminum blades secured to a steel hub;

.6 seismic restraint connection hardware factory secured to each unit heater.

.2 Acceptable manufacturers are:

.1 Modine Manufacturing Co.;

.2 Rosemex Inc.;

.3 Armstrong-Hunt Inc.;

.4 McQuay International;

.5 Engineered Air.

2.02 Cabinet Unit Heaters

.1 CSA certified hot water cabinet unit heaters in accordance with drawing schedule, each complete with:

.1 cabinet, of welded fabrication, constructed from one-piece top and sides, and one-piece partition panels and backsheet, both die-formed from single sheets of minimum #18 gauge insulated furniture grade steel and complete with minimum 825 mm (32-½") space at each end for piping and wiring, stamped grilles where required, and, for surface floor and wall mounted cabinets, key lock access doors for access to valves and speed controls;

.2 #16 gauge removable front panel with tamperproof fasteners, stamped grille where required, and insulation applied to the inside face;

.3 for all exposed cabinet surfaces, a baked enamel prime coat finish applied to cleaned metal surfaces;

.4 factory leak tested heating coil, consisting of seamless copper tubing mechanically expanded into and permanently bonded to continuous plate type aluminum fins, and equipped with screwed steel supply and return piping connections and silver brazed tube joints;

.5 removable galvanized steel fan board with centrifugal forward curved, formed aluminum fan wheel(s) with galvanized steel housings, direct connected to a continuous duty, three-speed, permanent split capacitor motor conforming to requirements specified in Section 20 05 00 – Common Work Results for Mechanical;

.6 for cabinets where indicated, duct connection collars;

.7 permanent, cleanable aluminum mesh filter;

.8 seismic restraint connection hardware factory secured to each unit as required.

.2 Acceptable manufacturers are:

.1 Modine Manufacturing Co.;

.2 Rosemex Inc.;

.3 Armstrong-Hunt Inc.;

.4 McQuay International;

.5 Engineered Air.

3 Execution

3.01 Installation of Motorized Heaters

.1 Provide motorized heaters.

.2 Secure unit heaters in place at proper height by means of hanger rods attached to structure. Ensure heaters are level and plumb. Confirm exact locations prior to roughing-in.

.3 Carefully coordinate installation of cabinet heaters with trades constructing building surfaces in or on which heaters are located. Confirm exact locations prior to roughing-in.

.4 Brace and secure each unit in accordance with requirements specified in Section 20 05 48.16 - Seismic Controls for Mechanical Systems.

.5 Connect with piping in accordance with drawing detail.

.6 Refer to Section 20 05 00 – Common Work Results for Electrical for equipment/system start-up requirements.

3.02 Demonstration and Training

.1 Include for a 4 hour on-site heater operation demonstration and training session. Training is to be a full review of all components including but not limited to construction details, operation, and maintenance.

End of Section

1 General

.1 General Requirements

.1 Conform to General Conditions for Mechanical Trades

.2 Related Work Specified Elsewhere

(1) General Conditions for Mechanical Trades
(2) Heating, Ventilation & Air Conditioning
(3) Heating, Ventilation & Air Conditioning Equipment
(4) Electrical

.2 Description of System

.1 Furnish and install all components, devices and control wiring for a fully integrated Energy Management and Environmental Control System incorporating Direct Digital Control (DDC), and equipment monitoring. The system shall control/monitor HVAC and plumbing equipment and systems as specified in this section. The work shall include but is not limited to the following:

(1) All necessary hardware, software, control panels, web access modules, control wiring, field devices, installation, documentation and owner training as specified.
(2) The installed system shall incorporate electronic and digital control devices to perform the control sequences and monitoring outlined herein. Specific control sequence requirements are as detailed elsewhere in this Section of the specification.
(3) VVT zone control dampers shall be installed in the duct system by the Sheet Metal Trade complete with necessary duct transitions, access doors, etc. The Temperature Control Contractor shall be responsible for coordination with the HVAC Contractor and the installation of the actuators.
(4) Control valves shall be installed in the piping system by the Mechanical Trade complete with transitions and unions as required.
(5) Testing, debugging, calibrating, adjustment, programming and confirmation of total system operation.

.3 Manufacturer and Installing Contractor

.1 The temperature control manufacturer shall be Distech Controls – local rep 519-893-2638.

.2 Any new building must be a seamless extension of the current Energy Management and Building Control System.

(1) The existing TAC Vista software is, and shall continue to be, the only head-end BAS server for the entire School Board.
(2) The head-end server contains the secure Energy Management Settings (i.e. Master Setpoints & Schedules) that are sent to all schools in real-time. The control system must be an extension of the head-end server and be able to be managed exclusively through the Vista head-end server.
(3) Monitoring of all school board control systems are done in real-time and must be presented at the exclusive Vista head-end server as first-priority data.
(4) The Vista head-end server has all the required controller databases and software to be able to centrally maintain and modify network configuration and controller software for the entire School Board. The Vista head-end server is the only system that can access the LacNet programming variables inside the controllers for real-time configuration of setpoint and time scheduling parameters.
(5) The graphics and controller database must be presented inside the Vista head-end server in its native format in order to preserve the real-time speed, integrity and multi-site administration of the entire system.

.3 The controls company shall have a service office and maintenance facility with in 6 kilometers of the Waterloo Region District Public School Board main office. The controls company shall be able to provide service to any school within 4 hours during normal working hours.

.4 Quality Assurance

.1 The system components shall be listed by Underwriters Laboratories Inc. and Canadian Standards Association.

.2 The system control products shall be stored and handled according to manufacturer's recommendations.

.3 The work shall be performed by skilled technicians all of whom shall be properly trained and qualified for this work.

2 PRODUCTS

.1 General

.1 The system shall integrate the operation of intelligent building management controllers distributed into the network.

.2 Provide web based access. Two Ethernet connections for communication shall be provided by the Electrical Division.

.3 The DDC System shall be generally comprised of the following devices to achieve the control functions described in this section:

(1) Distech Controls programmable controllers.
(2) Network repeaters as required by network lengths.
(3) Control relays.
(4) Control dampers and valves.
(5) Sensors, actuators and other input/output devices.

.4 Controllers shall execute the application programs, calculations, and commands to provide the control function specified for that unit. Each controller shall include its own micro-computer controller, power supply, input/output modules, termination modules and real time clock.

.5 Controllers shall be capable of full control functionality and alarm reporting independently or as a part of the DDC network.

.6 The system shall be stored in flash ram so no batteries are required.

.7 Each control device shall be modular and expandable to provide additional inputs and outputs and control functionality for that device

.8 Each controller shall be able to transfer and receive data via the network for performance of control functions.

.9 The system shall be modular, permitting expansion by adding hardware and software without changes in communication or processing equipment.

.10 The complete system shall be capable of communication over a LonWorks and/or BACnet network.

.11 The controllers shall monitor the status of all overrides and include this information in logs and summaries to inform the operator that automatic control has been inhibited.

.12 Controllers shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all subsidiary equipment and provide both local and remote annunciation of any component failures.

.13 Controllers shall activate an orderly shutdown of their operation in the event of loss of normal electrical power. Non-volatile memory shall be incorporated for all controller configuration data. The controllers shall automatically resume full operation without manual intervention.

.14 The controllers shall have sufficient memory to support their own operating system and data bases including:

(1) control processes
(2) energy management applications
(3) alarm management
(4) trend data
(5) operator input/output
(6) remote communications
(7) manual override monitoring

.15 Controllers shall incorporate the following software features:

(1) Energy management:
  (a) Time of Day Scheduling
  (b) Calendar Based Scheduling
  (c) Holiday Scheduling
  (d) Optimal Start and Stop
  (e) Demand Limiting
  (f) Heating/Cooling Interlock

(2) Alarm Management:
  (a) Alarm Management shall be provided to monitor, buffer and direct alarm reports to operator devices and memory files. The controllers shall perform alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic and prevent alarms from being lost.
  (b) All alarm or point change report shall include the points' English language description and the time and date of occurrence.
  (c) The user shall be able to define the specific reaction for each point, the priority level (3 in total) and ability to inhibit alarm reporting for each point.
  (d) The user shall be able to define conditions under which point changes need to be acknowledged by an operator and logged for analysis at a later date.
  (e) The user shall be able to print, display or store a unique 60 character alarm message to more fully describe the alarm condition or direct operator response. The message shall be customizable to describe each individual alarm.
  (f) In web access applications only critical alarms shall initiate a call to a remote operator device, otherwise call activity shall be minimized by time stamping and saving reports until a manual request is received or until the buffer space (minimum 50 alarms) is full.

(3) Trend Logs:
  (a) Controllers shall provide an automatic roll-over trend log, which stores records up to an operator-selected number at an operator-selected sampling rate and then overwrites the oldest record with each new record.
  (b) Sample intervals shall be from 1 minute to 24 hours.
  (c) Provide graphical and tabular displays

(4) Runtime Totalization:
  (a) The controllers shall automatically accumulate and store runtime hours for binary points with a sampling resolution of 1 minute. The user shall have the ability to define a warning limit to trigger maintenance or user-defined messages.

(5) Event Totalization:
  (a) Controllers shall have the ability to count events (such as on/off) and store up to 10 million events before reset with a user-defined limit used to trigger a user-defined message.

(6) Custom Programming:
  (a) The controllers shall permit user defined custom control processes based on:
    (i) any system measured data or status
    (ii) any calculated data
    (iii) any results from other processes
    (iv) Boolean logic
  (b) The custom processes may be triggered by:
    (i) Time-of-day
    (ii) calendar date
    (iii) events (point alarm etc.)

.16 The control strategy for each control loop shall be performed by software within the controller. The sequence of events required for each control loop is described for each system in the control sequence.

.17 Outdoor air temperature indication shall be available at each controller as an integral part of the control strategies for that controller. Should the network transmission of the common outdoor air temperature (or any other common value) fail, then each controller shall use the last good value received.

.18 Controls and Requirements for VVT Systems

(1) Where VVT controls are specified, units are to operate as part of a Variable Volume/Variable Temperature System complete with all necessary controls including zone dampers, temperature sensors, static pressure sensor probes and bypass damper.

(2) There shall be no zone controllers for the room control. Control shall be from a designated programmable controller for each air handling unit to ensure information transfer is fast enough to react to the changes in the environment.
(3) The VVT Control System shall include but not be limited to individual DDC room/zone sensors, corresponding zone dampers, bypass damper, connecting communication network, all required duct sensors, all required relays and other required control components and algorithms for complete control of the HVAC system according to the sequence of operation.
(4) Each VVT system shall be capable of operating as a stand alone system. Note that each VVT rooftop unit shall have its own designated controller that controls all zones directly in order to keep information exchange quicker and more efficient.

.2 Network Architecture

.1 The controllers on the local network shall communicate via a two wire LonTalk TP/FT-10 network.

.2 The control network shall be able to expand to match the requirements of the facility, including any future building additions.

.3 The control network shall be able to support a total developed length of 305 meters without using a network repeater.

.3 Control Panels

.1 Control panels shall be fully enclosed cabinets with all steel construction. Cabinets shall have a hinged door with locking latch or bolt-on cover plate. All cabinet locks shall be common keyed. Cabinets shall be finished with two coats of paint.

.4 Temperature Sensors

.1 Provide thermistor temperature sensors, not requiring transmitters, to measure temperature.

.2 Accuracy shall be +/-0.2°C from 0 to 70°C.

.3 Space sensors in occupied areas shall be Greystone TE200 series, type AE or Distech Smart Comfort SO having an integral push button for unoccupied override and an integral slider to adjust set point (LED display not required).

.4 In corridors and where noted on the drawings, provide stainless steel plate type sensors (push button override and LED display not required), Greystone TE200 series, type AS or equal.

.5 Duct temperature sensors shall be Greystone TE200 series, type B or equal having a stainless steel probe length to suit application and ABS enclosure. Duct averaging temperature sensors shall be Greystone TE200 series, type FD or equal having an element length to suit application, copper probe and ABS enclosure.

.6 Immersion temperature sensors shall be Greystone TE200 series, type C or equal having a ¼" OD stainless steel probe, 4" long and ABS enclosure. Immersion sensors shall be complete with thermowells. Thermal conductive compound shall be added inside the thermowell to provide optimum thermal transfer from the fluid to sensor. Stainless steel thermowells shall be used for steel pipe and brass thermowells shall be used in copper pipe.

.7 Outdoor temperature sensors shall be Greystone TE200 series, type F or equal having an ABS gasketed cover. A thermal radiation cover shall limit the sensor to solar radiation exposure.

.5 Carbon Dioxide Sensors

.1 Sensors shall Greystone CDD series or equal having the following features:

(1) 0-2000 ppm factory default detection range, field adjustable.
(2) Non-dispersive infrared sensing element with self-calibration algorithm.
(3) Guaranteed 5 year calibration interval.
(4) Powered by either AC or DC source.
(5) Accuracy: within 50 ppm or 3% of reading (whichever is greater).
(6) Operating humidity range: 0-95% RH.
(7) Operating temperature range: 0 to 50°C or greater.
(8) Stability: less than 2% full scale in 15 years
(9) Response time: less than 2 minutes for 90% step change.

.2 Duct mounted sensors shall be complete with ABS enclosure complete with sampling tube.

.3 Space mounted sensors shall be executive space type without LCD display.

.6 VVT System Dampers and Operators

.1 Rectangular dampers shall be Nailor 1010 or equal, parallel blade type complete with blade and edge seals. Use low profile dampers for heights less than 12" (300 mm). Dampers with heights less than 10" (250 mm) shall be single blade.

.2 Round dampers shall be Nailor 1090 or equal complete with blade gaskets and mounting bracket.

.3 Actuators shall be Belimo LMB24-SR-T or equal, proportional control, non-spring return, direct coupled, 24 V for 2-10 VDC or 4-20 mA, 45 in-lb torque, suitable for a maximum damper size of 6 square feet.

.7 Water Control Valves

.1 Heating and cooling control valves shall be Belimo CCV series characterized ball valves, complete with chrome plated brass trim and NPT female pipe connections. Radiation valves shall be complete with non-spring return modulating actuators. Control valves for coils heating a portion of outdoor air shall have spring return modulating actuators.

.2 Control valves shall be sized to provide approximately one half the circuit branch pressure drop to obtain good modulation control but they shall be no smaller than two pipe sizes less than the pipe they are installed in.

.3 Control valves in contact with domestic water (domestic flush valve) shall be Belimo HTCCV high temperature characterized ball valve with stainless steel ball and stem, NPT female pipe connections and TFX24 spring return to closed position actuator.

.8 Differential Pressure sensors

.1 Differential pressure sensors shall be provided for liquid or air differential pressure applications. The differential pressure range shall be selected to match the application. Select materials suitable for the measured variable, i.e.: water or air, and to withstand a minimum of two times the maximum pressure of the highest pressure range.

.2 Each sensor shall be provided with an industry standard, 0 to 10 Vdc output signal mounted at the sensor. The transmitter and sensor shall have a combined accuracy and repeatability of 1.0% of the differential pressure range. A pushbutton zero adjustment shall be provided.

.9 Freezestats

.1 Freezestats shall be complete with a vapour filled 20 foot bulb and 4 foot capillary. Wire freezestats to shut down the respective fans should temperature over any 12 in. of sensor length drop below the adjustable setpoint (2°C). Freezestats shall have manual reset.

3 EXECUTION

.1 Installation

.1 All controllers and components in the system and on the network shall be installed according to manufacturer recommendations, general installation standards for digital controls and in accordance with the approved shop drawings.

.2 Locate room sensors in the locations shown on the mechanical drawings. All sensors shall be mounted at barrier free height (3'-11" (1175 mm) above finished floor).

.3 All control components for off site system access shall be located where noted on the drawings. The Electrical Contractor shall provide all required connections / cabling for off site access to the web access components.

.4 All programmable controllers, web access components, relays and other control components shall be located within control panels. Control Panels shall be wall mounted and shall be located within suspended ceiling spaces or other locations approved by the Consultant.

.5 The Electrical Contractor will provide hand-off-auto switches in all starters controlled by the BAS.

.6 The Electrical Contractor will provide dedicated 120 VAC, 15 ampere power circuits wired to junction boxes on each floor for controls transformers.

.7 The supply of all motorized temperature control dampers complete with actuators shall be by this Section, except for dampers and actuators supplied with packaged air handlers. All dampers shall be installed into the duct system by the HVAC Trade complete with necessary duct transitions, access doors, etc. The Temperature Control Contractor shall be responsible for the actuators and all coordination with the HVAC Contractor.

.8 The supply of all automatic control valves shall be by This Section. All valves shall be installed into the piping system by Plumbing Trade complete with necessary fittings, etc. The Temperature Control Contractor shall be responsible for all coordination with the Plumbing Contractor.

.2 Generally duct mount carbon dioxide sensors shall be used where specified for air handling units; but, for gyms and single zone libraries, a wall mount carbon dioxide sensor shall be mounted next to the room temperature sensor.

.3 All carbon dioxide levels which are measured by the carbon dioxide sensors shall be made available to the Owner in the form of trend logs. Record readings at 10 minute intervals and keep them for at least 30 days.

.4 Freezestats shall be installed so that their sensing element runs horizontally across the coil face (not diagonally) with no more than 12" vertical drops at the outside coil frame. The full face of the coil shall be covered with no horizontal runs being more than 12" apart. The top and bottom horizontal run shall be within 6" of the coil frame. If more than one freezestat is required they shall be wired in series in order to detect a low temperature in portion of the coil. The sensing elements shall be firmly secured in place to avoid vibration without added air restriction.

.5 System Start-up and Acceptance

.1 Upon completion of installation, test, adjust and calibrate controls provided under this Section.

.2 On system completion, a demonstration of complete system operation shall be made to the Owner's authorized representative and Consultant.

.3 The Consultant shall verify through the Owners representatives that the entire system is complete and operating to the satisfaction of the Owner before final acceptance is approved.

.6 Training

.1 The Contractor shall provide competent instructors to give full instruction to designated personnel in the adjustment, operation and maintenance of the system installed rather than a general training course. Instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach. All training shall be held during normal work hours of 8:00 a.m. to 4:30 p.m. weekdays as follows:

.2 Provide 4 hours of training for Owner's operating personnel. Training shall include:

(1) Explanation of drawings, operations and maintenance manuals
(2) Explanation of web access program
(3) Explanation of adjustment procedures
(4) Trend Analysis

.7 Identification

.1 Provide system identification and provide nameplates identifying the following (nameplates shall be keyed to the wiring diagrams):

(1) Duct mounted sensors.
(2) Control panels (identify as to equipment / systems controlled). Each panel shall include an as-built drawing showing all the connected control points.
(3) Identify the emergency ventilation control switch with 'GLOBAL ROOFTOP UNIT CONTROL - VENTILATION LOCKOUT'

.8 Testing and Balancing

.1 During the system testing and balancing by the Testing and Balancing Agency, demonstrate the operation of all controls. During balancing procedures, set controls to a fixed mode (bypass damper locked fully closed and all zone dampers locked fully open) to prevent any changes during the balancing procedure.

.2 To ensure excessive noise is not generated by the VVT systems, the following shall be performed:

(1) For each VVT system, the Test and Balance Agency shall measure the static pressure in the main duct at the location of the bypass damper using a manometer when the system has been stabilized (all zone dampers are full open and the bypass damper is full closed). This information shall be given to the Temperature Control Contractor for verification that the VVT system is properly calibrated.

(2) For each VVT system, 10% of the dampers shall be set to the full open position and 90% shall be set at their minimum position (fully closed). When operating with these damper positions, the static pressure in the main duct at the location of the bypass damper shall again be measured by the Test and Balance Agency using a manometer to ensure it remains at the value measured when in the stabilized mode. This information shall be given to the Temperature Control Contractor for verification that the VVT system is operating correctly and is properly calibrated.

.9 Electrical Wiring

.1 Control transformers for the building automation / VVT temperature control systems shall be supplied and wired by the Temperature Control Trade from 120 V power sources in junction boxes provided by the Electrical Contractor. (At least one at each end of each floor accessible above ceiling tile in a corridor). All low voltage wiring (below 50 V) to the building automation / VVT temperature control systems shall be by the Temperature Control Contractor.

.2 The electrical contractor will rough-in thermostats in new concrete block walls.

.3 All wiring shall be installed to the standards specified in the Electrical Division.

.4 Use Echelon recommended orange jacket cable for all network wiring.

.5 Run all wiring in EMT conduit where exposed, where running within concrete block walls and where required by the Ontario Electrical Code (conduit supplied and installed by the Temperature Control Contractor). Plenum rated cable shall be used in return air ceiling plenums.

.6 Where wiring runs through Corridor suspended ceiling spaces, run in wall hooks where possible. The wall hooks shall be provided by the Electrical Contractor where indicated on the electrical drawings.

.7 Control relays necessary for BAS operation shall be provided by the Temperature Control Contractor but all contactors and their power supplies handling power wiring to the equipment shall be by the Electrical Contractor.

.10 General Requirements for VVT Systems

.1 Each VVT system shall be capable of maintaining an independent setback schedule. If any over-ride pushbutton in the associated system is activated, the complete VVT system shall reset to occupied mode for a pre-set time period. At the end of the override time period, setback mode will resume.

.2 Each zone thermostat shall be capable of maintaining independent comfort setpoints, adjustable by the zone occupants. The upper and lower limits of the permissible setpoint range shall be adjustable by the operator.

.3 When the HVAC unit is not in the heating or the cooling mode, the system shall go to ventilation mode. Ventilation mode is automatically sequenced every 20 minutes to avoid stale air in the space. The duration of ventilation mode is 5 minutes, after which the system resumes heating / cooling mode as required.

.4 Zone damper control shall be proportional modulation, not two- position control. Each zone thermostat shall be capable of initiating a heating or cooling mode. Averaging zone systems are not acceptable.

.5 The pressure control system must display duct static pressure and modulate the bypass damper or supply fan speed to maintain the desired system static pressure. During changeover from heating to cooling or cooling to heating the bypass controller will take control of all dampers in order to purge the duct system of extreme temperature air. Systems that use a time delay during system mode changeover are not acceptable.

4 Sequence of Operation

.1 General:

.1 All setpoints shall be adjustable.

.2 Outdoor air temperature shall be broadcasted to all controllers.

.3 A new outdoor air sensor shall be provided on a different north face and the minimum of this sensor and the original will be used for this building.)

.4 Heating mode: Heating is enabled between October 15 and April 15 or if the outdoor air temperature is below 10°C. This heating mode is used in all controllers for the building.

.5 Cooling Mode: Mechanical cooling is enabled if the outdoor air temperature is above 14°C.

.6 Carbon Dioxide Damper Override: In any air handling system with a return air or room air carbon dioxide sensor, it shall override the minimum position of the outdoor air damper during occupied mode. It shall override the minimum outdoor air damper between 0 and 40 % as the carbon dioxide varies between 1000 and 1200 ppm. All limit controls shall take priority to maintain safe supply air temperatures. An alarm shall be generated if the carbon dioxide level is higher than 1700 ppm or lower than 200 ppm.

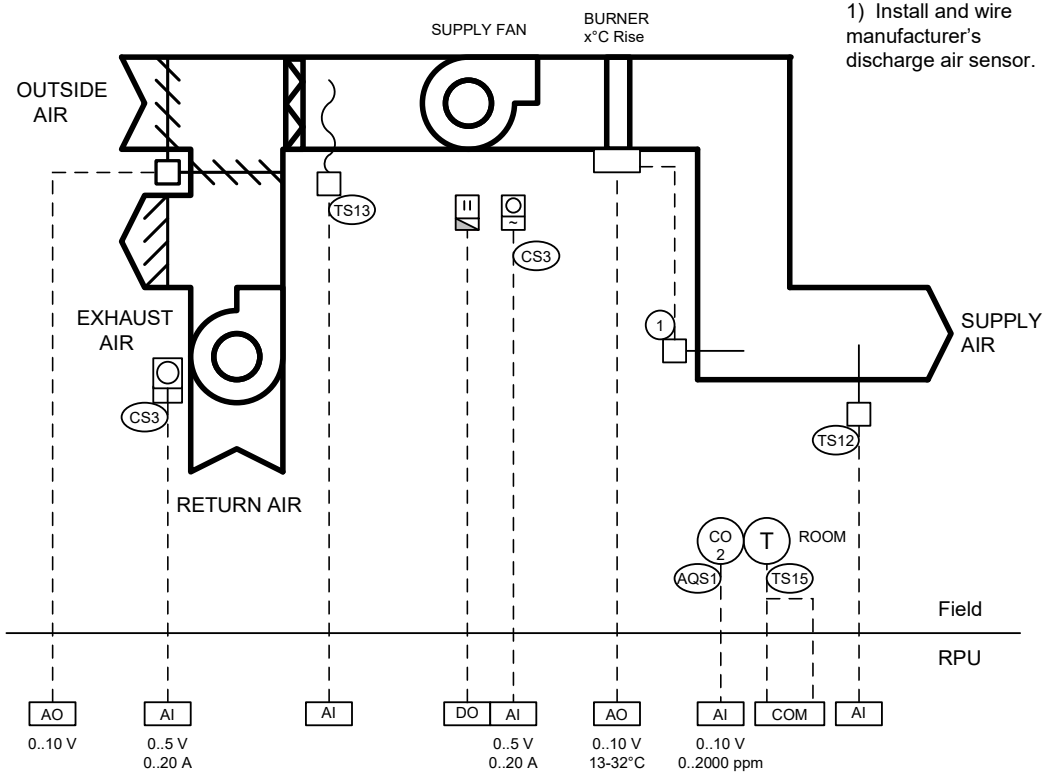
.7 Occupancy mode shall be determined by a weekly schedule with an annual holiday schedule. Each system shall have this schedule but there shall be provision for operating under a general (to the building) schedule as well. An adjustable parameter shall be available to select the local or general schedule for each system.

.8 Lead/lag: Devices designed for lead lag operation shall operate in automatic lead/lag mode to equalize run time. If the lead unit fails the lag shall automatically start and an alarm shall be generated. The lead unit shall be advanced through the series of devices in sequence every Tuesday at noon.

.2 See the graphical sequences at the end of this specification.

END OF SECTION

Gas-Fired Air Handling Unit



Notes
1) Install and wire manufacturer's discharge air sensor.

SEQUENCE OF OPERATION

Unoccupied Mode

The supply fan is off, the mixing dampers are in the 100% recirculation position, and the heating is off. If the space temperature falls below the unoccupied heating setpoint, the system will cycle on to provide heating. If the override pushbutton is pressed, the system will switch to the occupied mode for 2 hours (adjustable).

Occupied Mode

An optimized start routine is provided for heating. During morning warm-up the outside air minimum position is set to zero. The supply and return fans run continuously. The room temperature sensor modulates heating (resets the setpoint of the Eng. Air discharge air controller) in sequence with the mixing dampers (for free cooling) to maintain setpoint. Local setpoint adjust (+/-2°C) is provided.

Limits & Safeties

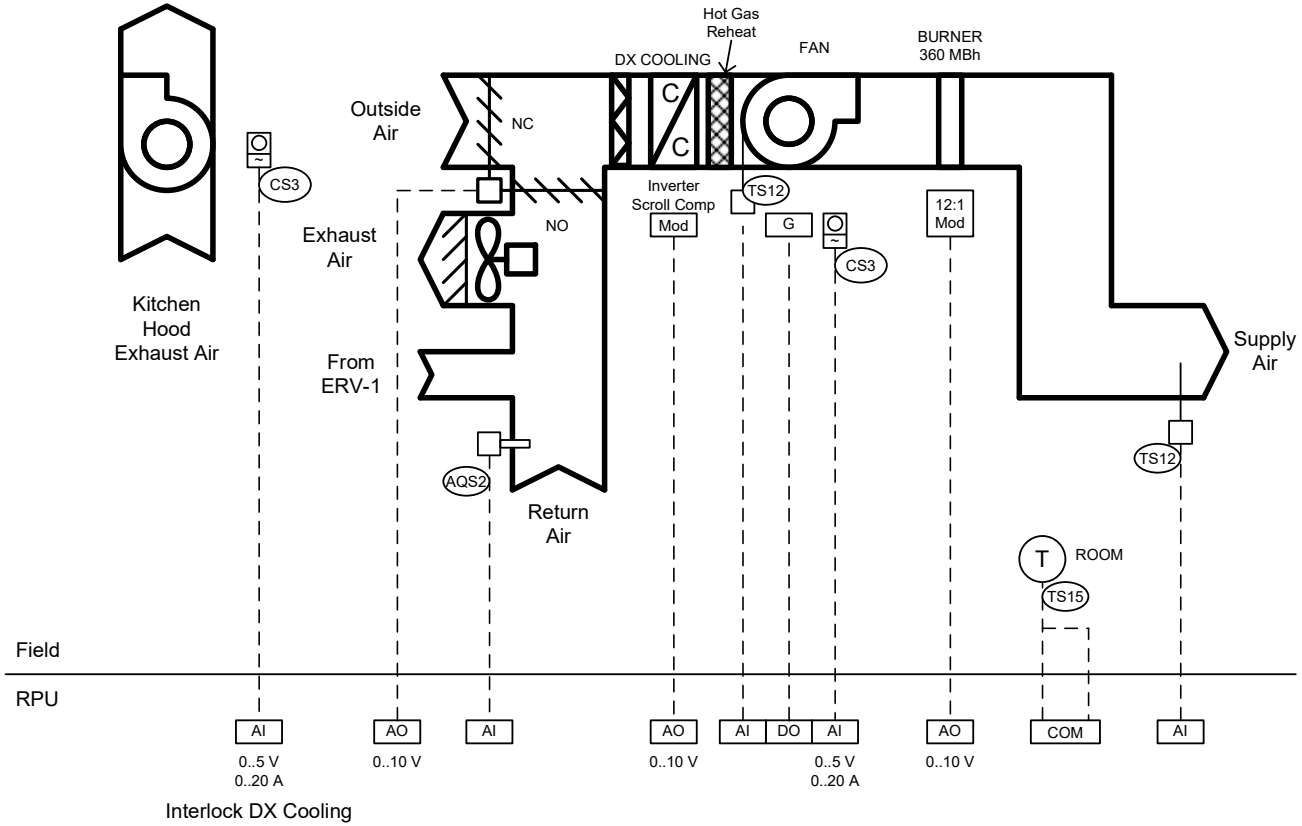
1) If the outside air temperature exceeds the free cooling setpoint, the mixed air dampers return to minimum outside air position.
2) The maximum amount of outside air is limited based on the outside air temperature to prevent excessively low supply air temperatures during startup.
3) The mixed air temperature sensor acts as a low limit to ensure temperature does not fall below setpoint.
4) The unit has an integral low limit auto bypass set at 4.4°C.
5) The unit has a blower delay-on timer.
6) A software freezestat shuts down the system if the supply air temp. falls below -1°C (auto reset, 3 minute delay-on, 5 minute delay-off).
7) The CO2 sensor will increase the amount of minimum outside air as the space CO_2 increases from 800 to 1200 ppm.

Alarms

An alarm will be generated upon the following conditions:
1) Supply or return fan status does not match start/stop signal.
2) Supply air temperature too high (65/55°C) or too low (1/5°C).
3) Space temperature too high (38/36°C) or too low (14/15°C).
4) Mixed air temperature too high (38/36°C) or too low (1/4°C).
5) Fan runtime setpoint exceeded.
6) Software freezestat tripped.
7) CO_2 too high (1800/1700 ppm) or too low (250/300 ppm).

	Job #:	Owner: Waterloo Region District School Board	Drawn By:	Title: **Gym Fan HV-27**	1
	Job Name: Elmira D.S.S. 2021 HVAC Renovations		Revision Date: March 10, 2021		

Single Zone Rooftop Unit



Notes:
1. Locate controllers in the new pump room in the kitchen area by the cafeteria.
2. HVAC-23 & 24 Replaces FC-23, 24 & 25)

Unit	Serves	SA	Fan	# Stages	# Stages	Power	RPU	Notes
		(cfm)	(hp)	Cooling	Heating	Exhaust		
HVAC-23	Cafeteria West	4000	4	2	2	Yes	x	
HVAC-24	Cafeteria East	4000	4	2	2	Yes	x	

	Job #:	Owner: Waterloo Region District School Board	Drawn By:	Title: **Cafeteria Fans**	2
	Job Name: Elmira D.S.S. 2021 HVAC Renovations		Revision Date: March 10, 2021		

SEQUENCE OF OPERATION

Unoccupied Mode

The supply fan is off, the mixing dampers are in the 0% outside air position, the heating is off and the cooling is off. The fan cycles on a call for unoccupied heating. If the override pushbutton is pressed, the system will switch to the occupied mode for 2 hours (adjustable).

Occupied Mode

An optimized start routine is provided for heating and cooling. During morning warm-up or cool-down the outside air minimum position is set to zero. The supply fan runs continuously. The room temperature sensor operates applicable stages of heating to maintain the occupied heating setpoint. It also modulates the mixing dampers (for free cooling) and operates applicable stages of mechanical cooling to maintain the occupied cooling setpoint. Local setpoint adjust (+/-2°C) is provided. The power exhaust fan (if applicable) cycles based on the rooftop economizer position.

Whenever the kitchen exhaust hood fan is on, the DX cooling on the two fans is locked off. Free cooling will still operate if the outdoor conditions are favourable.

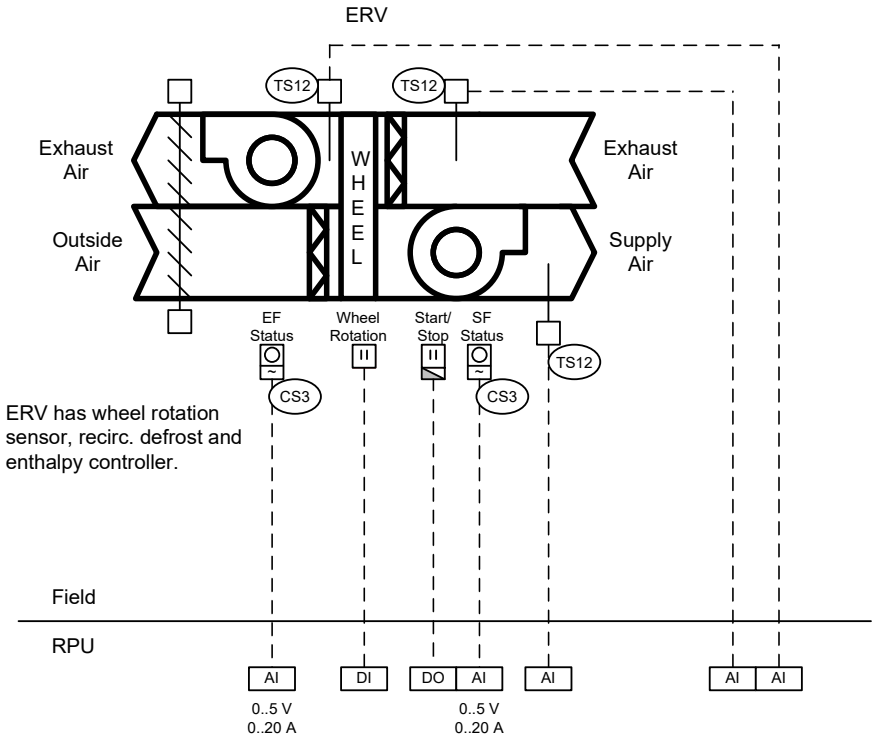
Limits & Safeties

1) Minimum outside air is provided by the energy recovery ventilator when enabled by the global minimum outside air time schedule.
2) The return air carbon dioxide sensor acts to increase the amount of minimum outside air from 0 to 40% as the reading increases from 1000 ppm to 1200 ppm.
3) If the outside air temperature exceeds the global free cooling setpoint (indicating that free cooling is unavailable) the mixing dampers return to minimum outside air position.
4) The maximum amount of outside air is limited based on the outside air temperature to prevent excessively low supply air temperatures during startup.
5) The mixed air temperature sensor acts as a low limit to ensure temperature does not fall below setpoint.
6) The supply air temp. sensor acts as a high limit for heating (58/48°C) and a low limit for cooling (6/11°C, 9/14°C).
7) The supply air temperature sensor acts as a software freezestat (2/5°C, 3 minute delay, auto reset after 5 minute delay).
8) The supply fan has a delay-off time of 90 seconds.
9) Cooling cannot turn on until heating has been off for a minimum of 5 minutes.
10) DX cooling has a minimum off-time of 5 minutes.
11) DX cooling is disabled when the outside air temp. is below the global DX disable setpoint or when the fan is off.
12) During occupied hours heating stage 2 has a delay-on time of 15 minutes, except when the outside air temperature is below -3/-1°C.
13) Gas heating is disabled when the outside air temperature is above the global heating disable setpoint or when the fan is off.
14) When ventilation lockout is engaged the outside air dampers close and the unit switches to unoccupied mode.
15) On a fire alarm condition, the system shuts down.

Alarms

An alarm will be generated upon the following conditions:

1) Fan status does not match start/stop signal.
2) Supply air temperature too high (65/60°C) or too low (5/7°C).
3) Space temperature too high (42/40°C) or too low (14/15°C).
4) Mixed air temperature too high (50/48°C) or too low (5/7°C).
5) Fan runtime exceeded weekly setpoint.
6) Software freezestat tripped.
7) Return air CO_2 too high (1700/1650 ppm) or too low (250/300 ppm).



UNIT	Air Flow	Cook	RPU	Notes
	(cfm)			
ERV-1	1100	ERV-1500	x	Serves HVAC-23 & 24

SEQUENCE OF OPERATION

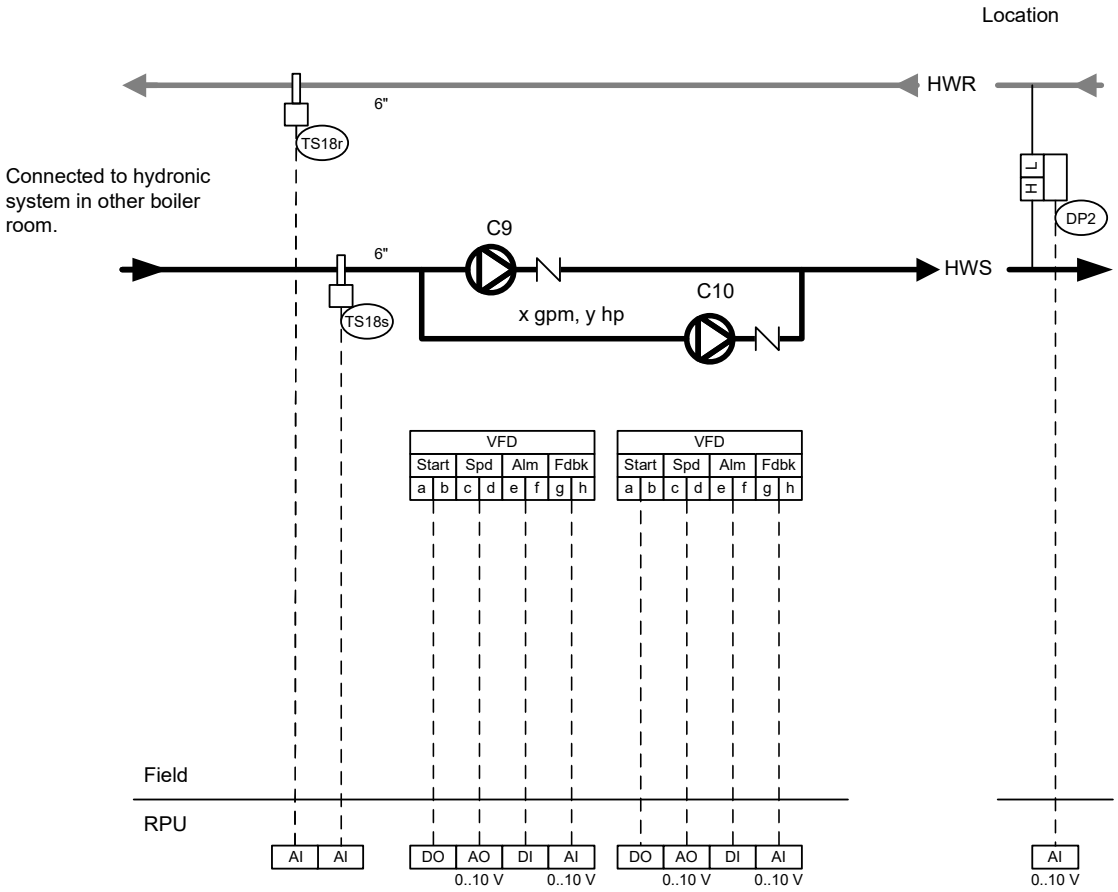
Unoccupied Mode
The exhaust fan is off, supply fan is off, heat wheel is off and the dampers are closed.

Occupied Mode
The supply and exhaust fans run continuously when the associated rooftop unit is operating and the ventilation time schedule is on. The heat wheel operates from internal controls.

Limits & Safeties
1) The unit has internal frost controls (exhaust fan stops, supply fan recirculates air) and enthalpy controller.
2) The supply air temperature sensor acts as a software freezestat (-1/5°C, 3 minute delay, auto reset after 5 minute delay).
3) The fans stop on a fire alarm condition.
4) If the mixed air damper position exceeds 30% outside air, the ERV stops.

Alarms
An alarm will be generated upon the following conditions:
1) Supply fan or exhaust fan in incorrect state.
2) Supply air temperature too high (35/33°C) or too low (1/3°C).
3) Return air temperature too high (40/38°C) or too low (14/15°C).
4) Exhaust air temperature too high (40/38°C) or too low (-10/-8°C)..
5) Fan runtime exceeded weekly setpoint.
6) Wheel rotation in incorrect state.

Single boiler and 4 pumps removed.



SEQUENCE OF OPERATION

When heating is enabled by outdoor air temperature and by calendar, one of the heating pumps (C9 or C10) runs constantly. They run as a lead-lag pair and change their lead designation every week. If the lead pump fails, the lag pump runs. The pump speed modulates to maintain the differential pressure between the supply and return mains at setpoint.

Limits and Safeties

1) The boiler system is shut down when the outside air temperature exceeds the global heating setpoint (2°C deadband).

Between Oct.15 and Apr.15 the boiler system is enabled constantly in case the outdoor air temperature fails and reads high.

Alarms

1) Hot water supply too high (93/88°C) or too low (32/27°C) when heat is enabled.
2) Hot water return too high (85/80°C) or too low (21/26°C) when heat is enabled.
3) Any pump in incorrect mode.
4) Differential pressure too high or too low.
5) VFD in alarm condition.

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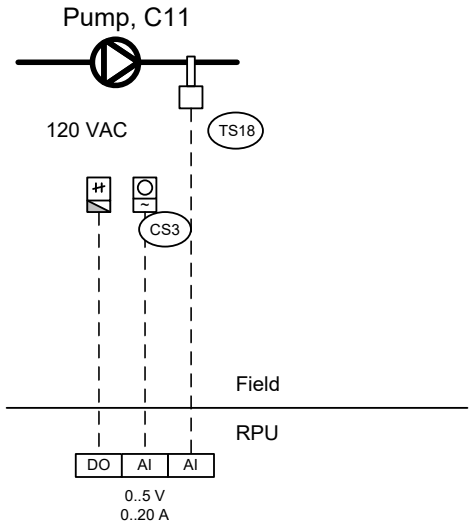
DOMESTIC HOT WATER RECIRCULATION PUMP



SEQUENCE OF OPERATION

The pump operates for 15 minutes prior to occupancy, and when the recirculation temperature falls below setpoint (during occupied periods). An alarm will be generated when the temperature exceeds programmed alarm limits during occupied periods.
An alarm will be generated if the pump status does not match the pump start/stop signal.

1 General

1.01 Summary

.1 Section Includes

.1 Circuit breaker retrofit installations. The existing low voltage switchboard is equipped with low voltage metal enclosed fusible disconnect switchboard structures of an obsolete vintage with little to no product support except unreliable retrofitted replacements, or the available product support is not available in the required device size.

.2 Related Requirements

.1 Section 26 28 16.02 – Molded Case Circuit Breakers.

1.02 References

.1 Execute the work in accordance with the requirements of Ontario Electrical Safety Code, the Canadian Electrical Code, the Ontario Building Code and all Authorities Having Jurisdiction (AHJ).

1.03 Submittals

.1 Provide detailed drawings of planned switchboard modifications after internal survey has been completed.

.2 Submit circuit breaker and accessory submittals in accordance with Section 26 28 16.02.

.3 Submit a detailed Method of Procedures (MOP) document that provides detailed step-by-step instructions for how the work is to be executed.

1.04 Closeout Submittals

.1 Record documentation:

.1 Exact modifications performed to the existing electrical distribution equipment.

.2 Inspection certificate from AHJ.

2 Products

2.01 Molded Case Circuit Breakers

.1 In accordance with Section 26 28 16.02.

.2 Interrupting capacity to match that of the upstream breaker.

2.02 Bussing Kits

.1 Copper, ampacity to match existing.

.2 Provide all accessories required for a complete installation.

3 Execution

3.01 Installers

.1 Installers List

.1 Bibico Electric Inc.

.2 Commercial Switchgear Ltd.

.3 Approved equal.

3.02 Examination

.1 Preparation and Scheduling

.1 Provide 12 weeks notice to Owner's personnel, and to the Consultant, prior to scheduled power shutdown dates.

.2 Shutdown to occur during overnight weekend hours.

.3 Provide power shutdown schedule for approval by the Owner.

.2 Survey of Internal Bussing

.1 During shutdown, survey the existing bussing to confirm available space for connecting the new devices.

.2 Coordinate site visits with circuit breaker vendors.

.3 Check and verify all dimensions on the job site. Exact bus orientation and configuration is to be verified by breaker manufacturer, or its representative.

3.03 Installation

.1 Include under this tender price for bus and bucket modification costs.

.2 Relocate existing branch circuit devices and branch feeders to allow space for new devices.

.3 Modify existing breaker bus to accept new molded case circuit breakers.

.4 Install new circuit breakers as indicated on the drawings.

.5 Make good existing breaker control wiring with new breaker controls. Bring replacement to pre-replacement status.

.6 Make good blank-off plates.

.7 Identify all new equipment. New switchboard branch breakers to be permanently identified with etched lamacoid nameplates in accordance with Section 26 05 53.

3.04 Field Tests and Inspections

.1 Test new devices in accordance with Section 26 28 16.02.

.2 Employ the services of the manufacturer's representative to perform testing, verification and commissioning of new breakers, new bus bar inter-connections and overall integrity of the modified switchboard.

.3 Provide for the costs of the Authority Having Jurisdiction to inspect and accept the work prior to re-energizing the switchboard.

3.05 System Startup

.1 At conclusion of installation, use appropriate arc flash protection during re-energizing of the equipment.

3.06 Cleaning

.1 Before energizing any systems, inspect and clean the inside of switchgears, duct assembly, and cabinets to ensure that they are completely free from dust and debris. Clean all polished, painted and plated work bright. Remove all debris, surplus material, and all tools. Carry out additional cleaning operating of systems as specified in other sections of this division.

End of Section

1 General

1.01 References

.1 Division 00 and Division 01 apply to and are a part of this Section.

1.02 Application

.1 This Section specifies requirements that are common to Mechanical Divisions work Sections and it is a supplement to each Section and is to be read accordingly. Where requirements of this Section contradict requirements of Divisions 00 or 01, conditions of Division 00 or Division 01 to take precedence.

.2 Be responsible for advising product vendors of requirements of this Section.

1.03 Section Includes

.1 Common requirements for electrical work.

.2 Mounting heights for electrical equipment and devices.

1.04 Related Requirements

.1 Provisions of this section apply to all sections of Division 26, Division 27, Division 28, and sections related to electrical utilities in Division 33.

.2 Document 00 64 01 – Request for Electronic Files Form.

.3 Section 07 60 00 – Flashing and Sheet Metal.

.4 Section 07 84 00 – Firestopping.

.5 Section 08 31 00 – Access Doors and Panels.

.6 Section 09 91 00 – Painting.

1.05 Intent

.1 Include all material, labour, equipment, and plant construction as necessary to make a complete installation as shown and specified hereinafter.

.2 Leave complete systems ready for continuous and efficient satisfactory operation.

1.06 Drawings and Specifications

.1 The drawings and specifications are complementary each to the other and what is called for by one to be binding as if called for by both. Should any discrepancy appear between the drawings and specifications, which leaves the Contractor in doubt as to the true intent and meaning of plans and specifications, a ruling is to be obtained from the Consultant in writing before submitting Bid. If this is not done, the maximum, the most expensive alternate or option will be provided in base tender bid.

.2 All drawings and all Divisions of these specifications shall be considered as a whole, and work of this Division shown anywhere therein shall be furnished under this Division.

.3 Drawings are diagrammatic and indicate the general arrangement of equipment and pathways. Most direct routing of conductors and wiring is not assured. Exact requirements are governed by architectural, structural, and mechanical conditions of the job. Consult all other drawings in preparation of the bid. Extra lengths of wiring or addition of pull and junction boxes, etc. necessitated by such conditions are to be included in the bid. Check all information and report and apparent discrepancies before submitting the bid.

.4 Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of pathways so as to best fit the layout of the job.

.5 Scaling off the drawings will not be sufficient or accurate for determining these locations. Where job conditions require reasonable changes in indicated arrangement and locations, such changes shall be made at no additional cost to the Owner.

.6 Because of the scale of the drawings, certain basic items, such as junction boxes, pull boxes, conduit fittings, etc. may not be shown, but where such items are required by other sections of the specifications of where there are required for proper installation of the work, such items are to be furnished and installed.

.7 Before ordering any conduit, cable tray, conductors, wireways, raceway bus duct, fittings, etc., verify all pertinent dimensions at the job site and be responsible for their accuracy.

.8 If obvious ambiguities or omissions are noticed when tendering refer same to the Consultant for a ruling and obtain the ruling in writing in the form of an Addendum. Claims for extras for ambiguities or omission of items brought to the attention of the Consultant after the award of a contract which, due to the nature of the ambiguity or omission, should have been brought to the attention of the Consultant during the tendering period, will not be allowed.

.9 The drawings are performance drawings, diagrammatic, and show locations for apparatus and materials. The drawings are intended to convey the scope of work and do not intend to show Architectural and Structural details. The locations shown are approximate, and may be altered, when approved by the Consultant, to meet requirements of the material and/or apparatus, other equipment and systems being installed, and of the building. Do not scale drawings.

.10 Provide any fitting, offset, transformation, etc., required to suit architectural and structural details but not shown.

1.07 Work Restrictions

.1 Refer to Section 01 14 00.

.2 Existing buildings:

.1 Examine the existing building, the site and surrounding areas and by fully informed as to the conditions and limitations under which the work has to be executed. Claims for additional costs will not be entertained with respect to conditions which could reasonably been ascertained by an inspection prior to Tender closing.

.2 All work in the existing building, other than minor works required to permit construction of the new addition, is to be performed in such a manner as to not disrupt the building operations.

.3 All systems are to be kept in full operation during normal building hours.

.4 Note that any noise generating works that disrupt the building operation shall be coordinated accordingly and carried out after/before normal operating hours.

.5 Cut, modify, or extend as necessary or as directed by the Consultant, the existing material or equipment to be reused or relocated to suit work under this contract.

.6 Existing materials and equipment which are to be used in new work shall be repaired and refinished as necessary. Provide additional new materials and components as required to facilitate reinstallation of such existing materials and equipment.

.7 Co-ordinate with the Owner, and refer to General Conditions.

.8 Do work in existing areas to best suit available space and not interfere with or obstruct use of existing facilities.

.9 Where disruptions of existing services are required, coordinate shut down with the Owner's operating staff and do the work at a time and in a manner mutually acceptable. Carefully schedule disruptions to keep "down time" to a minimum.

.3 Do all cutting, patching and making good to leave in a finished condition and to make the several parts of the Work come together properly. Co-ordinate work to keep cutting and patching to a minimum.

.4 Quality of workmanship and materials used in patching, making good and refinishing of existing construction and/or compartments shall be of a standard equal to that specified for new construction and if not specified, equal to or exceeding that of original existing work.

.5 Prior to cutting openings, examine wall, floor and ceiling construction for buried electrical cables and pipes; and take adequate protection. Conduct cable locating tests to locate buried cables in existing work.

1.08 Allowances

.1 Cash allowances are to be carried as indicated in Division 01 for the items indicated, each including all equipment, wiring material, labour, incidentals, profit, overhead, taxes, etc.

.1 Access Control and Intrusion Detection Systems.

.2 Integrated Telephone/Public Address (PA) System.

.3 Communications structured cabling.

.2 Conduit and wireway rough-in for the above systems is part of this contract, and is excluded from the above allowances.

1.09 Substitution Procedures

.1 Refer to Section 01 25 00 and General Provisions of the Contract.

.2 Where several manufacturers' names are given, the first named manufacturer constitutes the basis for job design and establishes the equipment quality required to be used in this contract.

.3 This contractor, at his option, may use equipment as manufactured by any of the listed manufacturers. This Contractor is responsible to ensure that all items submitted by these other manufacturers meets are requirements of the drawings and specification and fits in the allocated space. The final determination of a product being equivalent is to be determined by the Consultant when a catalog number is not listed, or listed in part.

.4 Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Consultant as described in the General Provisions of the Contract for Submittals. The Contractor bears full responsibility for the unnamed manufacturers' equipment adequately meeting the intent of the design. The Owner or the Consultant may reject manufacture at time of shop drawing submittal.

.5 In addition to manufacturer's products base specified or named as acceptable, other manufacturers of products may be proposed as substitutions to Consultant for review and consideration for acceptance, listing in each case a corresponding credit for each substitution proposed. However, base Bid Price on products base specified or named as acceptable. Certify in writing to Consultant that proposed substitution meets space, power, design, energy consumption, and other requirements of base specified or acceptable product. It is understood that there will be no increase in Contract Price by reason of any changes to associated equipment, mechanically, electrically, structurally or architecturally, required by acceptance of proposed substitution. Consultant has sole discretion in accepting any such proposed substitution of product. Do not order such products until they are accepted in writing by Consultant.

1.10 Contract Modification Procedures

.1 When submitting quotations in response to changes in the contract, quotations for electrical work are to include a breakdown of all material, including material unit rates, and labour units as indicated in the NECA Manual of Labor Units (MLU).

1.11 Coordination

.1 Refer to Section 01 31 00.

.2 Coordinate work with other trades to avoid conflict and to provide correct rough-in and connection for equipment furnished under other trades that require electrical connection. Inform Contractors of other trades of the required access to and clearances around electrical equipment to maintain serviceability and code compliance.

.3 Verify equipment dimensions and requirements with provision specified under this Section. Check actual job conditions before fabricating work. Report necessary changes in time to prevent needless work. Changes or additions subject to additional compensation, which are made without written authorization and an agreed price, shall be at Contractor's risk and expense.

.4 Read specifications and drawings of other trades and conform with their requirements before proceeding with any work specified in this Division related to other trades. Co-operate with all other trades on the job, so that all equipment can be satisfactorily installed, and so that no delay is caused to any other trades.

.5 Coordinate utility service outages with the owner. Obtain permission from Owner at least 24 hours before partially or completely disabling system. Minimize outage duration.

.6 [Existing Fire Alarm System: Maintain existing system in service. Disable system only to make switch overs and connections. Notify Owner at least 24 hours before partially or completely disabling system. Minimize outage duration.]

.7 [Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.]

.8 Co-ordinate work with all trades to ensure a proper and complete installation. Notify all trades concerned of the requirement for openings, sleeves, insets and other hardware necessary for the installation and, where work is to be integrated with the work of other trades or is to be installed in close proximity with the work of other trades, carefully co-ordinate the work prior to installation.

.9 Working Detail Drawings

.1 The contractor is to prepare working detail drawings supplementary to the contract drawings, when deemed necessary by the Consultant, for all areas where a multiplicity of materials and or apparatus occur, or where the work due to architectural and structural considerations involves special study and treatment. Such drawings may be prepared jointly by all trades affected, or by the one trade most affected with due regard for and approval of the other trades, all as the Consultant will direct in each instance. Such drawings must be reviewed by the Consultant before the affected work is installed.

.2 Carry out all alterations in the arrangement of work which has been installed without proper study and approval, even if in accordance with the contract documents, in order to make such work come within the finished lines of walls, floors and ceilings, or to allow the installation of other work, without additional cost. In addition, make any alterations necessary in other work required by such alterations, without additional cost.

1.12 Submittal Procedures

.1 Refer to Section 01 33 00.

.2 Before delivery to site of any item of equipment, submit shop drawings complete with all data, pre-checked and stamped accordingly, for review by the Consultant. Indicate project name on each brochure or sheet, make reference to the number and title of the appropriate specification section, type identifier such panelboard ID or luminaire type as indicated on appropriate schedule, and provide adequate space to accommodate the Consultant's review stamp(s).

.3 Verify field measurements and affected adjacent Work are coordinated, including passageway clearances for movement of equipment into location.

.4 Submit shop drawings to the Consultant in electronic (PDF) format, as coordinated after award of contract. Where submittals are derived from digital originals, do not print and rescan documents; submittals made as such will be immediately rejected.

.5 Submit a schedule of shop drawings within one week after award of contract. Group submittals by specification division as appropriate.

.6 Shop Drawings

.1 Submit for review, properly identified shop drawings showing in detail the design and construction of all equipment and materials as requested in sections of the specification governed by this Section.

.2 Obtain and comply with the manufacturer's installation instructions.

.3 Endorse each shop drawing copy "CERTIFIED TO BE IN ACCORDANCE WITH ALL REQUIREMENTS", stamp each copy with your company name, date each copy with the submittal date, and sign each copy. Shop drawings which are received and are not endorsed, dated and signed will be returned for re-submittal.

.4 The Consultant will stamp shop drawings as follows:

.1 Reviewed ( )

.2 Reviewed as Modified ( )

.3 Revise and Re-Submit ( )

.4 Not Reviewed ( )

.5 If "REVIEWED" is checked-off, the shop drawing is satisfactory. If "REVIEWED AS MODIFIED" is checked-off, the shop drawing is satisfactory subject to requirements of remarks put on shop drawing copies. If "REVISE AND RE-SUBMIT" is checked-off, the shop drawing is entirely unsatisfactory and must be revised in accordance with comments written on shop drawing copies and resubmitted. If "NOT REVIEWED" is checked-off, the shop drawing is in error of submission, not applicable for this project.

.6 This review by the Consultant is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that the Consultant approved the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor, and such review shall not relieve the Contractor of responsibility for errors or omissions in the shop drawings or of responsibility for meeting all requirements of the contract documents. Be responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation, and for co-ordination of the work as well as compliance with codes and inspection authorities such as CSA, etc.

1.13 Safety Requirements

.1 Refer to Section 01 35 29.

.2 Be responsible for the safety of workers and the equipment on the project in accordance with all applicable safety legislation passed by Federal, Provincial, and local authorities governing construction safety. The more stringent regulations prevail.

1.14 Regulatory Requirements

.1 Refer to Section 01 41 00.

.2 Codes and Standards

.1 Ontario Electrical Safety Code including all bulletins and amendments.

.2 Ontario Building Code and its referenced standards.

.3 Applicable CSA and ULC standards.

.4 [All work shall be in accordance with Owner's Design Guidelines.]

.3 Permits and Fees

.1 Obtain and pay for all permits and fees required for the execution and inspection of the electrical work and pay all charges incidental to such permits. Submit to Electrical Inspection Department and Supply authority necessary number of drawings and specifications for examination and approval prior to commencement of work. Arrange and pay for any special inspection of equipment specified if and when required.

.2 Apply, pay and obtain all permits as required for the electrical work.

.3 Upon substantial completion of your work, supply and turn over to the Consultant all required inspection certificates from governing authorities to certify that the work as installed conforms to the rules and regulations of the governing authorities.

.4 Patents

.1 Pay all royalties and licence fees, and defend all suits or claims for infringement of any patent rights, and save the Owner, Architect, Project Manager and Consultants harmless of loss or annoyance on account of suit, or claims of any kind for violation or infringement of any letters patent or patent rights, by this Subcontractor or anyone directly or indirectly employed by him or by reason of the use by him or them of any part, machine, manufacture or composition of matter on the work, in violation or infringement or such letters patent or rights.

1.15 References

.1 CSA Group

.1 CSA C22.1-18, Canadian Electrical Code, Part 1 (24th Edition), Safety Standard for Electrical Installations.

.2 CSA C235:19, Preferred voltage levels for AC Systems up to 50 000 V.

.3 Do underground systems in accordance with CSA C22.3 No. 7-15, Underground systems, except where specified otherwise.

.4 Ontario Electrical Safety Code (27th edition/2018), and all bulletins.

.2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)

.1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.

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

.1 Material Safety Data Sheets (MSDS).

.4 Electrical utility requirements and local applicable codes and regulations.

.5 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)

.1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

.6 2012 Ontario Building Code.

1.16 Definitions

.1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

1.17 Quality Assurance

.1 Refer to Section 01 43 00.

.2 The specifications contained herein are set forth as the minimum acceptable requirements. This does not relieve the Contractor from executing other quality assurance measures to obtain a complete operating system within the scope of this project.

.3 Ensure that all workmanship, all materials employed, all required equipment and the manner and method of installation conforms to accepted construction and engineering practices, and that each piece of equipment is in satisfactory working condition to satisfactorily perform its functional operation.

.4 Provide quality assurance tests and operational check on all components of the electrical distribution system, all lighting fixtures, and communication systems.

.5 Only first class workmanship will be accepted, not only in regards to durability, efficiency and safety, but also in regards to neatness of detail. Present a neat and clean appearance on completion to the satisfaction of the Consultant. Any unsatisfactory workmanship will be replaced at no extra cost.

.6 Conform to the best practices applicable to this type of work. Install all equipment and systems in accordance with the manufacturer's recommendations, but consistent with the General Requirements of this specification. Electrical Contractor will be held responsible for all damage to the work of his own or any other trade, resulting from the execution of his work. Store all electrical equipment and materials in dry locations.

.7 Provide foreman in charge of this work at all times.

.8 The contractor shall be fully liable to provide and maintain in force during the life of this Contract, such insurance, including Public Liability Insurance, Product Liability Insurance, Auto Liability Insurance, Worker's Compensation, and Employer's Liability Insurance.

.9 Governing Federal, Provincial and Municipal codes and regulations will be considered minimum standards for the work and where these are at variance with the drawings and specification, the more stringent ruling will apply.

.10 Where any code, regulation, bylaw, or standard is quoted it shall mean the current edition including all revisions or amendments at the time of the tender.

.11 In case of conflict, the codes and regulations take precedence over the Contract Documents. In no instance reduce the standard or scope of work or intent established by the drawings and specifications by applying any of the codes referred to herein.

1.18 Quality Control

.1 Refer to Section 01 45 00.

.2 Provide a full time Superintendent to oversee and coordinate all sub-trades in these divisions.

1.19 Temporary Utilities

.1 Refer to Section 01 51 00.

.2 Do not use any of the permanent facility systems during construction except as may be specified, or unless written approval is obtained from the Consultant.

.3 The use of permanent facilities for temporary construction service will not affect in any way the commencement day of the warranty period.

.4 Temporary heating during the construction period will be provided as described in Division 01.

1.20 Temporary Facilities and Controls

.1 Refer to Section 01 56 00.

.2 Prior to start of each work period in occupied area, install temporary protection to prevent damage to any personal property or furnishing. Coordinate with Owner's representative if any furniture must be relocated to facilitate work.

.3 [Submit temporary protection plan to Owner's Representative for approval prior to use.]

.4 Take necessary steps to ensure that required firefighting apparatus is accessible at all times. Flammable materials shall be kept in suitable places outside the building.

1.21 Product Requirements

.1 Refer to Section 01 61 00.

.2 The design, manufacture and testing of electrical equipment and materials shall conform to or exceed the latest applicable CSA, IEEE, and ANSI standards.

.3 All materials must be new and be ULC or CSA listed. Any materials not covered by the aforementioned listing standards shall be tested and approved by an independent testing laboratory, Technical inspection Services, or other government agency.

.4 Materials and equipment are specifically described and named in this Specification in order to establish a standard of material and workmanship.

.5 Materials required for performance of work shall be new and the best of their respective kinds and of uniform pattern throughout work.

.6 Materials shall be of Canadian manufacture where obtainable. Materials of foreign manufacture, unless specified, shall be approved before being used.

.7 Equipment items shall be standard products of approved manufacture. Identical units of equipment shall be of same manufacture. In any unit of equipment, identical component parts shall be of same manufacture, but the various component parts comprising the unit need not be of one manufacture.

.8 Chemical and physical properties of materials and design performance characteristics and methods of construction and installation of items of equipment, specified herein, shall be in accordance with latest issue of applicable Standards or Authorities when such are either mentioned herein, or have jurisdiction over such materials or items of equipment.

.9 Materials shall bear approval labels as required by Code and/or Inspection Authorities.

.10 Install materials in strict accordance with manufacturer's recommendations.

.11 Include items of material and equipment not specifically noted on Drawings or mentioned in Specification but which are necessary to make a complete and operating installation.

.12 Remove materials, condemned as not approved for use, from job site and deliver and install suitable approved materials in their place.

.13 Unless otherwise noted, equipment and material specifications in Sections of the Specification governed by this Section are based on products of a manufacturer selected by the Consultant for the purpose of setting a standard of quality, size, performance, capacity, appearance and serviceability.

.14 In most instances the names of acceptable manufacturers are also stated for materials and equipment, and you may base your tender price on equipment and materials produced by either the specified manufacturer or a manufacturer listed as acceptable.

.15 For any items of equipment, material, or for any system where acceptable manufacturers are not stated, you must provide only the equipment, material or system specified.

.16 If materials or equipment manufactured and/or supplied by a manufacturer named as acceptable are used in lieu of products of the manufacturer specified, be responsible for ensuring that the substituted material or equipment is equivalent in size, performance and operating characteristics to the specified materials or equipment, and it shall be understood that all costs for larger starters, additional space, larger power feeders, and changes to associated or adjacent work required as a result of providing materials and equipment named as acceptable in lieu of the specified product will be borne by Contractor.

.17 In addition to the manufacturers specified or named as acceptable, the Contractor may propose alternative manufacturers of equipment and/or apparatus to the Consultant for acceptance, listing in each case a corresponding credit for each alternative proposed, however, the tender price must be based on apparatus or materials specified or named as acceptable. Certify in writing to the Consultant that the alternative meets all space, power, design, and all other required of the specified or equivalent material or apparatus. In addition, it shall be understood that all costs for larger starters, space, power feeders, and changes to associated equipment, mechanical and/or electrical, required by acceptance of proposed alternatives, will be borne by the party making the proposal. Alternative equipment requiring greater than specified energy requirements or unduly limiting service space requirements will not be accepted.

.18 Where a manufacturer is not listed for a particular product, it will be deemed to mean that the contractor will provide the specified manufacturer's product.

1.22 Examination and Preparation

.1 Refer to Section 01 71 00.

.2 Examine the existing equipment, the site and surrounding areas and be fully informed as to the conditions and limitations under which the work has to be executed. Claims for additional costs will not be entertained with respect to conditions which could reasonably have been ascertained by an inspection prior to Tender closing.

.3 Examine work upon which your work depends. Report in writing defects in such work. Application of your work shall be deemed acceptance of work upon which your work depends.

.4 Drawings are, in part, diagrammatic and are intended to convey scope of work and indicate general and approximate location, arrangement and sizes of equipment, piping, and similar items. Obtain more accurate information about locations, arrangement and sizes from study and coordination of drawings, including shop drawings and manufacturers' literature and become familiar with conditions and spaces affecting these matters before proceeding with work.

.5 Where job conditions require reasonable changes in indicated locations and arrangements, make such changes with approval of the Consultant at no additional cost to the Owner. Similarly, where existing conditions interfere with new installation and require relocation, such relocation is included in work.

1.23 Cutting and Patching

.1 Refer to Section 01 73 00.

.2 The Electrical Contractor will be responsible for all cutting and patching required for the electrical installation. Structural members are not to be cut without the consent of the Consultant.

.3 All cutting and patching required under Division 26, Division 27, and Division 28 shall be in accordance with Division 01. Layout such work for approval before undertaking same.

.4 Cutting shall be kept to an absolute minimum and performed in a neat and workmanlike manner using the proper tools and equipment. Caution shall be exercised in all cutting and procedures to ensure that concealed services are not affected. Do not cut if in doubt. Request Consultant's presence to determine if concealed services exist.

.5 Assume responsibility for prompt installation of Work in advance of concrete pouring or similar Work. Should any cutting or repairing of finished/unfinished Work be required because such installation was not done, employ the particular trade, whose Work is involved, to do such cutting and patching. Pay for any resulting costs. Layout such Work for approval before undertaking same.

1.24 Cleaning and Waste Management

.1 Refer to Section 01 74 00.

.2 The Contractor and associated sub trades, at all times during construction, to keep the site free of all debris, boxes, packing, etc., resulting from work of this trade. At the completion of this work, the electrical installation is to be left in a clean and finished condition to the satisfaction of the Consultant.

.3 Clean and repair existing materials and equipment which remain or are to be reused.

.4 Luminaires to be reinstalled: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts and broken electrical parts.

.5 Assume responsibility for removing tools and waste materials on completion of Work, and leave Work in clean and perfect condition.

1.25 Starting and Adjusting

.1 Refer to Section 01 75 00.

.2 Conduct acceptance tests to demonstrate that the equipment and systems actually meet the specified requirements. Tests may be conducted as soon as conditions permit, and consequently make all changes, adjustments, or replacements required as the preliminary tests may indicate prior to the final tests. Tests shall be as specified in various sections of this Division. Carry out tests in the presence of the Consultant. Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project. The Electrical Contractor shall be in charge of the plant during tests. He shall assume responsibility for damages in the event of injury to the personnel, building, equipment, and shall bear all costs for liability, repairs, and restoration in this connection. Submit test results.

.3 Make tests of equipment and wiring at times requested.

.4 Tests shall include meggered insulation values, voltage and current readings to determine balance of panels and feeders under full load, and operation of each piece of equipment for correct operation.

.5 Supply meters, materials and personnel as required to carry out these tests.

.6 Test electrical work to standards and function of Specification and applicable codes in an approved manner. Replace defective equipment and wiring with new material and leave entire system in complete first class operating condition.

.7 Connect single phase loads so that there is the least possible unbalance of the supply phases.

.8 Submit all test results in report format.

.9 Trial Usage

.1 The Consultant reserves the right to use any system, piece of equipment, device, or material for such reasonable lengths of time and at such times as may be required to make a complete and thorough test of the same, or for the purpose of learning operational procedures, before the final completion and acceptance of the work. Such tests shall not be construed as evidence of acceptance of the work, and it is agreed and understood that no claim for damage will be made for injury or breakage to any part or parts of the above due to the aforementioned tests, where such injuries or breakage are caused by a weakness or inaccuracy of parts, or by defective materials or workmanship of any kind. Supply all labour and equipment required for such tests.

.2 Perform and pay for all costs associated with any testing required on the system components where, in the opinion of the Consultant the equipment manufacturer's ratings or specified performance is not being achieved.

1.26 Closeout Procedures

.1 Refer to Section 01 77 00.

.2 The Consultant will carry out inspections and prepare deficiency list for action by the Contractor, during and on completion of project.

.3 Furnish a Certificate of Acceptance from Inspection Department on completion of work.

1.27 Closeout Submittals

.1 Refer to Section 01 78 00.

.2 Project Record Documents

.1 Extra sets of white prints will be provided on which to make, as the job progresses, all approved changes and deviations from the original drawings. Complete Record Drawings accurately marked up in red ink must be submitted for approval before the contract is considered to be completed.

.2 Changes and deviations include those made by addenda, change orders, and supplemental instructions, and changes and deviations to be marked on the white print record drawings indicated on supplemental drawings issued with addenda, change orders, and supplemental instructions. Maintain the "as-built" white prints at the site for periodic inspection by the Consultant throughout the duration of the work.

.3 Upon substantial completion of the work, obtain a set of reproducible white prints of the drawings and neatly amend the print in accordance with the marked-up white prints to produce a true "as-built" set of drawings.

.4 As-built drawings are to indicate all circuiting as installed and all distribution junction box locations as well as conduit routes.

.5 Trace routing of existing panelboard feeders for all panelboards and indicate on as-built drawings.

.6 As-Built AutoCAD Drawings

.1 Submit completed Document 00 64 01 to the Consultant, and remit payment as indicated for release of Consultant's AutoCAD files.

.2 Request CAD release form from Consultant, and submit back to Consultant.

.3 Transfer the information from the "as-built" white prints to the files, and submit to the Consultant for review.

.4 Employ a competent computer draftsperson to indicate changes on the electronic set of record drawings. Provide drawings in PDF and AutoCAD formats.

.5 Submit three (3) USB flash drives including as-built drawings in AutoCAD format, one with each O&M manual.

.6 Provide three (3) sets of full size as-built drawings in hard copy format, one with each O&M manual.

.7 As-built Single Line Diagram

.1 Provide in Main Electrical Room one wall mounted copy of as-built Single Line Diagram on 6 mm (1/4 in) foam board.

.2 As-built Single Line Diagram to indicate manufacturer name and catalogue numbers of as-installed products.

.3 Operations and Maintenance (O&M) Data

.1 Submit two complete sets of Operation and Maintenance instruction manuals in hard copy, and one in electronic format. Include in each copy of the manual:

.1 Verification certificates for installation of life safety systems by the manufacturer's representative.

.2 A copy of "reviewed" shop drawings.

.3 Complete explanation of operating principles and sequences.

.4 Recommended maintenance practices and precautions.

.5 Complete wiring and connection diagrams.

.6 Certificates of guarantees.

.2 Ensure that operating and maintenance instructions are specific and apply to the model and types of equipment provided.

.3 Include attendance records for each training session in the O&M manual.

.4 Warranties

.1 Submit a written guarantee to the Owner for one year from the date of acceptance. This guarantee shall bind the contractor to correct, replace or repair promptly any defective equipment workmanship without cost to the Owner.

.2 All equipment, materials and workmanship shall be unconditionally guaranteed for a minimum period of one year from the date of acceptance.

.3 Provide warranty certificates, wherever given or required, in excess of the normal warranty period showing the name of the firm giving the warranty, dated and acknowledged, on specific equipment and systems.

.4 Warranties for temperature controls and building automation systems will start on the date of verification of acceptance by the Consultant.

.5 Include these certificates with the maintenance and operating manuals in the appropriate sections.

2 Products – Not Used

3 Execution

3.01 Demolition

.1 Refer to Division 02 and Section 26 05 05.

.2 Remove all electrical equipment and devices on redundant structures. Make safe all circuits, and provide continuity of remaining circuits.

.3 To make safe: Withdraw redundant wiring and remove unwanted conduit/wiring and accessories. Position breakers to OFF position and update panel schedules.

.4 Make safe any redundant mechanical devices as shown on mechanical drawings.

.5 Maintain continuity of existing services for other circuits/devices serving areas outside the Work area. Provide additional wiring/conduits/boxes etc. to suit existing services to be maintained and also implement new Work as detailed.

.6 Allow for this work in Tender Price.

.7 Turn over designated equipment to the Owner. Dispose of unwanted materials and equipment.

3.02 Concrete Work

.1 Refer to Division 03 – Concrete.

.2 Provide all concrete work required for the electrical work. Reinstall surfacing as per architectural requirements.

.3 Provide a 100 mm (4 inch) high concrete housekeeping pad for floor mounted electrical distribution equipment, such as the following:

.1 Transformers.

.2 Switchgear and switchboards.

.3 Distribution panelboards.

.4 Engine Generators.

.5 Uninterruptible Power Supplies and batteries.

.6 Transfer Switches.

3.03 Lintels

.1 Refer to Division 04 – Masonry.

.2 Lintels for openings in masonry shall conform with requirements of by-laws, and as approved by the Structural Engineer.

.3 Pay all costs for lintels over openings, required solely by the electrical trades, not shown on architectural or structural drawings.

3.04 Metals

.1 Refer to Division 05 – Metals.

.2 Steel construction required solely for the work of this trade, and not shown on architectural or structural drawings shall be provided by this Division to the requirements of Division 05.

3.05 Flashing and Sheet Metal

.1 Refer to Section 07 60 00.

.2 Flash all conduits and systems passing through roof or built into an outside wall, or a waterproof floor.

.3 Provide copper flashing for sleeves passing through exterior walls or waterproof floors.

3.06 Firestopping

.1 Provide firestopping in accordance with Section 07 84 00.

.2 Ensure that fire ratings of floors and walls are maintained.

.3 Provide ULC classified firestopping products by 3M or Hilti which have been tested in accordance with CAN4-S115.

.4 Pack clearance spaces, fill all spaces between openings, pipes and ducts passing through fire separations and install firestopping systems in accordance with the appropriate ULC system number for the products and type of penetration.

.5 Install firestopping systems using personnel trained or instructed by the product manufacturer.

3.07 Access Doors

.1 Provide access doors in accordance with Section 08 31 00.

.2 Group conduit work to ensure the minimum number of access doors is required.

.3 Access doors are to be installed by the trade responsible for the particular type of construction in which the doors are required.

3.08 Painting and Finishes

.1 Refer to Section 09 91 00.

.2 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.3 Repair and finish factory finished equipment, damaged or scratched during installation, in an approved manner.

.4 All structural steel including hangers, brackets, supports and other ferrous metals shall be shop or factory prime painted wherever practicable. Wherever structural steel including hangers, brackets, supports, and other ferrous metals cannot be shop or factory prime painted, wire brush to remove all traces of rust, clean of all traces of dirt, oil, and grease, and apply one coat of an approved rust inhibiting primer in accordance with CGSB-GB-40d, and leave ready to receive finish paint.

.5 Primary and final painting for Work, other than items specified as factory primed or finished, will be performed as described in Division 09 – Finishes.

.6 All electrical fittings, supports, hanger rods, pull boxes, channel frames, conduit racks, outlet boxes, brackets, clamps etc., to have galvanized finish or paint finish over corrosion-resistant primer.

.7 All panelboards, motor starters etc., to be factory finished with baked on enamel. All enamel to be baked on gloss over corrosion resistant primer.

.8 Touch up minor damage to finish on factory finished equipment. Items suffering major damage to finish shall be replaced at the direction of the Consultant.

.9 Protect work so that finishes will not be damaged or marred during construction. Maintain the necessary protection until completion of the work.

.10 Provide all exposed ferrous metal work on equipment with at least one factory prime coat, or paint one prime coat on job. Clean up or wire brush all equipment, etc., before painting.

.11 For factory applied finishes, repaint or refinish surfaces damaged during shipment, erection or construction work.

3.09 Location of Outlets

.1 Refer to Architectural drawings for dimensions denoting exact locations.

.2 The Consultant reserves the right to change the location of outlets to within 3 m from the point indicated on the plans without extra charge providing the Contractor is advised before installation is made.

.3 Location of lighting, convenience, telephone, power and communication outlets shall be subject to change, without extra cost to Owners, provided information is given prior to installation. No extra amount will be paid for extra labour and materials for relocating outlets up to 3000 mm from their original location nor will credits be anticipated where relocation up to 3000 mm reduces materials and labour. Other cases will be considered on their individual merits.

.4 Coordinate location of boxes with latest architectural drawings and instructions to suit door swings, millwork etc. prior to rough-in.

3.10 Mounting Heights and Device Locations

.1 Refer to architectural drawings for exact location of electrical equipment and devices.

.2 Architectural elevations take precedence over electrical elevations. If there are conflicts between architectural and electrical, adjust locations of electrical equipment at no additional cost to the owner.

.3 Prior to roughing-in, the contractor is to mark locations of electrical equipment and devices for conflicts with architectural, studs, etc. If conflicts are noted, inform the consultant for a decision prior to commencing the rough-in.

.4 Mounting heights of equipment and devices listed below is from finished floor to centreline of equipment, unless specified or indicated otherwise.

.5 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.6 Install electrical equipment at following heights above finished floor (AFF). Dimensions are to centre of device unless indicated otherwise.

.1 Power door operator push buttons: 1000 mm.

.2 HVAC thermostats and manual HVAC controls: 1200 mm.

.3 Local switches, and manual lighting control devices:

.1 1100 mm.

.2 Locate on lock side of door.

.4 System furniture service fittings: to suit furniture layout.

.5 Wall receptacles:

.1 General: min. 400 mm AFF.

.2 Above top of counters: 175 mm.

.3 Above top of continuous baseboard heater, or mechanical heating/radiation units: 75 mm to bottom of device.

.4 In fan rooms, mechanical rooms, and electrical rooms: 1100 mm.

.6 Outlets in raceways or millwork to be located as per Architectural details.

.7 Door bell pushbuttons: 1100 mm.

.8 Panelboards: as indicated in Section 26 24 16.

.9 Emergency lighting remote heads: 300 mm below finished ceiling, or 2400 mm AFF for exposed areas or areas with ceiling height above 2750 mm (9 feet).

.10 Communications:

.1 Typical communication outlets (voice and data): 400 mm.

.2 Communications outlets for wall mounted telephones, intercom, or similar: 1100 mm.

.3 Television outlets: 200 mm below finished ceiling.

.4 Wall mounted public address speakers: 2100 mm.

.5 Clocks: 2100 mm.

.11 Access control card readers and keypads: 900 mm.

.12 Fire alarm manual pull stations: 1200 mm.

.13 Wall mounted fire alarm audible devices, including bells or horns:

.1 2300 mm to the top of the device in areas of ceiling height 2450 mm or greater.

.2 150 mm below the finished ceiling for ceiling heights less than 2450 mm, measured to the top of the device.

.14 Wall mounted fire alarm visible signal devices, including strobes: 2300 mm.

.15 Fire Alarm emergency telephones: 1400 mm.

3.11 Manufacturer's Instructions

.1 Where the specifications call for an installation to be made in accordance with Manufacturer's recommendations, a copy of such recommendations shall be at all times be kept on the job site and be available to the Owner's Representative.

.2 Follow manufacturer's instructions where they cover points now specifically indicated on the drawings and specifications. If they are in conflict with the drawings and specifications obtain clarification from the Consultant before starting work.

3.12 Tests and Acceptance

.1 The operation of the equipment and electrical system does not constitute an acceptance of the work by the Owner. The final acceptance is to be made after the Contractor has adjusted his equipment and demonstrated that it fulfills the requirements of the drawings and the specifications.

.2 Testing of all systems shall be performed in the presence of the Owner's designated representative. The contractor shall give 72 hours advance notice to the Owner before beginning the tests.

.3 Upon completion of the installation, the Contractor shall furnish certificates of approval from all authorities having jurisdiction, as applicable. Contractor shall demonstrate that work is complete and in perfect operating condition, with raceway and conduit systems properly grounded, wiring free from grounds, shorts, and that the entire installation is free for any physical defects.

3.13 Closeout Activities

.1 Refer to Section 01 79 00.

.2 In the presence of the Owner, demonstrate the proper operation of all systems.

.3 Instruct the Owner's designated representatives in all aspects of the operation and maintenance of systems and equipment listed in the trade sections governed by this Section. Obtain in writing from the Consultant a list of the Owner's representatives qualified to receive instructions.

.4 Arrange for and pay for the services of qualified service technicians and other manufacturer's representatives required for instruction of specialized portions of the installation.

End of Section

1 General

1.01 Section Includes

.1 Work in existing facilities.

.2 Electrical demolition.

1.02 Related Requirements

.1 Section 02 41 19.01 – Selective Structural Demolition.

1.03 Scheduling

.1 Refer to Section 01 14 00, and Section 01 73 00.

.2 All work in the existing building, other than minor works required to permit construction of the new Work, is to be performed in such a manner as to not disrupt the building operations.

.3 All systems are to be kept in full operation during normal building hours.

.4 Coordinate any noise generating works that disrupt the building operation to be carried out after/before normal operating hours.

2 Products

2.01 Materials

.1 Materials and equipment for patching and extending work: As specified in individual sections.

3 Execution

3.01 Examination

.1 Verification of Conditions

.1 Verify field measurements and circuiting arrangements are as shown on Drawings.

.2 Verify that abandoned wiring and equipment serve only abandoned facilities.

.3 Demolition drawings are based on casual field observation. Report discrepancies to the Consultant before disturbing existing installation.

.4 Beginning of demolition means installer accepts existing conditions.

.2 Tracing Existing Electrical Circuits

.1 Trace all circuits in the area of work listed as existing, and verify existing conditions prior to any modifications as indicated.

.2 Where drawings indicate “connect to existing circuit”, use a spare breaker, where available. Otherwise, verify existing load with a meter and advise the Consultant if the additional load will cause a circuit to trip.

.3 Where provided panelboard schedules indicate "Existing Circuit" or similar, provide the correct description for the circuit. Existing Circuit will not be acceptable in the final panelboard schedules submitted as part of closeout submittals.

.3 Existing Cabling in Return Air Plenums

.1 In ceilings being used as a return air-plenum, Contractor to review existing low-voltage cabling uncovered as part of the work.

.2 Immediately notify the Consultant if any cables identified are not plenum rated (i.e. CMP, or FT6 rated).

3.02 Preparation

.1 Coordinate utility service outages with utility company.

.2 Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

.3 Existing electrical service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switch overs and connections. Obtain permission from Owner at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

.4 Existing Telephone System: Maintain existing system in service. Notify Owner at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

.5 Existing Fire Alarm System: Maintain existing system in service. Minimize outage duration. Provide fire watch as required. Make temporary connections to maintain service in areas adjacent to work area.

3.03 Demolition

.1 Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.

.2 Demolish and extend existing electrical work to Section 02 41 19, and this Section.

.3 Remove, relocate, and extend existing installations to accommodate new construction.

.4 Remove abandoned wiring to source of supply.

.5 When relocating or removing equipment, should any circuits be abandoned, the conductors to these circuits must be removed or properly terminated as detailed in Ontario Electrical Safety Code (OESC) bulletin 12-25-1, or latest revision.

.6 Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

.7 Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.

.8 Disconnect and remove abandoned panelboards and distribution equipment.

.9 Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

.10 Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

.11 Repair adjacent construction and finishes damaged during demolition and extension work.

.12 Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

.13 Maintain continuity of existing services for other circuits/devices serving areas outside the Work area. Provide additional wiring/conduits/boxes etc. to suit existing services to be maintained and also implement new Work as detailed.

3.04 Restoration

.1 Install relocated materials and equipment under the provisions of Division 01.

3.05 Cleaning

.1 Clean and repair existing materials and equipment which remain or are to be reused.

.2 Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts, and broken electrical parts.

.3 Waste Management

.1 Turn over designated equipment to the Owner.

.2 Dispose of unwanted materials and equipment.

3.06 Protection

.1 Maintain access to existing electrical installations which remain active. Modify installation or provide access panels as appropriate.

End of Section

1 General

1.01 Section Includes

.1 Building wire and cable.

.1 Armoured cable.

.2 Metal clad cable.

.3 Wiring connectors and connections.

.2 Permitted voltage drop for feeder and branch circuits.

.3 Conductor sizes are based on copper unless indicated as aluminum or "AL".

1.02 References

.1 CSA Group:

.1 CSA C22.1-18, Canadian Electrical Code, Part 1 (24th Edition), Safety Standard for Electrical Installations.

.2 Ontario Electrical Safety Code (27th edition/2018).

.3 CSA C22.2 No. 0.3-09 (R2019), Test methods for electrical wires and cables.

.4 CSA C22.2 No. 48-15, Nonmetallic sheathed cable.

.5 CSA C22.2 No. 51-14, Armoured cables.

.6 CSA C22.2 No. 52-15, Underground secondary and service-entrance cables.

.7 CSA C22.2 No. 65-13, Wire connectors.

.8 CSA C22.2 No. 75-17, Thermoplastic insulated wires and cables.

.9 CSA C22.2 No. 123-16, Aluminum sheathed cables.

.10 CSA C22.2 No. 131-14, Type TECK 90 cable.

.2 NECA (National Electrical Contractors Association) - Standard of Installation.

.3 NETA (International Electrical Testing Association) - ATS-2003 - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

.4 CAN/ULC-S139:2017 – Standard Method of Fire Test for Evaluation of Integrity of Electrical Power, Data and Optical Fibre Cables.

1.03 Coordination

.1 Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.

1.04 Closeout Submittals

.1 Record Documents: Indicate as-constructed feeder sizes on single line diagram.

2 Products

2.01 Manufacturers

.1 BICC Phillips.

.2 General Cable.

.3 Nexans.

.4 Prysmian.

.5 Southwire.

2.02 Regulatory Requirements

.1 Provide products listed and classified by CSA Group as suitable for the purpose specified and indicated.

2.03 Conductor Material

.1 Submit bid based on copper conductors only, unless aluminum is explicitly indicated on the drawings.

[OR]

2.04 Building Wire

.1 RW90:

.1 Single copper conductor.

.2 Minimum #12 AWG for branch circuit wiring.

.3 Minimum #14 AWG for 120 V control wiring.

.4 Chemically cross-linked polyethylene insulation.

.5 Rated for 90 degrees C, 600 V.

.6 Suitable for handling to minus 40 degrees C.

.7 For interior installations in conduit.

.2 RWU90:

.1 Single copper conductor.

.2 Minimum 12 AWG for branch circuit wiring.

.3 Minimum 14 AWG for 120 V control wiring.

.4 Chemically cross-linked polyethylene insulation.

.5 Rated for 90 degrees C, 600 V.

.6 Suitable for handling to minus 4 degrees C.

.7 For exterior installations in conduit.

.3 T90 Nylon:

.1 Single copper conductor.

.2 Thin wall PVC insulation with nylon covering.

.3 Rated for 90 degrees C, 600 V.

.4 May be used up to size 10 AWG for interior installations.

.5 Base conduit fill on RW90 cable diameters.

2.05 Armoured Cable

.1 Description: Type AC.

.2 Two, three or four copper conductors rated RW90, 1000 V.

.3 Bare copper ground wire.

.4 Insulation Voltage Rating: 600 volts.

.5 Insulation Temperature Rating: 90 degrees C (194 degrees F).

.6 Insulation Material: Thermoplastic.

.7 Runs to be limited to fixture drops and in walls, maximum exposed run 1.5 m.

.8 Do not daisy chain (leap frog) luminaires with armoured cable.

2.06 Fire Rated Cables

.1 General:

.1 2 hour fire rating to ULC S139 and to meet 2020 Ontario Building Code Rule 3.2.7.10.

.2 Alternative means of compliance:

.1 Conduits encased in a minimum of 50 mm (2 in) of concrete.

.2 Be protected by a fire rated assembly listed to achieve the minimum fire rating as indicated.

.2 Manufacturers:

.1 nVent Pyrotenax 1850 series (basis of design).

.2 VITALink MC Brand Type MC, manufactured by Marmon Wire & Cable Inc. (listed by ULC under ULC category code 'FHIT7' or 'FHJR7', dated 19 May 2015).

.1 Request quotation from Bhavik Jain at Cerco Cable (905.670.3777) for field certification of installed Vitalink cables prior to requesting Engineer's construction field review.

.2 2-Hour rated Vitalink RC90 power cable must be installed according to UL protocol FHIT7.120 – Electrical circuit integrity systems certified in Canada.

.3 Substitution Limitations:

.1 "Lifeline" installed in conduit may only be considered if listed by ULC under ULC Category Codes 'FHIT7' or 'FHJR7'.

2.07 Wiring Termination

.1 Lugs, terminals, or screws used for termination of wiring to be suitable for copper conductors. 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. Maintain phase sequence and colour coding throughout.

.2 Splice wire, up to and including No. 6 gauge, with nylon insulated expandable spring type connectors.

.1 Thomas & Betts – Marr Max Series

.3 Splice large conductors using compression type connections insulated with heat shrink sleeves.

.1 Thomas & Betts – 5400 Series lugs & heat shrink type #s series

2.08 Conductors, Wires, and Cables

.1 Indoor wiring installed in conduit, unless otherwise noted: 600 volt "RW90 XLPE".

.2 Wiring in channel back of fluorescent lighting fixtures: 600 volt type GTF or TEW.

.3 Lighting and power branch circuit wiring:

.1 Copper, minimum No. 12 gauge.

.2 Home runs to lighting and receptacle panels, which exceed 22 m (75 feet) in length: minimum No. 10 gauge.

.4 Size wires for 2 per cent maximum voltage drop to farthest outlet on a maximum 80 per cent loaded circuit.

.5 Outdoor wiring: “RWU90 XLPE”.

.6 Conductors shall be colour coded. Conductors No. 10 gauge and smaller shall have colour impregnated into insulation at time of manufacture. Conductors size No. 8 gauge and larger may be colour coded with adhesive colour coding tape but only black insulated conductors shall be employed in this case, except for neutrals which shall be white wherever possible.

.7 Colour coding as follows:

.1 Phase "A" - Red

.2 Phase "B" - Black

.3 Phase "C" - Blue

.4 Control - Orange

.5 Ground - Green

.6 Neutral - White

.8 Neatly train circuit wiring in cabinets, panels, pull boxes and junction boxes and hold with nylon cable ties.

3 Execution

3.01 Examination

.1 Verify that field measurements are as indicated.

.2 Wire and cable routing indicated is approximate unless dimensioned.

.3 Voltage Drop

.1 Ensure voltage drop in power and control conductors is in accordance with the requirements of the OESC.

.2 Size conductors accordingly when sizes are not identified.

.1 Feeder conductors: maximum voltage drop of 2 per cent.

.2 Branch circuit conductors: maximum voltage drop of 3 per cent.

.4 Verify that mechanical work likely to damage wire and cable has been completed.

.5 Verify that raceway installation is complete and supported.

3.02 Preparation

.1 Completely and thoroughly swab raceway before installing wire.

3.03 Installation

.1 Route wire and cable as required to meet project conditions.

.2 Install cable to CSA C22.1.

.3 Conduit and cable supports:

.1 All wiring to be installed in EMT at all exposed areas and in partitions unless otherwise specified.

.2 All mechanical equipment to be connected with liquid tight flexible conduit.

.3 Support cables above accessible ceiling, using spring metal clips to support cables from structure. Do not rest cable on ceiling panels.

.4 Conductors

.1 Provide separate neutral for each circuit. Common neutrals not permitted.

.2 Use solid conductor for feeders and branch circuits 10 AWG and smaller.

.3 Use stranded conductors for control circuits.

.4 Use conductor not smaller than 12 AWG for power and lighting circuits.

.5 Use conductor not smaller than 16 AWG for control circuits.

.6 Armoured cable (commonly referred to as BX) is only to be used for light fixture connections and limited to maximum 1830 mm in length.

.7 Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 25 m.

.5 Pulling conductors

.1 Pull all conductors into raceway at same time.

.2 Use suitable wire pulling lubricant for building wire 4 AWG and larger.

.3 Neatly train and lace wiring inside boxes, equipment, and panelboards.

.4 Protect exposed cable from damage.

.6 Connectors

.1 Use suitable cable fittings and connectors.

.2 Clean conductor surfaces before installing lugs and connectors.

.3 Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

.4 Use split bolt connectors for copper conductor splices and taps 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 per cent of insulation rating of conductor.

.5 Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.

.6 Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

.7 Identification

.1 Identify and colour code wire and cable to Section 26 05 53. Identify each conductor with its circuit number or other designation indicated.

.2 Where colour-coded tape is utilized, apply a minimum of 50 mm (2 inches) at terminations, junction and pull boxes and conduit fittings. Do not paint conductors under any condition.

.3 Utilize colour coding on bussing in panels and, switchgear, disconnects, and metering cabinets to match conductor colour coding.

End of Section

1 General

1.01 Section Includes

.1 Low-voltage control cabling.

.2 Control-circuit conductors.

1.02 References

.1 CSA Group:

.1 CSA C22.1-18, Canadian Electrical Code, Part 1 (24th Edition), Safety Standard for Electrical Installations.

.2 Ontario Electrical Safety Code (27th edition/2018).

.3 CSA C22.2 No. 0.3-09 (R2019), Test methods for electrical wires and cables.

.4 CSA C22.2 No. 48-15, Nonmetallic sheathed cable.

.5 CSA C22.2 No. 51-14, Armoured cables.

.6 CSA C22.2 No. 65-13, Wire connectors.

.7 CSA C22.2 No. 75-17, Thermoplastic insulated wires and cables.

.8 CSA C22.2 No. 208-14, Fire alarm and signal cable.

.2 NECA (National Electrical Contractors Association) - Standard of Installation.

1.03 Coordination

.1 Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.

2 Products

2.01 Regulatory Requirements

.1 Conform to CSA C22.1.

.2 Provide products listed and classified by CSA Group as suitable for the purpose specified and indicated.

2.02 Low Voltage Wiring

.1 LVT:

.1 Multi conductor PVC insulated.

.2 Bare copper ground conductor.

.3 Overall PVC jacket.

.4 Rated 30 V.

.5 CMP (FT6) rated if cable is exposed.

.6 CMR (FT4) rated if cable is installed in conduit.

.2 Category 5e Network Cabling.

.1 CMP (FT6) rated if cable is exposed.

.2 CMR (FT4) rated if cable is installed in conduit.

2.03 Terminations and Splices

.1 All terminations and splices shall be of an approved type for the conductors being used.

.2 Where conductors are terminated or spliced, it shall be done in the following manner:

.1 Where a single solid conductor is terminated in a device under one screw or clamping mechanism, no additional terminating hardware is required.

.2 Where multiple or stranded conductors are terminated in a device under one screw or clamping mechanism, self insulated crimp-on cable ends or approved equal shall be used up to and including No. 10 sized conductors. Approved compression lugs shall be used for larger conductor sizes.

.3 Where multiple conductors are spliced, properly sized Wing Nut connectors, or approved equal, shall be used for up to two No. 8 or three No. 10 AWG conductors. Pressure type sleeve cable connectors, splices, tee's, etc., shall be used for all larger size connections and terminations.

.4 Insulate all bare surfaces of splices with heat shrink sleeving or equivalent.

.5 Conductors connected to ground rods for service or equipment grounding or to building structural or architectural elements shall be terminated, connected and spliced using a thermoweld process or approved non-mechanical compression type connectors.

.3 Install all service and feeder conductors as continuous lengths without breaks, measured and cut based on site dimensions.

3 Execution

3.01 Examination

.1 Verify that mechanical work likely to damage wire and cable has been completed.

.2 Verify that raceway installation is complete and supported.

.3 Verify that field measurements are as indicated.

.4 Wire and cable routing indicated is approximate unless dimensioned.

3.02 Preparation

.1 Completely and thoroughly swab raceway before installing wire.

3.03 Installation

.1 Route control cabling as required to meet project conditions.

.2 Install cable to the CSA C22.1.

.3 Conduit and supports

.1 All wiring to be installed in EMT at all exposed areas and in partitions unless otherwise specified.

.2 All mechanical equipment to be connected with liquid tight flexible conduit.

.3 Support cables above accessible ceiling, using spring metal clips to support cables from structure. Do not rest cable on ceiling panels.

.4 Conductors

.1 Use stranded conductors for control circuits.

.2 Use conductor not smaller than 16 AWG for control circuits.

.5 Pulling conductors

.1 Pull all conductors into raceway at same time.

.2 Neatly train and lace wiring inside boxes, equipment, and panelboards.

.3 Neatly train circuit wiring in cabinets, panels, pull boxes and junction boxes and hold with nylon cable ties.

.4 Protect exposed cable from damage.

.6 Connectors

.1 Use suitable cable fittings and connectors.

.2 Clean conductor surfaces before installing lugs and connectors.

.3 Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.

.4 Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

.7 Identification

.1 Identify and colour code wire and cable to Section 26 05 53. Identify each conductor with its circuit number or other designation indicated.

.2 Where colour coded tape is utilized, apply a minimum of 50 mm (2 inches) at terminations, junction and pull boxes and conduit fittings. Do not paint conductors under any condition.

End of Section

1 General

1.01 Section Includes

.1 Grounding electrodes and conductors.

.2 Equipment grounding conductors.

.3 Bonding.

.4 The terms “connect” and “bond” are used interchangeably in this Specification and have the same meaning.

1.02 Related Requirements

.1 Section 09 65 36.13 – Static-Dissipative Resilient Flooring: Grounding of static dissipative tile (SDT).

.2 Section 09 69 00 – Access Flooring: Grounding of raised floor pedestals.

.3 Section 27 05 26 – Grounding and Bonding for Communications Systems.

1.03 References

.1 CSA Group

.1 CSA C22.1-18, Canadian Electrical Code, Part 1 (24th Edition), Safety Standard for Electrical Installations.

.2 Ontario Electrical Safety Code (27th edition/2018).

.3 CSA C22.2 No.0.4-17, Bonding of electrical equipment.

.4 CSA C22.2 No. 41-13, Grounding and bonding equipment.

.5 CSA C22.2 No. 75-17, Thermoplastic insulated wires and cables.

.2 ANSI/TIA/EIA J-STD-607-A - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.

.3 Institute of Electrical and Electronics Engineers, Inc.

.1 IEEE 81-1983 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.

1.04 Action Submittals

.1 Product Data: Provide for grounding electrodes and connections.

1.05 Informational Submittals

.1 Test Reports: Indicate overall resistance to ground and resistance of each electrode.

.2 Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 Closeout Submittals

.1 Project Record Documents: Record actual locations of components and grounding electrodes.

.2 Certificate of Compliance: Indicate approval of installation by authority having jurisdiction.

1.07 Regulatory Requirements

.1 Products: Listed and classified testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

2 Products

2.01 Manufacturers

.1 B-Line by Eaton.

.2 Hubbell (Burndy).

.3 Panduit.

.4 Thomas & Betts.

2.02 Performance Criteria

.1 Grounding System Resistance: 5 ohms.

.2 Provide all equipment grounding as required regardless of whether it has been shown on drawings or called for in this specification. Arrange grounds so that under normal operating conditions no injurious amount of current will flow in any grounding conductor.

2.03 Grounding and Bonding Conductors

.1 Electrical grounding conductors shall be CSA C22.2 No. 75 insulated stranded copper, except that sizes #10 AWG and smaller shall be solid copper. Insulation colour shall be continuous green for all equipment grounding conductors.

.2 Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes #10 AWG and smaller shall be ASTM B1 solid bare copper wire.

2.04 Rod Electrodes

.1 Material: Copper-clad steel.

.2 Diameter: 19 mm.

.3 Length: 3000 mm.

2.05 Ground Rods

.1 Copper clad steel, 19 mm (3/4 inch) diameter by 3000 mm (10 feet) long, conforming to CSA C22.2 No. 41.

.2 Quantity of rods shall be as required to obtain the specified ground resistance.

2.06 Splices and Termination Components

.1 Components shall meet or exceed CSA C22.2 No. 41, and be clearly marked with the manufacturer, catalog number, and permitted conductor size(s).

2.07 Ground Connections

.1 Below Grade: Exothermic-welded type connectors.

.2 Above Grade:

.1 Bonding Jumpers: compression type connectors, using zinc-plated fasteners and external tooth lockwashers.

.2 Ground Busbars: Two-hole compression type lugs using tin-plated copper or copper alloy bolts and nuts.

2.08 Ground Terminal Blocks

.1 At any equipment mounting location (e.g. backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide screw lug-type terminal blocks.

2.09 Splice Case Ground Accessories

.1 Splice case grounding and bonding accessories shall be supplied by the splice case manufacturer when available. Otherwise, use 6 AWG insulated ground wire with shield bonding connectors.

2.10 Mechanical Connectors

.1 Material: Bronze.

2.11 Wire

.1 Material: Stranded copper.

.2 Foundation Electrodes: 2/0 AWG.

.3 Grounding Electrode Conductor: Size to meet Ontario Electrical Safety Code requirements.

2.12 Grounding Well Components

.1 Well Pipe: 200 mm by 600 mm long concrete pipe with belled end.

.2 Well Cover: Cast iron with legend "GROUND" embossed on cover.

3 Execution

3.01 Examination

.1 Verify that final backfill and compaction has been completed before driving rod electrodes.

3.02 Installation

.1 General

.1 Ground in accordance with the Ontario Electrical Safety Code, as shown on drawings, and as hereinafter specified.

.2 System Grounding:

.1 Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformers.

.2 Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.

.3 Equipment Grounding: Metallic structures (including ductwork and building steel), enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits shall be bonded and grounded.

.4 Ground electrical equipment and wiring in accordance with Ontario Electrical Safety Code and Local Inspection Authority's Rules and Regulations.

.5 Install grounding conductors, outside Electric Rooms and Electrical Closets in conduit and conceal where possible. Make connections to water mains, all metallic piping systems, neutral and equipment with brass, copper or bronze bolts and connectors or weld using Cadweld or Thermoweld processes.

.6 Provide grounding conductors, sized as per Code, and connect to grounding bus or water main wherever non-raceways are installed.

.2 Provide grounding electrode conductor and connect to reinforcing steel in foundation footing. Bond steel together.

.3 Provide bonding to meet Regulatory Requirements.

.4 Bond together metal siding not attached to grounded structure; bond to ground.

.5 Install ground grid under access floors indicated.

.6 Bond together each metallic raceway, pipe, duct and other metal object entering space under access floors. Bond to underfloor ground grid. Use #6 AWG bare copper conductor.

.7 Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

.8 Ground Resistance

.1 Grounding system resistance to ground not to exceed 5 ohms. Make necessary modifications or additions to the grounding electrode system for compliance without additional cost to the Owner. Final tests shall assure that this requirement is met.

.2 Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

.3 Services at power company interface points shall comply with the power company ground resistance requirements.

.9 Ground Rod Installation

.1 Drive each rod vertically in the earth, not less than 3000 mm (10 feet) in depth.

.2 Where permanently concealed ground connections are required, make the connections by the exothermic process to form solid metal joints. Make accessible ground connections with mechanical pressure type ground connectors.

.3 Where rock prevents the driving of vertical ground rods, install angled ground rods or grounding electrodes in horizontal trenches to achieve the specified resistance.

.10 Inaccessible Grounding Connections

.1 Make grounding connections, which are buried or otherwise normally inaccessible (except connections for which periodic testing access is required) by exothermic weld.

.11 Secondary Equipment and Circuits

.1 Main Bonding Jumper: Bond the secondary service neutral to the ground bus in the service equipment.

.2 Metallic Piping, Building Steel, and Supplemental Electrode(s):

.1 Provide a grounding electrode conductor sized per code between the service equipment ground bus and all metallic water and gas pipe systems, building steel, and supplemental or made electrodes. Jumper insulating

joints in the metallic piping. All connections to electrodes shall be made with fittings that conform to CSA C22.2 No 41.

.2 Provide a supplemental ground electrode and bond to the grounding electrode system.

.3 Conduit Systems:

.1 Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor.

.2 Non-metallic conduit systems shall contain an equipment grounding conductor, except that non-metallic feeder conduits which carry a grounded conductor from exterior transformers to interior or building-mounted service entrance equipment need not contain an equipment grounding conductor.

.3 Conduit containing only a grounding conductor, and which is provided for mechanical protection of the conductor, shall be bonded to that conductor at the entrance and exit from the conduit.

.4 Feeders and Branch Circuits: Install equipment grounding conductors with all feeders and power and lighting branch circuits.

.5 Boxes, Cabinets, Enclosures, and Panelboards:

.1 Bond the equipment grounding conductor to each pull box, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes (except for special grounding systems for intensive care units and other critical units shown).

.2 Provide lugs in each box and enclosure for equipment grounding conductor termination.

.3 Provide ground bars in panelboards, bolted to the housing, with sufficient lugs to terminate the equipment grounding conductors.

.6 Receptacles shall not be grounded through their mounting screws. Ground with a jumper from the receptacle green ground terminal to the device box ground screw and the branch circuit equipment grounding conductor.

.7 Raised Floors: Provide bonding of all raised floor components.

.12 Corrosion Inhibitors

.1 When making ground and ground bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

.13 Conductive Piping

.1 Bond all conductive piping systems, interior and exterior, to the building to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.

3.03 Field Quality Control

.1 Perform inspections and tests listed in NETA ATS, Section 7.13.

End of Section

1 General

1.01 Section Includes

.1 Conduit and equipment supports.

.2 Anchors and fasteners.

1.02 References

.1 CSA C22.1-18, Canadian Electrical Code, Part 1 (24th Edition), Safety Standard for Electrical Installations.

.2 Ontario Electrical Safety Code (27th edition/2018).

.3 CECA - Canadian Electrical Contractors Association.

1.03 Closeout Submittals

.1 Submit the following in the Operation and Maintenance Manual for products used over the course of the project:

.1 Product Data: Provide manufacturer's catalogue data for fastening systems.

.2 Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

1.04 Regulatory Requirements

.1 Provide products listed and classified by Canadian Standards as suitable for purpose specified and shown.

2 Products

2.01 Manufacturers

.1 B-line by Eaton.

.2 Burndy Canada Ltd. (Hubbell).

.3 Erico Caddy.

.4 E. Myatt & Co. Inc.

.5 Hilti Canada.

.6 Thomas & Betts.

.7 Unistrut.

.8 Approved equal.

2.02 General

.1 All supporting devices, strut channel, threaded rod, anchors, etc. to be used shall be of the “hot dipped” galvanized type. Electrogalvanized components will not be accepted.

.2 Materials and Finishes: Provide adequate corrosion resistance.

.3 Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.

.4 Anchors and Fasteners:

.1 Concrete Structural Elements: Use expansion anchor sand preset inserts.

.2 Steel Structural Elements: Use beam clamps and welded fasteners.

.3 Concrete Surfaces: Use self-drilling anchors and expansion anchors.

.4 Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts and hollow wall fasteners.

.5 Solid Masonry Walls: Use expansion anchors and preset inserts.

.6 Sheet Metal: Use sheet metal screws.

.7 Wood Elements: Use wood screws.

2.03 Anchors and Hangers

.1 Hangers for electrical conduit shall be galvanized after fabrication.

.2 Perforated strapping: not permitted.

2.04 Inserts

.1 Use only factory-made threaded or toggle type.

.2 Where inserts cannot be placed, use factory-made expansion shields for light weights, where approved by the Consultant.

.3 Do not use powder-activated tools except with the written permission of the Consultant.

2.05 Sleeves

.1 Through interior walls, use standard weight steel pipes, conduit, or 18 gauge galvanized steel. Cut flush with finished surfaces. Check room finish schedules.

.2 Through exterior walls above grade, floors, and roof use standard weight steel pipes, machine cut, flush with finished surface inside and to suit flashing outside.

.3 Through exterior walls below grade, water-proofed floors, and other water-proof walls, use heavy weight cast iron pipes, machine cut. Extend sleeves 100 mm (4 inches) above finished floors, and cut flush with underside of floor.

2.06 Steel Channel

.1 Description: Painted steel.

2.07 Supports

.1 Steel supports in wet or dry locations to be galvanized after fabrication.

.2 Where galvanized members are bolted together use cadmium plated bolts.

.3 For hanger rods use minimum 10 mm (3/8 inch) diameter steel threaded rod. Use clevis type attachment.

.4 Provide minimum 100 mm (4 inch) high concrete bases for all floor mounted equipment.

2.08 Supports and Bases

.1 Submit proposed method of attachment of hangers and beam clamps, to cellular steel deck for approval before proceeding with Work.

.2 Supply and erect special structural Work required for the installation of electrical equipment. Provide anchor bolts and other fastenings unless noted otherwise. Mount equipment required to be suspended above floor level, where details are not shown, on a frame or platform bracketed from the wall or suspended from the ceiling. Carry supports to either the ceiling or the floor, or both as required, at locations where, because wall thickness is inadequate, it is not permitted to use such brackets.

.3 Electrical panels, switches or other electrical equipment shall be complete with suitable bases or mounting brackets.

.4 Provide channel or other metal supports where necessary, to adequately support lighting fixtures. Do not use wood unless wood forms part of the building structure.

.5 Support hangers, in general, from inserts in concrete construction or from building structural steel beams, using beam clamps. Provide additional angle or channel steel members, required between beams for supporting conduits and cables.

.6 Provide any additional supports required from existing concrete construction for any piping or equipment, by drilling same and installing expansion bolt cinch anchors.

.7 Do not use explosive drive pins in any section of Work without obtaining prior approval.

2.09 Threaded Rod Covers

.1 Protect cable from abrasion caused by contact with threaded rod.

.2 To meet UL 94V-0 specifications.

.3 Colour: Black.

.4 Example product: Panduit TRC18FR-X20Y.

3 Execution

3.01 Installation

.1 Obtain permission from Consultant before drilling or cutting structural members.

.2 Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

.3 Install surface-mounted cabinets and panelboards with minimum of four anchors.

.4 In wet and damp locations use steel channel supports to stand cabinets and panelboards 25 mm (1 inch) off wall.

.5 Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

.6 Where threaded rod is exposed in data centre, provide threaded rod cover.

.7 Provide inserts, sleeves, equipment supports and hangers, sealing of sleeves and openings, as required for all electrical work. Ensure that the load onto structures does not exceed the maximum loading per square metre as shown on Structural Drawings or as directed by the Consultant.

.8 Provide insets, holes, anchor bolts and sleeves in time when walls, floors, and roof are erected.

.9 Provide sleeves at each place where electrical devices pass through a wall, floor or roof.

.10 Size sleeves to provide 13 mm (1/2 inches) clearance all round.

.11 Sleeves are not required in interior walls and dry area floors where conduit is installed ahead of floor construction.

.12 Seal all openings and sleeves after installation of equipment:

.1 With an approved material to maintain fire rating where sleeves and openings pass through fire separations and floors.

.2 With an approved material to maintain fire rating for sleeves and openings provided for future equipment.

.13 Provide all flashing and waterproofing for sleeves through roof and exterior walls to the requirements of Division 07.

.14 Place insets only in structural members and not in the finishing material.

.15 Secure all supports and hangers to the structure unless noted otherwise.

.16 Suspend hanger rods from approved concrete inserts and from beam clamps. Obtain Consultant's approval before welding to steel structural members.

.17 Secure supports to precast concrete members to inserts originally cast into the members or by rods passing between the members and connected to a steel plate bearing.

.18 Sealing of Sleeves and Openings to Maintain Fire Rating

.1 Use Dow-Corning #3-6548 'Silicone RTV' foam, Thomas & Betts "Flamesafe' firestopsystem, Electrovert 'Flameseal" firestop putty, or approved equal materials installed in accordance with the manufacturer's specifications and recommendations.

.2 Submit data sheets for review prior to installation.

.19 Supports

.1 All conduits, panels, etc. to be securely and adequately supported.

.2 Where more than three conduits run together, conduit racks to be used.

.3 Single runs of conduit to be supported by galvanized conduit straps or ring bolt type hangers. Tie wire or perforated metal strap hangers will NOT be accepted.

End of Section

1 General

1.01 Section Includes

.1 Metal conduit.

.2 Flexible metal conduit.

.3 Liquid tight flexible metal conduit.

.4 Electrical metallic tubing.

.5 Fittings and conduit bodies.

1.02 References

.1 Canadian Standards Association

.1 CSA C22.1-18, Canadian Electrical Code, Part 1 (24th Edition), Safety Standard for Electrical Installations.

.2 Ontario Electrical Safety Code (27th edition/2018).

.3 CAN/CSA-C22.2 No. 18 – Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.

.4 CSA C22.2 No. 45 – Rigid Metal Conduit.

.5 CSA C22.2 No. 45.1 – Rigid Metal Conduit - Steel.

.6 CSA C22.2 No. 56 – Flexible Metal Conduit and Liquid - Tight Flexible Metal Conduit.

.7 CSA C22.2 No. 83.1 – Electrical Metallic Tubing - Steel.

.8 CSA C22.2 No. 211.1 – Rigid Types EB1 and DB2/ES2 PVC Conduit.

.9 CSA C22.2 No.211.2 – Rigid PVC (Unplasticized) Conduit.

.10 CSA C22.2 No. 211.3 – Reinforced Thermosetting Resin Conduit (RTRC) on Fittings.

.11 CSA C22.2 No. 227.1 – Electrical Nonmetallic Tubing.

.12 CSA C22.2 No. 227.2.1 – Liquid-Tight Flexible Nonmetallic Conduit.

1.03 Project Record Documents

.1 Accurately record actual routing of conduits larger than 51 mm.

.2 Accurately record actual routing of all conduits installed below grade, regardless of size, including whether direct buried or installed in concrete duct bank.

1.04 Regulatory Requirements

.1 Provide products listed and classified by CSA (Canadian Standards Association) as suitable for purpose specified and shown.

1.05 Delivery, Storage, and Handling

.1 Accept conduit on site. Inspect for damage.

.2 Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

1.06 Project Conditions

.1 Verify that field measurements are as shown on drawings.

.2 Verify routing and termination locations of conduit prior to rough-in.

.3 Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

2 Products

2.01 Manufacturers

.1 Where products are listed in this section based on a single manufacturer, the equivalent product from the following manufacturers is acceptable:

.1 Appleton.

.2 Columbia-MBF.

.3 Crouse-Hinds by Eaton.

.4 Hubbell.

.5 Thomas & Betts Ltd.

2.02 Conduit Requirements

.1 Minimum size: 21 mm (3/4 inch) unless otherwise specified.

.2 Outdoor locations, above grade: use rigid steel.

.3 Wet and damp locations: use rigid and non-metallic tubing.

.4 Dry locations:

.1 Concealed: Use electrical metallic tubing

.2 Exposed: Use electrical metallic tubing.

2.03 Metal Conduit

.1 Rigid Steel Conduit: C22.2 No. 45.1.

.2 Rigid Aluminum Conduit: C22.2 No. 45.

.3 Intermediate Metal Conduit (IMC): Rigid steel.

.4 Fittings and Conduit Bodies: Material to match conduit.

2.04 Flexible Metal Conduit

.1 Description: Interlocked steel construction.

.2 Fittings: CSA C22.2 No. 56.

2.05 Liquid Tight Flexible Metal Conduit

.1 Description: Interlocked steel aluminum construction with PVC jacket.

.2 Fittings: CSA C22.2 No. 56.

2.06 Electrical Metallic Tubing (EMT)

.1 Description: CSA C22.2 No. 83.1; galvanized tubing.

.2 Fittings and Conduit Bodies: CSA C22.2 No. 83.1; steel type.

2.07 Electrical Nonmetallic Tubing (ENT)

.1 Not permitted.

2.08 Conduit, Fittings, and Accessories

.1 Conduit accessories, conduits and fittings conforming to CSA Standard C22.2 No. 18-1972.

.2 Rigid conduit bushings:

.1 Thomas & Betts Ltd. - Series 5031.

.3 EMT Connectors:

.1 Thomas & Betts Ltd. - Steel City TC 121E Series.

.4 Ground Bushings:

.1 Thomas & Betts – Blackjack or 1220 Series.

.5 Flexible conduit connectors:

.1 Thomas & Betts Ltd. - Series 3110.

.2 EMT couplings: steel concrete tight to match connectors.

.6 Terminate rigid conduit entering boxes or enclosures with nylon insulated steel threaded bushings.

.1 Thomas & Betts – 8125 Series.

.7 Terminate EMT entering boxes or enclosures with nylon insulated steel concrete tight connectors.

.8 Terminate flexible conduit entering boxes or enclosures with nylon insulated steel connectors.

.1 Thomas & Betts – 5332 Series.

3 Execution

3.01 Installation

.1 Install conduit to CSA C22.1.

.2 Arrangement and supports

.1 Arrange supports to prevent misalignment during wiring installation.

.2 Arrange conduit to maintain headroom and present neat appearance.

.3 Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

.4 Group related conduits; support using conduit rack.

.5 Construct rack using steel channel; provide space on each for 25 per cent additional conduits.

.6 Fasten conduit supports to building structure and surfaces to Section 26 05 29.

.7 Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports

.8 Do not attach conduit to ceiling support wires.

.9 Route exposed conduit parallel and perpendicular to walls.

.10 Route conduit installed above accessible ceilings parallel and perpendicular to walls.

.11 Route conduit in and under slab from point-to-point.

.12 Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

.13 Provide suitable fittings to accommodate expansion and deflection where conduit crosses expansion joints.

.3 Clearances

.1 Maintain adequate clearance between conduit and piping.

.2 Maintain 300 mm (12 inch) clearance between conduit and surfaces with temperatures exceeding 40 degrees C.

.4 Conduit bends

.1 Install no more than equivalent of three 90 degree bends between boxes.

.1 Use conduit bodies to make sharp changes in direction, as around beams.

.2 Use hydraulic one-shot bender to fabricate bends in metal conduit larger than 50 mm size.

.5 Install wall entrance seals where conduits pass through exterior walls below grade.

.6 Provide expansion coupling in conduit runs at building expansion joints and in long runs subject to thermal expansion, all in accordance with manufacturer recommendations.

.7 Cut conduit square using saw or pipe cutter; de-burr cut ends.

.8 Bring conduit to shoulder of fittings; fasten securely.

.9 Use suitable caps to protect installed conduit against entrance of dirt and moisture.

.10 Use conduit hubs or sealing locknuts to fasten conduit and to cast boxes.

.11 Provide suitable pull string in each empty conduit except sleeves and nipples.

.12 Ground and bond conduit to Section 26 05 26.

.13 Identify conduit to Section 26 05 53.

.14 Wiring Methods

.1 Install wiring in conduit unless otherwise specified.

.2 Install wiring and conduit work in a concealed manner. Surface conduit work is not permitted unless specifically noted.

.3 Use thin wall conduit, up to and including 53 mm (2 inch) conduit size, for branch circuit and feeder wiring in ceilings, furred spaces, and in hollow walls and partitions. Use rigid galvanized steel conduit for wiring in poured concrete, where exposed, and for conduit 65 mm or larger. Use rigid PVC conduit for wiring in slabs on grade and wiring below grade.

.4 Aluminium conduit may be used, in lieu of rigid steel conduit, in clean and dry locations, but shall not be used in poured concrete, or for signal and intercommunication systems wiring.

.5 Flexible conduit and armoured cable will be accepted for a maximum length of 1500 mm for final connection to lighting fixtures. Do not connect from fixture to fixture.

.6 Conduit manufacturer's touch-up enamel shall be used to repair all scratches and gouges on epoxy-coated conduit.

End of Section

1 General

1.01 Section Includes

.1 Wall and ceiling outlet boxes.

.2 Pull and junction boxes.

1.02 Related Requirements

.1 Section 26 09 23 – Lighting Control Devices.

.2 Section 26 27 16 – Electrical Cabinets and Enclosures.

.3 Section 26 27 26 – Wiring Devices: Wall plates in finished areas, floor box service fittings, fire-rated poke-through fittings, and access floor boxes.

.4 Section 26 27 26.13 – Floor Box Assemblies.

1.03 References

.1 CSA C22.1-18, Canadian Electrical Code, Part 1 (24th Edition), Safety Standard for Electrical Installations.

.2 Ontario Electrical Safety Code (27th edition/2018).

.3 CAN/CSA-C22.2 No. 18 - Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.

.4 CSA C22.2 No. 18.1 (CSA/UL/ANCE) - Metallic Outlet Boxes.

.5 CSA C22.2 No. 40 - Cutout, Junction and Pull Boxes.

.6 CAN/CSA-C22.2 No. 85 - Rigid PVC Boxes and Fittings.

1.04 Closeout Submittals

.1 Record actual locations and mounting heights of outlet, pull, and junction boxes on project record documents.

1.05 Regulatory Requirements

.1 Provide products listed and classified by CSA (Canadian Standards Association) as suitable for the purpose specified and indicated.

2 Products

2.01 Outlet Boxes

.1 Sheet Metal Outlet Boxes: CSA C22.2 No. 18, galvanized steel.

.1 Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 13 mm male fixture studs where required.

.2 Concrete Ceiling Boxes: Concrete type.

.2 Non-metallic Outlet Boxes: CSA C22.2 No. 18.

.3 Cast Boxes: CSA C22.2 No. 18, Type FD, aluminum. Provide gasketed cover by box manufacturer. Provide threaded hubs.

.4 Wall Plates for Finished Areas: As specified in Section 26 27 26.

2.02 Pull Boxes and Junction Boxes

.1 Sheet Metal Boxes: CSA C22.2 No. 18, galvanized steel.

.2 Hinged Enclosures: As specified in Section 26 27 16.

.3 Surface Mounted Cast Metal Box: CSA C22.2 No. 18, Type 4; flat-flanged, surface mounted junction box:

.1 Material: Cast aluminum.

.2 Cover: Provide with ground flange, neoprene gasket, and stainless steel cover screws.

2.03 Outlet Boxes

.1 Conform to CSA C22.2 No. 18.

.2 Where 103 mm (4 inch) square outlet boxes are installed in exposed concrete or cinder block finished areas, blocks will be cut as described in Division 04 as instructed under this Section. Cut openings to provide a close fit to boxes and covers so that edges of openings are not visible after installation of plates. Use of mortar to patch up openings that are cut too large or to patch ragged edges is not permitted.

.3 Ceiling boxes: 103 mm (4 inch) octagon or square, complete with fittings, where required to support fixtures.

.4 Switch and receptacle boxes:

.1 103 mm (4 inch) square with plaster ring, where flush mounted in plaster walls.

.2 Iberville 1104 series box, or equal, where flush mounted in wood or drywall, with stud fasteners as required.

.3 Masonry boxes in masonry walls.

.5 Where boxes are surface mounted in unfinished areas they shall be FS conduits.

.6 Standard outlet boxes manufactured from code gauge galvanized steel.

.7 Provide a suitable outlet box for each light, switch, receptacle or other outlet, approved for the particular area it is to be installed.

.8 Support outlet boxes independently of conduit and cable.

.9 Locate outlet boxes, mounted in hung ceiling space, so they do not obstruct or interfere with the removal of lay-in ceiling tiles.

.10 Offset outlet boxes, shown back to back in partitions, horizontally a minimum 150 mm (6 inch) to minimize noise transmission between adjacent rooms.

.11 Use gang boxes at locations where more than one device, of the same system only, is to be mounted. Utilize separate boxes for each system.

.12 Use tile wall covers where 103 mm (4 inch) square outlet boxes are installed in exposed concrete or cinder block in finished areas.

.13 Provide flush mount boxes, panels, cabinets and electrical devices, which are installed in finished areas, with suitable flush trims and doors or covers, unless specifically noted otherwise.

.14 Provide pre-formed polyethylene vapour barriers for all boxes located in walls with internal vapour barriers.

3 Execution

3.01 Examination

.1 Verify locations of floor boxes prior to rough-in.

3.02 Installation

.1 Install boxes to CSA C22.1.

.2 Install in locations as shown on drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.

.3 Set wall mounted boxes at elevations to accommodate mounting heights indicated.

.4 Electrical boxes are shown on drawings in approximate locations unless dimensioned. Adjust box location up to 3 m (10 feet) if required to accommodate intended purpose.

.5 Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.

.6 Maintain headroom and present neat mechanical appearance.

.7 Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

.8 Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 150 mm (6 inch) from ceiling access panel or from removable recessed luminaire.

.9 Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods.

.10 Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.

.11 Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.

.12 Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

.13 Use flush mounting outlet box in finished areas.

.14 Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

.15 Do not install flush mounting box back-to-back in walls; provide minimum 150 mm separation. Provide minimum 600 mm separation in acoustic rated walls.

.16 Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

.17 Use stamped steel bridges to fasten flush mounting outlet box between studs.

.18 Install flush mounting box without damaging wall insulation or reducing its effectiveness.

.19 Use adjustable steel channel fasteners for hung ceiling outlet box.

.20 Do not fasten boxes to ceiling support wires.

.21 Support boxes independently of conduit.

.22 Use gang box where more than one device is mounted together. Do not use sectional box.

.23 Use gang box with plaster ring for single device outlets.

.24 Use cast outlet box in exterior locations exposed to the weather.

.25 Use cast outlet box in wet locations.

.26 Set floor boxes level.

.27 Large pull boxes: Use hinged enclosure in interior dry locations, surface-mounted cast metal box in other locations.

3.03 Adjusting

.1 Adjust floor box flush with finish flooring material.

.2 Adjust flush-mounting outlets to make front flush with finished wall material.

.3 Install knockout closures in unused box openings.

3.04 Cleaning

.1 Clean interior of boxes to remove dust, debris, and other material.

.2 Clean exposed surfaces and restore finish.

End of Section

1 General

1.01 Section Includes

.1 Metal Raceway is an enclosed pathway used for surface distribution of branch circuit electrical wiring, and cabling for voice, data, multi-media, low voltage, and optical fiber. Raceway is typically installed in existing building structures, or after construction is complete. A complete raceway system includes raceway, covers, mounting hardware, various fittings, and outlet boxes installed at specific locations. Specific codes and standards apply to electrical wires and telecommunications cables that are deployed within metal raceway. Compliance to codes and standards is required for installation, grounding and bonding, and cable deployment.

1.02 Related Requirements

.1 Section 26 05 33.13 – Conduit for Electrical Systems.

.2 Section 26 05 33.16 – Boxes for Electrical Systems.

1.03 Quality Assurance

.1 Product free from defects in material or workmanship.

.2 Materials and work specified in this document shall comply with, and are not limited to the codes, standards, and regulations listed below.

.1 CSA C22.1 - Canadian Electrical Code, Part I, Safety Standard for Electrical Installations.

.2 National Electrical Manufacturer's Association (NEMA)

.1 ANSI/NEMA WD-6-2002: Wiring Devices – Dimensional Requirements

.2 NEMA 250-2003: Enclosures for Electrical Equipment.

.3 Performance Requirements:

.1 Metal raceway and fittings UL Listed and CSA certified.

1.04 Submittals

.1 Product Data Sheet.

.2 Manufacturer's Instructions.

.3 Product Catalog Literature.

.4 Product Drawings.

1.05 Warranty

.1 Product is warranted free of defects in material or workmanship.

.2 Product is warranted to perform the intended function within design limits.

2 Products

2.01 Manufacturers

.1 Wiremold Legrand.

.2 Hubbell.

.3 Thomas & Betts Canada.

2.02 Surface Mounted Raceway, General

.1 The raceway and all system components must be UL Listed and exhibit non-flammable self-extinguishing characteristics tested to comparable specifications of UL94V-0. The raceway base and cover shall be manufactured by rigid compound, available in ivory or white colours, and allow for field painting.

2.03 Metal Raceway

.1 Metal raceway shall be a one-piece design with base and cover, factory assembled, with mounting hardware and instructions included.

.2 Metal raceway, cover, surface boxes, shall be a formed steel construction with a thickness of 0.040", and zinc plated. Related fittings shall be galvanized on all surfaces.

.3 Metal raceway, cover, and related fittings shall have an Ivory color powder coat paint finish on all external surfaces.

.4 Have tools available for field cutting and bending.

.5 Assembly and disassembly of raceway base, cover, and fittings requiring no special tools.

.6 Available fittings including couplings, internal and external elbows, tees, entrance fittings, conduit adapters and bushings.

.7 Available fittings including internal, external and flat elbows, and tee fitting, with a 1 ½" radius to accommodate communications UTP and fiber cabling minimum bend radius requirements.

.8 Installed fittings designed to overlap the raceway to cover exposed or uneven edges from field cutting.

2.04 Device Boxes

.1 Compatible device boxes shall have a removable knockout portion to permit metal raceway entry and exit.

.2 Device boxes available in standard NEMA single- and double-gang, and multiple gang up to six-gang. Device box depth shall range from 1.125" to 2.75".

.3 Device boxes shall have a single seam construction with rounded corners to eliminate sharp edges.

.4 Assembled device box front face design to permit flush mounting of standard wall plates to minimize perimeter profile exposure.

.5 Device boxes shall have threaded standoff posts attached to the base, to facilitate mounting of covers with short screws for ease of alignment during installation.

3 Execution

3.01 Preparation

.1 Submit layout drawings of the raceway system for reviewed prior to installation.

.2 Installation of metal raceway in wet areas is not permitted.

.3 Manufacturer's instructions for installing raceway and fittings shall be followed by the installer.

.4 All wall surfaces, or other permanent structures to which raceway is mounted shall be finished complete.

3.02 Installation

.1 Mount base and cover together to wall or structure using the appropriate fasteners and clips, per manufacturer's instructions.

.2 Securely support raceway in intervals not exceeding 3 m (10 feet) or per manufacturer's instructions.

.3 Install fittings and device boxes in the specified locations, per manufacturer's instructions and per contract drawing specifications.

.4 Completed raceway installation shall be mechanically continuous and connected to all electrical outlets, device boxes, and enclosures with no gaps or exposed cuts.

.5 Provide insulated ground wire for power raceways per OESC requirements. Raceway shall not be used as the primary ground path.

.6 Prior to wire and cable installation, the raceway system shall be installed complete, including insulating bushings, adapters, fittings, outlets, boxes, and enclosures. Unused raceway openings shall be closed.

.7 Make wiring connections with the proper approved insulated wire connectors or lugs. Exposed conductors at harness wiring junctions are not permitted regardless of connection method.

.8 Provide a physical barrier in raceway and boxes to separate power and communication wiring.

.9 Install covers on raceway, boxes and fittings after wiring is complete, or if wire and cable installation is to be done at a later date.

3.03 Field Quality Control

.1 Verify layout of system to contract drawings.

.2 Raceway system shall be free of dents, scratches, bare metal edges, and exposed uneven cuts.

.3 Securely fasten all outlets, boxes, and enclosures walls or permanent structures.

.4 Verify that all wiring junctions or connections have no exposed conductors prior to energizing the circuits.

.5 Verify that all bonding locations are code and standards compliant.

.6 Verify that power and communications wiring are separated by a physical barrier in raceway and boxes.

End of Section

1 General

1.01 Section Includes

.1 This section provides minimum acceptance requirements for vibration isolation for all electrical equipment, conduit, and piping.

1.02 Related Requirements

.1 Concrete work is described in Division 03.

1.03 Submittals

.1 All vibration isolation systems shall be by one manufacturer.

.2 All outdoor mounted equipment shall be restrained for the highest wind speed as specified by the project's structural engineer, the governing building code(s) or the authority having jurisdiction.

.3 Submit shop drawings for all devices specified herein and as indicated and scheduled on the drawings. Submittals shall indicate full compliance with the device specification in Part 2. Any deviation shall be specifically noted and subject to engineer approval. Submittals shall include device dimensions, placement, attachment and anchorage requirements.

1.04 Quality Assurance

.1 Unless otherwise directed by the local authority having jurisdiction, the following codes and standards will apply:

.1 International Building Code 2009

.2 American Society of Civil Engineers 7-05

.3 Ontario Building Code, Latest Edition

.2 Manufacturer's Qualifications: Firms regularly engaged in manufacture of vibration control products of type, size, and capacity required, whose products have been in satisfactory use in similar service for not less than 5 years.

2 Products

2.01 Manufacturers

.1 Vibro-Acoustics.

.2 Kinetics Noise Control.

.3 BVA Systems.

.4 Vibron Limited.

.5 Mason Industries.

2.02 Vibration Isolation

.1 Springs: All springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. All springs except internal nested springs shall have an outside diameter not less than 0.8 of the compressed height of the spring. Ends of springs shall be square and ground for stability. Laterally stable springs shall have kx/ky ratios of at least 0.9. All springs shall be fully color-coded to indicate capacity – color striping is not considered adequate.

.2 Corrosion Protection: All springs shall be powder-coated enamel. Housings shall be hot dipped galvanized, powder-coated enamel, or painted with rust-resistant paint.

.3 Isolators:

.1 Vibration Isolation Pads: Type N – Neoprene pad type isolators, 3/8" (10 mm) minimum thick, ribbed on both sides.

.1 Type NSN – Sandwich neoprene pad type isolators, with 3/8" (10 mm) minimum thick ribbed neoprene pads bonded to each side of a 10 ga (3.5 mm) minimum galvanized metal plate. Isolator pads shall be selected to ensure that deflection does not exceed 20% of isolator free height.

.2 Rubber-in-Shear Floor Mounts: Type RD – "Double-deflection" neoprene isolators, with neoprene-coated metal surfaces, and top and bottom surfaces ribbed. Isolators shall have bolt holes in the base.

.3 Restrained Spring Floor Mounted Isolators: Type CSR – Laterally stable, vertically restrained spring isolators with welded steel housings and heavy top plates for supporting equipment. Springs shall be supported either with a neoprene cup or a metal base plate complete with a ribbed neoprene pad, minimum 1/4" (6 mm) thick, bonded to the base plate. Housings shall include vertically restraining limit stops. Minimum clearance around the restraining bolts and between the housing and the spring shall be 1/2" (13mm). Top plate and restraining bolts shall be out of contact with the housing during normal operation and neoprene grommets shall be incorporated to minimize short-circuiting of restraining bolts. For outdoor applications, housing must be hot-dip galvanized. For indoor applications, powder-coated finish for the housing is acceptable.

3 Execution

3.01 General

.1 Coordinate size, doweling, and reinforcing of concrete equipment housekeeping pads and piers with vibration isolation manufacturer to ensure adequate space and prevent edge breakout failures. Pads and piers must be adequately doweled in to structural slab.

.2 Coordinate locations and sizes of structural supports with locations of vibration isolators (e.g., roof curbs, cooling towers, air-cooled chillers, etc.).

.3 Isolated equipment, duct and piping located on roofs must be attached to the structure. Intermediate supports between the restraint and structure that are not attached to the structure must be approved by the restraint manufacturer.

3.02 Vibration Isolation

.1 Ensure housekeeping pads have adequate space to mount equipment and isolator housings and shall also be large enough to ensure adequate edge distance for isolator anchors.

.2 Select and locate vibration isolation equipment to give uniform loading and deflection, according to weight distribution of equipment.

.3 Engine-generator set silencers and associated exhaust piping shall be supported with Type SHR isolators with a minimum 40 mm (1-1/2 inch) static deflection.

.4 Equipment Isolation:

			Slab on Grade			Floor Span								
						Up to 20 ft.			20 to 30 ft.			30 to 40 ft.		
Equipment Type	HP and Other	RPM	Base Type	Isolat or Type	Min. Defl., in.	Base Type	Isolat or Type	Min. Defl., in.	Base Type	Isolat or Type	Min. Defl., in.	Base Type	Isolat or Type	Min. Defl., in.
Transformers														
All	All	All	N/A	NSN	0.12	N/A	NSN	0.12	N/A	NSN	0.12	NM	RD/N SN	0.25
Engine-Driven Generators														
All	All	All	N/A	CSR	0.75	N/A	CSR	1.50	N/A	CSR	2.50	N/A	CSR	3.50

Notes:	(1) Units that are suspended overhead shall use isolation hangers in place of floor mounted isolators with equal or greater deflection. (2) Floor spans are defined as the distance between structural support columns or walls.

.5 There shall be no rigid contact of isolated equipment with shaft walls, floor slabs, partitions, or non-flexible conduits connections.

.6 Where recommended by the manufacturer, isolator base plates shall be bolted to the structure or foundation. Bolting shall incorporate neoprene bushings and washers.

3.03 Site Tests and Inspections

.1 After installation, arrange and pay for the vibration isolation product manufacturer, or representative, to visit the site to verify that the vibration isolation systems are installed and operating properly, and shall submit a certificate so stating. Verify that isolators are adjusted, with springs perpendicular to bases or housing, adjustment bolts are tightened up on equipment mountings, and hangers are not cocked.

End of Section

1 General

1.01 Section Includes

.1 Nameplates and labels.

.2 Wire and cable markers.

.3 Conduit markers.

.4 Receptacle labels.

.5 Signage.

1.02 Related Requirements

.1 Section 27 05 53 – Identification for Communications Systems.

1.03 Submittals

.1 Product Data: Provide catalogue data for nameplates, labels, and markers.

.2 Provide shop drawings of nameplates for Consultant's review prior to fabrication (scale 1:1)

.3 Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under regulatory requirements. Include instructions for storage, handling, protection, examination, preparation and installation of Product.

1.04 Regulatory Requirements

.1 Provide products listed and classified by CSA (Canadian Standards Association) as suitable for the purpose specified and indicated.

2 Products

2.01 Nameplates and Labels

.1 Nameplates:

.1 Engraved three-layer laminated plastic, letters on contrasting background.

.2 Colours to match existing building system, where applicable. If no building system exists, use the following:

.1 347/600 Volt System: White text on Blue Background.

.2 120/208 Volt System: Black text on White Background.

.3 Fire Detection System: White text on Red Background.

.4 Emergency Lighting System: Red text on White Background.

.5 LV Systems: White text on Green Background.

.3 Confirm colours with Engineer prior to ordering nameplates.

.2 Equipment Nameplates to indicate:

.1 Equipment/Panelboard ID

.2 Ampacity.

.3 Voltage

.4 Number of Phases

.5 Number of wires in system

.6 Interrupting Capacity

.7 Size, number of poles, Panelboard ID, and circuit number of upstream overcurrent protection device.

.1 Location of upstream device if not in the same room.

.3 Coordination Study Labels to Section 26 05 73.16.

.4 Arc Flash Study Labels to Section 26 05 73.19.

.5 Locations:

.1 Distribution panelboards, and individual distribution panelboard branch breakers.

.2 Receptacle panelboards.

.3 Each electrical distribution and control equipment enclosure.

.4 Uninterruptible Power Supply.

.5 Mechanical Equipment.

.6 UPS Receptacles.

.7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.8 Terminal cabinets, junction boxes, and pull boxes: indicate system and voltage.

.9 Transformers: indicate capacity, primary and secondary voltages.

.6 Letter Size:

.1 Use 3 mm letters for identifying individual equipment and loads.

.2 Use 6 mm letters for identifying grouped equipment and loads.

.7 Labels:

.1 Mechanically fastened with sheet metal screws, with 5 mm white letters on black background.

.2 White letters on red background for UPS and equipment, and devices downstream of UPS.

.3 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.

.4 Wording on nameplates and labels to be approved by the Engineer prior to manufacture.

.5 Allow for minimum of twenty-five (25) letters per nameplate and label.

.6 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.7 Terminal cabinets and pull boxes: indicate system and voltage.

2.02 Wiring Identification

.1 Identify wiring with permanent indelible identifying markings, numbered, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

2.03 Wire Markers

.1 Description: tape, split sleeve, or tubing type wire markers.

.2 Locations: Each conductor at panelboard gutters, pull boxes, outlet and junction boxes and each load connection.

.3 Legend:

.1 Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.

.2 Control Circuits: Control wire number indicated on shop drawings.

2.04 Conduit Markers

.1 Colour code conduits, boxes and metallic sheathed cables.

.2 Location: Provide markers for each conduit longer than 2 m.

.3 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.

.4 Colours to match equipment nameplate background colour:

.1 347/600 Volt System: Blue.

.2 120/208 Volt System: Black.

.3 Fire Alarm System: Red.

.4 Emergency Lighting System: Red/White.

.5 LV Systems (EPO, Remote Monitoring, Generator Control, Communications): Green.

.6 120/208 Volt Uninterruptable Power Supply (UPS): Orange

.5 Confirm colours with Engineer prior to commencing rough-in.

2.05 Branch Breaker Labels

.1 General:

.1 Legibly identify every circuit and circuit modification as to its clear, evident, and specific purpose or use. Include sufficient detail to allow each circuit to be distinguished from all others.

.2 Label spare positions that contain unused overcurrent devices or switches.

.3 Do not describe any circuit in a manner that depends on transient conditions of occupancy.

.2 Switchboards, distribution panelboards, enclosed breakers, and disconnect switches:

.1 Locate identification at each switch.

.2 Branch breaker nameplates on switchboards, distribution panelboards and switchboards, and generator load breakers to indicate:

.1 Locate identification at each switch on a switchboard.

.2 Identification of downstream equipment fed from the breaker.

.1 Location of downstream device if not in the same room.

.3 Breaker size and number of poles.

.4 Interrupting Capacity.

.5 Circuit number (where applicable).

.6 Do not describe any circuit in a manner that depends on transient conditions of occupancy.

.3 Lighting and Receptacle Panelboards:

.1 Provide a circuit directory that is located on the face or inside of the panel door.

.2 Do not describe any circuit in a manner that depends on transient conditions of occupancy.

2.06 Receptacle Labels

.1 Label all receptacles with the panelboard ID and circuit number.

.2 Use receptacle labels by electronic labeller Brother P-Touch, model PT-20/25, Dymo-Tape or approved equal.

.3 Location: On receptacle wall plate.

3 Execution

3.01 Equipment Nameplates from Manufacturers

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

.2 Manufacturers' nameplates and CSA labels are to be visible and legible after equipment is installed. Provide warning signs, as specified, or to meet requirements of Inspection Department, Health and Safety, and the Consultant.

.3 Label power outlets with circuit identification on visible portion of faceplate or surface mounted outlet box.

3.02 Conduit Identification

.1 Locate labels as follows:

.1 At every end of every conduit, duct or cable run, adjacent to item of equipment serviced.

.2 On each exposed conduit, duct or cable passing through a wall, partition or floor (one on each side of such wall partition or floor).

.3 At intervals of 50'-0" along every exposed conduit, duct or cable run exceeding 50'-0" in length.

.4 At every access point on concealed conduit duct or cable.

.2 Place labels so as to be visible from 5'-0" above adjacent floor platform.

3.03 Preparation

.1 Degrease and clean surfaces to receive nameplates and labels.

3.04 Application

.1 Confirm colours prior to start of work.

.2 Install nameplate and label parallel to equipment lines.

.3 Secure nameplate to equipment front using adhesive.

.4 Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.

.5 Identify conduit using field painting.

.6 Paint coloured band on each conduit longer than 2 m.

.7 Paint bands 6 m on centre.

3.05 Labelling

.1 Colour code wiring consistently throughout the installation and generally match colour coding of internal wiring of pre-wired components.

.2 Label wiring with point name using Thomas & Betts 12 character polestar metalized labels with 3 rows of characters per label, or equal by Brady. Label to occur as a minimum at both ends and at pull boxes of the wiring run.

.3 Identify all pull boxes, junction boxes, etc. (installed as part of this project or used by this project) with the exact use of the box. Indelible felt pen marker is acceptable.

.4 Label light control items with point name using Thomas & Betts 12 character label, or equal by Brady. Label to be black lettering on clear backing.

.5 Label relays and controllers inside panels using Thomas & Betts 12 character label, or equal by Brady.

.6 Provide red, 13 mm (1/2 inch) diameter, sticker on emergency light fixture frame. Include circuit number on sticker with thin permanent black mark pen.

3.06 Labels and Signs

.1 Manufacturers' nameplates and CSA labels are to be visible and legible after equipment is installed. Provide warning signs, as specified, or to meet requirements of Inspection Department, Health and Safety, and the Consultant.

.2 Label power outlets with circuit identification on visible portion of faceplate or surface mounted outlet box.

End of Section

1 General

1.01 Section Includes

.1 The contractor shall provide an Arc Flash Hazard Analysis Study per the requirements described in CSA-Z462 Standard for Electrical Safety in the Workplace.

.2 The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are obtained in CSA-Z462-08, Annex D, or more recent of the standard as cited by this Section.

.3 The scope of the studies shall include all existing distribution equipment and all new distribution equipment supplied by the equipment Manufacturer under this contract.

1.02 Related Requirements

.1 Section 26 05 73.16 – Coordination Studies.

.2 Single Line Diagram.

1.03 References

.1 References

.1 Institute of Electrical and Electronics Engineers, Inc. (IEEE):

.1 IEEE 141 – Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems

.2 IEEE 242 – Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems

.3 IEEE 399 – Recommended Practice for Industrial and Commercial Power System Analysis

.4 IEEE 241 – Recommended Practice for Electric Power Systems in Commercial Buildings

.5 IEEE 1015 – Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.

.6 IEEE 1584-2018 - Guide for Performing Arc-Flash Hazard Calculations

.2 American National Standards Institute (ANSI):

.1 ANSI C57.12.00 – Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers

.2 ANSI C37.13 – Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures

.3 ANSI C37.010 – Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis

.4 ANSI C 37.41 – Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories.

.3 Ontario Electrical Safety Code (27th edition/2018).

.4 CSA Z462-15, Workplace electrical safety.

1.04 Submittals

.1 Submit the protective device coordination study to the Consultant prior to receiving final review of the distribution equipment shop drawings and/or prior to release of equipment drawings for manufacturing. If formal completion of the studies may cause delay in equipment manufacturing, approval from the engineer may be obtained for preliminary submittal of sufficient study data to ensure that the selection of device and characteristics will be satisfactory.

1.05 Closeout Submittals

.1 The results of the protective device coordination and arc flash hazard analysis studies shall be summarized in a final report. Three (3) bound copies of the complete final report shall be submitted. Additional copies of the complete report with input and output data shall be provided on CD in PDF format.

.2 The report shall include the following sections:

.1 Executive Summary.

.2 Descriptions, purpose, basis and scope of the study.

.3 Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short circuit duties.

.4 Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip unit settings, fuse selection.

.5 Fault current calculations including a definition of terms and guide for interpretation of the computer printout.

.6 Details of the incident energy and flash protection boundary calculations.

.7 Recommendations for system improvements, where needed.

.8 Single Line Diagram.

.3 Arc flash labels (refer to CSA Z462 Annex Q) shall be provided in hard copy only.

1.06 Qualifications

.1 Arc flash hazard analysis studies shall be conducted under the supervision and approval of a Registered Professional Electrical Engineer skilled in performing and interpreting the power system studies.

.2 The Registered Professional Electrical Engineer shall be a full-time employee of the equipment manufacturer or an approved engineering firm.

.3 The equipment manufacturer or approved engineering firm shall demonstrate experience with Arc Flash Hazard Analysis by submitting names of at least ten actual arc flash hazard analysis it has performed in the past year.

1.07 Computer Analysis Software

.1 The studies shall be performed using the latest revision of the SKM or equivalent.

2 Products

2.01 Manufacturers

.1 Independent Testing Organizations:

.1 AC Tesla.

.2 Brosz and Associates.

.3 C-INTECH.

.4 Eastenghouse.

.5 Enkompass.

.6 G.T. Wood.

.2 Electrical distribution manufacturers:

.1 Eaton.

.2 Schneider Electric.

2.02 Studies

.1 The contractor shall furnish an Arc Flash Hazard Analysis Study per CSA Z462, reference Section 4.1.8.2.2, 4.3.3.

2.03 Data Collection

.1 Contractor shall furnish all data as required by the power system studies. The Engineer performing arc flash hazard analysis studies shall furnish the Contractor with a listing of required data immediately after award of the contract. 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 the release of the equipment for manufacturing.

.2 Source combination may include present and future motors and generators.

.3 If applicable, include fault contribution of existing motors in the study. The Contractor shall obtain required existing equipment data, if necessary, to satisfy the study requirements.

2.04 Arc Flash Hazard Analysis

.1 The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in CSA Z462 Annex D.

.2 The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, panelboards and splitters) where work could be performed on energized parts.

.3 The Arc-Flash Hazard Analysis shall include all significant locations in 240 volt and 208 volt systems fed from transformers equal to or greater than 112.5 kVA where work could be performed on energized parts.

.4 Safe working distances shall be based upon the calculated arc flash boundary considering an incident energy of 1.2 calories per square centimetre.

.5 When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations.

.6 The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for all normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum and will assume a minimum motor contribution (all motors off). Conversely, the maximum calculation will assume a maximum contribution from the utility and will assume the maximum amount of motors to be operating. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable.

.7 The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators should be decremented as follows:

.1 Fault contribution from induction motors should not be considered beyond 3-5 cycles.

.8 Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g. contributions from permanent magnet generators will typically decay from 10 per unit to 3 per unit after 10 cycles).

.9 For each equipment location with a separately enclosed main device (where there is adequate separation between the line side terminals of the main protective device and the work location), calculations for incident energy and flash protection boundary shall include both the line and load side of the main breaker.

.10 When performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculation.

.11 Mis-coordination should be checked amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.

.12 Arc Flash calculations shall be based on actual overcurrent protective device clearing time.

.13 Maximum clearing time will be capped at 2 seconds based on IEEE 1584.

.14 Where it is not physically possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.

2.05 Report Sections

.1 Incident energy and flash protection boundary calculations:

.1 Arcing fault magnitude.

.2 Protective device clearing time.

.3 Duration of arc.

.4 Arc flash boundary.

.5 Working distance.

.6 Incident energy.

.7 Hazard Risk Category.

.8 Recommendations for arc flash energy reduction.

3 Execution

3.01 Field Adjustment

.1 Adjust relay and protective device settings according to the recommended settings table provided by the coordination study. Field adjustments to be completed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

.2 Make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.

.3 Notify Owner in writing of any required major equipment modifications.

3.02 Arc Flash Warning Labels

.1 The contractor of the Arc Flash Hazard Analysis shall provide a 3.5 inch by x 5 inch thermal transfer type label of high adhesion polyester for each work location analyzed.

.2 All labels will be based on recommended overcurrent device settings and will be provided after the results of the analysis have been presented to the owner and after any system changes, upgrades or modifications have been incorporated in the system.

.3 The label shall include the following information, at a minimum:

.1 Location designation.

.2 Nominal voltage.

.3 Flash protection boundary.

.4 Hazard risk category.

.5 Incident energy.

.6 Working distance.

.7 Engineering firm and issue date.

.8 Labels shall be machine printed, with no field markings.

.4 Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings.

.1 For each 600 volt, and applicable 208 volt panelboard, one arc flash label shall be provided.

.2 For each motor control center, one arc flash label shall be provided.

.3 For each low voltage switchboard, one arc flash label shall be provided.

.4 For each switchgear, one flash label shall be provided.

.5 For medium voltage switches one arc flash label shall be provided.

.5 Arc Flash Warning Label General Instructions:

.1 Only qualified electricians who recognize and avoid the electrical and Arc Flash hazards are allowed to place the arc flash warning labels.

.2 Electricians should wear suitable PPE, such as electrical safety boots, Safety Glasses, etc. while performing labeling.

.3 Generally, arc flash label shall be put on a prominent pre-cleaned place on the front of the electrical equipment (such as switchgear, panel, disconnect switch, generator output breaker). Label should be visible and readable, displayed horizontally, attached flatly and securely, and not allowed to cover other signs or labels on the equipment.

.4 Under the special request of the client, labels could be put on the back of the panel door when the panel is located in clean and finished spaces such as an office area.

.5 When putting a label on small equipment with no space labeling on the wall just beside the equipment is allowed.

.6 Special request may be attached to this General Instruction. For examples, more than one identical label is applied for large equipment; different labels could be applied for different sections of one equipment; for a splitter with several disconnect switches only one label is placed on the splitter for this group.

.7 Take the pictures for each label to indicate both names of the label and equipment and labeling area of the equipment. Email these pictures to the Consultant for quality control and record.

End of Section

1 General

1.01 Section Includes

.1 Electrical connections to equipment specified in other sections.

1.02 Related Requirements

.1 Division 08 – Openings.

.2 Division 11 – Equipment.

.3 Division 14 – Conveying Equipment.

.4 Division 21 – Fire Suppression.

.5 Division 22 – Plumbing.

.6 Division 23 – Heating, Ventilating, and Air Conditioning.

1.03 References

.1 NEMA WD 1 - General Colour Requirements for Wiring Devices.

.2 NEMA WD 6 - Wiring Devices - Dimensional Requirements.

1.04 Coordination

.1 Coordinate work to Section 01 31 00.

.2 Obtain and review shop drawings, product data, and manufacturer's instructions for equipment provided under other sections.

.3 Determine connection locations and requirements.

.4 Sequence rough-in of electrical connections to coordinate with installation schedule for equipment.

.5 Sequence electrical connections to coordinate with start-up schedule for equipment.

1.05 Submittals

.1 Submit to Section 01 33 00.

.2 Product Data: Provide wiring device manufacturer's catalogue information showing dimensions, configurations, and construction.

.3 Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.06 Regulatory Requirements

.1 Provide products listed and classified by testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

2 Products

2.01 Common Motor Requirements

.1 Motors up to and including 1/3 HP, shall be 1 phase, 60 Hz, 120 volts.

.2 Motors 1/2 HP and above shall be 3 phase, 60 Hz, 575 volts or 208 volts.

2.02 Cords and Caps

.1 Attachment Plug Construction: Conform to NEMA WD 1.

.2 Configuration: NEMA WD 6; match receptacle configuration at outlet provided for equipment.

.3 Cord Construction: NFPA 70, Type SJO multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.

.4 Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

3 Execution

3.01 Wiring of Equipment Provided Under Other Divisions

.1 Use the following procedure with regard to wiring of motors and equipment provided under other Divisions.

.2 The following equipment shall be responsibility of the trade supplying the equipment unless otherwise noted, in accordance with the requirements laid out in the individual section, or this division:

.1 Motors.

.2 Starters.

.3 Variable Frequency Drives.

.4 Motor Control Centres.

.5 Control wiring.

.3 In every instance, install starter, motor control centre, variable frequency drivers (VFD), etc. and wire to line side of the starter, the Motor Control Centre, or VFD. Extend wiring from starter, motor control centre or VFD to motor as indicated.

.4 Provide all wiring for starters and VFD's from supply to starter to VFD and to motor. Coordinate requirements with the appropriate trade.

.5 Provide 500 mm of liquid tight flexible metal conduit for final connection to motor. Provide disconnect switches where required by code, and as indicated on the drawings.

.6 Where individual starters and controls are grouped together provide a panel for mounting this equipment. Provide a feeder, main fused disconnect and a splitter of adequate size and capacity and wire to line side of the starters on this panel and from starters to motors.

.7 Equipment, General

.1 Ascertain exact locations of starters, motor control centres, motors, etc. from drawings and coordinate exact locations with the supplying trade.

.2 Control wiring shall be the responsibility of the supplying trade.

.1 Control wiring shall be in accordance with Section 26 05 19, and Section 26 05 23.

.2 Control wiring shall be installed in conduit in accordance with Section 26 05 33.13.

.8 Conveying Equipment (e.g. Elevators): in accordance with Section 26 05 83.14.

.9 Plumbing Equipment

.1 Ascertain exact locations of starters, motor control centres, motors, infra-red plumbing fixture controls from Mechanical Drawings and coordinate exact locations with plumbing trade.

.2 Provide branch circuit wiring and an outlet for each infra-red plumbing fixture control.

.3 Control wiring shall be the responsibility of the plumbing trade, as described above.

.10 HVAC Equipment

.1 Ascertain exact locations of starters, motor control centres, motors, motorized dampers, VAV boxes, and heating control valves from HVAC drawings and coordinate exact locations with HVAC Division.

.2 In the case of unit heaters, reheat coils and cabinet unit heaters, terminate wiring on terminals provided. Control wiring, thermostats, or other control devices shall be the responsibility of the HVAC trade, as described above.

.3 Provide branch circuit wiring and an outlet for each motorized damper, variable air volume (VAV) box, or heating control valve. Control wiring shall be the responsibility of the HVAC trade, as described above.

3.02 Examination

.1 Verify that equipment is ready for electrical connection, wiring, and energization.

3.03 Electrical Connections

.1 Make electrical connections to equipment manufacturer's instructions.

.2 Make conduit connections to equipment using flexible conduit. Use liquid-tight flexible conduit with watertight connectors in damp or wet locations.

.3 Make wiring connections using wire and cable with insulation suitable for temperatures encountered in heat producing equipment.

.4 Provide receptacle outlet where connection with attachment plug is indicated. Provide cord and cap where field-supplied attachment plug is indicated.

.5 Provide suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

.6 Install disconnect switches, controllers, control stations, and control devices as indicated.

.7 Modify equipment control wiring with terminal block jumpers as indicated.

.8 Provide interconnecting conduit and wiring between devices and equipment where indicated.

.9 Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.

End of Section

1 General

1.01 Section Includes

.1 Commissioning of all building electrical systems and component including:

.1 Testing and adjustment.

.2 Demonstration and training.

.3 Instructions of all procedures for Owner's personnel.

.4 Updating as-built data.

.5 Co-ordination of Operation and Maintenance material.

.2 Provide labour and material to conduct the commissioning process as outlined in this specification section, including the hiring of an Independent Testing Contractor (ITC) as detailed below.

.3 Provisions of this section shall apply to all sections of Division 26, Division 27, Division 28, and sections related to electrical utilities in Division 33.

1.02 Related Requirements

.1 Testing and commissioning are called for throughout the individual specifications. This does not relieve this trade from providing all testing and commissioning necessary to ensure that systems and equipment operate as required and that they interface with other systems and equipment as required.

.2 Section 26 08 50 – Commissioning of Lighting: additional commissioning requirements for commissioning of lighting and lighting controls.

1.03 Commissioning Process Allocation

.1 The commissioning process shall be allocated a value equal to 5 per cent of the contract. The Electrical Contractor may draw from this allocation as the commissioning process is completed.

.2 The Electrical Contractor shall submit all test and verification forms. The Consultant will use these forms to calculate percentage complete.

.3 The Electrical Contractor may claim up to 3 per cent of the contract from this allocation leading up to performance testing. The remaining 2 per cent shall not be paid out until the performance testing, O&M manuals, and training have been completed satisfactorily.

1.04 Definitions

.1 Cx – Commissioning.

.2 Commissioning Authority

.1 The Commissioning Authority (CxA), also referred to as the Commissioning Consultant, shall be hired by The Owner.

.2 The CxA responsibilities shall include:

.1 preparing the commissioning plan

.2 co-ordinating with the contractor to schedule tests

.3 preparing a test form manual

.4 witnessing selected tests

.5 receiving all test forms

.6 co-ordinating the contractors training

.7 chair the commissioning meetings

.3 The Electrical Contractor shall co-operate with the CxA.

.4 The Electrical Contractor shall provide assistance to the CxA and have personnel available during the performance testing procedure. Each electrical system shall be tested in the operational mode.

1.05 Submittals

.1 Conform to Section 01 33 00 for requirements for shop drawings and record drawings.

.2 A commissioning document shall be prepared by the CxA prior to conducting these activities for use by the Commissioning Team.

.3 The electrical sub-contractor shall be responsible for ensuring all activities are properly documented in this manual and co-ordinated through the General Contractor.

.4 As-built drawings and data books must be available two weeks prior to commissioning for review and use by the consultant and Commissioning Team prior to the start of the commissioning activities.

1.06 Closeout Submittals

.1 Attendance records for all training sessions.

.2 Testing reports for system load balance measurements, infra-red test and harmonics tests.

1.07 Quality Assurance

.1 Provide qualified trades persons, certified testing agencies, factory trained and approved by the Commissioning Team Leader.

.2 Submit the names of all personnel to be used during the Commissioning activities.

1.08 Warranty

.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 Electrical Contractor shall fill out the warranty form listing the equipment and systems and the start and finishing dates for warranty.

.3 Refer to Division 01 and Section 26 05 00 for the requirements during the warranty period.

2 Products

2.01 Equipment

.1 The Contractor and manufacturers shall provide all instrumentation and equipment necessary to conduct the tests specified. The Contractor shall advise the Consultant of instrumentation to be used and the dates the instruments were calibrated.

3 Execution

3.01 The Commissioning Process

.1 The purpose of the commissioning process is to fully test all building systems including architectural, mechanical and electrical components and operating procedures by challenging these systems to realistic operation conditions.

.2 The commissioning process consists of:

.1 Shop Drawings and Record Drawings

.2 Installation inspection and equipment verification

.3 Independent testing contractor

.4 Testing of equipment and systems

.5 Commissioning meetings

.6 Operating and maintenance manuals

.7 Operating training

.8 Commissioning Agent testing

.9 Systems Demonstration and turnover

.10 Testing forms

.11 Warranties

3.02 Preparation

.1 Provide test instruments required for all activities as defined in the commissioning documents.

.2 Verify all systems are in compliance with the requirements of the commissioning documents prior to the pre-commissioning check out operation.

.3 Confirm all scheduled activities have identified personnel available.

.4 Where systems or equipment do not operate as required, make the necessary corrections or modifications, re-test and re-commission.

3.03 System Description

.1 Perform all start-up operations, control adjustment, trouble shooting, servicing and maintenance of each item of equipment as defined in the commissioning documentation.

.2 Owner will provide list of personnel to receive instructions and will co-ordinate their attendance at agreed upon times.

.3 Prepare and insert additional data in the operations and maintenance manuals and update as-built drawings when need for additional data becomes apparent during the commissioning exercise.

.4 Where instruction is specified in the commissioning manual, instruct personnel in all phases of operation and maintenance using operation and maintenance manuals as the basis of instruction.

.5 Conduct presentation on Owner's premises. Owner will provide space.

3.04 Commissioning

.1 Commission the components of the electrical system using the NETA Acceptance Testing Specifications.

.2 Refer to the project commissioning plan prepared by the CxA.

.3 Commissioning activities for the electrical systems must have available up to date as-built drawing information and accurate Operations and Maintenance Manuals. These documents shall be a major part of this activity.

.4 Contractor shall be responsible to update all documentation with information and any changes duly noted during the Commissioning exercise.

.5 Contractor shall arrange for all outside suppliers, equipment manufacturers, test agencies and others as identified in the commissioning sections of this specification. The cost associated with this requirement shall be included as part of the tender price.

3.05 Final Report

.1 This trade shall assemble all testing data and commissioning reports and submit them to the General Contractor for submission to the Owner.

.2 Each form shall bear signature of recorder, and that of supervisor of reporting organizer.

3.06 Schedule of Activities

.1 Commissioning activities shall be conducted based on pre-established schedule with all members of the commissioning team.

.2 In addition, there will be two meetings held through the contract duration to introduce the parties of the commissioning team, establish the schedules and deadlines for the various activities and review the Commissioning Manual.

.3 Adhering to the established schedule is very important as the co-ordination and scheduling of the participants will be difficult to alter once this is established. Close co-ordination of this schedule is important.

.4 In the event project cannot be commissioned in the allotted time slot, the contractor shall pay for all costs associated with assembling the Commissioning Team at a later date. If the contractor has not performed his duties to reach commissioning stage as outlined earlier, he will incur all expenses of other trades and the Commissioning Team due to his non-compliance.

3.07 Installation Inspection and Equipment Verification

.1 The Electrical Contractor shall co-ordinate with the Electrical Consultant who will inspect the electrical installation.

.2 The Electrical 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 Voltage and current ratings.

3.08 Independent Testing Contractor

.1 The Independent Testing Contractor (ITC) shall be hired by the contractor and shall issue reports to the Electrical Consultant.

.2 The ITC shall conduct load balancing measurements to verify load balancing performed in accordance with Section 26 05 00.

3.09 Testing of Equipment and Systems

.1 The Electrical Contractor shall be responsible for all tests detailed in this Section, and those tests required by a manufacturer as part of their installation requirements.

.2 The Electrical Contractor shall schedule all tests which shall be witnessed by the Electrical Consultant or the Commissioning Consultant. The contractor shall complete and sign the testing forms.

.3 The Electrical Contractor shall conduct tests on the following equipment as a minimum. Refer to the individual specification sections for test procedures.

.1 Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables.

.2 Section 26 05 73.16 – Coordination Studies.

.3 Section 26 24 13 – Switchboards.

.4 Section 26 24 16 – Panelboards.

.5 Section 26 24 19 – Motor Control Centres.

.6 Section 27 51 16 – Public Address Systems.

.7 Section 28 10 00 –Access Control.

.8 Section 28 46 21.11 – Addressable Fire Alarm Systems.

.4 When all testing has been completed and all mechanical and electrical systems are operational the contractor shall conduct system load balance measurements, infra-red test and harmonics tests.

3.10 Commissioning Meetings and Reporting

.1 The Electrical Contractor shall include the schedule for all tests in the construction schedule.

.2 The Commissioning meetings shall occur during the regular construction meetings. The testing schedules and the results of all tests shall be reviewed.

.3 All testing forms and reports associated with the electrical systems shall be directed to the Electrical Consultant, with copies to the Architect, Commissioning Consultant, and the Owner.

.4 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 Minutes of commissioning meetings

.7 Manufacturers' Certificates

3.11 Operating and Maintenance Manual

.1 Conform to the specification section for the requirements of the O&M manuals.

3.12 Closeout Activities

.1 Conform to section for requirements for instructions to the Building Owner for each system and equipment.

.2 The training shall be provided by qualified technicians or electricians and shall be conducted in a classroom and at the equipment or system.

.3 The training sessions shall be scheduled, co-ordinated and video taped by the Commissioning Consultant.

.4 Each training session shall be structured to cover:

.1 The operating and maintenance manual.

.2 Operating procedures.

.3 Maintenance procedures.

.4 Troubleshooting procedures.

.5 Spare parts.

.5 Submit a course outline to the Electrical Consultant before training commences. Provide course documentation for up to eight people.

.6 The training session shall be scheduled and co-ordinated by the Commissioning Consultant. The Commissioning Consultant shall video tape the sessions.

.7 Training shall be provided for the following systems:

.1 Electrical Systems including distribution and lighting: 8 hour minimum

.2 Section 27 51 16 – Public Address Systems: 1 hour minimum

.3 Section 28 10 00 – Access Control: 1 hour minimum

.4 Section 28 46 21.11 – Addressable Fire Alarm Systems: 2 hours minimum

.8 The Electrical Contractor shall conduct a walkthrough of the installation. During the walkthrough the Electrical Contractor shall:

.1 Identify equipment.

.2 Identify electrical panels.

.3 Identify starters and disconnects.

.4 Review the electrical power distribution.

.5 Review the light power distribution.

.6 Review the switchgear.

.7 Review the general maintenance procedures.

3.13 The Electrical System Demonstration and Turnover

.1 The system demonstration and turnover to The Owner shall occur when:

.1 The installation is complete.

.2 The acceptance test conducted by the Electrical Consultant has been completed successfully.

.3 Training has been completed.

.4 Equipment Operating and Maintenance Manuals have been accepted.

.5 System operating manuals have been accepted.

.6 Shop-drawings have been updated.

.7 As-built drawings have been completed.

.8 The commissioning process has been completed successfully and system operation accepted by the Electrical Consultant and Commissioning Consultant.

.2 The systems demonstration shall be conducted by the Electrical Contractor and manufacturers. The demonstration shall cover a physical demonstration of equipment installation and operation.

3.14 Testing Forms

.1 The Electrical Contractor and manufacturers shall fill out the forms listed in this section or provide other forms. The forms must be approved by the Electrical Consultant and the Owner before they are used.

End of Section

1 General

1.01 Section Includes

.1 Common requirements for commissioning of all electric lighting, including interior, exterior, and emergency lighting.

.2 The party responsible for the functional testing shall not be directly involved in either the design or construction of the project.

1.02 Related Requirements

.1 Section 26 09 23 – Lighting Control Devices.

.2 Section 26 09 26 – Lighting Control Panelboards.

.3 Section 26 09 43 – Network Lighting Controls.

.4 Section 26 51 00 – Interior Lighting.

.5 Section 26 52 13.13 – Emergency Lighting.

.6 Section 26 56 19 – LED Exterior Lighting.

1.03 References

.1 ASHRAE

.1 ASHRAE Guideline 0-2005 – The Commissioning Process.

.2 ASHRAE 90.1-2013 – Energy Standard for Building Except Low-Rise Residential Buildings.

.2 Illumination Engineering Society (IES)

.1 IES DG-29-11 – Design Guide for the Commissioning Process Applied to Lighting and Control Systems.

.3 Ontario Building Code

.1 Supplementary Standard SB-10: Energy Efficiency Requirements, December 22, 2016 update.

1.04 Action Submittals

.1 Refer to Section 01 33 00.

.2 Submit sample commissioning forms.

1.05 Closeout Submittals

.1 Section 01 33 00 and Section 01 78 00: Submittals for project closeout.

.2 Submit commissioning reports.

.1 Submit a floor plan or spreadsheet table checklist that indicates each local lighting control device, occupancy sensors, daylighting controls, system component.

.2 Submit the system sequence of operation fully describing the equipment components and functionality, including set points and alarm functions.

.3 The detailed sequence of operation shall be provided regardless of the completeness and clarity of the sequences in the controls specification and/or drawings.

.3 The functional testing party shall provide documentation certifying that the installed lighting controls meet or exceed all documented performance criteria.

2 Products – Not Used

3 Execution

3.01 Site Tests and Inspections

.1 Sensor placement and orientation for all sensor types.

.2 Occupancy sensor function, sensitivity, and time delays.

.3 Daylight harvesting sensor calibration.

.4 Automated shade operation.

.5 Manual control placement and operation.

.6 Automated control operation, including scheduled on/off functions and dimming trims and presets.

.7 Override operation, access, and functionality.

.8 Centralized control interfaces and operation.

.9 Client education of operations.

.10 Documentation archived to client.

3.02 Functional Testing

.1 Lighting control devices and control systems shall be tested to ensure that control hardware and software are calibrated, adjusted, programmed, and in proper working condition in accordance with the construction documents and manufacturer's installation instructions.

.2 When occupant sensors, time switches, programmable schedule controls, or photosensors are installed, at a minimum, the following procedures shall be performed:

.1 Confirm that the placement, sensitivity and time-out adjustments for occupant sensors yield acceptable performance, lights turn off only after space is vacated and do not turn on unless space is occupied.

.2 Confirm that time switches and programmable schedule controls are programmed to turn the lights off.

.3 Confirm that photosensor controls reduce electric lights levels based on the amount of usable daylight in the space as specified.

End of Section

1 General

1.01 Section Includes

.1 Occupancy and Vacancy sensors.

.2 Power packs, and auxiliary relays, momentary switches.

.3 Manual controls devices, including dimming switches and low voltage momentary switches.

.4 Timer switches.

.5 Daylight harvesting photo sensors.

.6 Emergency lighting control units.

1.02 Products Installed But Not Supplied Under This Section

.1 Line voltage manual control devices, as described in Section 26 27 26 – Wiring Devices.

.2 Multi-zone scene controllers, as described in Section 26 09 36 – Modular Dimming Controls.

1.03 Related Requirements

.1 Section 26 08 50 – Commissioning of Lighting.

.2 Section 26 27 26 – Wiring Devices.

.3 Section 26 50 00 – Lighting.

1.04 References

.1 Canadian Standards Association (CSA) (www.csa.ca).

.1 CSA C22.1-18, Canadian Electrical Code, Part 1 (24th Edition), Safety Standard for Electrical Installations.

.2 Ontario Electrical Safety Code (27th edition/2018).

.3 CSA C22.2 No. 14 Industrial Control Equipment

.4 CSA C22.2 No. 184 - Solid-State Lighting Controls

.5 CSA C22.2 No. 184.1 - Solid State Dimming Controls.

.6 CSA C22.2 No. 156 - Solid-State Speed Controls

.7 CSA C22.2 No. 42.1 - Cover Plates for Flush Mounted Wiring Devices

.8 CSA C22.2 No. 42 - General Use Receptacles

.2 National Electrical Manufacturers Association (NEMA)

.1 WD1 (R2005) — General Color Requirements for Wiring Devices.

.2 WD6 – Dimensional Specifications

.3 Ontario Building Code.

.4 UL 924 - Standard for Safety of Emergency Lighting and Power Equipment.

1.05 Submittals

.1 In accordance with Section 01 33 00.

.2 Product Data:

.1 Submit manufacturer's descriptive literature and product specifications for each product.

.2 Manufacturer's product drawings.

.3 Manufacturer's installation instructions

1.06 Quality Assurance

.1 Manufacturer Qualifications: Products free of defects in material and workmanship.

1.07 Warranty

.1 Product is warranted free of defects in material and workmanship.

.2 Product is warranted to perform the intended function within design limits.

2 Products

2.01 Manufacturers

.1 Wattstopper (Basis of Design).

.2 Cooper Lighting Solutions.

.3 Hubbell.

.4 Leviton.

.5 Lutron.

.6 Sensorswitch.

2.02 General Requirements of all Sensors and Power Packs

.1 Manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1 per cent.

.2 Five year warranty and CUL listed.

.3 In the event of failure, provide a bypass manual "override on" feature on each sensor.

.4 When bypass utilized, lighting to remain on constantly, or control is to be diverted to a wall switch until sensor is replaced. The override feature is to be designed for use by building maintenance personnel and not be readily achieved by building occupants.

2.03 Occupancy and Vacancy Sensors

.1 General:

.1 Sensors using passive infrared, ultrasonic, microphonic, and multi-technology adaptive technology.

.2 Sensor timeouts configurable by system software.

.3 Electrical: Rating: 24 VDC input voltage, up to 40 mA current draw.

.4 Mechanical: Mounting: Sensors for mounting on ceilings and walls, including corners, must be available.

.5 Environmental:

.1 Operating Temperature Range: 0 degrees C to 40 degrees C

.2 Relative Humidity: 0 per cent to 95 per cent non-condensing.

.2 Dual Technology Wall Switch Sensor, 24V

.1 Wattstopper DW-100-24-W series (Basis of Design).

.2 Sensor capable of detecting presence in the control area by detecting Doppler shifts in transmitted ultrasound and passive infrared heat changes.

.3 Utilize a dual sensing verification principle for coordination between ultrasonic and Passive Infrared (PIR) Technologies to reduce likelihood of false triggering.

.4 For best results, sensor shall feature a trigger mode where the end-user can choose which technology will activate the sensor from Off mode (initial), the type of detection that will reset the time delay (maintain), and the type of detection that will cause the sensor to be turned back on immediately after the lights are turned off due to lack of motion (re-trigger). Selection of technologies for initial, maintain, and re-trigger shall be done with DIP switches.

.5 Sensor shall have its trigger mode factory preset to allow for quick installation in most applications. In this default setting, both technologies must occur in order to initially activate lighting systems. Detection by either technology shall maintain the lighting on, and detection by either technology shall turn lights back on after lights were turned off for 5 seconds or less in automatic mode, and 30 seconds or less in manual mode.

.6 Robotic test method, as referred in the NEMA WD 7 Guide, shall be utilized for minor motion coverage verification.

.7 Ultrasonic sensing shall be volumetric in coverage with a frequency of 40 kHz. It shall utilize Advanced Signal Processing which automatically adjusts the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout controlled space.

.8 The PIR technology shall utilize a temperature compensated, dual element sensor and a multi-element Fresnel lens. The lens shall filter short wavelength IR, such as those emitted by the sun and other visible light sources. Face lens grooves in to avoid dust and residue build up which affects IR reception.

.9 Utilize zero crossing circuitry to reduce stress on relay, and therefore increase sensor life.

.10 Operate at 24 VDC and halfwave rectified and utilize a power pack or lighting control system input module to supply power.

.11 To blend in aesthetically, sensor protrusion not more than 3/8” from the wall and utilize colour-matched lens.

.12 To assure detection at desktop level uniformly across the space, sensor shall have a 28 segment, 2 level, Fresnel injection molded lens.

.13 Sensor shall feature a walk-through mode, where lights turn off 3 minutes after the area is initially occupied if no motion is detected after the first 30 seconds, set by DIP switch.

.14 To avoid false ON activations and to provide immunity to RFI and EMI, Detection Signature Analysis shall be used to examine the frequency, duration, and amplitude of a signal, to respond only to those signals caused by human motion.

.15 Coverage up to 1,000 sq. ft. for walking motion, with a field view of 180 degrees.

.16 Automatic-ON or manual-ON operation, adjustable with a DIP switch.

.17 Sensor shall have an adjustable time delay.

.18 Each sensing technology shall have an LED indicator that remains active at all times, in order to verify detection within the area to be controlled.

.19 Sensor shall have a service switch to allow end-users to operate the sensor in the unlikely event of a failure; set by a trim pot.

.20 Sensor shall have a built-in light level that features simple, one-step daylighting setup that works from 8 fc to 180 fc.

.21 The Dual Technology wall switch sensor shall be a completely self-contained control system that replaces a standard toggle switch

.3 Dual Technology Ceiling Mounted Sensor, 24V

.1 Wattstopper DT-300 series (Basis of Design).

.2 The Dual Technology sensor shall be capable of detecting presence in the control area by detecting doppler shifts in transmitted ultrasound and passive infrared heat changes.

.3 Sensor shall utilize Dual Sensing Verification Principle for coordination between ultrasonic or microphonic and Passive Infrared (PIR) Technologies. Detection verification of both technologies must occur in order to activate lighting systems. Upon verification, detection by either technology shall keep the lighting on.

.4 Sensor shall have a retrigger feature in which detection by either technology shall retrigger the lighting system on within 5 seconds of being switched off.

.5 Sensors shall be ceiling mounted with a flat, unobtrusive appearance, and provide 360 degree coverage.

.6 Ultrasonic sensing shall be volumetric in coverage, with a frequency of 40 kHz. It shall utilize Advanced Signal Processing that automatically adjusts the detection threshold dynamically to compensate for changing levels of activity and airflow throughout a controlled space.

.7 To avoid false ON activations, and to provide immunity to RFI and EMI, Detection Signature Analysis shall be used to examine the frequency, duration, and amplitude of a signal, in order to respond only to those signals caused by human motion.

.8 The PIR technology shall utilize a temperature compensated, dual element sensor and a multi-element Fresnel lens. The lens shall be Poly IR4 material to offer superior performance in the infrared wavelengths and filter short wavelength IR, such as those emitted by the sun and other visible light sources. The lens shall have grooves facing in to avoid dust and residue build up which affects IR reception.

.9 Sensors shall operate at 24 VDC, and halfwave rectified, and utilize a 24 V power pack.

.10 Sensors shall feature a walk-through mode, where lights turn off 3 minutes after the area is initially occupied if no motion is detected after the first 30 seconds.

.11 The sensor shall have a built-in light level sensor that works from 10 fc to 300 fc.

.12 The sensors shall feature terminal style wiring.

.13 Each sensing technology shall have an LED indicator that remains active at all times in order to verify detection within the area to be controlled. The LED can be disabled for applications that require less sensor visibility.

2.04 Special Purpose Occupancy Sensors

.1 Occupancy Sensors for High bay applications:

.1 For use in warehouses, distribution centers, and gymnasiums.

.2 Maximum 14 m (45 feet) mounting height.

.3 Surface-mount or end-mount model to suit application.

.4 180 degree and 360 degree coverage lenses available.

.5 Low-voltage, passive infrared (PIR) sensor.

.6 End-mount model to attach directly to industrial T5HO and T8 fixtures through an extended 13 mm (0.5 inch) chase nipple or junction box.

.7 Adjustable timeout for maximum energy savings.

.8 Basis of design: Lutron LUT-WSPSM24V-360-CPN6111 and similar.

2.05 Power Packs

.1 General:

.1 Self-contained transformer and relay module.

.2 Internal relay controlling up to 20A for 120, 230, 277VAC or 347VAC ballast loads and 120VAC incandescent loads.

.3 Provide a 24 VDC, 150 mA output.

.4 Capable of parallel wiring without regard to AC phases on primary.

.5 Power pack can be used as a standalone, low voltage switch, or can be wired to sensor for auto control.

.6 Construction: high impact, UL rated plastic case

.7 Power pack shall be UL/CUL Listed, FCC Certified, UL 2043 plenum rated and meets ASHRAE 90.1 requirements

.8 Shall at minimum meet the following environmental specifications:

.1 Operating Temperature Range: 0 degrees C to 40 degrees C

.2 Relative Humidity: 0 per cent to 95 per cent non-condensing

.2 Power Pack and Auxiliary Relay, 347 V

.1 Power Pack: Wattstopper B347D-P Series (Basis of Design)

.2 Auxiliary Relay: Wattstopper S347-E-P Series (Basis of Design)

.3 Power pack shall be a self-contained transformer and relay module measuring 45 mm by 70 mm by 38 mm (1.75 inch by 2.75 inch by 1.5 inch).

.4 For ease and speed of installation, power pack shall have 12 mm (1/2") snap-in nipple for 12 mm (1/2") knockouts and mounting on outside of enclosure.

.5 Power pack shall have dry contacts capable of switching 15 amp ballast @ 347 VAC, 60Hz.

.6 Power pack shall have primary voltage input of 347 VAC.

.7 Power pack shall provide a 24 VDC, 114 mA output, with the relay connected.

.8 Power pack shall be capable of parallel wiring without regard to AC phases on primary.

.9 Power pack can be used as a standalone, low voltage switch, or can be wired to sensor for auto control.

.10 Power pack shall have hold-ON and hold-OFF inputs for integration with lighting control panels, BMS and other building systems.

.11 Power pack shall have overcurrent protection if the low voltage current drawn exceeds 150 mA. In the event of an overcurrent, the low voltage output current shuts down and the LED will blink to indicate a fault condition.

.12 Power pack shall have an LED to indicate status of relay.

.13 Power pack shall utilize Zero Crossing Circuitry to protect from the effects of inrush current and increase product longevity.

2.06 Dimming Switches

.1 Direct control of dimming luminaires up to the luminaire manufacturer's specified rating.

.2 Coordinate dimming signal configuration (2-wire phase cut, 3-wire, 4-wire 0-10V, or 4-wire DALI) with the fixture ballast or driver per Section 26 50 00, lighting fixture schedule, and related sections.

.3 Compatible with related lighting control devices i.e. occupancy sensors.

.4 Submit luminaire manufacturer's dimmer compatibility documentation to demonstrate compatibility and limits of dimming level.

.5 Acceptable Manufacturers:

.1 Lutron NovaT* style dimmers.

.2 Equal by Cooper.

.3 Equal by Philips.

.4 Approved Equal.

2.07 Sequences of Operation

.1 Vacancy Sensor Operation: Manual On, Manual/Auto Off.

3 Execution

3.01 Installation

.1 In accordance with manufacturer's instructions.

.2 Minimum 14 AWG from the circuit control hardware relays.

.3 It shall be the contractor's responsibility to locate and aim sensors in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Rooms shall have 90 per cent to 100 per cent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective room.

.4 It is the contractor's responsibility to arrange a pre-installation meeting with manufacturer's factory authorized representative, at Owner's facility, to verify placement of sensors and installation criteria.

.5 Proper judgement must be exercised in executing the installation so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components.

.6 Install manual control devices and sensors in accordance with manufacturer's instructions for Vacancy Operation.

3.02 Training

.1 Provide training in accordance with Section 01 79 00.

3.03 Site Tests and Inspections

.1 In accordance with Section 26 08 50.

.2 Upon completion of the installation, the system shall be completely commissioned to verify all adjustments and sensor placement to ensure a trouble-free lighting control system.

.3 Submit commissioning report to the Consultant and the commissioning authority for review.

.4 Provide the Consultant and Commissioning Authority with ten working days written notice of the scheduled commissioning date.

End of Section

1 General

1.01 Section Includes

.1 Power distribution panelboards – Circuit breaker type.

.2 Lighting and Appliance Branch Circuit Panelboards.

1.02 Related Requirements

.1 Section 26 28 16.02 – Molded Case Circuit Breakers.

.2 Section 26 43 13 – Surge Protective Devices for Low-Voltage Electrical Power Circuits.

1.03 References

.1 CSA C22.1-18, Canadian Electrical Code, Part 1 (24th Edition), Safety Standard for Electrical Installations.

.2 Ontario Electrical Safety Code (27th edition/2018).

.3 CSA C22.2 No.29 - Panelboards and Enclosed Panelboards.

.4 NEMA AB1 - Molded Case Circuit Breakers, Molded Case Switches, and Circuit - Breaker Enclosures.

.5 NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays Rated 600 Volts.

.6 NEMA KS1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

.7 NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment (published by the International Electrical Testing Association).

.8 The panelboards and circuit breakers referenced herein are designed and manufactured according to the latest revision of the following specifications.

.1 NEMA PB 1 - Panelboards

.2 NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

.3 NEMA AB 1 - Molded Case Circuit Breakers

.4 CSA C22.2 No. 29-M1989 - Panelboards and Enclosed Panelboards

.5 CSA C22.2 No. 5-M91 - Molded Case Circuit Breakers

1.04 Submittals

.1 Submit in accordance with Section 01 33 00.

.2 Shop drawings shall contain overall panelboard dimensions, interior mounting dimensions, and wiring gutter dimensions. The location of the main, branches, and solid neutral shall be clearly shown. In addition, the drawing shall illustrate one line diagrams with applicable voltage systems.

.3 Shop drawings

.1 Indicate the following:

.1 Outline and support point dimensions

.2 Voltage

.3 Main bus ampacity

.4 Integrated short circuit ampere rating

.5 Circuit breaker arrangement, types and sizes.

.2 The following information shall be submitted to the Engineer:

.1 Breaker layout drawing with dimensions indicated and nameplate designation

.2 Component list

.3 Conduit entry/exit locations

.4 Assembly ratings including:

.1 Short-circuit rating

.2 Voltage

.3 Continuous current

.5 Cable terminal sizes

.6 Product data sheets

.3 Where applicable, the following additional information shall be submitted to the Engineer:

.1 Key interlock scheme drawing and sequence of operations

.4 Submittals for Construction

.1 The following information shall be submitted for record purposes:

.1 Installation information

1.05 Closeout Submittals

.1 Refer to Section 01 78 00.

.2 Record actual locations of panelboards and record actual circuiting arrangements in project record documents.

.3 Maintenance Data: Include spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

.4 Final as-built drawings and information shall incorporate all changes made during the manufacturing and installation process.

.5 Include a copy of each panelboard schedule in the Operation and Maintenance manual.

1.06 Maintenance Material Submittals

.1 Manufacturer shall provide installation instructions and NEMA Standards Publication PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

.2 Equipment operation and maintenance manuals shall be provided with each assembly shipped and shall include instruction leaflets, instruction bulletins and renewal parts lists where applicable, for the complete assembly and each major component.

.3 Provide two of each panelboard key.

.4 Provide final panelboard schedules indicating panelboard data, phasing, breaker sizes, and loads served.

1.07 Quality Assurance

.1 Regulatory Requirements

.1 Products: Listed and classified by CSA (Canadian Standards Association).

.2 Qualifications

.1 The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

1.08 Delivery, Storage, and Handling

.1 Inspect and report concealed damage to carrier within their required time period.

.2 Handle carefully to avoid damage to panelboard internal components, enclosure, and finish.

.3 Store in a clean, dry environment. Maintain factory packaging and, if required, provide an additional heavy canvas or heavy plastic cover to protect enclosure(s) from dirt, water, construction debris, and traffic.

.4 Equipment shall be handled and stored in accordance with manufacturer's instructions. One copy of these instructions shall be included with the equipment at time of shipment.

1.09 Manufacturer Warranty

.1 Warrant specified equipment to be free from defects in materials and workmanship for two years from the date of purchase.

2 Products

2.01 General

.1 Description: CSA C22.2 No.29, circuit breaker type.

2.02 Distribution Panelboards – Circuit Breaker Type

.1 Manufacturers:

.1 Square D by Schneider Electric, I-LINE Series.

.2 Eaton Cutler-Hammer, PRL 3 and PRL4 Series.

.3 Equal by Siemens.

.2 The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer ten days prior to bid date.

.3 Panelboard Bus:

.1 Copper, ratings as indicated.

.2 Provide copper neutral bus for panelboards indicated for 4-wire systems.

.3 Provide copper ground bus in each panelboard.

.4 Short Circuit Ratings:

.1 Panelboards rated 600 V shall have minimum integrated short-circuit ratings as shown on the drawings or as herein scheduled, but not less than 65 000 amperes RMS symmetrical.

.2 Distribution panelboards with bolt-on devices contained therein shall have interrupting ratings as specified herein or indicated on the drawings.

.3 Panelboards shall be fully rated.

.4 Where indicated, provide circuit breakers ULC listed for application at 100 per cent of their continuous ampere rating in their intended enclosure.

.5 Minimum integrated short circuit rating: Panelboards rated 240 V shall have minimum integrated short-circuit ratings as shown on the drawings or as herein scheduled, but not less than 10 000 amperes RMS symmetrical.

.6 Molded Case Circuit Breakers: To Section 26 28 16.02.

.7 Circuit Breaker Accessories: Trip units and auxiliary switches as indicated.

.8 Cabinet Front: Surface type, fastened hinge and latch, metal directory frame, finished in manufacturer's standard gray enamel.

.9 Enclosures: CSA type 2 sprinklerproof complete with drip hood, or as noted.

.10 Trims shall be equipped with a flush lock.

.11 Breaker positions labeled as “Spare” or “Space” shall constitute no less than 20 per cent of available breaker positions, whether indicated or not in panelboard schedules.

.12 Each panel shall be complete with a directory which shall be mounted inside door in a metal frame with clear plastic cover and copy in each Data Book. Use final Room Numbers for directories.

2.03 Branch Circuit Panelboards

.1 Manufacturers:

.1 Square D by Schneider Electric, NQ or NQOD Series.

.2 Eaton Cutler-Hammer, POW-R-LINE 1, POW-R-LINE 2, POW-R-LINE 3 Series.

.3 Equal by Siemens.

.2 Description: CSA C22.2 No.29, circuit breaker type, lighting and appliance branch circuit panelboard.

.3 Panelboard Bus:

.1 Copper, ratings as indicated.

.2 Provide copper neutral bus in each panelboard.

.3 Provide copper ground bus in each panelboard.

.4 Provide insulated ground bus where scheduled.

.4 Minimum Integrated Short Circuit Rating: 10 000 amperes RMS symmetrical for 240 volt panelboards, or as indicated.

.5 Molded Case Circuit Breakers: NEMA AB 1, plug-on type thermal magnetic trip circuit breakers, with common trip handle for all poles, listed as Type SWD for lighting circuits, Type HACR for air conditioning equipment circuits, Class A ground fault interrupter circuit breakers where scheduled. Do not use tandem circuit breakers.

.6 Current Limiting Molded Case Circuit Breakers where indicated: NEMA AB 1, circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size Class RK-5 fuse.

.7 Cabinet Front: Surface cabinet front with concealed trim clamps, concealed hinge, metal directory frame, and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.

.8 Enclosure shall be CSA type 2 sprinklerproof complete with drip hood, or as noted.

.9 Trims shall be equipped with a flush lock

.10 Breaker positions labeled as “Spare” or “Space” shall constitute no less than 20 per cent of available breaker positions, whether indicated or not in panelboard schedules.

.11 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.

.1 Install circuit breakers in panelboards before shipment.

.2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.12 Panelboards rated 240 Vac or less shall have short-circuit ratings as shown on the drawings or as herein scheduled, but not less than 10,000 amperes RMS symmetrical.

.13 Bus and breakers rated for symmetrical interrupting capacity, as indicated.

.14 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.

.15 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.

.16 Two keys for each panelboard and key panelboards alike.

.17 Copper bus with neutral of same ampere rating as mains.

.18 Mains: suitable for bolt-on breakers.

.19 Trim with concealed front bolts and hinges.

.20 Trim and door finish: baked grey enamel.

.21 The minimum short-circuit rating for branch circuit panelboards shall be as specified herein or as indicated on the drawings. Panelboards shall be fully rated.

.22 Bolt-on type, heavy-duty, quick-make, quick-break, single- and multi-pole circuit breakers of the types specified herein, shall be provided for each circuit with toggle handles that indicate when unit has tripped.

.23 Circuit breakers shall be thermal-magnetic type with common type handle for all multiple pole circuit breakers. Circuit breakers shall be minimum 100-ampere frame and through 100-ampere trip sizes shall take up the same pole spacing. Circuit breakers shall be ULC listed as type SWD for lighting circuits.

.1 Circuit breaker handle locks shall be provided for all circuits that supply exit signs, emergency lights, energy management, and control system (EMCS) panels and fire alarm panels.

.24 Circuit breakers shall have a minimum interrupting rating of 10 000 amperes symmetrical at 240 volts, and 14 000 amperes symmetrical at 480 volts, unless otherwise noted on the drawings.

.25 Each panel shall be complete with a directory which shall be mounted inside door in a metal frame with clear plastic cover and copy in each Data Book. Use final Room Numbers for directories.

.26 Lighting and receptacle panels shall be surface or flush-mounting type, as shown.

.27 Panels shall be dead front type in code gauge steel enclosures. All panels shall be sprinkler proof c/w drip hoods as required.

.28 Panels shall have mains of voltage and capacity, and main and branch breakers, as shown on the drawings. Spaces shall include necessary bus work such that Owners, at a later date, need buy only the breakers.

.29 Where panels exceed 42 circuits, use multi-section panel with main cross-over solid bus bars. Main bus capacity of each section shall be full size to match cross-over bus.

.30 Breakers shall have bolted type connections. Multi-pole breakers shall be common trip type with a single handle, suitable for voltage applied and of same manufacture as single pole breakers.

.31 Panels for 120/208 volt, 3-phase, 4-wire systems shall be complete with full size breakers.

.32 Where shown on drawings or required by code, certain breakers shall include ground fault interrupter.

.33 Provide lighting and receptacle panels, surface or flush-mounting type, as shown.

.34 Provide locking bars on non-switched circuits where panels are used for switching lighting circuits.

.35 Panels for non-linear loads shall be complete with lugs for double neutrals.

.36 Panels shall be given a rust-resistant treatment to both tub and trim.

.37 Flush panels shall have concealed hinges and flush type combination lock latch. Locks shall be chrome plated. Doors shall open minimum 135 degrees. Trims shall have fasteners concealed and shall be prime coated to receive room finish paint.

.38 Surface mounted panels shall have manufacturer's standard surface door trim complete with lock and latch. Finish shall be grey.

.39 Recessed panels shall have standard flush trims.

.40 Co-ordinate panel finish with Room Finish Schedule.

2.04 Molded Case Circuit Breakers

.1 Breakers: to Section 26 28 16.02.

.2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.3 Main breaker: 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 10 per cent of 15 A to 30 A breakers installed as indicated. Turn over unused lock-on devices to Owner.

.5 Lock-on devices for fire alarm, security, and sprinkler circuits.

.6 Provide shunt trips, bell alarms, and auxiliary switches as shown on the contract drawings.

.7 Provide breakers for externally mounted Surge Protective Devices in accordance with Section 26 43 13.

2.05 Construction

.1 General:

.1 Interiors shall be completely factory assembled. They shall be designed such that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors.

.2 Surface trims shall be same height and width as box. Flush trims shall overlap the box by 3/4 of an inch on all sides.

.3 A temporary directory card with a clear plastic cover shall be supplied and mounted on the inside of each door.

.4 All locks shall be keyed alike. Key same as existing.

.2 Branch Circuit Panelboards:

.1 Trims for branch circuit panelboards shall be supplied with a hinged door over all circuit breaker handles. Doors in panelboard trims shall not uncover any live parts. Doors shall have a semi flush cylinder lock and catch assembly. Door-in-door trim shall be provided. Both hinged trim and trim door shall utilize three point latching. No tools shall be required to install or remove trim. Trim shall be equipped with a door-actuated trim locking tab. Equip locking tab with provision for a screw such that removal of trim requires a tool, at the owner's option. Installation shall be tamper resistant with no exposed hardware on the panelboard trim.

.3 Distribution Panelboards:

.1 Distribution panelboard trims shall cover all live parts. Switching device handles shall be accessible.

2.06 Bus

.1 Main bus bars shall be copper sized in accordance with CSA standards to limit temperature rise on any current carrying part to a maximum of 65 degrees C above an ambient of 40 degrees C maximum.

.2 A copper system ground bus shall be included in all panelboards.

.3 Full-size (100 per cent rated) insulated copper neutral bars shall be included for panelboards shown with neutral. Bus bar taps for panels with single-pole branches shall be arranged for sequence phasing of the branch circuit devices. Neutral busing shall have a suitable lug for each outgoing feeder requiring a neutral connection. 200 per cent rated neutrals shall be supplied for panels designated on drawings with oversized neutral conductors.

2.07 Equipment Identification

.1 Provide equipment identification in accordance with Section 26 05 53.

.2 Nameplate for each panelboard size 4 engraved.

.3 Nameplate for each branch circuit in distribution panelboards size 2 engraved.

.4 Complete circuit directory with typewritten legend showing location and load of each circuit.

.5 Provide an engraved nameplate for each panelboard section.

.6 Provide copies of all circuit directories in Manuals.

2.08 Source Quality Control

.1 The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of NEMA and CSA standards.

3 Execution

3.01 Installation

.1 Install panelboards to CSA C22.1.

.2 Install panelboards plumb.

.3 Height: 1800 mm to top of panelboard; install panelboards taller than 1800 mm with bottom no more than 100 mm above floor.

.4 Provide filler plates for unused spaces in panelboards.

.5 Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.

.6 Provide engraved plastic nameplates under the provisions of Section 26 05 53.

.7 Ground and bond panelboard enclosure according to Section 26 05 26.

.8 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.9 Install surface mounted panelboards on fire rated plywood backboards in accordance with Section 06 10 00. Where practical, group panelboards on common backboard.

.10 Connect loads to circuits.

.11 Connect neutral conductors to common neutral bus with respective neutral identified.

.12 Deliver five (5) duplicate keys for each panel lock to Owner.

.13 Mount electrical panels, where possible, with top of trim at uniform height of 2000 mm.

.14 Cap ends of conduits in accessible locations in ceiling spaces above panels, to allow for future wiring.

.15 The Contractors shall install all equipment per the manufacturer's recommendations and the contract drawings.

.16 Install panelboards in accordance with manufacturer's written instructions, NEMA PB 1.1 and Electrical Code requirements.

.17 After completion of wiring, type directory showing a clear description of each circuit being controlled from panel and place in metal frame inside door.

.18 Provide revised directories for existing panels if revised.

.19 Provide circuit breaker handle locks for all circuits that supply exit signs, emergency lights, energy management, and control system (EMCS) panels and fire alarm panels.

.20 [Provide three 27 mm empty conduits from top of lighting, receptacle, telephone, signal and communication panels recessed in walls, to ceiling space.]

3.02 Field Quality Control

.1 Perform inspections and tests listed in NETA ATS, Section 7.4 for switches, Section 7.5 for circuit breakers.

.2 Inspect complete installation for physical damage, proper alignment, anchorage, and grounding.

.3 Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads within 20 per cent of each other. Maintain proper phasing for multi-wire branch circuits.

.4 Check tightness of bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written specifications.

3.03 Adjusting

.1 Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other.

.2 Maintain proper phasing for multi-wire branch circuits.

End of Section

1 General

1.01 Section Includes

.1 Switches, receptacles, wiring devices, cover plates and their installation.

1.02 Related Requirements

.1 Section 26 09 23 – Lighting Control Devices.

.2 Section 26 27 26.13 – Floor Box Assemblies.

1.03 Unit Prices

.1 [Refer to Document 00 43 00.26.]

.2 Submit with Tender unit prices to provide the following. Include installation in the unit price:

.1 5-15R [specification grade] duplex receptacle complete with wiring and conduit, based on 10 metre distance from the local panelboard.

.2 5-20R [specification grade] duplex receptacle complete with wiring and conduit, based on 10 metre distance from the local panelboard.

.3 Unit cost of additional conduit and wire for the above items.

1.04 References

.1 CSA Group:

.1 CSA C22.1-18, Canadian Electrical Code, Part 1 (24th Edition), Safety Standard for Electrical Installations.

.2 Ontario Electrical Safety Code (27th edition/2018).

.3 CSA C22.2 No. 14-13, Industrial control equipment

.4 CSA C22.2 No. 42-10 (R2015), General use receptacles, attachment plugs, and similar devices.

.5 CSA C22.2 No. 42.1-13, Cover plates for flush-mounted wiring devices.

.6 CSA C22.2 No. 55-15 (R2020), Special use switches.

.7 CSA C22.2 No.111-10 (R2015), General-use snap switches.

.8 CSA C22.2 No. 182.1-17, Plugs, receptacles, and cable connectors of the pin and sleeve type

1.05 Informational Submittals

.1 Submit shop drawings and product data in accordance with Section 01 33 00.

.2 Product Data: Provide manufacturer's catalogue information showing dimensions, colours, and configurations.

.3 Submit manufacturer's installation instructions.

2 Products

2.01 Manufacturers

.1 Eaton.

.2 Hubbell Bryant.

.3 Leviton.

.4 Molex.

.5 Pass & Seymour (Legrand).

2.02 Wall Switches

.1 Single pole, double pole, three-way, four-way switches to: CSA C22.2 No.55 and CSA C22.2 No.111.

.2 Description: CSA-C22.2 No.111, Commercial Spec Grade, AC only general-use snap switch.

.3 Local switches shall be 20 ampere, silent, brown coloured, AC type and CSA certified, specification grade. Provide switches rated to suit system voltage 120 V or 347 V.

.4 Manually-operated general purpose AC switches with following features:

.1 Terminal holes approved for 10 AWG wire.

.2 Silver alloy contacts.

.3 Urea or melamine moulding for parts subject to carbon tracking.

.4 Suitable for back and side wiring.

.5 Voltage: 120 volt or 347 volt, AC as indicated.

.6 Current: 20 amperes.

.7 Body and Handle: white plastic with toggle handle. Confirm finish colour prior to ordering.

.8 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.

.9 Example Products (Decorator style):

.1 120 volt:

.1 Hubbell HBL2121 series.

.2 347 volt:

.1 Pass & Seymour 2601-347 series.

.10 Example Products (Toggle style):

.1 120 volt:

.1 Hubbell HBL1221 (single pole).

.2 Hubbell HBL1222 (double pole).

.3 Hubbell HBL1223 (three-way).

.4 Hubbell HBL1224 (four-way).

.2 347 volt:

.1 Hubbell HBL18221 (single pole).

.2 Hubbell HBL18223 (three-way).

.3 Pass & Seymour PS372030I.

.11 Local switches and receptacles shall be of the same manufacturer throughout except where a specified item is not made by that manufacturer.

2.03 Receptacles

.1 General

.1 Description: CSA C22.2 No.42, Commercial Spec Grade general use receptacles.

.2 Device Body: white plastic.

.3 Configuration: Type as specified and indicated.

.4 Convenience Receptacle: Type 5-15, 5-20 where indicated.

.5 GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

.6 Data Room Receptacle Types: As indicated on drawings.

.7 Receptacles of one manufacturer throughout project.

.2 Receptacles shall be white coloured, specification grade, unless noted otherwise.

.3 Receptacles shall be as listed below:

.1 15 ampere, 120 volt, single phase grounded duplex receptacle shall be NEMA-U- ground type CSA Configuration 5-15R.

.2 20 ampere, 120 volt, single phase grounded duplex receptacle shall be NEMA-U-ground type CSA Configuration 5-20RA

.3 15 ampere, 120 volt, weatherproof receptacles shall be equal to those above but complete with gasketed cast plate and hinged covers.

.4 Other types of receptacles shall be provided as shown on Drawings.

.5 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA-C22.2 No.42 with following features:

.1 White urea moulded housing.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Break-off links for use as split receptacles.

.4 Eight back wired entrances, four side wiring screws.

.5 Triple wipe contacts and riveted grounding contacts.

.6 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:

.1 White urea moulded housing.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Four back wired entrances, 2 side wiring screws.

.7 Other receptacles with ampacity and voltage as indicated.

.8 Example Products (Decorator style duplex 5-15R):

.1 Pass & Seymour 26252 Series.

.2 Hubbell HBL2152 Series.

.9 Ground Fault Circuit Interrupter (GFCI or GFI) Receptacles

.1 Protected by a ground fault circuit interrupter of the Class A type.

.2 Any receptacle within 1.5 m of a sink must be GFCI protected.

.3 Any receptacle located outdoor must be GFCI protected.

.10 Isolated Ground (IG) Receptacles:

.1 Marked as such (green triangle).

.2 Example Products:

.1 Hubbell IG2152 (15A duplex decorator style, orange faceplate).

.11 Tamper-resistant receptacles.

.1 Marked as such (for example “TR”).

.2 To be used in the following spaces:

.1 Child care facilities and kindergarten classrooms.

.2 Guest rooms and suites of hotels and motels.

.3 Preschools and elementary education facilities, including kindergarten facilities.

.4 Dwelling units.

.3 Example Products:

.1 Hubbell BR15WHITR (15A duplex decorator style).

.2 Hubbell BR20WHITR (20A duplex decorator style).

.12 Wet location and weatherproof devices:

.1 Receptacles and cover plates suitable for wet locations, cover plates to provide shielding with and without a plug inserted into the receptacle in accordance with OESC rule 26-702. Cover plates to be marked “Extra Duty”.

.2 Receptacles shall be 20 A rated, GFI.

2.04 Cover Plates

.1 Cover plates for wiring devices to: CSA C22.2 No. 42.1.

.2 Cover plates from one manufacturer throughout project.

.3 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.4 Stainless steel, vertically brushed, cover plates, thickness 2.5 mm for wiring devices mounted in flush-mounted outlet box.

.5 Cast cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

.6 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.

.7 Weatherproof spring-loaded cast aluminum cover plates complete with gaskets for single receptacles or switches.

.8 Decorative Cover Plate: Polycarbonate.

.1 Pass & Seymour TP26W series.

.9 Switch, receptacle, telephone and other plates shall be stainless steel 18-8 chrome metal alloy, Type 302, non-metallic in finished areas and pressed steel in unfinished areas. Finish brush marks shall be run in a vertical direction.

.10 Wet Location and weatherproof devices: receptacles and cover plates shall be suitable for wet locations, and provide shielding with and without a plug inserted into the receptacle in accordance with 2018 OESC rule 26-710.

2.05 Pendant Receptacles

.1 Pendant cord mounted single receptacles complete with strain relief device.

.2 Strain relief system: Hubbell Kellems Grips, Molex, or equal.

2.06 Receptacle Cord Reels

.1 Retractable cable reel, mounted to structure above. 125 V, 5-15R [5-20R] C/W [25] [40] feet of cabtire (or equal).

.2 Provide framing bracket to support reel at underside of structure above.

.3 Connect to GFCI breakers.

.4 Manufacturers:

.1 Hubbell HBL-C40-123TT.

.2 Woodhead (Molex) 997 series.

.3 Approved equal.

2.07 Special Wiring Devices

.1 Pilot lights as indicated, with neon type 0.04 W, 125 V lamp and red plastic jewel flush type.

2.08 Pin and Sleeve Devices

.1 Manufacturers:

.1 Crouse-Hinds by Eaton.

.2 Hubbell.

.3 Meltric.

.4 Mennekes.

.5 Russellstoll (Thomas & Betts).

.6 Walther Electric.

.2 Refer to equipment schedule and plans for locations and specific requirements.

2.09 Regulatory Requirements

.1 Provide products listed and classified by CSA (Canadian Standards Association).

3 Execution

3.01 Examination

.1 Verify that outlet boxes are installed at proper height.

.2 Verify that wall openings are neatly cut and will be completely covered by wall plates.

.3 Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.02 Preparation

.1 Provide extension rings to bring outlet boxes flush with finished surface.

.2 Clean debris from outlet boxes.

3.03 Installation

.1 Install to CSA C22.1.

.2 Mounting heights in accordance with Section 26 05 00.

.3 Install devices plumb and level.

.4 Install switches with OFF position down.

.5 Install wall dimmers to achieve full rating specified and indicated after de-rating for ganging as instructed by manufacturer.

.6 Do not share neutral conductor on load side of dimmers.

.7 Install receptacles with grounding pole on bottom.

.8 Connect wiring device grounding terminal to outlet box with bonding jumper.

.9 Install decorative plates on switch, receptacle, and blank outlets in finished areas.

.10 Connect wiring devices by wrapping conductor around screw terminal.

.11 Use jumbo size plates for outlets installed in masonry walls.

.12 Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

.13 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.14 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.3 Connect receptacle grounding terminal to the outlet box with an insulated green ground strap.

.4 [Provide a combination-type arc-fault circuit interrupter on all dwelling unit branch circuit breakers supplying 125 V receptacles rated 20 A or less except for receptacles serving kitchen counters, refrigerators, bathrooms, or sump pumps in accordance with OESC requirements.]

.5 Receptacles for maintenance of HVAC and similar equipment located on rooftops.

.1 Provide weatherproof GFI 5-20R receptacles on roof, installed at 750 mm (30 inches) above finished roof level, complete with wet location cover plate.

.2 Locate within 7500 mm (25 feet) of new HVAC equipment, and at least 1800 mm (6 feet) away from roof line.

.3 Refer to 2018 OESC rules 2-316, 26-708, and 26-710, and OESC bulletin 26-27-0, or latest edition.

.15 Cover plates:

.1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.2 Install suitable common cover plates where wiring devices are grouped.

.3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

.4 Do not install plates until final painting of room or area is completed. Remove protective covering.

.16 Circuit identification: in accordance with Section 26 05 53.

3.04 Field Quality Control

.1 Inspect each wiring device for defects.

.2 Operate each wall switch with circuit energized and verify proper operation.

.3 Verify that each receptacle device is energized.

.4 Test each receptacle device for proper polarity.

.5 Test each GFCI receptacle device for proper operation.

3.05 Adjusting

.1 Adjust devices and wall plates to be flush and level.

3.06 Cleaning

.1 Clean exposed surfaces to remove splatters and restore finish.

End of Section

1 General

1.01 Summary

.1 Section Includes

.1 In-slab and poke-through style floor monuments for electrical, communications, and audio/video purposes.

.2 Related Requirements

.1 Section 03 80 00 – Concrete Cutting and Boring.

.2 Section 26 27 26 – Wiring Devices.

.3 Section 27 15 13 – Communications Copper Horizontal Cabling.

1.02 Reference Standards

.1 Except as modified by governing codes and by the Contract Documents, comply with the latest applicable provisions and latest recommendations of the following:

.1 U.L Standard #514

1.03 Submittals

.1 Submit manufacture's catalog cuts and specifications for all floor boxes, and accessories.

2 Products

2.01 Manufacturers

.1 Canadian Electric Raceways.

.2 Hubbell.

.3 Wiremold.

.4 Wellmark.

.5 Steel City.

2.02 Floor Monuments, General

.1 Power: two duplex 5-20R receptacles.

.2 Data: up to four voice/data drops.

.3 Audio/Video:

.1 VGA

.2 PC Audio.

.4 Power and Low Voltage Divider.

.5 Monument lid should be flush with finished floor, and be able to accept a cut-to-fit carpet or vinyl tile.

2.03 Floor Boxes

.1 Floor Boxes: CSA C22.2 No. 18, fully adjustable, 38 mm deep.

.2 Material: Cast metal.

.3 Shape: Rectangular.

.4 Service Fittings: As specified in Section 26 27 26.

.5 Cast aluminum boxes for devices installed below raised floor or on side of overhead cable tray for computer room

3 Execution

3.01 Installation

.1 Electrical contractor to verify the thickness of the floor and select the through floor component that fits floor thickness.

.2 Install so that cover plates are flush with top of finished floor.

.3 The electrical documents shall not be used for the purpose of establishing locations of floor outlets. The location of such outlets shall be established by the Architect.

End of Section

1 General

1.01 Submittals

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

.2 Product Data:

.1 Provide fuse performance data characteristics for each fuse type and size above 200 amps. Performance data to include: average melting time-current characteristics.

.3 Shop Drawings:

.1 Provide shop drawings in accordance with Section 01 33 00.

1.02 Delivery, Storage, and Handling

.1 Ship fuses in original containers.

.2 Do not ship fuses installed in switchboard.

.3 Store fuses in original containers in storage cabinet.

.4 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19.

1.03 Maintenance Material Submittals

.1 Provide maintenance materials in accordance with Section 01 78 00.

.2 3 spare fuses of each type and size installed above 600 A.

.3 6 spare fuses of each type and size installed up to and including 600 A.

2 Products

2.01 Manufacturers

.1 Bussman by Eaton.

.2 GEC.

.3 Littelfuse.

.4 Mersen.

.5 Substitutions: not permitted.

2.02 Fuses - General

.1 Fuse type references L1, L2, J1, R1, etc. have been adopted for use in this specification.

.2 Fuses: product of one manufacturer.

.3 Fuses shall be sized as shown, time delay type, and of the same type throughout.

.4 Fuses shall be CSA certified Class-J for 1-600A or Class-L for 650 Amps and above.

2.03 Fuse Types

.1 Class J fuses.

.1 Type J1, time delay, capable of carrying 500 per cent of its rated current for 10 seconds minimum.

.2 Type J2, fast acting.

.2 Class L fuses.

.1 Type L1, time delay, capable of carrying 500 per cent of its rated current for 10 seconds minimum.

.2 Type L2, fast acting.

.3 Class R fuses.

.1 Type R1, (UL Class RK1), time delay, capable of carrying 500 per cent of its rated current for 10 seconds minimum, to meet UL Class RK1 maximum let-through limits.

.2 Type R2, time delay, capable of carrying 500 per cent of its rated current for 10 seconds minimum.

.3 Type R3, (UL Class RK1), fast acting Class R, to meet UL Class RK1 maximum let-through limits.

2.04 Fuse Requirements

.1 Dimensions and Performance: CSA C22.2 No. 248 Series, Class as specified or indicated.

.2 Voltage: Provide fuses with voltage rating suitable for circuit phase-to-phase voltage.

.3 Power Load Feeder Switches: HRC-1 Class J time delay type.

.4 Other Feeder Switches: HRC-1 Class J time delay type.

2.05 Spare Fuse Cabinet

.1 Description: Wall-mounted sheet metal cabinet, suitably sized to store spare fuses and fuse pullers specified.

.2 Doors: Hinged, with hasp for Owner's padlock.

.3 Finish: Prime finish for field painting.

.4 Dimensions: Minimum 3 foot by 3 foot by 1 foot.

3 Execution

3.01 Installation

.1 Install fuses to manufacturer's instructions.

.2 Install fuse with label oriented such that manufacturer, type, and size are easily read.

.3 Install spare fuse cabinet in electrical room.

.4 Provide a complete set of fuses in each fusible device supplied under this Division and provide 3 spare fuses for each size used in spare fuse cabinet.

End of Section

1 General

1.01 Section Includes

.1 Materials for Molded-Case Circuit Breakers (MCCB).

.2 Accessories

1.02 Related Requirements

.1 Section 26 24 13 – Switchboards.

.2 Section 26 24 16 – Panelboards.

1.03 References

.1 CSA C22.1-18, Canadian Electrical Code, Part 1 (24th Edition), Safety Standard for Electrical Installations.

.2 Ontario Electrical Safety Code (27th edition/2018).

.3 CSA-C22.2 No. 5-02, Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

.4 NEMA AB1 - Molded Case Circuit Breakers, Molded Case Switches, and Circuit - Breaker Enclosures.

.5 NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment (published by the International Electrical Testing Association).

1.04 Submittals

.1 Submit product data in accordance with Section 01 33 00.

.2 Include time-current characteristic curves for breakers with ampacity of 400 A and above, or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

.3 Include termination temperature rating in degrees C.

.4 Certificate of Origin

.1 Prior to any installation of circuit breakers in either a new or existing installation, Contractor must submit three (3) copies of a certificate of origin from the manufacturer, duly signed by the factory and the local manufacturer's representative, certifying that all circuit breakers come from this manufacturer, they are new and they meet standards and regulations. These certificates must be submitted to the Engineer for approval.

.2 A delay in the production of the certificate of origin won't justify any extension of the contract and additional compensation.

.3 Any work of manufacturing, assembly or installation should begin only after acceptance of the certificate of origin by Engineer. Unless complying with this requirement, Engineer reserves the right to mandate the manufacturer listed on circuit breakers to authenticate all new circuit breakers under the contract, and that, to Contractor's expense.

.4 In general, the certificate of origin must contain:

.1 The name and address of the manufacturer, and the person responsible for authentication. The responsible person must sign and date the certificate;

.2 The name and address of the licensed dealer, and the person of the distributor responsible for the Contractor's account.

.3 The name and address of the Contractor, and the person responsible for the project.

.4 The name and address of the local manufacturer's representative. The local representative must sign and date the certificate.

.5 The name and address of the building where circuit breakers will be installed:

.1 Project title

.2 End user's reference number

.3 The list of circuit breakers

2 Products

2.01 General

.1 Molded-case circuit breakers, Circuit breakers, and Ground-fault circuit-interrupters, Fused circuit breakers, and Accessory high-fault protectors: to CSA C22.2 No. 5

.2 Bolt-on Molded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.

.3 Plug-in Molded case circuit breakers: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.

.4 Common-trip breakers: with single handle for multi-pole applications.

.5 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

.1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.

.6 Circuit breakers with interchangeable trips.

2.02 Interrupting Capacity

.1 Protective devices shall be fully rated, for required available fault current. Series rated shall not be used on this installation.

.2 Refer to panelboard and switchboard Specification Sections.

2.03 Molded Case Circuit Breakers – General

.1 Molded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

.2 NEMA AB 1, circuit breakers with integral thermal and instantaneous magnetic trip in each pole.

.3 Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.

.4 1-, 2-, or 3-pole bold on, single-handle common trip voltage as indicated on drawings.

.5 Overcentre toggle-type mechanism, quick-make, quick-break action. Trip indication is by handle position.

.6 Calibrate for operation in 40 degree C ambient temperature.

2.04 Molded Case Circuit Breakers – Up to 150 Ampere

.1 Permanent trip unit containing individual thermal and magnetic trip elements in each pole, unless noted otherwise on drawings.

2.05 Molded Case Circuit Breakers – 151 to 399 Ampere

.1 Variable magnetic trip elements. Provide push-to-trip button on cover of breaker for mechanical tripping.

2.06 Molded Case Circuit Breakers – 400 Ampere and Above

.1 Electronic trip type with adjustments for long-time, instantaneous and short-time functions.

.2 Provide ground fault function for breakers greater than 400 Amps.

.3 1000 Amp and Above:

.1 Modbus Communications

.1 Breaker status.

.1 Open.

.2 Closed.

.3 Tripped.

.2 Cause of trip.

.3 Time of trip.

.4 Current at time of trip.

.5 RMS currents per phase and ground.

.6 Peak demand.

.7 Present demand.

.8 Energy consumption.

.4 1200 Amp and Above:

.1 Provide handle mechanisms that are lockable in the open (off) position.

2.07 Additional Features

.1 Provide as indicated on drawings:

.1 Shunt trip

.2 Auxiliary switch

.3 Motor-operated mechanism.

.4 Under-voltage release

.5 On-off locking device

.6 Handle mechanism

3 Execution

3.01 Installation

.1 Install circuit breakers as per related sections.

End of Section

1 General

1.01 Section Includes

.1 Fusible and non-fusible enclosed low-voltage disconnect switches from 30 to 800 amps.

1.02 Related Requirements

.1 Section 26 28 13 – Fuses.

1.03 References

.1 Canadian Standards Association

.1 CSA C22.1-18, Canadian Electrical Code, Part 1 (24th Edition), Safety Standard for Electrical Installations.

.2 Ontario Electrical Safety Code (OESC) 27th Edition, 2018.

.3 CAN/CSA-C22.2 No. 4-16 – Enclosed and Dead-Front Switches.

.4 CSA C22.2 No. 248 series – Low-voltage fuses.

.2 NETA (International Electrical Testing Association) ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.04 Submittals

.1 Product Data: Provide switch ratings, and enclosure dimensions.

1.05 Closeout Submittals

.1 Record actual locations of enclosed switches in project record documents.

2 Products

2.01 Manufacturers

.1 Eaton Cutler-Hammer.

.2 Siemens.

.3 Square D by Schneider Electric.

2.02 Regulatory Requirements

.1 Products: Listed and classified by CSA or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

2.03 Disconnect Switches

.1 Provide dedicated disconnect switches at electrical equipment.

.2 Fused or un-fused disconnect or safety switches: Type "A", quick-make, quick-break construction with provision for padlocking switches in either "ON" or "OFF" position.

.1 Quick-make, quick-break.

.2 Heavy duty industrial type.

.3 Lockable with up to 3 padlocks.

.4 Cover interlocked with switch mechanism.

.5 Viewing window for viewing blades.

.3 Fused switches equipped with fuse clips designed for Class "J" fuses and designed to reject standard NEC fuses.

.4 Enclosure: CSA Type 1 sprinkler-proof, or as noted.

.5 Switches throughout project of same manufacturer.

3 Execution

3.01 Installation

.1 Provide fused or un-fused safety or disconnect switches as shown and as required by Code.

.2 Install disconnect switches complete with fuses, if applicable, to CSA C22.1.

.3 Apply neatly typed adhesive tag on inside door of each fusible switch indicating NEMA fuse class and size installed.

.4 Coordinate fuse ampere rating with installed equipment. Fuse ampere rating variance between original design information and installed equipment, size in accordance with Bussmann Fusetron 40 degree C recommendations. Do not provide fuses of lower ampere rating than motor starter thermal units.

End of Section

1 General

1.01 Section Includes

.1 Common requirements for all electric lighting, including interior, exterior, and emergency lighting.

1.02 Related Requirements

.1 Section 26 09 23 – Lighting Control Devices.

.2 Section 26 51 19.00 – LED Interior Lighting.

1.03 References

.1 CSA Group

.1 CSA C22.1-18, Canadian Electrical Code, Part 1 (24th Edition), Safety Standard for Electrical Installations.

.2 Ontario Electrical Safety Code (27th edition/2018).

.3 CSA C22.2 No. 9.0 - General Requirements for Luminaires.

.4 CSA C22.2 No. 250.0 - Luminaires (Bi-National Standard, with UL 1598).

.5 CAN/CSA E920-98 (R2017) - Ballasts for Tubular Fluorescent Lamps - General and Safety Requirements (Adopted IEC 920:1990, first edition, including Amendment 1:1993 and Amendment 2:1995, with Canadian deviations).

.6 CAN/CSA-E61347-2-3:03 (R2013) - Lamp controlgear - Part 2-3: Particular Requirements for A.C. supplied electronic ballasts for fluorescent lamps (Adopted CEI/IEC 61347-2-3:2000, first edition, 2000-10, with Canadian deviations).

.2 Illumination Engineering Society (IES)

.1 IES HB-10-11 – The Lighting Handbook, 10th Edition.

.2 IES LM-79-08 – Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products.

.3 IES LM-80-08 – IES Approved Method for Measuring Lumen Maintenance of LED Light Sources.

.3 NEMA WD 6 - Wiring Devices - Dimensional Requirements.

1.04 Submittals

.1 Refer to Section 01 33 00.

.2 General

.1 The Contractor shall be responsible for supplying equipment product data, and as indicated in the specification, partial or complete working samples of the specified equipment in a timely fashion for design team approval, prior to releasing orders on equipment. Contractor shall be responsible for coordinating all aspects of order placement, deposits, shop drawing procurement, order release, order follow-up, delivery tracking, etc. with Distributor in a timely fashion. Some luminaires may require at least 12 to 16 weeks of lead time or more- the Contractor is responsible for allowing sufficient time for the order-and-deposit process, shop drawing procurement, submittal, and review process. Substitutions will not be accepted on the basis of the contractor's obligation to make any deadlines, contractual or otherwise, agreed by the contractor toward the completion of this project. Lamp submittals are as important and necessary as luminaire submittals and must be supplied by the Contractor to assure correct lamp wattage, color and efficacy.

.2 All submittals shall be generated by respective factories with their seals or other authentication marks and each submittal sheet shall be clearly labeled with respective luminaire type, complete catalog number relevant to submitted

luminaire, date of submittal generation and name, phone number, and email address of submittal author in order to track provenance of information. The Consultant may contact respective factory submittal source.

.3 The lighting equipment specified herein has been carefully chosen for its ability to meet the luminous environment requirements of this project. Calculations were typically made to determine luminances, luminance ratios, and/or horizontal and vertical illuminances and uniformities. In some instances, virtual reality "images" were generated with lighting calculation software to assist the Design Team and/or the Client in assessing the lighting quality of the spaces or areas. Equipment and/or manufacturers which have been shown to comply with the established criteria, including ASHRAE/IES 90.1 or California Title 24 or other such energy code as applicable by ordinance, code, Federal law, or mandate, and/or intended LEED or other green-building certification, is specified herein. Substitutions in all likelihood will be unable to meet all or some of the salient criteria as the specified equipment.

.4 Where permitted, substitution submittals shall consist of a physical description, detailed dimensioned drawing and complete photometric and electric data of the proposed lamp, ballast, driver, or transformer as required, and luminaire. Working samples of lamp and luminaire substitutions must also be supplied at time of substitution request for visual check of finish, operating and photometric characteristics, and functional and aesthetic design. Photometric reports must list the actual candela values of the luminaire's distribution with specified or similar lamp in at least five horizontal planes with elevation angles in increments not greater than 5° from nadir to zenith. If additional data is required to account for asymmetric distributions, then this shall also be supplied. Candela curves, lux or footcandle and lumen tables and iso-lux-or-footcandle contours are not acceptable. The Contractor shall be responsible for negotiation with the client, Consultant, Lighting Designer, and Electrical Engineer prior to substitution submittal to as assure fees are available for: redesign project based on proposed substitution ; or review by Consultant, Lighting Designer and Electrical Engineer of all photometric, sample, design and calculation documentation and virtual reality renderings (provided by Contractor) for proposed substitutions. All substitutions must be identified and approved prior to bid date; and all contractor negotiations re: additional fees for redesign work due to substitutions must occur prior to bid date. A Substitution Request Form shall be completed, submitted, and postmarked along with all relevant documentation required on the Substitution Request Form two weeks prior to bid date. No substitutions will be considered without compliance with this paragraph. Contractor's bid value and/or schedule commitments shall not be based on substitutions in expectation of design team approval, nor on Contractor estimated value of specified equipment. If submitted substitution fails to comply with any specification requirements or is rejected for any or no reason whatsoever, Contractor will furnish specified equipment at no additional cost or delay to the Owner.

.5 The Contractor shall be responsible for obtaining from his supplying lighting manufacturers, for each luminaire, a recommended maintenance manual including:

.1 Vendor and local representative's contact information

.2 Tools required

.3 Instructions

.4 Types of cleaners to be used

.5 Replacement parts identification lists

.6 Equipment product data (high-quality reproducible copies)

.7 Warranty documentation

.3 Shop Drawings:

.1 Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

.2 Wiring diagrams for power, signal and control wiring.

.4 Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes and the following:

.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 The product literature shall provide an explanation of all options and descriptors in the catalog number as submitted.

.3 Include luminaire weight.

.4 Provide complete photometric data prepared by independent testing laboratory for each luminaire, for approval by Engineer.

.5 Physical description of lighting fixtures including dimensions.

.6 Ballast, including BF.

.7 Energy-efficiency data, including ballast input wattage.

.8 Life, output (lumens, CCT and CRI), and energy efficiency data for lamps.

.5 Photometric Data and Calculations

.1 Provide Luminaire Data Photometric Testing performed by an independent agency complying with IESNA Lighting Measurement Testing and Calculation Guides.

.2 Submit photometric calculations for typical areas based on layouts as indicated on the drawings.

.1 Submit a photometric calculation for the typical areas based on the existing conditions.

.2 Submit a photometric calculation for the same typical areas based on the proposed new fixtures.

.3 Clearly indicate mounting heights, heights of calculation zones, light loss factors and surface reflectance values.

.4 Use the follow photometric parameters:

.1 Recoverable Light Loss Factors: 0.8

.2 Ceiling reflectance values of 80 per cent.

.3 Wall reflectance value of 50 per cent.

.4 Floor reflectance value of 20 per cent.

.3 Submittals shall be in PDF format, and the native file of the software used to make the photometric analysis.

.4 Submit IES photometric data files for the existing and proposed luminaires.

1.05 Closeout Submittals

.1 Section 01 33 00 and Section 01 78 00: Submittals for project closeout.

.2 Submit manufacturer's operation and maintenance instructions for each product.

.3 Provide a list of all lamp types used on the project, use ANSI and manufacturer’s codes.

1.06 Definitions

.1 BF: Ballast factor.

.2 CCT: Correlated colour temperature.

.3 CRI: Colour-rendering index.

.4 HID: High-intensity discharge.

.5 LER: Luminaire efficacy rating.

.6 LED: Light Emitting Diode.

.7 Lumen: Measured output of lamp and luminaire, or both.

.8 Luminaire: Complete lighting fixture, including ballast housing if provided.

1.07 Delivery, Storage, and Handling

.1 Deliver, store and handle materials in accordance with Section 01 61 00.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Disposal and recycling of fluorescent lamps as per local regulations.

1.08 Maintenance Material Submittals

.1 Refer to Section 01 78 00.

.2 Extra Stock Materials:

.1 Provide an additional 2 per cent spare luminaires of each new type to be provided.

.3 Spare Parts:

.1 Provide 1 per cent of each plastic lens type.

.2 Provide 2 per cent replacement lamps for each lamp type.

.3 Provide 1 per cent of each ballast type.

.4 Tools: Provide three of each type of any special tools required for system use and maintenance.

1.09 Warranty

.1 Refer to Section 01 78 00 and Section 26 05 00.

.2 LED Luminaires shall have a manufacturer’s warranty for a period of not less than five years.

2 Products

2.01 Luminaires

.1 In accordance with related sections.

2.02 Regulatory Requirements

.1 Products shall be listed and classified by CSA (Canadian Standards Association), ULC (Underwriter’s Laboratories of Canada), or certified by recognized independent testing organizations that test to CSA standards.

.2 All equipment and parts specified herein shall bear the "ULC Approved" label (or other NRTL label) indicating compliance with UL requirements or as otherwise allowed by the Authority Having Jurisdiction. All luminaires shall be ULC/ NRTL or CSA listed and labeled for installation in fireproof or non-fireproof construction, dry, damp, or wet locations as required.

2.03 Luminaire Disconnect Plugs

.1 Shall be installed on all 120 V and 347 V luminaires before the ballast or LED driver inputs.

.2 Shall be a bright colour to aid in identification as a safety device.

.3 600V rated.

.4 Types and application:

.1 3-wire disconnect plug to be used for all 3-wire ballasts, such as dimming ballasts using three-wire phase control.

.2 2-wire disconnect plug to be used on all other luminaires.

.5 Code requirements:

.1 Listed to UL 2459.

.2 Listed to CSA 182.3.

.6 Example Manufacturers:

.1 Thomas and Betts Marrette Series Luminaire Disconnect

.2 Ideal Industries Inc. PowerPlug Series Luminaire Disconnect

3 Execution

3.01 Installation

.1 Install lighting equipment, including but not limited to luminaires, controls, auxiliary devices and the integration of same in strict conformance with all manufacturers' recommendations and instructions the securing of which shall be the responsibility of the Contractor.

.2 Luminaires shall be integrated with controls in accordance with respective luminaire manufacturers' and controls manufacturers' recommendations and instructions and to provide a complete, trouble-free operation without compromising safety, code and UL/CSA/NOM requirements.

.3 Contractor shall be responsible for sealing all outdoor luminaires for wet locations (i.e. all knock-outs, all pipe and wire entrances, etc.) as is standard industry practice to prevent water from entering luminaires.

.4 The Contractor shall coordinate the lighting system installation with the relevant trades so as to eliminate interferences with hangers, mechanical ducts, sprinklers, pipes, steel, etc.

.5 For installation in suspended ceilings, ensure that the luminaires are supported such that there is no resultant bowing or deflection of the ceiling system greater than 1/360 of the length of the total span of the ceiling member.

.6 Mounting heights and configuration of the luminaires shall be as specified in the Luminaire Schedule portion of the Specification or indicated on the drawings, and where conflicts exist, as approved by the Consultant.

.7 All luminaires shall be installed plumb and true and level as viewed from all directions unless specifically identified otherwise in the Luminaire Schedule. Luminaires shall remain plumb and true without continual adjustment or visibly obvious means beyond what is shown on luminaire submittal drawings.

.8 Suspended luminaires shall be installed plumb and true and level unless specifically identified otherwise in the Luminaire Schedule portion of this Specification and at a height from finished floor as specified on the drawings, details and Luminaire Schedule. In cases where this is impractical, refer to the Consultant for a decision. All appurtenances shall be consistently organized for a neat, uniform appearance.

.9 Luminaire finishes which are disturbed in any way during construction shall be touched up or refinished in a manner satisfactory to the Consultant.

.10 Reflector cones, louvers, baffles, lenses, trims and other decorative elements shall be installed after completion of ceiling tile installation, plastering, painting and general cleanup.

.11 Whenever a luminaire or its hanger canopy is installed directly to a surface mounted junction box, a finishing ring painted to match the ceiling, shall be used to conceal the junction box.

.12 All lamps shall be seasoned for a minimum of 12 hours and a maximum of 100 hours in full-on mode without dimming. All lamps used for convenience lighting during construction shall be replaced with identical new lamps, which shall then be seasoned as described above, immediately prior to the date of substantial completion as determined by the Consultant.

.13 All accessories shall be properly installed and adjusted by Contractor in accordance with specification and installation instructions. Any spare items shall be clearly labeled (indicate type of accessory and associated luminaire types).

.14 Locate and install luminaires as indicated.

.15 Provide adequate support to suit ceiling system.

.16 For fluorescent lighting, provide instant start ballasts for all areas with no occupancy sensors and program rapid start in areas with occupancy sensors.

.17 Install suspended luminaires and exit signs using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.

.18 Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.

.19 Install clips to secure recessed grid-supported luminaires in place.

.20 Install wall mounted luminaires at height as indicated.

.21 Install accessories provided with each luminaire.

.22 Install specified lamps in luminaire.

.23 Clean and re-lamp existing luminaires to be reused.

.24 Check lighting luminaires and mountings for their electrical and physical characteristics in relation to conditions due to building construction and mechanical equipment. Make necessary adjustments to luminaires or hanging arrangement without expense to Owners. Give notification at time of shop drawings and before construction if decision on necessary changes is required.

.25 Do not mount luminaires above pipes, ducts or equipment. In event of unavoidably tight locations, provide hangers to clear obstruction. Check layouts of other trades on job and plan co-operatively. Luminaires in any room shall hang at one height. Obtain approval before any changes are made to layouts shown.

3.02 Testing and Adjustment

.1 As required, all adjustable luminaires shall be aimed, focused, locked, etc., by the Contractor under the observation of the Consultant. As aiming and adjusting is completed, locking setscrews and bolts and nuts shall be tightened securely by the Contractor.

.2 All ladders, scaffolds, lifts, etc. required for aiming and adjusting luminaires shall be furnished by the Contractor.

.3 The Contractor shall be responsible for notifying the Consultant of appropriate time for staking any outdoor luminaire locations which are called out as "to be field located" on drawings and Luminaire Schedule, and shall supply equipment and personnel for staking at the direction of the Consultant.

.4 Where possible, units shall be focused during the normal working day. However, where daylight interferes with seeing lighting effects, aiming shall be accomplished at night.

3.03 Wiring

.1 Install luminaire disconnect plugs on all new luminaires not provided as such from the manufacturer.

.2 Connect luminaires to branch circuit outlets provided under Section 26 05 33.13 using flexible conduit.

.3 Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

.4 Bond products and metal accessories to branch circuit equipment grounding conductor.

3.04 Luminaire Supports

.1 Support luminaires independently of ceiling framing, unless ceiling is certified by the manufacturer to support weight of installed devices. Confirm if T-bar ceilings are metric or imperial and provide luminaires to suit ceiling dimensions.

.2 Provide chain hangers for new and existing luminaires.

3.05 Luminaire Alignment

.1 Locate recessed ceiling luminaires as indicated on reflected ceiling plan. Recessed luminaires shall be installed to permit removal from below. Include accessories and materials to meet applicable codes and regulatory requirements.

.2 Align luminaires mounted in continuous rows to form straight uninterrupted line.

.3 Align luminaires mounted individually parallel or perpendicular to building grid lines.

.4 Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Secure to prevent movement.

3.06 Field Quality Control

.1 Operate each luminaire after installation and connection. Inspect for proper connection and operation.

.2 Wiring connections to the branch circuit shall be made using building wire with insulation suitable for temperature conditions within luminaire.

.3 Fixtures supported by suspended ceiling systems shall be securely fastened to the ceiling framing member by mechanical means, such as bolts, screws, or rivets. Ceiling framing members must be securely attached to each other and to the building structure as required by all applicable codes and standards. Use of integral clips is not acceptable.

.4 Occupancy Sensors

.1 Locate and aim sensors in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas.

.2 Rooms shall have 90 per cent to 100 per cent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s).

.3 Exercise proper judgment in executing the work to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components.

3.07 Cleaning

.1 All luminaires and accessories shall be thoroughly cleaned after being installed. All fingerprints, dirt, tar, smudges, drywall mud and dust, etc. shall be removed by the Contractor from the luminaire bodies, reflectors, trims, and lens or louvers prior to final acceptance. All reflectors shall be free of paint other than factory-applied, if any. All reflectors, cones and lenses shall be cleaned only according to manufacturers' instructions.

.2 Clean electrical parts to remove conductive and deleterious materials.

.3 Remove dirt and debris from enclosures.

.4 Clean photometric control surfaces as recommended by manufacturer.

.5 Clean finishes and touch up damage.

3.08 Protection of Finished Work

.1 Re-lamp luminaires that have failed lamps.

.2 Re-lamp luminaires used for temporary lighting at Substantial Completion.

3.09 Commissioning

.1 Measure samples of each new luminaire type to be replaced as described in PART 1 of this section for demonstration of energy savings.

.2 Sensor placement and orientation for all sensor types.

.3 Occupancy sensor function, sensitivity, and time delays.

.4 Daylight harvesting sensor calibration.

.5 Automated shade operation.

.6 Manual control placement and operation.

.7 Automated control operation, including scheduled on/off functions and dimming trims and presets.

.8 Override operation, access, and functionality.

.9 Centralized control interfaces and operation.

.10 Client education of operations.

.11 Documentation archived to client.

End of Section

1 General

1.01 Section Includes

.1 Solid state, light emitting diode (LED) source interior luminaires.

.2 New, fully integrated luminaires for indoor applications.

1.02 Related Requirements

.1 Section 26 09 23 – Lighting Control Devices.

.2 Section 26 50 00 – Lighting.

.3 Section 26 51 19.16 – LED Retrofit Lamps.

.4 Section 26 52 13.13 – Emergency Lighting.

1.03 References

.1 Canadian Standards Association (CSA)

.1 CSA C22.1-18, Canadian Electrical Code, Part 1 (24th Edition), Safety Standard for Electrical Installations.

.2 Ontario Electrical Safety Code (27th edition/2018).

.3 CSA C22.2 No. 9.0 - General Requirements for Luminaires.

.4 CSA C22.2 No. 250.0 - Luminaires (Bi-National Standard, with UL 1598).

.2 DesignLights Consortium (DLC).

.1 Technical Requirements Table v2.1, or latest edition.

.2 Where the specifications do not explicitly call for DLC qualified LED luminaires, the technical criteria provided in the DLC Technical Requirements provide the basis of the requirements for this section of the Specification.

.3 Energy Star

.1 Program Requirements for Luminaires - Eligibility Criteria, Version 1.2, or latest edition.

.4 Illuminating Engineering Society (IES)

.1 IES HB-10-11 – The Lighting Handbook, 10th Edition.

.2 IES LM-79-08 – Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products.

.3 IES LM-80-08 – IES Approved Method for Measuring Lumen Maintenance of LED Light Sources.

.4 TM-21-11- IES Technical Memorandum on Projecting Long Term Lumen Maintenance of LED Light Sources.

.5 National Electrical Manufacturer's Association (NEMA)

.1 SSL-1-10 – Electronic Drivers for LED Devices, Arrays, or Systems.

.2 WD 6 - Wiring Devices - Dimensional Requirements.

1.04 Definitions

.1 CCT: Correlated colour temperature.

.2 CRI: Colour-rendering index.

.3 LED: Light Emitting Diode.

.4 Lumen: Measured output of lamp and luminaire, or both.

.5 Luminaire: Complete lighting fixture, including ballast housing if provided.

1.05 Action Submittals

.1 Refer to Section 01 33 00 and Section 26 50 00.

.2 Product submittals shall be accompanied by product specification sheets or other documentation that includes the designed parameters as detailed in this specification. These parameters include (but not limited to):

.1 Maximum power in Watts.

.1 If a transformer is used in conjunction with a driver (for example on some 347 volt lighting circuits), the maximum power shall include the transformer losses.

.2 L70 in hours, when extrapolated for the worse case operating temperature. TM-21 report shall be submitted to demonstrate this.

.3 Product submittals shall be accompanied by performance data that is derived in accordance with appropriate IESNA testing standards and tested in a laboratory that is NVLAP accredited for Energy Efficient Lighting Products.

1.06 Informational Submittals

.1 Installation instructions.

1.07 Closeout Submittals

.1 Section 01 33 00 and Section 01 78 00: Submittals for project closeout.

.2 Submit manufacturer's operation and maintenance instructions for each product.

1.08 Regulatory Requirements

.1 Products shall be listed and classified by CSA (Canadian Standards Association), ULC (Underwriter’s Laboratories of Canada), or certified by recognized independent testing organizations that test to CSA standards.

.2 Products shall be certified by a recognized testing agency accredited by the Standards Council of Canada and bear a certification mark from that agency.

.3 All luminaires shall be listed and labeled for installation in fireproof or non-fireproof construction, dry, damp, or wet locations as required.

.4 Recessed fixtures mounted in an insulated ceiling shall be listed for use in insulated ceilings.

1.09 Delivery, Storage, and Handling

.1 Deliver, store and handle materials in accordance with Section 01 61 00.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

1.10 Extra Stock Materials

.1 Refer to Section 01 78 00.

.2 Provide the following additional equipment as listed herein.

.1 Provide an additional 2 per cent spare luminaires of each new type to be provided.

.2 Provide 1 per cent of each plastic lens type.

.3 Provide three of each type of any special tools required for system use and maintenance.

1.11 Warranty

.1 Refer to Section 01 78 00 and Section 26 05 00.

.2 The manufacturer shall provide a warranty against loss of performance and defects in materials and workmanship for the luminaires for a period of 5 years after acceptance of the luminaires. Warranty shall cover all components comprising the luminaire.

.3 All warranty documentation shall be provided to customer prior to the first shipment.

.4 LED Luminaires shall have a manufacturer's warranty for a period of not less than five years.

.5 LED boards, drivers and associated components shall have a warranty of 5 years on the LEDs, 5 years on the driver, 10 years on the paint finish.

2 Products

2.01 Indoor LED Luminaires, General

.1 Initial delivered lumens – thermal losses should be less than 10 per cent when operated at a steady state at an average ambient operating temperature of 25 degrees C, and optical losses should be less than 15 per cent.

.2 Average Delivered Lumens – Average delivered lumens over 50 000 hours should be minimum of 85 per cent of initial delivered lumens.

.3 All luminaires shall be tested per LM79/80 and published L70 data.

.4 Available in 3500 K correlated colour temperature, CRI greater than or equal to 80, or as indicated.

.5 Accessibility and Maintenance:

.1 All LED luminaires shall be field serviceable, with LED arrays, LED modules, drivers, etc. fully serviceable and easily accessible. In the case of recessed ceiling mounted, and in the case of surface mounted ceiling fixtures, these components must be accessible from below. Luminaires in which any of these components are accessible only from above are not acceptable.

.2 Ballasts, drivers, LED arrays, LED modules, and lamps shall be serviceable while the fixture is in its normally installed position. Ballasts or drivers shall not be mounted to removable reflectors or wireway covers unless so specified. In the case of ceiling mounted luminaires, the serviceable components must be accessible from below.

.6 Housings:

.1 Formed to prevent warping and sagging. Housing, trim and lens frame shall be true, straight (unless intentionally curved), and parallel to each other as designed.

.2 Sheet steel housings to be minimum 20 gauge.

.3 Wireways and fittings: free of burrs and sharp edges, and shall accommodate internal and branch circuit wiring without damage to the wiring.

.4 When installed, any exposed fixture housing surface, trim frame, door frame, and lens frame shall be free of light leaks.

.5 Hinged door frames shall operate smoothly without binding. Latches shall function easily by finger action without the use of tools.

.6 Drivers shall not be mounted to removable reflectors or wireway covers unless so specified.

.7 Mechanical Safety: Lighting fixture closures (lens doors, trim frame, hinged housings, etc.) shall be retained in a secure manner by captive screws, chains, aircraft cable, captive hinges, or fasteners such that they cannot be accidentally dislodged during normal operation or routine maintenance.

.8 Metal Finishes:

.1 Fixture finish and construction to meet ULC listings and CSA certifications related to intended installation.

.2 All metal components of fixtures shall be painted after fabrication to mitigate raw metal edges, and thus prevent premature corrosion.

.3 The manufacturer shall apply standard finish (unless otherwise specified) over a corrosion-resistant primer, after cleaning to free the metal surfaces of rust, grease, dirt and other deposits. Edges of pre-finished sheet metal exposed during forming, stamping or shearing processes shall be finished in a similar corrosion resistant manner to match the adjacent surface(s). Fixture finish shall be free of stains or evidence of rusting, blistering, or flaking, and shall be applied after fabrication.

.4 Interior light reflecting finishes shall be white with not less than 85 per cent reflectance, except where otherwise shown on the drawing.

.9 Wiring:

.1 Lighting fixtures shall have a specific means for grounding metallic wireways and housings to an equipment grounding conductor.

.2 Supplied complete with a luminaire disconnect plug.

2.02 Drivers, General

.1 Electronic LED drivers shall be integral to the luminaire, and be designed to be accessible in the field for replacement and servicing.

.2 Input Voltage:

.1 Driver with a voltage range of (120-277) +/- 10% or (347-480) +/- 10%.

.2 Refer to lighting fixture schedule.

.3 For luminaires connected to a 347 volt circuit and utilizing a natively 120-277 volt driver, provide an appropriately sized step down transformer.

.3 Input frequency 60 Hz.

.4 Load regulation: +/- 1 per cent from no load to full load.

.5 Output ripple less than 10 per cent.

.6 Output should be isolated.

.7 Case temperature: rated for -40 degrees C through +80 degrees C.

.8 Overheat protection, self-limited short circuit protection and overload protected.

.9 Primary fused.

.10 Driver life rating not less than 50 000 hours

.11 Power Factor and Total Harmonic Distortion

.1 Power factor of greater than or equal to 0.9 at full load.

.2 THD of less than or equal to 20 per cent at full load.

.12 Dimming Control:

.1 Coordinate with Section 26 09 23.

.2 0-10 V dimming control typical for all fixtures unless otherwise noted.

.3 Control range: 10 per cent to 100 per cent typical, unless noted otherwise.

.4 Provide a mock-up to demonstrate the luminaire is free of flicker throughout the dimming range when used with the dimming controllers described in related sections.

2.03 Downlight Luminaires

.1 Minimum Light Output: 500 lm.

.2 Zonal lumen density: Minimum 75 per cent between 0 degrees and 60 degrees from nadir.

.3 Minimum luminaire efficacy: 45 lumens per watt.

.4 Correlated Colour Temperature (CCT): 3500 K

.5 Colour Rendition Index (CRI): 80 CRI minimum.

.6 Minimum L70 lumen maintenance to occur at 50 000 hours in accordance with LM-80 testing data and TM-21 extrapolation.

2.04 Nominal 305 mm by 1220 mm (1 foot by 4 foot) Luminaires for Ambient Lighting of Interior Spaces

.1 Minimum Light Output: 1 500 lm.

.2 Zonal lumen density:

.1 Minimum 75 per cent between 0 degrees and 60 degrees from nadir.

.3 Spacing Criteria:

.1 0 degrees to 180 degrees: 1.0 – 2.0

.2 90 degrees to 270 degrees: 1.0 – 2.0

.4 Minimum luminaire efficacy: 85 lumens per watt.

.5 Correlated Colour Temperature (CCT): 3500 K

.6 Colour Rendition Index (CRI): 80 CRI minimum.

.7 Minimum L70 lumen maintenance to occur at 50 000 hours in accordance with LM-80 testing data and TM-21 extrapolation.

2.05 Nominal 610 mm by 1220 mm (2 foot by 4 foot) Luminaires for Ambient Lighting of Interior Spaces

.1 Minimum Light Output: 3 000 lm.

.2 Zonal lumen density:

.1 Minimum 75 per cent between 0 degrees and 60 degrees from nadir.

.3 Spacing Criteria:

.1 0 degrees to 180 degrees: 1.0 – 2.0

.2 90 degrees to 270 degrees: 1.0 – 2.0

.4 Minimum luminaire efficacy: 85 lumens per watt.

.5 Correlated Colour Temperature (CCT): 3500 K

.6 Colour Rendition Index (CRI): 80 CRI minimum.

.7 Minimum L70 lumen maintenance to occur at 50 000 hours in accordance with LM-80 testing data and TM-21 extrapolation.

2.06 Linear Ambient Luminaires: Indirect

.1 Minimum Light Output: 500 lm per foot.

.2 Zonal lumen density:

.1 Minimum 50 per cent between 90 degrees and 150 degrees from nadir.

.3 Minimum luminaire efficacy: 85 lumens per watt.

.4 Correlated Colour Temperature (CCT): 3500 K

.5 Colour Rendition Index (CRI): 80 CRI minimum.

.6 Minimum L70 lumen maintenance to occur at 50 000 hours in accordance with LM-80 testing data and TM-21 extrapolation.

2.07 Linear Ambient Luminaires: Indirect/Direct

.1 Minimum Light Output: 500 lm per foot.

.2 Zonal lumen density:

.1 Minimum 25 per cent between 0 degrees and 60 degrees from nadir.

.2 Minimum 50 per cent between 90 degrees and 150 degrees from nadir.

.3 Minimum luminaire efficacy: 85 lumens per watt.

.4 Correlated Colour Temperature (CCT): 3500 K

.5 Colour Rendition Index (CRI): 80 CRI minimum.

.6 Minimum L70 lumen maintenance to occur at 50 000 hours in accordance with LM-80 testing data and TM-21 extrapolation.

2.08 Linear Ambient Luminaires: Direct/Indirect

.1 Minimum Light Output: 500 lm per foot.

.2 Zonal lumen density:

.1 Minimum 40 per cent between 0 degrees and 60 degrees from nadir.

.2 Minimum 35 per cent between 90 degrees and 150 degrees from nadir.

.3 Minimum luminaire efficacy: 85 lumens per watt.

.4 Correlated Colour Temperature (CCT): 3500 K

.5 Colour Rendition Index (CRI): 80 CRI minimum.

.6 Minimum L70 lumen maintenance to occur at 50 000 hours in accordance with LM-80 testing data and TM-21 extrapolation.

2.09 Linear Ambient Luminaires: Direct

.1 Minimum Light Output: 375 lm per foot.

.2 Zonal lumen density:

.1 Minimum 40 per cent between 0 degrees and 60 degrees from nadir.

.3 Minimum luminaire efficacy: 85 lumens per watt.

.4 Correlated Colour Temperature (CCT): 3500 K

.5 Colour Rendition Index (CRI): 80 CRI minimum.

.6 Minimum L70 lumen maintenance to occur at 50 000 hours in accordance with LM-80 testing data and TM-21 extrapolation.

3 Execution

3.01 Verification of Conditions

.1 Coordinate the lighting system installation with the relevant trades so as to eliminate interferences with hangers, mechanical ducts, sprinklers, piping, steel, etc.

3.02 Installation

.1 Install lighting equipment, including but not limited to luminaires, controls, auxiliary devices and the integration of same in strict conformance with all manufacturers' recommendations and instructions the securing of which shall be the responsibility of the Contractor.

.2 Integrate luminaires with controls in accordance with respective luminaire manufacturers' and controls manufacturers' recommendations and instructions and to provide a complete, trouble-free operation without compromising safety, code and CSA requirements.

.3 Seal all luminaires for wet locations (i.e. all knock-outs, all pipe and wire entrances, etc.) as is standard industry practice to prevent water from entering luminaires.

.4 Luminaire Alignment

.1 Locate recessed ceiling luminaires as indicated on reflected ceiling plan. Install recessed luminaires to permit removal from below. Include accessories and materials to meet applicable codes and regulatory requirements.

.2 Align luminaires mounted in continuous rows to form straight uninterrupted line.

.3 Align luminaires mounted individually parallel or perpendicular to building grid lines.

.4 Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Secure to prevent movement.

.5 Locate and install luminaires as indicated. Mounting heights and configuration of the luminaires shall be as specified in the Luminaire Schedule portion of the Specification or indicated on the drawings, and where conflicts exist, as approved by the Consultant.

.6 Installed all luminaires plumb and true and level as viewed from all directions unless specifically identified otherwise in the Lighting Fixture Schedule. Luminaires shall remain plumb and true without continual adjustment or visibly obvious means beyond what is shown on luminaire submittal drawings.

.7 For installation in suspended ceilings, ensure that the luminaires are supported such that there is no resultant bowing or deflection of the ceiling system greater than 1/360 of the length of the total span of the ceiling member.

.5 Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.

.6 Whenever a luminaire or its hanger canopy is installed directly to a surface mounted junction box, use a finishing ring painted to match the ceiling to conceal the junction box.

.7 Suspended Luminaires:

.1 Install suspended luminaires and exit signs using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.

.2 Suspended luminaires shall be installed plumb and true and level unless specifically identified otherwise in the Luminaire Schedule portion of this Specification and at a height from finished floor as specified on the drawings, details and Luminaire Schedule. In cases where this is impractical, refer to the Consultant for a decision. All appurtenances shall be consistently organized for a neat, uniform appearance.

.8 Install wall mounted luminaires at height as indicated.

.9 Accessories:

.1 Reflector cones, louvers, baffles, lenses, trims and other decorative elements shall be installed after completion of ceiling tile installation, plastering, painting and general cleanup.

.2 Install accessories provided with each luminaire.

.3 All accessories shall be properly installed and adjusted by Contractor in accordance with specification and installation instructions. Any spare items shall be clearly labeled (indicate type of accessory and associated luminaire types).

3.03 Testing and Adjustment

.1 As required, all adjustable luminaires shall be aimed, focused, locked, etc., by the Contractor under the observation of the Consultant. As aiming and adjusting is completed, locking setscrews and bolts and nuts shall be tightened securely by the Contractor.

.2 All ladders, scaffolds, lifts, etc. required for aiming and adjusting luminaires shall be furnished by the Contractor.

.3 Where possible, units shall be focused during the normal working day. However, where daylight interferes with seeing lighting effects, aiming shall be accomplished at night.

3.04 Luminaire Supports

.1 Provide adequate support to suit ceiling system.

.2 Support luminaires independently of ceiling framing, unless ceiling is certified by the manufacturer to support weight of installed devices. Confirm if T-bar ceilings are metric or imperial and provide luminaires to suit ceiling dimensions.

.3 Provide chain hangers for new and existing luminaires.

.4 Install clips to secure recessed grid-supported luminaires in place.

.5 Fixtures supported by suspended ceiling systems shall be securely fastened to the ceiling framing member by mechanical means, such as bolts, screws, or rivets. Ceiling framing members must be securely attached to each other and to the building structure as required by all applicable codes and standards. Use of integral clips is not acceptable.

3.05 Wiring

.1 Install luminaire disconnect plugs on all new luminaires not provided as such from the manufacturer.

.2 Connect luminaires to branch circuit outlets provided under Section 26 05 33.13 using flexible conduit.

.3 Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

.4 Bond products and metal accessories to branch circuit equipment grounding conductor.

3.06 Field Quality Control

.1 Operate each luminaire after installation and connection. Inspect for proper connection and operation.

.2 Make wiring connections to the branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

.3 Occupancy Sensors.

.1 Locate and aim sensors in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas.

.2 Rooms shall have 90 per cent to 100 per cent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room.

.3 Exercise proper judgment in executing the work to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components.

3.07 Cleaning

.1 Thoroughly clean all luminaires and accessories after installation. All fingerprints, dirt, tar, smudges, drywall mud, dust, etc. shall be removed by the Contractor from the luminaire bodies, reflectors, trims, and lens or louvers prior to final acceptance. All reflectors shall be free of paint other than factory-applied, if any. All reflectors, cones and lenses shall be cleaned only according to manufacturers' instructions.

.2 Clean electrical parts to remove conductive and deleterious materials.

.3 Remove dirt and debris from enclosures.

.4 Clean photometric control surfaces as recommended by manufacturer.

.5 Clean finishes and touch up damage.

.6 Luminaire finishes which are disturbed in any way during construction shall be touched up or refinished in a manner satisfactory to the Consultant.

3.08 Commissioning

.1 In accordance with Section 26 08 50.

End of Section

1 General

1.01 Conditions and Requirements

.1 Refer to the General Conditions, Supplementary General Conditions, and General Requirements.

.2 Provisions of this Section shall apply to all Sections of Division 27.

.3 Refer to Consultant's drawings for exact location of electrical equipment and devices. Refer to Designer drawings for additional notes which complement these specifications.

.4 The Division 26 specification documents shall be followed in conjunction with the specification in this section.

1.02 Related Requirements

.1 Division 25 – Integrated Automation.

.2 Division 26 – Electrical.

.3 Division 28 – Electronic Safety and Security.

1.03 Intent

.1 Include all material, labour, equipment, and plant construction as necessary to make a complete installation as shown and specified hereinafter. Sections of this specification are not intended to delegate functions nor to delegate work and supply to any specific Trade. It shall be your responsibility to ensure that the systems specified hereafter are complete and operative.

1.04 Reference Standards

.1 The equipment, material and installation shall conform to the latest version of the applicable Codes, Standards (including technical service bulletins and addenda) and regulations of authorities having jurisdiction.

.2 BICSI

.1 Telecommunications Distribution Methods Manual

.2 Cabling Installation Manual

.3 Outside Plant Manual

.3 Canadian Standards Association (CSA)

.1 CSA C22.1-18, Canadian Electrical Code, Part 1 (24th Edition), Safety Standard for Electrical Installations.

.2 Ontario Electrical Safety Code (27th edition/2018).

.3 CSA T529 – Commercial Building Telecommunications Cabling Standard (ANSI/EIA/TIA-568-B).

.4 CSA T530 – Commercial Building Standard For Telecommunications Pathways And Spaces (TIA/EIA 569-A).

.5 CSA T528 – Administration Standard For The Telecommunications Infrastructure Of Commercial Buildings (ANSI/EIA/TIA-606).

.6 CSA T527 – Commercial Building Grounding And Bonding Requirements For Telecommunications (ANSI/EIA/TIA-607).

.7 CSA C22.2 No. 214 – Communications Cables.

.8 CSA C22.2 No. 232-M – Fibre Optic Cables.

.9 CSA C22.2 No. 182.4-M90 – Plugs, Receptacles, and Connectors for Communication Systems.

.4 TIA

.1 TIA/EIA-568-B.1 – Commercial Building Telecommunications Cabling Standard

.2 TIA/EIA-568-B.2 – Balanced Twisted Pair Cabling Components

.3 TIA/EIA-568-B.3 – Optical Fibre Cabling Components Standard

.5 ISO

.1 ISO/IEC IS 11801A – Generic Cabling for Customer Premises.

.6 CENELEC EN 50173 – Performance Requirements for Generic Cabling Schemes.

.7 IEC

.1 IEC 603-7, PART 7 – Detailed Specification For Connectors, 8-Way, Including Fixed And Free Connectors With Common Mating Features.

.2 IEC 807-8 – Rectangular Connectors For Frequencies Below 3 MHz, Part 8: Detailed Specification For Connectors, Four-Signal Contacts And Earthing Contacts For Cable Screens, First Edition.

.8 FIPS PUB 174 – Commercial Building Telecommunications Wiring Standard. Federal Information Standard Publication.

.9 UL 444 and 13 – Adopted Test and Follow-Up Service Requirements For the Optional Qualification of 100Ω Twisted-Pair (Cables).

.10 NEMA WC 63 – Performance Standard For Field Testing Of Unshielded Twisted-Pair Cabling System.

.11 ANSI/EIA/TIA

.1 ANSI/EIA/TIA-492AAAA – Detailed Specification For 62.5µm Core Diameter / 125µm Cladding Diameter Class 1a Multimode, Graded-Index Optical Waveguide fibres.

.2 ANSI/EIA/TIA-492BAAA – Detailed Specifications For Class Iva Dispersion-Unshifted Singlemode Optical Waveguide Fibres Used In Communication Systems.

.3 ANSI/EIA/TIA-472CAAA – Detailed Specifications For All Dielectric (Construction 1) Fibre optic Communications Cable For Indoor Plenum Use, Containing Class 1a, 62.5µm Core Diameter / 125µm Cladding Diameter Fibre optic(s).

.4 ANSI/EIA/TIA-472DAAA – Detailed Specifications For All Dielectric Fibre optic Communications Cable For Outdoor Plant Use, Containing Class 1, 62.5µm Core Diameter / 250µm Cladding Diameter Fibre optic(s).

.5 ANSI/EIA/TIA-455 – Test Procedures For Fibre optics, Cables And Transistors.

.6 ANSI/EIA/TIA-598 – Colour Coding of Fibre Optic Cables.

.7 ANSI/EIA/TIA-604-3 – FOCIS 3 Fibre Optic Connector Intermateability Standard.

.8 ANSI/EIA/TIA-606 – Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.

.9 ANSI/EIA/TIA-607 – Commercial Building Grounding and Bonding Requirements for Telecommunications.

.12 ANSI Z136.2 – American Standards For The Safe Operation of Fibre optic Communication Systems Utilizing Laser Diode And LED Sources.

.13 ANSI/CEA

.1 ANSI/ICEA S-83-640 – Fibre Optic Outside Plant Communications Cable.

.2 ANSI/ICEA S-83-596 – Fibre Optic Premises Distribution Cable.

1.05 Submittals

.1 Before delivery to site of any item of equipment, the electrical contractor shall submit 6 copies of shop drawings c/w all data, pre-checked and stamped accordingly, for approval to the Engineer. Indicate project name on each brochure or sheet. Submit shop drawings within 1 week after award of contract, for the following:

.1 Copper Cabling

.2 Fibre Optic Cabling

.3 Fabric Innerduct

.4 Racks, managers

.5 Patch Panels

.6 Telecommunications Outlets, Faceplates

.7 Fibre Optic Routing System

.8 Rack Power Distribution Units

1.06 Record Documentation

.1 To Section 01 78 00.

.2 Red lines, mark-ups by this contractor.

1.07 Operation and Maintenance Manuals

.1 Refer to Division 01.

1.08 Inspections

.1 The Engineer and/or the Project Manager will carry out inspections and prepare deficiency list for action by the Contractor, during and on completion of project.

1.09 Drawings and Specifications

.1 The drawings and specifications are complementary each to the other and what is called for by one to be binding as if called for by both. Should any discrepancy appear between the drawings and specifications which leaves the Contractor in doubt as to the true intent and meaning of plans and specifications, a ruling is to be obtained from the Engineer in writing before submitting Tender. If this is not done, the maximum, the most expensive alternate or option will be provided in base tender bid.

.2 All drawings and all Divisions of these specifications shall be considered as a whole and work of this Division shown anywhere therein shall be furnished under this Division.

.3 Drawings are diagrammatic and indicate the general arrangement of equipment and pathways. Most direct routing of cabling is not assured. Exact requirements shall be governed by architectural, structural, and mechanical conditions of the job. Consult all other drawings in preparation of the bid. Extra lengths of wiring or addition of pull and junction boxes, etc. necessitated by such conditions shall be included in the bid. Check all information and report and apparent discrepancies before submitting the bid.

.4 Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of pathways so as to best fit the layout of the job.

.5 Scaling off the drawings will not be sufficient or accurate for determining these locations. Where job conditions require reasonable changes in indicated arrangement and locations, such changes shall be made by the Contractor at no additional cost to the Owner.

.6 Before ordering any conduit, cable tray, cables, fittings, etc., this Contractor shall verify all pertinent dimensions at the job site and be responsible for their accuracy.

1.10 Material

.1 This contractor is responsible to ensure that all items submitted meet all requirements of the drawings and specification, and fits in the allocated space. The final determination of a product being acceptable shall be determined by the Engineer.

1.11 Testing Data

.1 The contractor shall provide a complete testing report utilizing a testing device as specified in the applicable TIA/EIA standard with the correct adapter and test. All copper tests shall be compliant to the current TIA/EIA standards: Perm Link or Channel.

.2 The Summary report shall provide be provided to the end user in a universal format so that there is no need to purchase any software to read and print the report.

.1 Utilizing Adobe Acrobat is an acceptable manner.

1.12 Painting and Finishes

.1 Minor damages to finish on factory finished equipment shall be touched up to the Engineer's satisfaction. Items suffering major damage to finish shall be replaced at the direction of the Engineer. Protect work so that finishes will not be damaged or marred during construction. Maintain the necessary protection until completion of the work.

1.13 Safety

.1 The Contractor shall be responsible for the safety of his workmen and the equipment on the project in accordance with all applicable safety legislation passed by Federal, Provincial, and local authorities governing construction safety. The more stringent regulations shall prevail.

1.14 Warranty

.1 Submit a written performance warranty to the Owner for two years for the complete installation from the date of testing and acceptance.

.2 The contractor shall also provide a two years labour warranty on the installation.

2 Products

2.01 Material Approval

.1 The design, manufacture and testing of electrical equipment and materials shall conform to or exceed the latest applicable CSA, IEEE, and ANSI standards.

.2 All materials must be new and be ULC or CSA listed. Any materials not covered by the aforementioned listing standards shall be tested and approved by an independent testing laboratory, Technical inspection Services, or other government agency.

3 Execution

3.01 Workmanship and Contractor's Qualifications

.1 Only first class workmanship will be accepted, not only in regards to durability, efficiency and safety, but also in regards to neatness of detail. Present a neat and clean appearance on completion to the satisfaction of the Engineer. Any unsatisfactory workmanship will be replaced at no extra cost.

.2 Conform to the best practices applicable to this type of work. Install all equipment and systems in accordance with the manufacturer's recommendations, but consistent with the General Requirements of this Specification. This Contractor will be held responsible for all damage to the work of his own or any other trade, resulting from the execution of his work. Store all equipment and materials in dry locations.

.3 Provide foreman in charge of this work at all times.

.4 The contractor shall be fully liable to provide and maintain in force during the life of this Contract, such insurance, including Public Liability Insurance, Product Liability Insurance, Auto Liability Insurance, Worker's Compensation, and Employer's Liability Insurance.

3.02 Work Sequence

.1 Prior to start of each work period in occupied area, temporary protection shall be installed to prevent damage to any personal property or furnishing. Coordinate with Owner's representative if any furniture must be relocated to facilitate work.

.2 Owner's representative shall approve temporary protection plan prior to use.

.3 Necessary steps shall be taken by contractor to ensure that required fire fighting apparatus is accessible at all times. Flammable materials shall be kept in suitable places outside the building.

3.03 Coordination

.1 Coordinate work with other trades.

.2 Verify equipment dimensions and requirements with provision specified under this Section. Check actual job conditions before fabricating work. Report all necessary changes in time to prevent needless work. Changes or additions subject to additional compensation, which are made without written authorization and an agreed price, shall be at Contractor's risk and expense.

.3 Read specifications and drawings of other trades and conform with their requirements before proceeding with any work specified in this Division related to other trades. Cooperate with all other trades on the job, so that all equipment can be satisfactorily installed, and so that no delay is caused to any other Trades.

3.04 Manufacturers' Instructions

.1 Where the specifications call for an installation to be made in accordance with Manufacturer's recommendations, a copy of such recommendations shall be at all times be kept on the job site and be available to the Owner's Representative.

.2 Follow manufacturer's instructions where they cover points now specifically indicated on the drawings and specifications. If they are in conflict with the drawings and specifications obtain clarification from the Consultant before starting work.

3.05 Quality Assurance

.1 See General Provisions of the Contract.

.2 The specifications contained herein are set forth as the minimum acceptable requirements. This does not relieve the Contractor from executing other quality assurance measures to obtain a complete operating system within the scope of this project.

.3 The Contractor shall ensure that all workmanship, all materials employed, all required equipment and the manner and method of installation conforms to accepted construction and engineering practices, and that each piece of equipment is in satisfactory working condition to satisfactorily perform its functional operation.

.4 Provide quality assurance tests and operational check on all components of the electrical distribution system, all lighting fixtures, and communication systems.

3.06 Labels and Signs

.1 Labelling shall be as per TIA/EIA-606.

3.07 Adjust and Clean-Up

.1 The Contractor and associated sub trades, at all times during construction, to keep the site free of all debris, boxes, packing, etc., resulting from work of this Trade. At the completion of this work, the installation is to be left in a clean and finished condition to the satisfaction of the Engineer.

3.08 Tests and Acceptance

.1 The operation of the equipment does not constitute an acceptance of the work by the Owner. The final acceptance is to be made after the Contractor has adjusted his equipment and demonstrated that it fulfils the requirements of the drawings and the specifications.

.2 Testing of all systems shall be performed in the presence of the Owner's designated representative. The contractor shall give 72 hours advance notice to the Owner before beginning the tests.

.3 Upon completion of the installation, the Contractor shall furnish certificates of approval from all authorities having jurisdiction, as applicable. Contractor shall demonstrate that work is complete and in perfect operating condition. In the presence of the Owner, the Contractor shall demonstration the proper operation of all miscellaneous systems.

End of Section

1 General

1.01 Description

.1 This section specifies general grounding and bonding requirements of telecommunication installations for equipment operations.

.2 "Grounding electrode system" refers to all electrodes required by Electrical Code, as well as including made, supplementary, telecommunications system grounding electrodes.

.3 The terms "connect" and "bond" are used interchangeably in this specification and have the same meaning.

1.02 Related Requirements

.1 Section 09 69 00 – Access Flooring.

.2 Section 26 05 26 – Grounding and Bonding for Electrical Systems.

.3 Section 27 11 16 – Communications Cabinets, Racks, Frames, and Enclosures.

1.03 References

.1 Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

.2 American Society for Testing and Materials (ASTM):

.1 ASTM B1-2001 - Standard Specification for Hard-Drawn Copper Wire.

.2 ASTM B8-2004 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.

.3 Institute of Electrical and Electronics Engineers, Inc. (IEEE):

.1 IEEE 81-1983 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.

.4 Canadian Standards Association (CSA):

.1 CSA C22.1-12 - Canadian Electrical Code, Part I (22nd Edition), Safety Standard for Electrical Installations.

.2 Ontario Electrical Safety Code (25th Edition / 2012).

.5 Telecommunications Industry Association, (TIA)

.1 TIA J-STO-607-A - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.

.6 Underwriters Laboratories, Inc. (UL):

.1 UL 44-2005 - Thermoset-Insulated Wires and Cables.

.2 UL 83-2003 - Thermoplastic-Insulated Wires and Cables.

.3 UL 467-2004 - Grounding and Bonding Equipment.

.4 UL 486A-486B-2003 - Wire Connectors.

1.04 Submittals

.1 Submit in accordance with Section 01 33 00.

.2 Shop Drawings:

.1 Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.

.2 Include the location of system grounding electrode connections and the routing of aboveground and underground grounding electrode conductors.

.3 Test Reports: Provide certified test reports of ground resistance.

.4 Certifications: Two weeks prior to substantial performance, submit four copies of the following:

.1 Certification that the materials and installation is in accordance with the drawings and specifications.

.2 Certification, by the Contractor, that the complete installation has been properly installed and tested.

2 Products

2.01 Grounding and Bonding Conductors

.1 Equipment grounding and bonding conductors shall be UL 83 insulated stranded copper, except that sizes 6 mm² (10 AWG) and smaller shall be solid copper. Insulation colour shall be continuous green for all equipment grounding conductors. Cable insulation shall be plenum rated (CMP).

.1 Example: American Insulated Wire Corp, Telcoflex III series.

.2 Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes 6 mm² (10 AWG) and smaller shall be ASTM B1 solid bare copper wire.

.3 Telecom System Grounding Riser

.1 Telecom System Grounding Riser Conductor: Telecommunications Grounding Riser shall be in accordance with J STO-607A. Use a minimum 50mm² (1/0 AWG) insulated stranded copper grounding conductor unless indicated otherwise.

2.02 Telecommunication and Equipment Ground Busbars

.1 Provide solid copper busbar, pre-drilled from two-hole lug connections with a minimum thickness of 6 mm (1/4 inch) for wall and backboard mounting using standard insulators sized as per details on the electrical drawings.

.2 Manufacturers:

.1 Newton Instrument Company.

.2 Panduit.

.3 Burndy.

.4 Thomas and Betts.

2.03 Splices and Termination Components

.1 Components shall meet or exceed UL 467 and be clearly marked with the manufacturer, catalog number, and permitted conductor size(s).

2.04 Ground Connections

.1 Above Grade:

.1 Bonding Jumpers: compression type connectors, using zinc-plated fasteners and external tooth lockwashers.

.2 Ground Busbars: Two-hole compression type lugs using tin-plated copper or copper alloy bolts and nuts.

.3 Rack and Cabinet Ground Bars: two-hole compression-type lugs using zinc-plated or copper alloy fasteners.

3 Execution

3.01 General

.1 Ground in accordance with the Electrical Code, as shown on drawings, and as hereinafter specified.

.2 Equipment Grounding: IT cabinets, and other conductive items in close proximity with electrical circuits shall be bonded and grounded.

3.02 Secondary Equipment and Circuits

.1 Conduit Systems:

.1 Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor.

.2 Non-metallic conduit systems shall contain an equipment grounding conductor, except that non-metallic feeder conduits which carry a grounded conductor from exterior transformers to interior or building-mounted service entrance equipment need not contain an equipment grounding conductor.

.3 Conduit containing only a grounding conductor, and which is provided for mechanical protection of the conductor, shall be bonded to that conductor at the entrance and exit from the conduit.

.2 Feeders and Branch Circuits: Install equipment grounding conductors with all feeders and power and lighting branch circuits.

.3 Boxes, Cabinets, Enclosures, and Panelboards:

.1 Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes (except for special grounding systems for intensive care units and other critical units shown).

.2 Provide lugs in each box and enclosure for equipment grounding conductor termination.

.3 Provide ground bars in panelboards, bolted to the housing, with sufficient lugs to terminate the equipment grounding conductors.

.4 Receptacles shall not be grounded through their mounting screws. Ground with a jumper from the receptacle green ground terminal to the device box ground screw and the branch circuit equipment grounding conductor.

3.03 Corrosion Inhibitors

.1 When making ground and ground bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

3.04 Telecommunications System

.1 Bond telecommunications system grounding equipment to the electrical grounding electrode system.

.2 Furnish and install all new wire and hardware required to properly ground, bond and connect communications raceway, cable tray, metallic cable shields, and equipment to a ground source.

.3 Ground bonding jumpers shall be continuous with no splices. Use the shortest length of bonding jumper possible.

.4 Provide ground paths that are permanent and continuous with a resistance of 1 ohm or less from raceway, cable tray, and equipment connections to the building grounding electrode. The resistance across individual bonding connections shall be 10 milliohms or less.

.5 Above-Grade Grounding Connections: When making bolted or screwed connections to attach bonding jumpers, remove paint to expose the entire contact surface by grinding where necessary; thoroughly clean all connector, plate and other contact surfaces; and apply an appropriate corrosion inhibitor to all surfaces before joining.

.6 Bonding Jumpers:

.1 Use insulated ground wire of the size and type shown on the Drawings or use a minimum of #6 AWG insulated copper wire.

.2 Assemble bonding jumpers using insulated ground wire terminated with compression connectors.

.3 Use compression connectors of proper size for conductors specified. Use connector manufacturer's compression tool.

.7 Bonding Jumper Fasteners:

.1 Conduit: Fasten bonding jumpers using screw lugs on grounding bushings or conduit strut clamps, or the clamp pads on push-type conduit fasteners. When screw lug connection to a conduit strut clamp is not possible, fasten the plain end of a bonding jumper wire by slipping the plain end under the conduit strut clamp pad; tighten the clamp screw firmly. Where appropriate, use zinc-plated external tooth lockwashers.

.2 Wireway and Cable Tray: Fasten bonding jumpers using zinc-plated bolts, external tooth lockwashers, and nuts. Install protective cover, e.g., zinc-plated acorn nuts on any bolts extending into wireway or cable tray to prevent cable damage.

.3 Ground Plates and Busbars: Fasten bonding jumpers using two-hole compression lugs. Use tin-plated copper or copper alloy bolts, external tooth lockwashers, and nuts.

.4 Unistrut and Raised Floor Stringers: Fasten bonding jumpers using zinc-plated, self-drill screws and external tooth lockwashers.

3.05 Communications Raceway Grounding

.1 Conduit: Use insulated #6 AWG bonding jumpers to ground metallic conduit at each end and to bond at all intermediate metallic enclosures.

.2 Wireway: use insulated #6 AWG bonding jumpers to ground or bond metallic wireway at each end at all intermediate metallic enclosures and across all section junctions.

End of Section

1 General

1.01 Summary

.1 Provide a complete system of empty conduit, pull boxes, outlets, and sleeves for enclosure of wiring by communications cabling.

1.02 Related Requirements

.1 Section 26 05 33.13 – Conduit for Electrical Systems.

.2 Section 26 05 33.16 – Boxes for Electrical Systems.

1.03 References

.1 BISCI Telecommunications Distribution Methods Manual, 13th Edition (2014).

2 Products

2.01 Outlets

.1 Wall outlets shall be 115 mm square boxes with plaster rings to suit single gang devices unless otherwise noted.

.2 Provide 53 mm conduit through walls as noted.

2.02 Conduits

.1 Conduit size shall be in accordance with recommended standard for conduits in Building as published by BICSI.

.2 Minimum conduit size shall be 21 mm diameter.

.3 Minimum space requirements in pull boxes for 90 degree pulls, shall be as follows:

Maximum conduit size	Size of pull boxes in millimetres			For each additional conduit size increase width by:
	Width	Length	Depth	
21 mm	150 mm	300 mm	100 mm	50 mm
27 mm	200 mm	400 mm	150 mm	75 mm
35 mm	250 mm	450 mm	200 mm	75 mm
41 mm	300 mm	600 mm	250 mm	100 mm
53 mm	350 mm	750 mm	300 mm	125 mm

.4 Plenum cables are permitted in accessible ceilings. Provide 'J' hooks in these locations for later cable installation by others.

.5 Plywood backboards shall be minimum 1200 mm by 2400 mm, 19 mm thick, painted with 2 coats of fire retardant light grey enamel.

.6 Provide a minimum of two 5-15R duplex receptacles on separate circuits at each backboard.

3 Execution

3.01 Installation

.1 Vertically mount outlet boxes, unless noted otherwise, 300 mm to centre above floor, or 150 mm above counter top where shown at counters or benches.

.2 Fish conduit, clear blockages and outlet and clean out pull boxes at completion of installation. Leave conduit free of water or excess moisture. Install No. 12 gauge galvanized soft iron pull wire, or 1/8 inch nylon pull cord continuously from outlet to outlet, through conduit and fasten at each box.

.3 Conduit shall have a bending radius of not less than nine times conduit diameter. Ream out conduit and identify ends with green paint.

.4 Install additional steel pull boxes in such a manner that, throughout entire system, there shall be not more than two 90 degree or equivalent bends or more than 30 000 mm in each run, so that wire or cables may be pulled in or withdrawn with reasonable ease. Minimum space requirements in pull boxes having one conduit each in opposite ends of the box, shall be as follows:

Maximum conduit size	Size of pull boxes in millimetres			For each additional conduit size increase width by:
	Width	Length	Depth	
21 mm	150 mm	300 mm	100 mm	50 mm
27 mm	200 mm	400 mm	150 mm	75 mm
35 mm	250 mm	450 mm	200 mm	75 mm
41 mm	300 mm	600 mm	250 mm	100 mm
53 mm	350 mm	750 mm	300 mm	125 mm

.5 Show as-installed conduit routing and location of all pull boxes on the record drawings, prior to project completion, for use by future installer to facilitate wiring and equipment installation. Include above noted information on final record drawings at project completion.

End of Section

1 General

1.01 Section Includes

.1 Provide a complete system of empty conduits, pull boxes, outlets, and sleeves for enclosure of wiring by other under Cash Allowance. Refer to General Requirements.

1.02 Related Requirements

.1 Section 26 05 33.13 – Conduit for Electrical Systems.

.2 Section 26 05 33.16 – Boxes for Electrical Systems.

.3 Section 28 46 21.11 – Addressable Fire Alarm Systems.

1.03 References

.1 BISCI Telecommunications Distribution Methods Manual, 13th Edition (2014).

2 Products

2.01 Outlets

.1 Wall outlets shall be 115 mm square boxes with plaster rings to suit single gang devices unless otherwise noted.

2.02 Conduits

.1 Conduit size shall be in accordance with recommended standard for conduits in Building as published by BICSI.

.2 Minimum conduit size shall be 21 mm diameter.

.3 Minimum space requirements in pull boxes for 90 degree pulls, shall be as follows:

Maximum conduit size	Size of pull boxes in millimetres			For each additional conduit size increase width by:
	Width	Length	Depth	
21 mm	150 mm	300 mm	100 mm	50 mm
27 mm	200 mm	400 mm	150 mm	75 mm
35 mm	250 mm	450 mm	200 mm	75 mm
41 mm	300 mm	600 mm	250 mm	100 mm
53 mm	350 mm	750 mm	300 mm	125 mm

.4 Plenum cables are permitted in accessible ceilings. Provide ‘J’ hooks in these locations for later cable installation by others.

.5 Plywood backboards shall be minimum 1200 mm by 2400 mm, 19 mm thick, painted with two coats of fire retardant light grey enamel.

.6 Provide a minimum of two duplex receptacles on separate circuits at each backboard.

.7 Provide fire alarm over-ride feature at fire alarm control panel (FACP) to deactivate public address system when Fire Alarm System is in alarm.

3 Execution

3.01 Installation

.1 Vertically mount outlet boxes, unless noted otherwise, 300 mm to centre above floor, or 150 mm above counter top where shown at counters or benches.

.2 Fish conduit, clear blockages and outlet and clean out pull boxes at completion of installation. Leave conduit free of water or excess moisture. Install No. 12 gauge galvanized soft iron pull wire, or 1/8" nylon pull cord continuously from outlet to outlet, through conduit and fasten at each box.

.3 Conduit bonds shall have a bending radius of not less than nine times conduit diameter. Ream out conduit and identify ends with green paint.

.4 Install additional steel pull boxes in such a manner that, throughout entire system, there shall be not more than two 90 degree or equivalent bends or more than 30,000 mm in each run, so that wire or cables may be pulled in or withdrawn with reasonable ease. Minimum space requirements in pull boxes having one conduit each in opposite ends of the box, shall be as follows:

Maximum conduit size	Size of pull boxes in millimetres			For each additional conduit size increase width by:
	Width	Length	Depth	
21 mm	150 mm	300 mm	100 mm	50 mm
27 mm	200 mm	400 mm	150 mm	75 mm
35 mm	250 mm	450 mm	200 mm	75 mm
41 mm	300 mm	600 mm	250 mm	100 mm
53 mm	350 mm	750 mm	300 mm	125 mm

.5 Show as-installed conduit routing and location of all pull boxes on the record drawings, prior to project completion, for use by Cash Allowance installer to facilitate wiring and equipment installation. Include above noted information on final record drawings at project completion.

End of Section

1 General

1.01 Summary

.1 Provide a complete system of empty conduits, terminal cabinets, plywood backboards, pull boxes and outlets for enclosure of wiring by Security Contractor under Cash Allowance.

1.02 Related Requirements

.1 Section 26 05 33.13 – Conduit for Electrical Systems.

.2 Section 26 05 33.16 – Boxes for Electrical Systems.

2 Products

2.01 Outlets

.1 Wall and door outlets shall be single boxes, or 115 mm square boxes with plaster rings to suit single gang devices unless otherwise noted. Coordinate with Security Contractor.

2.02 Conduits

.1 Provide conduit in all walls, exposed areas and inaccessible ceilings. All conduit work shall be concealed.

.2 Minimum conduit size shall be 21 mm diameter.

.3 Provide J hooks in accessible ceilings for plenum rated wiring.

.4 Minimum space requirements in pull boxes for 90 degree pulls, shall be as follows:

Maximum conduit size	Size of pull boxes in millimetres			For each additional conduit size increase width by:
	Width	Length	Depth	
21 mm	150 mm	300 mm	100 mm	50 mm
27 mm	200 mm	400 mm	150 mm	75 mm
35 mm	250 mm	450 mm	200 mm	75 mm
41 mm	300 mm	600 mm	250 mm	100 mm
53 mm	350 mm	750 mm	300 mm	125 mm

.5 Plywood backboards shall be minimum 1200 x 2400 mm, 19 mm thick, painted with 2 coats of fire retardant light grey enamel.

.6 Provide a minimum of 2 duplex receptacles on separate circuits at each backboard.

3 Execution

3.01 Installation

.1 Vertically mount outlet boxes, unless noted otherwise, 300 mm to centre above floor, or 150 mm above counter top where shown at counters or benches.

.2 Fish conduit, clear blockages and outlet and clean out pull boxes at completion of installation. Leave conduit free of water or excess moisture. Install No. 12 gauge galvanized soft iron pull wire, or 1/8" nylon pull cord continuously from outlet to outlet, through conduit and fasten at each box.

.3 Conduit bonds shall have a bending radius of not less than nine times conduit diameter. Ream out conduit and identify ends with green paint.

.4 Install additional steel pull boxes in such a manner that, throughout entire system, there shall be not more than two 90 degree or equivalent bends or more than 30 m in each run, so that wire or cables may be pulled in or withdrawn with reasonable ease. Minimum space requirements in pull boxes having one conduit each in opposite ends of the box, shall be as follows:

Maximum conduit size	Size of pull boxes in millimetres			For each additional conduit size increase width by:
	Width	Length	Depth	
21 mm	150 mm	300 mm	100 mm	50 mm
27 mm	200 mm	400 mm	150 mm	75 mm
35 mm	250 mm	450 mm	200 mm	75 mm
41 mm	300 mm	600 mm	250 mm	100 mm
53 mm	350 mm	750 mm	300 mm	125 mm

.5 Show as-installed conduit routing and location of all pull boxes on the record drawings, prior to project completion, for use by Security installer to facilitate wiring and equipment installation. Include above noted information on final record drawings at project completion.

End of Section

1 General

1.01 Summary

.1 The work covered under this section consists of the furnishing of all necessary labor, supervision, materials, equipment, and services to completely execute the system of non-continuous cable supports ("J-Hooks") as described in this specification.

1.02 Scope

.1 Non-continuous cable supports.

.2 Adjustable non-continuous cable support sling.

.3 Multi-tiered non-continuous cable support assemblies.

.4 Non-continuous cable support assemblies from tee bar.

.5 Non-continuous cable support assemblies from drop wire/ceiling.

.6 Non-continuous cable support assemblies from beam, flange.

.7 Non-continuous cable support assemblies from C & Z Purlin.

.8 Non-continuous cable support assemblies from wall, concrete, or joist.

.9 Non-continuous cable support assemblies from threaded rod.

.10 Raised floor non-continuous cable support assemblies.

.11 Cantilever-Mounted Option for non-continuous cable supports.

.12 Installation accessories for non-continuous cable supports.

1.03 Definitions

.1 UTP: Unshielded twisted pair.

.2 ANSI: American National Standards Institute

.3 ASTM: American Society for Testing and Materials

.4 EIA: Electronic Industries Alliance

.5 TIA: Telecommunications Industry Association

.6 cULus: Listed by Underwriters Laboratories based on both Canadian and US (United States) standards requirements.

1.04 Submittals

.1 Submit product data on non-continuous cable support devices, including attachment methods. Product data to include, but not limited to materials, finishes, approvals, load ratings, and dimensional information.

1.05 Quality Assurance

.1 Non-continuous cable supports and cable support assemblies shall be listed by Underwriters Laboratories for both Canadian and US standards (cULus).

.2 Non-continuous cable supports shall have the manufacturers name and part number stamped on the part for identification.

.3 Manufacturer: Company specializing in manufacturing products specified in this section with a minimum of five years documented experience in the industry, and certified ISO 9000.

2 Products

2.01 Manufacturers

.1 ERICO, Inc.

.2 Eaton B-Line.

2.02 References

.1 ASTM B633 Standard Specification for Electro-deposited Coatings of Zinc on Iron and Steel

.2 ASTM B 695-90 Standard Specification for coatings of Zinc Mechanically Deposited on Iron and Steel

.3 ASTM A123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

.4 ASTM A924/A924M Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

.5 ASTM A109 Standard Specification for Steel, Strip, Carbon, Cold-Rolled

.6 ASTM A167 Standard Specification for Stainless and heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

.7 ASTM A480/A480M Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.

.8 ASTM A568 Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy Hot-Rolled and Cold-Rolled

.9 A653 G60-Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-coated (Galvannealed) by the Hot-Dip process

.10 ASTM A666 Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar

.11 ASTM A682 Standard Specification for Steel, Strip, High-Carbon, Cold-Rolled, Spring Quality

.12 ASTM A879 Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface

.13 ASTM B117 Standard Method of Salt Spray (Fog) Testing

.14 ASTM D610 Standard test Method for Evaluating Degree of Rusting on Painted Steel Surfaces UL 2043 - Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces.

.15 ANSI/ TIA/ EIA 568 Commercial Building Telecommunications Cabling Standard, current revision level.

.16 ANSI/ TIA/ EIA 569 Commercial Building Standard for Telecommunications Pathways and Spaces, current revision level.

.17 NFPA 70 National Electrical Code®

2.03 Non-Continuous Cable Support Systems

.1 Non-continuous cable supports

.1 Non-continuous cable supports shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cables; cULus Listed.

.2 Non-continuous cable supports shall have flared edges to prevent damage while installing cables.

.3 Non-continuous cable supports sized 1 5/16” and larger shall have a cable retainer strap to provide containment of cables within the hanger. The cable retainer strap shall be removable and reusable and be suitable for use in air handling spaces.

.4 Non-continuous cable supports shall have an electro-galvanized or G60 finish and shall be rated for indoor use in non-corrosive environments.

.5 Stainless Steel non-continuous cable supports are intended for indoor and outdoor use in non-corrosive environments or where only mildly corrosive conditions apply.

.6 Non-continuous cable supports shall be ERICO CableCatTM J-hook series CAT12, CAT21, CAT32, CAT64, CAT21SS, CAT32SS, CAT64SS; CAT-CMTM Double J-Hook CAT100CM; CAT-CMTM U-hook series CAT200CMLN, CAT300CMLN; and CAT-CMTM retainer CATRT200CM, CATRT300CM.

.2 Adjustable non-continuous cable support sling

.1 Constructed from steel and woven laminate; sling length can be adjusted to hold up to 425 4-pair UTP; rated for indoor use in non-corrosive environments. Rated to support Category 5 and higher cable, or optical fiber cable; cULus Listed.

.2 Adjustable non-continuous cable support sling shall have a static load limit of 100 lbs.

.3 Adjustable non-continuous cable support sling shall be suitable for use in air handling spaces.

.4 If required, assemble to manufacturer recommended specialty fasteners including beam clips, flange clips, C and Z purlin clips.

.5 Acceptable products: ERICO CADDY CableCatTM CAT425.

.3 Multi-tiered non-continuous cable support assemblies

.1 Multi-tiered non-continuous cable support assemblies shall be used where separate cabling compartments are required. Assemblies may be factory assembled or assembled from pre-packaged kits. Assemblies shall consist of a steel angled hanger bracket holding up to six non-continuous cable supports, rated for indoor use in non-corrosive environments; cULus Listed.

.2 If required, the multi-tier support bracket may be assembled to manufacturer recommended specialty fasteners including beam clamps, flange clips, C and Z purlin clips.

.3 The multi-tiered support bracket shall consist of ERICO CADDY CATHBA and CableCatTM J-Hooks with screws.

.4 Non-continuous cable support assemblies from tee bar

.1 Tee bar support bracket with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments; cULus Listed.

.2 Acceptable products: ERICO CADDY CAT12TS, CAT21528, CAT32528.

.5 Non-continuous cable support assemblies from drop wire/ceiling

.1 Fastener to wire/rod with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments; cULus Listed.

.2 Acceptable products: ERICO CADDY CAT124Z34, CAT126Z34, CAT214Z34, CAT216Z34, CAT324Z34 or CAT326Z34.

.6 Non-continuous cable support assemblies from beam, flange

.1 Fastener to beam or flange with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments; cULus Listed.

.2 Acceptable products: ERICO CableCatTM J-hook series CAT12, CAT21, CAT32, CAT64 with CADDY beam clamps and CADDY flange clips.

.7 Non-continuous cable support assemblies from C & Z Purlin

.1 Fastener to C or Z purlin with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments, cULus Listed.

.2 Acceptable products: ERICO CableCatTM J-hook series CAT12, CAT21, CAT32, CAT64 with CADDY Purlin hangers.

.8 Non-continuous cable support assemblies from wall, concrete, or joist

.1 Fastener to wall, concrete, or joist with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments, cULus Listed.

.2 Acceptable products: ERICO CableCatTM J-hook series CAT12, CAT21, CAT32, CAT64, with CADDY angle bracket.

.9 Non-continuous cable support assemblies from threaded rod

.1 Fastener to threaded rod with one non-continuous cable support, factory or jobsite assembled, rated for indoor use in non-corrosive environments, cULus Listed.

.2 The multi-tiered support bracket shall have a static load limit of 300 lbs.

.3 U-hooks and Double J-hook shall attach directly to threaded rod using standard nuts.

.4 Acceptable products: ERICO CableCatTM J-hook, CAT12, CAT21, CAT32, CAT64 with CADDY CATHBA series; CAT-CMTM Double J-hook CAT100CM, CAT-CMTM Direct mount U-hook CAT200CMLN, CAT300CMLN; or AFAB series.

.10 Raised floor non-continuous cable support assemblies

.1 Fastener to raised (access) floor pedestal with one non-continuous cable support, factory or jobsite assembled, rated for indoor use in non-corrosive environments; cULus Listed.

.2 Acceptable products: ERICO CADDY CAT12CD1B, CAT21CD1B or CAT32CD1B; CAT64CD1B.

.11 Cantilever-Mounted cable supports

.1 U-hook shall be able to be assembled to a wide variety of wall mount brackets.

.2 Spacing of individual U-hooks as needed, max of 4’ to 5’ apart.

.3 U-hooks may have the optional attachment of a cable roller for ease in pulling cables.

.4 Acceptable products: ERICO CAT-CMTM U-hooks CAT200CMLN, CAT300CMLN: CAT-CM roller assemblies CATRL200CM, CATRL300CM; CATWMCM bracket.

.12 Installation accessories for non-continuous cable supports

.1 Cable Pulley

.1 Non-continuous cable supports may be used as an installation tool when a removable pulley assembly is included. The pulley shall be made of plastic and be without sharp edges. The pin and bail assembly must be able to be secured to the J-Hook during cable installation. The pulley must remain secured while cables are being pulled.

.2 The pin and roller assembly must be removed after cables are installed.

.3 Acceptable products: ERICO CADDY CAT32PLR, CAT64PLR.

.2 Cable Protector

.1 The protective steel tube shall fit over threaded rod and be at least 4” in length.

.2 The tube shall prevent damage to cables placed in or pulled through CAT-CMTM U-hooks. The tube shall not inhibit the pulling of cables.

.3 Acceptable products: ERICO CAT-CMTM CATTBCM.

2.04 Finishes

.1 ASTM B633 Standard Specification for Electro-deposited Coatings of Zinc on Iron and Steel

.2 ASTM B 695 Standard Specification for coatings of Zinc Mechanically Deposited on Iron and Steel

.3 ASTM A123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

.4 ASTM A924/A924M Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

.5 Non-continuous cable supports used where only mildly corrosive conditions apply shall be stainless steel, AISI type 304.

3 Execution

3.01 Installation

.1 Installation and configuration shall conform to the requirements of the current revision levels of ANSI/ EIA/TIA Standards 568 & 569, NFPA 70 (National Electrical Code), applicable local codes, and to the manufacturer's installation instructions.

.2 Install cables using techniques, practices, and methods that are consistent with Category 5 or higher requirements and that supports Category 5 or higher performance of completed and linked signal paths, end to end.

.3 Install cables without damaging conductors, shield, or jacket.

.4 Do not bend cables, in handling or in installing, to smaller radii than minimums recommended by manufacturer.

.5 Pull cables without exceeding cable manufacturer's recommended pulling tensions. Use pulling means that will not damage media.

.6 Do not exceed load ratings specified by manufacturer.

.7 Adjustable non-continuous support sling shall have a static load limit of 100 lbs.

.8 Follow manufacturer's recommendations for allowable fill capacity for each size non-continuous cable support.

End of Section

1 General

1.01 Section Includes

.1 Firestopping through penetrations in fire rated assemblies.

1.02 Related Requirements

.1 Section 07 84 00 – Firestopping.

1.03 References

.1 ASTM E 84, “Surface Burning Characteristics of Building Materials”.

.2 ASTM E 119, “Fire Tests of Building Construction and Materials”.

.3 ASTM E 814, “Fire Tests of Penetration Firestop Systems”.

.4 ANSI/UL263, “Fire Tests of Building Construction and Materials”.

.5 ANSI/UL723, “Surface Burning Characteristics of Building Materials”.

.6 ANSI/UL1479, “Fire Tests of Through Penetration Firestops”.

.7 Underwriters Laboratories Inc. (UL) – Fire Resistance Directory

1.04 Performance Requirements

.1 Fire rated pathway devices shall be the preferred product and shall be installed in all locations where frequent cable moves, add-ons and changes will occur, such devices shall:

.1 Meet the hourly rating of the floor or wall penetrated.

.2 Permit the allowable cable load to range from 0% to 100% visual fill thereby eliminating the need to calculate allowable fill ratios.

.3 Not require any additional action on the part of the installer to open or close the pathway device or activate the internal smoke and fire seal, such as, but not limited to:

.1 Opening or closing of doors.

.2 Twisting an inner liner.

.3 Removal or replacement of any material such as, but not limited to, sealant, caulk, putty, pillows, bags, foam plugs, foam blocks, or any other material.

.4 Permit multiple devices to be ganged together to increase overall cable capacity.

.5 Allow for retrofit to install around existing cables.

.6 Include an optional means to lengthen the device to facilitate installation in thicker barriers without degrading fire or smoke sealing properties or inhibiting ability of device to permit cable moves, add-ons, or changes.

.2 Where single cables (up to 0.27 in. (7 mm) diameter) penetrate gypsum board/stud wall assemblies, a fire-rated cable grommet may be substituted. Acceptable products shall be molded from plenum-grade polymer and conform to the outer diameter of the cable forming a tight seal for fire and smoke. Additionally, acceptable products shall lock into the barrier to secure cable penetration.

.3 Where non- mechanical products are utilized, provide products that upon curing do no re-emulsify, dissolve, leach, breakdown or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture characteristic during or after construction.

.4 Where it is not practical to use a mechanical device, openings within floors and walls designed to accommodate telecommunications and data cabling shall be provided with re-enterable products that do not cure or dry.

.5 Cable trays shall terminate at each barrier and resume on the opposite side such that cables pass independently through fire-rated pathway devices. Cable tray shall be rigidly supported independent from fire-rated pathway devices on each side of barrier.

1.05 Submittals

.1 Submit under provisions of Section 01 33 00.

.2 Product Data: Provide manufacturer's standard catalog data for specified products demonstrating compliance with referenced standards and listing numbers of systems in which each product is to be used.

.3 Shop Drawings: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance ratings.

.4 Certificates: Product certificates signed by firestop system manufacturer certifying material compliance with applicable code and specified performance characteristics.

.5 Installation Instructions: Submit manufacturer's printed installation instructions.

1.06 Quality Assurance

.1 Products/Systems: Provide firestopping systems that comply with the following requirements:

.1 Firestopping tests are performed by a qualified, testing and inspection agency. A qualified testing and inspection agency is UL, or another agency performing testing and follow-up inspection services for firestop system acceptable to authorities having jurisdiction.

.2 Firestopping products bear the classification marking of qualified testing and inspection agency.

.2 Installer Qualifications: Experience in performing work of this section who is qualified by the firestopping manufacturer as having been provided the necessary training to install firestop products in accordance with specified requirements.

1.07 Delivery, Storage, and Handling

.1 Delivery:

.1 Manufacturer's original, unopened, undamaged containers, identification labels intact identifying product and manufacturer, date of manufacture; lot number; shelf life, if applicable; qualified testing and inspection agency's classification marking; and mixing instruction for multicomponent products.

.2 Handle and store products according to manufacturer's recommendations published in technical materials. Leave products wrapped or otherwise protected and under clean and dry storage conditions until required for installation.

.2 Storage and Protection:

.1 Store materials protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

1.08 Project Conditions

.1 Do not install firestopping products when ambient or substrate temperatures are outside limitations recommended by manufacturer.

.2 Do not install firestopping products when substrates are wet due to rain, frost, condensation, or other causes.

.3 Maintain minimum temperature before, during, and for a minimum 3 days after installation of materials.

.4 Do not use materials that contain flammable solvents.

.5 Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.

.6 Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

.7 Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.

2 Products

2.01 Manufacturers

.1 Specified Technologies Inc.
200 Evans Way, Somerville, NJ 08876. Tel: (800) 992-1180, Fax: (908) 526-9623, Email: specseal@stifirestop.com, Website: www.stifirestop.com.

.2 Single Source: Obtain firestop systems for each type of penetration and construction condition indicated only from a single manufacturer.

2.02 Materials

.1 General: Use only firestopping products that have been tested for specific fire resistance rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire rating involved for each separate instance.

2.03 Fire Rated Cable Pathways

.1 Steel raceway with intumescent foam pads allowing 0 to 100 percent cable fill, the following products are acceptable:

.1 Specified Technologies Inc. (STI) EZ-PATH Fire Rated Pathway.

3 Execution

3.01 Examination

.1 Before beginning installation, verify that substrate conditions previously installed under other sections are acceptable for installation of firestopping in accordance with manufacturer's installation instructions and technical information.

.2 Surfaces shall be free of dirt, grease, oil, scale, laitance, rust, release agents, water repellants, and any other substances that may inhibit optimum adhesion.

.3 Provide masking and temporary covering to protect adjacent surfaces.

.4 Do not proceed until unsatisfactory conditions have been corrected.

3.02 Installation

.1 General: Install through-penetration firestop systems in accordance with Performance Criteria and in accordance with the conditions of testing and classification as specified in the published design.

.2 Manufacturer's Instructions: Comply with manufacturer's instructions for installation of firestopping products.

3.03 Field Quality Control

.1 Keep areas of work accessible until inspection by authorities having jurisdiction.

.2 Where deficiencies are found, repair firestopping products so they comply with requirements.

3.04 Adjusting and Cleaning

.1 Remove equipment, materials, and debris, leaving area in undamaged, clean condition.

.2 Clean all surfaces adjacent to sealed openings to be free of excess firestopping materials and soiling as work progresses.

End of Section

1 General

1.01 Section Includes

.1 Modifications to existing fire alarm system, including provision of new zones as indicated, relocating and new fire alarm devices as indicated on the drawings, and system verification to the appropriate codes and standards. Complete systems shall be left ready for continuous and efficient satisfactory operation.

.2 Update annunciators / [passive] [active] graphic to include additions and renovated areas, as applicable.

.3 New devices connected directly to the existing fire alarm system shall of the manufacturer's current product selection, and to match the existing system.

.4 Verify system upon completion of installation and submit verification report to the Consultant with close-out documents and as-built drawings.

1.02 Related Requirements

.1 Section 21 10 00 – Water-Based Fire-Suppression Systems.

.2 Section 26 05 33.13 – Conduit for Electrical Systems.

.3 Section 26 05 33.16 – Boxes for Electrical Systems.

.4 Section 26 05 33.23 – Surface Raceways for Electrical Systems.

.5 Latest fire alarm verification report.

1.03 References

.1 The publications listed below form a part of this specification. The publications are referenced in text by the basic designation only. Comply with latest edition/amendment referenced Code/Publication.

.1 CSA C22.1-18, Canadian Electrical Code, Part 1 (24th Edition), Safety Standard for Electrical Installations.

.2 Ontario Electrical Safety Code (27th edition/2018).

.3 Ontario Building Code.

.4 Ontario Fire Code.

.5 ULC-S524 Installation of Fire Alarm Systems.

.6 ULC-S537 Verification of Fire Alarm Systems.

.7 All requirements of the Authority Having Jurisdiction (AHJ).

1.04 Submittals

.1 Provide submittals to the Consultant for review in accordance with Section 01 33 00.

.2 Submit to the Fire Department, drawings showing bells, manual pull stations, complete wiring diagrams and annunciator details and obtain their approval.

.3 All references to manufacturer's model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality.

.4 Shop Drawings

.1 Include sufficient information, clearly presented, to determine compliance with drawings and specifications.

.2 Include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, and device arrangement.

.3 Show annunciator layout and main control panel module layout, configurations and terminations.

.4 Show device layout, complete riser diagram, and auxiliary functions.

.5 The supplier of the system shall prepare a complete zoning schedule and artwork layout for active graphic to be included with submittal package.

.5 Manuals

.1 Submit complete operating and maintenance manuals listing the manufacturer's name(s) including technical data sheets (with model numbers to be used indicated).

.2 Wiring diagrams indicating terminals and the interconnections between the items of equipment.

.3 Provide a clear and concise description of operation which gives, in detail, the information required to properly operate the equipment.

1.05 Quality Assurance

.1 Approvals

.1 The system shall have proper listing and/or approval from the following nationally recognized agencies:

.1 FM Factory Mutual.

.2 UL Underwriters Laboratories Inc.

.3 ULC Underwriters Laboratories Canada.

.2 The fire alarm control, panel shall meet the modular listing requirements of ULC. Each subassembly of the FACP, including all printed circuit boards, shall include the appropriate ULC modular label.

.2 Fire alarm shall conform to the Building Code, Ontario Regulations 925/75 and as amended subsequently.

.3 Fire alarm system installation shall conform to ULC Standard S524-M, latest edition.

.4 All devices/components shall be suitable for the locations, environment, temperatures in which they are to be installed.

.5 The fire alarm system shall be manufactured by an ISO 9001 certified company and meet the requirements of BS EN9001: ANSI/ASQC Q9001-1994.

.6 The FACP and peripheral devices shall be manufactured 100% by a single manufacturer (or division thereof).

1.06 Warranty

.1 All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one (1) year from the date of acceptance.

2 Products

2.01 Existing Systems

.1 The existing Fire Alarm System is as indicated on drawings Edwards EST series single-stage fire alarm system.

.1 The location of the Fire Alarm Control Panel is as indicated on the drawings.

.2 There is [one] passive graphic annunciator to be updated, location as indicated on the drawings.

2.02 Manufacturers

.1 The system components shall be selected so as to match and be compatible with the existing Fire Alarm System.

2.03 Equipment and Material, General

.1 Review latest verification report, and review existing system during tender walkthrough and note all required modifications.

.2 All equipment and components shall be new, and the manufacturer's current model.

.3 All equipment and components shall be installed in strict compliance with manufacturers' recommendations.

.4 All Equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place. (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

2.04 Conduit and Wire

.1 Existing conventional zone wiring is existing to remain.

.2 New conduit and wire for new zones and new devices to Section 27 15 01.19.

.3 [Conduit

.1 Conduit shall be in accordance with the Electrical Safety Authority (ESA), local and provincial requirements.

.2 All wiring shall be installed in conduit or raceway to Section 26 05 33.13 and Section 26 05 33.23.

.4 Wire

.1 All fire alarm system wiring to suit new devices shall be new.

.2 Wiring shall be in accordance with local, provincial and national codes and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as outlined in the Ontario Electrical Safety Code and as recommended by the fire alarm system manufacturer.

.3 All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signalling system, as outlined in the Ontario Electrical Safety Code.

.5 Terminal Boxes, Junction Boxes and Cabinets:

.1 All boxes and cabinets shall be listed for their purpose and use.]

2.05 Main Fire Alarm Control Panel

.1 Add new zones, zone modules, etc., for new work as required, and connect all new devices to Fire Alarm Control Panel.

.2 Remote Annunciator and Passive Graphic

.1 Connect all new zones for the new work to annunicators.

.2 Provide new passive graphic, multicolour, under glass with anodized frame and concealed tamperproof mounting.

2.06 System Components

.1 Programmable Electronic Sounders:

.1 Electronic sounders shall match existing system.

.2 Shall be flush mounted as required.

.3 Mini horns shall be provided in all Classroom areas etc. and where shown.

.2 Audible/Visual Combination Devices:

.1 Shall meet the applicable requirements of sounders listed above for audibility.

.2 Shall have a built in strobe, 15 candela.

.3 Strobe Synchronizing Modules:

.1 Synchronize strobes at 1 Hz and horns at temporal over single wire pan.

.4 Manual Fire Alarm Stations

.1 Manual fire alarm stations shall be non-coded, non-breakable glass type.

.2 Stations must be designed such that after an actual activation, they cannot be restored to normal without the use of a special tool.

.3 An operated station shall automatically condition itself so as to be visually detected, as operated, at a minimum distance of 100 feet (30.5 m) front or side.

.4 Manual stations constructed of metal, with operating instructions provided on the cover. The word FIRE shall appear on the manual station in letters one half inch (12.7 mm) in size or larger.

.5 Manual stations shall be c/w polycarbonate vandal covers.

.5 Conventional Photoelectric Area Smoke Detectors

.1 Photoelectric smoke detectors shall be two wire, ceiling-mounted, light scattering type using an LED light source.

.2 Each detector shall contain a remote LED output and a built-in test switch.

.3 Detector shall be provided on a twist-lock base.

.4 It shall be possible to perform a calibrated sensitivity and performance test on the detector without the need for the generation of smoke. The test method shall test all detector circuits.

.5 A visual indication of an alarm shall be provided by dual latching Light Emitting Diodes (LEDs), on the detector, which may be seen from ground level over 360 degrees. These LEDs shall flash every 10 seconds, indicating that power is applied to the detector.

.6 The detector shall not go into alarm when exposed to air velocities of up to 3000 feet (914.4 m) per minute.

.7 The detector screen and cover assembly shall be easily removable for field cleaning of the detector chamber.

.8 All field wire connections shall be made to the base through the use of a clamping plate and screw.

.6 Conventional Ionization Type Area Smoke Detectors

.1 Ionization type smoke detectors shall be a two wire, using a dual unipolar chamber.

.2 Each detector shall contain a remote LED output and a built-in test switch.

.3 Detector shall be provided on a twist-lock base.

.4 It shall be possible to perform a calibration sensitivity and performance test on the detector without the need for the generation of smoke.

.5 A visual indication of an alarm shall be provided by dual latching Light Emitting Diodes (LEDs) over 360 degrees, on the detector, which may be seen from ground level. This LED shall flash every 10 seconds, indicating that power is applied to the detector.

.6 The detector shall not alarm when exposed to air velocities of up to 1 200 feet (365.76 m) per minute. The detector screen and cover assembly shall be easily removable for field cleaning of the detector chamber.

.7 All field wire connections shall be made to the base through the use of a clamping plate and screw.

.7 Duct Smoke Detectors

.1 Duct smoke detectors shall be complete with visual alarm and power indicators, and a reset switch. Each detector shall be installed upon the with properly sized air sampling tubes.

.8 Automatic Conventional Heat Detectors

.1 Automatic heat detectors shall have a combination rate of rise and fixed temperature rated at 135 degrees F (57.2 degrees C) for areas where ambient temperatures do not exceed 100 degrees F (37.7 degrees C), and 200 degrees F (93.33 degrees C) for areas where the temperature does not exceed 150 degrees F (65.5 degrees C).

.2 Automatic heat detectors shall be a low profile, ceiling mount type with positive indication of activation.

.3 The rate of rise element shall consist of an air chamber, a flexible metal diaphragm, and a factory calibrated, moisture-proof, trouble free vent, and shall operate when the rate of temperature rise exceeds 15 degrees F (9.4 degrees C) per minute.

.4 The fixed temperature element shall consist of a fusible alloy retainer and actuator shaft.

.5 Automatic heat detectors shall have a smooth ceiling rating of 2 500 square feet (762 square metres).

2.07 Operation Sequences

.1 The fire alarm system shall be a Zoned Single Stage Non-Coded System as defined in the Ontario Building Code.

.2 Basic Performance:

.1 Initiation Device Circuits (IDC) shall be wired Class A.

.2 Notification Appliance Circuits (NAC) shall be wired Class B (NFPA Style Y).

.3 Alarm signals arriving at the main FACP shall not be lost following a power failure (or outage) until the alarm signal is processed and recorded.

.3 Basic System Functional Operation:

.1 An alarm is caused by actuation of any one of the following devices:

.1 Pulling a manual station

.2 Operation of an automatic fire alarm detector

.3 Operation of a sprinkler flow switch

.4 Operation of a smoke detector

.2 If, in any area of the building, an alarm is caused by actuation of the aforementioned devices, the following shall occur:

.1 Signals in the building shall sound.

.2 Annunciators shall indicate exact zone where alarm originated

.3 Fans shall be automatically turned off.

.3 Central station shall be automatically alerted via telephone lines connected for fire alarm system.

.4 If, in any area of the building, supervised valves of the sprinkler, systems are operated or exhibit short or open circuits, the following shall occur:

.1 The annunciator shall identify, as a separate zone, the item causing the trouble signal.

.2 The trouble buzzer on the annunciator(s) shall sound.

.3 The signals in the building shall not be sounded.

3 Execution

3.01 Verification of Conditions

.1 Conduct an impedance test of initiation and signal circuits, and submit report to the Consultant. Report any discrepancies in circuit loading.

3.02 Installation

.1 Install fire alarm system devices in accordance with specification, codes, and manufacturer's instructions.

.2 Entire installation shall be done under supervision of manufacturer. Upon completion of installation, check entire system to approval and correct any malfunction immediately.

.3 Sprinkler/Standpipe System Connections.

.1 Refer to Section 21 10 00.

.2 Connect contact of sprinkler flow, supervisory and standpipe system switches to fire alarm zones indicated.

.4 Align alarm devices and signals, where grouped together, one above the other.

.5 Mount devices at the following heights unless otherwise shown:

.1 Signal devices:

.1 300 mm below finished ceiling

.2 2050 mm above floor in unfinished areas.

.2 Manual Pull Stations:

.1 1200 mm above finished floor level.

.3 In areas with separate signal devices for fire suppression and/or preaction, provide a lamacoid nameplate for base building signalling devices.

.6 Test each automatic detector to ensure correct wiring and zoning by setting off its rate of rise component and sounding the bells or by ringing it out. Test each smoke detector, sprinkler system and standpipe valves to ensure correct wiring.

.7 Manufacturer shall examine Drawings and Specifications prior to award of Contract to ensure that detectors, control panels and miscellaneous devices being supplied will provide a satisfactory working installation.

3.03 Field Quality Control

.1 Testing and Verification

.1 Provide the service of a competent, factory trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with CAN/ULC S537.

.2 Check for correct connections and test for short circuits, ground faults, continuity, and insulation.

.3 Perform audibility test of space and provide annunciation devices to suit ambient sound levels. Ensure coverage for fire alarm signalling devices on base building fire alarm system. Provide audible test of signaling devices after other systems have been commissioned to verify operation at computer room ambient sound level.

.4 [Verify activation of all relocated devices, including flow switches, trouble, and supervisory signals from the relocated preaction assembly.]

.5 Provide the service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system.

.6 All initial testing shall be in accordance with CAN/ULC-S537. A representative of the electrical contractor shall be present to participate and assist the manufacturer representative during the course of the verification. The electrical contractor shall make good any deficiencies discovered during the verification. All devices, new and existing, shall be verified. The electrical contractor shall provide one person for assistance with the verification.

.7 Include associated costs in Tender Price.

.8 Carry out a complete audibility test and submit report.

.9 On completion of the verification the manufacturer shall supply a certificate, together with detailed inspection record sheets showing location of each device and certifying the test results per unit, confirming that the system is installed, supervised and operational.

.2 Manufacturer Services

.1 The manufacturer(s) of the fire alarm shall make a complete inspection of all existing and new components installed for system(s), such as manual stations, horns, and annunciators and sprinkler and standpipe valves and smoke detectors to ensure the following:

.1 That the system is complete in accordance with Specifications.

.2 That the system is connected according to ULC requirements.

.3 That the system is connected in accordance with the Manufacturer's recommendations.

.4 That the regulations concerning the supervision of components have been adhered to (e.g. stations, detectors, supervised valves, bells), and are properly wired and supervised.

.5 That all valves are properly connected and displayed correctly on each annunciator.

.6 That any subsequent changes necessary to conform to the above will be carried out with technical advice supplied by the Manufacturer.

.7 That all thermal detectors, smoke detectors and manual pull stations have been operated and are in good working order.

.8 That all sprinkler system and standpipe system valves have been operated and are in good working order.

.9 That all annunciators correctly pin-point the origin of any fire alarm.

.10 That actual smoke concentration of sufficient density, have been applied to each smoke detector to cause the detector to be set off and that the sensitivity of each smoke detector has been set.

.11 That all existing devices are in good working order. Include for replacement of any defective/damaged devices at no extra cost to Owner.

.12 That signal audibility is acceptable in all areas. Submit audibility readings for every room.

.13 If existing audible signal devices have been discontinued by the manufacturer (for example mechanical horns), allow for replacement of all audible devices so that all devices generate similar sounds and sound patterns when activated.

3.04 Demonstration

.1 At the final inspection a factory trained representative of the manufacturer of the major equipment shall demonstrate that the systems function properly in every respect.

3.05 Training

.1 Provide instruction as required to the building personnel and fire and safety personnel. "Hands-on" demonstrations of the operation of the system shall be provided.

End of Section

1 General

1.01 References

.1 CAN/ULC-S1001-11 – Integrated Systems Testing of Fire Protection and Life Safety Systems.

1.02 Purpose

.1 To verify that installations are in accordance with project requirements.

.2 To ensure proper system operation.

1.03 Commissioning Organizations

.1 Certified member of Electrical Contractors Association of Ontario (ECAO) or Canadian Fire Alarm Association (CFAA.)

1.04 Related Requirements

.1 Section 01 91 13 – General Commissioning Requirements.

2 Products – Not Used

3 Execution

3.01 Procedures

.1 Perform Commissioning of integrated systems in accordance with CAN/ULC-S1001.

.2 Follow manufacturer's recommendations for testing.

.3 Inspect wiring connections to all devices comprising the system.

.4 Verify supervision of wiring at every device connection to a supervised circuit.

.5 Test operation of every device on a system to verify its function.

.6 Examine equipment for any apparent damage or tampering that may interfere with its intended operation.

.7 Test equipment with capabilities for field adjustment to establish that it functions as intended under the conditions prevailing at its point of installation.

.8 Examine devices for evidence of damage or obstructions which may interfere with their operating mechanisms.

.9 Test automatic devices by simulating an operating condition.

.10 Wiring:

.1 Inspect every device and test to demonstrate that disconnection of the device from the circuit or malfunction of the equipment or wiring activates the required supervisory signals. Inspection shall include verification that:

.1 Supervisory signals operate in response to open circuits, short circuits, ground faults and disconnection of plug-in components;

.2 Terminations of conductors entering and leaving equipment have been made;

.3 Circuit polarities are in accordance with the system design, where applicable.

.2 In addition, test to establish that the power supplied to any device is within its recommended operating range and that the required voltage levels are maintained and that the fusing is correct.

.11 Initiating Devices - Manual:

.1 Inspect manual alarm stations in consideration of the following:

.1 The device shall be mounted with sufficient clearance to facilitate ease of access and proper operation;

.2 Operate each manual alarm station, toggle switch and key switch to verify proper functions.

.12 Automatic heat detectors:

.1 Use a heat source reproducible in its intensity, as recommended by the manufacturer of the device, to initiate an alarm.

.2 Test equipment - Heat lamp or Air heater. DO NOT USE AN OPEN FLAME HEAT SOURCE.

.3 Apply heat source as to not damage or operate fusible disc parts.

.13 Automatic heat detectors - non-resettable:

.1 Test by simulating its electrical operation by jumpering the wiring points (creating a short) adjacent to its operating mechanism.

.14 Automatic smoke detectors - area type:

.1 Test by introducing smoke into its detecting chamber. This may consist of actual smoke from burning materials or artificially generated smoke aerosol spray as recommended by the manufacturer. The sensitivity should be noted and adjusted if necessary.

.15 Automatic smoke detectors:

.1 Examine the air sampling arrangements of the detectors under actual conditions of balanced air circulation by conducting a check of the field sensitivity and a check of the air velocity in accordance with the manufacturers' recommendations.

.2 Test gas to be used similar to Automatic Smoke Detector.

.16 Alarm signals - audible:

.1 Test on main power supply and standby power supply with the maximum expected load on the system.

.2 The audible signalling appliances shall function as intended and shall be audible throughout the building over the background noise present.

.3 Decibel recordings in each area covering 100 sq. metres shall be taken.

.4 The level of sound should usually be 15 dB above ambient noise level.

.17 Alarm signals - visual:

.1 The visual signal appliances shall function as intended and shall be clearly visible.

.18 Fire suppression supervision:

.1 Coordinate with the requirements of Section 21 12 00, and Section 21 13 00.

.2 Sprinkler and standpipe trade to active each sprinkler and standpipe supervisory and alarm device by operating valves and producing flows as required in conjunction with fire alarm technician to observe activation of flow switches, pressure switches, supervised valves, etc.

.19 Annunciators, printers and workstations:

.1 Inspect and operate to establish that their operation in conjunction with the control equipment and other system components, is as intended. The equipment shall be inspected to ensure:

.1 The zone of each alarm initiating device is properly indicated;

.2 The legend is clearly visible;

.3 Adequate voltage under local conditions is present;

.4 Wiring connections have been made in a workmanlike manner.

.5 Proper care must be taken to establish that each item is complete and satisfactory.

.20 Standby power supplies - batteries:

.1 Examine batteries for possible damage and consideration of the following:

.1 The charging system functions as intended;

.2 The installation has not resulted in the bypassing of a fuse or a similar protective device;

.3 The installation protects the batteries from accidental or mechanical damage.

.4 The batteries must be able to operate the fire alarm system with the charger input disconnected for one rated load cycle.

.21 Control equipment and transponders:

.1 Test to establish that they function as intended. The following examinations and tests shall be performed:

.1 A visual and physical inspection of all cables, plug interconnections, plug-in circuit components, lamps, sockets and controls to establish that their mechanical and electrical connections and mounting are as required for intended function and, where applicable, to confirm electrical supervision;

.2 Verification that all field wiring is terminated in a workman-like manner;

.3 All lamps and indicators shall be tested for operation and intended function;

.4 All keypad functions shall be tested for operation and intended function;

.5 All control unit functions shall be operated to verify appropriate response including all software routines and programme functions are simulated;

.6 Simulation of open circuits, short circuits and ground faults on all relevant internal circuits in order to confirm the appropriate supervisory response;

.2 Commissioning Report:

.1 Provide in accordance with requirements of Section 01 91 13, supplemented as specified herein.

.2 Report to include relevant information of the system including:

.3 Each system part described.

.4 How the system is operated.

.5 What functions the system performs.

.6 Requirements for tests and service.

.7 Itemization of all devices connected on the system, their general location.

.8 The date of the performed tests.

.9 All pertinent details of the report sheets requested.

.3 Verification:

.1 The Commissioning Report to be submitted to the Commissioning Manager upon completion of commissioning and will be subject to verification by the Commissioning Manager.

End of Section

1 General

1.01 Section Includes

.1 Addressable Fire Detectors

1.02 Related Requirements

.1 Section 26 05 00 – Common Work Results for Electrical.

.2 Section 28 46 21.11 – Addressable Fire Alarm Systems.

2 Products

2.01 Analytical Microprocessor Addressable Detectors – General

.1 Early warning analog addressable detectors shall use state-of-the-art multi-sensor technology. Each detector shall incorporate a microprocessor capable of making alarm decisions based on fire parameter algorithms stored in the detectors head. The microprocessor shall evaluate all sensing elements simultaneously and take into account real-time environmental conditions and the duration of an event, resulting in reliable and accurate decisions that distinguish real fire conditions from unwanted deceptive nuisance alarms. Digital filters shall eliminate signal patterns that are not typical of fires. Detectors that use the control panel processor to make alarm decisions are not acceptable.

.2 Addressable detectors shall be capable of full digital communications using both broadcast and polling protocols. The maximum total analog loop response time for detectors shall be 750 ms. The maximum alarm response time for the system to sound an alarm shall not be more than 3-seconds regardless of the detector location or the number of detectors on the addressable loop. The analog loop controller shall support up to 250 devices including 125 modules, 125 detectors and 125 isolator bases. The analog loop must not require shielded wire and shall be capable of a total distance of 4000 feet minimum using #18 AWG twisted pair when 100 addressable detectors and 100 addressable modules are connected. The analog loop shall support up to 124 wiring T-taps.

.3 The analog loop controller shall be able to “map” and supervise the location of each addressable device installed on the loop. Device supervision shall be provided for any device that is missing, added or changes to the device type, alarm settings, features, location or changes to the wiring layout or detector bases. It shall be possible to display or print the device “map” from a laptop. The “map” shall indicate all devices on the addressable loop complete with the customer defined device location name, device and base type, supervision information and wiring as-built layout including all T-taps. If two devices are inadvertently switched during routine maintenance, the loop controller shall be able to identify the change and if the device types are identical, it shall automatically download environmental information specific to that device location and all programming shall remain intact for the respective location of each device. No reprogramming or manual addressing shall be required. If the device types do not match, both devices shall still provide their inherent protection, programmed functions shall respond accordingly for that device location and a trouble shall be logged on the system. The “map” shall indicate which devices have been switched, what device type was expected and what device type is actually installed in that location.

.4 Each detector shall have the ability to learn its environment and automatically adjust its reference value for changes in its environment. Detectors that require adjustments to their sensitivity settings months after they are installed are not acceptable. Environmental compensation shall allow each sensing element to adapt to short and long term changes caused by dirt, dust, humidity, temperature and ageing. The detector shall adjust and update its sensitivity (% obscuration) and ambient temperature baselines for each sensing element approximately six times per hour. The detector shall utilise a 4-hour rolling average of the environmental information and for verification purposes also maintain a 24-hour average of the analog values, both of which may be taken into account in the alarm decision making process.

.5 The detector’s on-board microprocessor shall monitor the environmental effects on its baseline and generate a “maintenance alert” message at the control panel when the detectors environmental compensation is 80% used up indicating it should be cleaned. This event shall be programmable to initiate any type of system response such as send an e-mail message to maintenance. When the environmental compensation head room is 100% used up, a trouble condition shall latch on the system to advise that the detector requires cleaning immediately. Up to this point the detectors sensitivity shall not have been compromised. Dirty detectors that continue to be ignored will eventually post an internal device fault and will not false alarm as a result of the accumulation of dirt. Dirty detectors that false alarm if not cleaned are not acceptable.

.6 The detector shall be capable of identifying up to 32 self-diagnostic codes including verification that the detectors reference value is within its prescribed factory and ULC limits. Sensitivity reports shall include the percent obscuration that the detectors alarm level is set at and the percentage of compensation used as a result of environmental factors (dirt, dust, humidity, etc.). This information shall be available for system maintenance and may be requested per device or generate reports based on only the detectors that require cleaning.

.7 The early warning analog addressable detectors and the analog loop controller shall provide increased reliability and inherent survivability through intelligent analog conventional operation. Detectors shall automatically change to stand alone, conventional device operation in the event of a loop controller polling communications failure. In the analog conventional detector mode, each detector shall continue to operate using its programmed sensitivity and "learned" environmental information stored in the detector's memory at the time of communication failure. The analog loop controller shall be capable of monitoring the loop and activating a loop alarm, without communicating to the devices, if any detector reaches its alarm sensitivity threshold.

.8 Each Signature Series device shall be capable of automatic electronic addressing and/or custom addressing without the use of DIP or rotary switches. Devices using DIP or rotary switches for addressing, either in the base or on the detector shall not be acceptable.

.9 Each detector shall have a separate means of displaying communication and alarm status. A green LED shall flash to confirm normal status communication with the analog loop controller. A red LED shall flash to display alarm status. Both LED's on steady shall indicate an alarm in the conventional stand-alone mode status. The LEDs shall be visible through a full 360 degree viewing angle.

.10 It shall be possible to matrix program Signature analog detectors. Responses shall be programmable based on activated detectors within the physical location to one another and/or the number of activated detectors in a programmable group or groups.

.11 All detectors shall be compatible with all Signature Series mounting bases.

2.02 Detectors – Combination Fixed Temperature/Rate of Rise Heat Detector

.1 Heat Detector shall have a solid state heat sensor, and shall transmit an alarm at a fixed temperature of 135 degrees F (57 degrees C) or due to a temperature Rate of Rise of 15 degrees F/minute (9 degrees C/minute). The detector shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the time required to process an alarm. The heat detector shall be rated for ceiling installation at 70 feet (21.3 m) centers and be suitable for wall mount applications.

2.03 Detectors - Fixed Temperature Heat Detector,

.1 Heat detector shall have a solid-state heat sensor, and shall transmit an alarm at a fixed temperature of 135 degrees F (57 degrees C). Detector shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the time required to process an alarm. Heat detector shall be rated for ceiling installation at 70 feet (21.3 m) centers and be suitable for wall mount applications.

2.04 Detector Bases – Standard

.1 Mounting bases shall support all microprocessor-based detector types detailed in this specification

.2 Removal of the respective detector shall not affect communications with other addressable devices.

.3 Field wiring connections shall be made to the room side of the base, so that wiring connections can be made or disconnected by the contractor without the need for remove the mounting base from the electrical box. Bases will have the option of external LED operation, Relay Base or Data Line Isolator Base.

2.05 Detector Base – Relay

.1 The relay base shall support all Addressable Detector types and have the following requirements:

.2 Form "C" contacts rated at 1 amp @ 30VDC and listed for "pilot duty".

.3 The position of the contact shall be supervised.

.4 Separate power shall not be required to the relay base.

.5 The relay shall automatically de-energize when a detector is removed.

.6 The relay operation shall be exercised by the detector processor on power up.

.7 The relay shall be a bi-stable type and selectable for normally open or normally closed operation.

.8 For added survivability, relay operation shall be controlled by the detectors microprocessor. The relay shall be capable or operation in the conventional stand-alone mode in the event communication is lost with the loop controller. Relay bases not controlled by the detector's microprocessor shall not be acceptable.

2.06 Detectors - Photoelectric Smoke Detector, (Duct Detector Use)

.1 Photoelectric detector shall utilize a light scattering type photoelectric smoke sensor to detect visible particulates produced by combustion. The integral microprocessor shall dynamically examine values from the sensor and initiate a system alarm based on the analysis of data.

.2 The alarm set point shall be field selectable to any of five sensitivity settings ranging from 1.0% to 3.5% smoke obscuration per foot. The photo detector shall be suitable for operation in the following environment:

.1 Temperature: 0 degrees C to 49 degrees C (32 degrees F to 120 degrees F).

.2 Humidity: 0-93% RH, non-condensing.

.3 Elevation: no limit.

2.07 Duct Detector Housing

.1 The Analytical Microprocessor-based photoelectric smoke detector shall be readily adaptable for use in air duct smoke detection applications, using a housing that mounts to the outside of the duct. When used for duct smoke detection, the smoke detectors will not forfeit any of the system functionality that they have when used as area smoke detectors.

.2 The duct smoke detection housing shall allow the detector to sample and compensate for, variations in duct air velocity between 300 and 4 000 feet per minute.

.3 Remote alarm LEDs and Remote Test Stations shall be supported by the duct smoke detector and provided where indicated.

.4 Install duct smoke detectors in heated areas (indoors).

3 Execution

3.01 Installation

.1 Installation to Section 28 46 21.11.

3.02 Field Tests and Inspections

.1 Testing, and inspection to Section 28 46 21.11.

.2 Verification to Section 28 46 21.11.

End of Section

1 General

1.01 Section Includes

.1 Intelligent Modules.

.2 Fire Alarm Pull Stations for Single Stage Fire Alarm Systems.

1.02 Related Requirements

.1 Section 21 05 23 - General-Duty Valves for Water-Based Fire Suppression.

.2 Section 26 05 00 – Common Work Results for Electrical.

.3 Section 28 46 21.11 – Addressable Fire Alarm Systems.

1.03 References

.1 CAN/ULC-S528, Manual Stations for Fire Alarm Systems.

2 Products

2.01 Microprocessor Based Intelligent Modules

.1 General

.1 Zone Addressable Modules (ZAM) shall be used for the monitoring of water flow, valve tamper, fire suppression control panels, non-addressable detectors, and for control of fans or dampers that require shutdown or manual control in an alarm condition.

.2 Monitor ZAM's shall monitor any N/O contact device and be capable of powering 2-wire smoke detectors. The ZAM will communicate the zone's status (normal, alarm, trouble) to the transponder. The ZAM's zone address shall be set at the time of installation via a dip switch package.

.3 Control ZAM's shall be able to provide supervised or non-supervised control of any control function. The ZAM will communicate the zone's status (normal, trouble) to the transponder. Each control ZAM shall provide a double pole double throw relay for switching loads of up to 120 VAC. Each common leg of the relay shall be equipped with a replaceable 2 Amp fuse. The ZAM's zone address shall be set at the time of installation via a dip switch package.

.4 Fire Alarm / Life Safety System shall incorporate microprocessor-based addressable modules for the monitoring and control of system Input and Output functions over a 2 wire electronic communications loop, using both broadcast and serial polling protocols. All modules shall display communications and alarm status via LED indicators. The function of each connected module shall be determined by the module type, and shall be defined in the system software through the application of a personality code. All addressing of the Microprocessor-based Addressable Modules shall be done electronically, and the electrical location of each module shall be automatically reported to the Fire Alarm Control Panel, where it may be downloaded into a PC, or printed out. The addressing of the modules will not be dependent on their electrical location on the circuit. All field wiring to the Microprocessor-based Addressable Modules shall be supervised for opens and ground faults and shall be location identified to the module of incidence. Diagnostic circuitry, and their associated indicators, with reviewable Trouble Codes, shall be integral to the Microprocessor-based Addressable Modules to assist in troubleshooting system faults. Each module shall be suitable for operation in the following environment:

.1 Temperature: 0°C to 49°C (32°F to 120°F)

.2 Humidity: 0-93% RH, non-condensing

.2 Single Input Module:

.1 Microprocessor-based Addressable Modules shall be used to provide one (1) supervised Class A input circuit capable of latching operation for use with contact devices, non-damped Waterflow Switches, non-latching supervisory sprinkler switches.

.3 Dual Input Module:

.1 Microprocessor-based Addressable Modules shall be used to provide two (2) independent supervised Class A input circuits capable of operation with contact devices. Both of the input circuits shall be terminated to, and operated from, the same microprocessor-based addressable module.

.2 Modules configured for water flow operation shall have an automatic delay of 15 seconds before reporting the water flow alarm condition to the Fire Alarm Control Panel. The module shall monitor sprinkler supervisory switches and shall automatically report the supervisory function to the Fire Alarm Control Panel each time the associated dry contact closes.

.4 Monitor Module:

.1 The Microprocessor-based Addressable Monitor Module shall be factory set to support one (1) supervised Class A Normally-Open Active Non-Latching Monitor circuit. The module shall automatically report the monitor function to the Fire Alarm Control Panel each time the associated dry contact closes.

.5 Control Relay Module:

.1 Microprocessor-based Addressable Control Relay Modules shall provide one form "C" dry relay contact rated at 2 amps @ 24 V DC or 0.5 amps at 120 V AC to, control external appliances or equipment processes. The control relay module shall be rated for pilot duty applications. The position of the relay contact shall be confirmed by the system firmware.

2.02 Microprocessor Based Addressable Manual Pull Stations

.1 Addressable manual fire alarm boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.

.2 Stations must be designed such that after an actual activation, they cannot be restored to normal without the use of a special tool.

.3 All operated stations shall have a positive, visual indication of operation and utilize a key type reset.

.4 Manual fire alarm boxes shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 44 mm or larger.

.5 All addressing of the Manual Pull Stations shall be done electronically, and the electrical location of each station shall be automatically reported to the Fire Alarm Control Panel, where it may be downloaded into a PC, or printed out. The addressing of the Manual Pull Station will not be dependent on their electrical location on the circuit.

.6 The manual station shall be suitable for mounting on a North American 1-1/2 inch (38 mm) deep, 4 inch square electrical box with 1/2 inch (13 mm) raised cover.

.7 All Manual Fire Alarm station shall be suitable for operation in the following environment:

.1 Temperature: 0°C to 49°C (32°F to 120°F)

.2 Humidity: 0-93 per cent RH, non-condensing.

.8 Pull Station Cover

.1 All Manual Fire Alarm pull stations shall be provided with a clear, tamperproof, polycarbonate shield and frame that fits over manual pull stations. When lifted to gain access to the actual alarm, it shall sound a 95 dB or 105 dB warning horn.

.2 The cover is connected to the frame by a cable. When the cover is lifted, it hangs off of the frame and the horn will sound until the cover is snapped back onto the frame (or for the life of the battery).

.3 Battery shall be provided for each cover.

.1 Tamper or protecting covers for manual stations shall comply with CAN/ULC-S528, Including Accessories.

.9 Pull stations shall be addressable, single action, non-coded, single stage, semi-flush mounted type.

.10 Provide contacts for connection to magnetic locking devices power supply such that upon activation of the local pull station or first stage fire alarm signal the magnetic locks release.

.11 The approximate location of all initiating devices is shown on the drawings. All existing initiating devices shall not be disturbed unless absolutely necessary to facilitate installation of a new device. No existing devices are to be disturbed without specific authorization by the Project Manager

3 Execution

3.01 Installation

.1 Installation to Section 28 46 21.11.

.2 Install manual pull stations at 1200 mm above finished floor.

.3 Where possible, install the manual station on the latch side of a single door at a maximum lateral distance of 1500 mm (59 in) from the door opening.

.4 Install manual pull stations on both sides of a series of doors exceeding 12 m (39 feet) in total width, and within 1500 mm (59 in) of each side of the opening.

3.02 Testing and Inspection

.1 Testing, and inspection to Section 28 46 21.11.

3.03 Verification

.1 Verification to Section 28 46 21.11.

End of Section

1 General

1.01 Section Includes

.1 Fire Alarm Horns.

.2 Fire Alarm Strobes.

.3 Combination Horn/Strobes.

1.02 Related Requirements

.1 Section 26 05 00 – Common Work Results for Electrical.

2 Products

2.01 General

.1 All appliances which are supplied for the requirements of this specification shall be ULC Listed.

.2 All appliances of the same manufacturer as the Fire Alarm Control Panel specified to ensure absolute compatibility between the appliances and the control panels, and to insure that the application of the appliances are done in accordance with the single manufacturer's instructions.

.3 Any appliances that do not meet the above requirements, and are submitted for use must show written proof of their compatibility for the purpose intended. Such proof shall be in the form of documentation from all manufacturers that clearly states that their equipment (as submitted) is 100% compatible with each other for the purpose intended.

2.02 Horns

.1 Vibrating horn: semi-flush mounted, 24 VDC, selectable 94 dBA or 98 dBA, suitable for installation in a standard electrical box.

.2 Red enamel typical, or white enamel as indicated on the drawings, and as confirmed by the Owner.

.3 Red enamel typical, or white enamel as indicated on the drawings, and as confirmed by the Owner.

2.03 Horn-Strobes

.1 Vibrating horn: semi-flush mounted, 24 VDC, selectable 94 dBA or 98 dBA, suitable for installation in a standard electrical box.

.2 Red enamel typical, or white enamel as indicated on the drawings, and as confirmed by the Owner.

.3 Provide horn-strobes where shown on plans and drawings. Strobe output shall be determined as required by its specific location and application from a family of 15/75 cd, 30 cd, and 110 cd devices. Strobes shall provide a synchronized flash.

.4 Strobes shall be 24 VDC and ULC listed.

.5 Strobe circuits shall be coordinated with audible circuits such that activation of an audible circuit results in activation of the companion strobe circuit. The strobe circuits shall be capable of being arranged such that they continue to operate in the event that the audible circuits have been silenced and remain operating until the FACP has been reset. Strobe circuits should also be coordinated with the audible circuits such that they are zoned in the same manner as the audible circuits

.6 All strobes and combination horn strobes shall be mounted such that the bottom of the device is mounted 80 inches above the finished floor or 6 inches below the ceiling, whichever is lower.

2.04 Strobes

.1 Strobes shall be supplied where shown on plans and drawings. Strobe output shall be determined as required by its specific location and application from a family of 15/75 cd, 30 cd, and 110 cd devices. Strobes shall provide a synchronized flash.

.2 Size strobe power supplies based on all strobes set at 75 cd with exact setting determined in the field to provide adequate visual signals in accordance with CAN/ULC-S524.

3 Execution

3.01 Installation

.1 Installation to Section 28 46 21.11.

3.02 Testing and Inspection

.1 Testing, and inspection to Section 28 46.21 11.

3.03 Verification

.1 Verification to Section 28 46 21.11.

End of Section